Exhibit “A”

City of Philadelphia Hazard Mitigation Plan



May 2026

TETRA TECH

City of Philadelphia Hazard Mitigation Plan

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#105S045002

PREPARED FOR

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EXECUTIVE SUMMARY

Hazard Mitigation Overview

Hazard mitigation is the use of long-term and short-term policies, programs, projects, and other activities to minimize the loss of life, injury, and property damage that can result from a disaster. Communities, residents, and businesses across the United States have been faced with continually increasing costs associated with natural and human-caused hazards. Hazard mitigation is the first step in reducing risk and is the most effective way to reduce costs associated with hazards.

The City of Philadelphia has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the City's planning area; this plan was prepared as an update to the 2022 City of Philadelphia HMP. The updated 2026 HMP (also referred to as "the plan") includes citywide analysis and assessment of hazards, risk, and capabilities.

The plan complies with federal and state hazard mitigation planning requirements to establish the Planning Partners' eligibility for funding under Federal Emergency Management Agency (FEMA) grant programs. The federal Disaster Mitigation Act of 2000 requires state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Pennsylvania Emergency Management Agency (PEMA) supports plan development for jurisdictions in Pennsylvania.

The Planning Process

This HMP update documents the process and outcomes of the planning participants' mitigation planning efforts. To support the planning process, the planning participants accomplished the following:

- Reconvened the standing Stakeholder Steering Committee, composed of subject matter experts from various City departments, who provided guidance for the 2026 update. This committee was complemented by additional stakeholder and public groups, including the All-Stakeholder Work Group and the Public Steering Committee. The engagement of these three groups facilitated comprehensive evaluation of decisions throughout the process from diverse perspectives. Additionally, their involvement helped ensure that the plan remained community-focused and garnered the necessary community and stakeholder support.
- Reviewed the 2022 City of Philadelphia All-Hazard Mitigation Plan
- Identified hazards of concern to the City to be included in the update
- Profiled the hazards of concern
- Estimated the inventory at risk and potential losses associated with these hazards
- Reviewed and updated the mitigation goals and objectives
- Reviewed mitigation strategy and actions outlined in the 2022 HMP to indicate progress
- Developed new mitigation actions to reduce the vulnerability of assets from the hazards of concern
- Involved a wide range of stakeholders and the public in the plan update process
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from PEMA and FEMA

Involvement by Stakeholders and the Public

The Planning Partners kept stakeholders and the general public informed throughout the planning process and provided opportunities for public comment and input. In addition, numerous agencies and stakeholders participated as core or support members of the Steering Committee, All-Stakeholder Work Group, or Public Steering Committee, providing input and expertise throughout the planning process.

Multiple Agency Support for Hazard Mitigation

Primary responsibility for the development and implementation of mitigation strategies and policies lies with local governments. However, local governments are not alone; various partners and resources at the regional, state, and federal levels are available to assist communities in the development and implementation of mitigation strategies. In Pennsylvania, PEMA is the lead agency providing hazard mitigation planning assistance to local jurisdictions. In addition, FEMA provides grants, tools, guidance, and training to support mitigation planning.

In updating the HMP, the City fully coordinated with and solicited participation from City government, relevant organizations and groups, state and federal agencies, and the general public. This coordination ensured that stakeholders had established communication channels and relationships to support mitigation planning and mitigation actions included in the plan.

Additional input and support for this planning effort was obtained from a wide range of agencies as well as through public involvement. Under the project management of the City of Philadelphia Office of Emergency Management (OEM), the City of Philadelphia Hazard Mitigation Steering Committee provided oversight for the preparation of this plan. The Steering Committee includes representatives from the following:

- City of Philadelphia Office of Emergency Management
- City of Philadelphia Office of Sustainability
- City of Philadelphia Fire Department Planning Unit
- City of Philadelphia Water Department
- City of Philadelphia Office for People with Disabilities
- City of Philadelphia Planning Commission
- City of Philadelphia Department of Public Property
- City of Philadelphia Department of Licenses and Inspections
- City of Philadelphia Office of Transportation and Infrastructure Systems
- City of Philadelphia Office of the Community Development Block Grant-Disaster Recovery Office
- City of Philadelphia Budget Office
- City of Philadelphia Parks and Recreation
- City of Philadelphia Department of Public Health

Risk Assessment for Local Hazards of Concern

The Planning Partners evaluated each the City's risk and vulnerability due to each of the hazards of concern, based on past events, past and predicted future losses, and the expected probability of future occurrence. From these evaluations, hazards were ranked as high, medium, or low risk. The hazard rankings were used to focus and

prioritize mitigation strategies. Summary overall hazard rankings for the City of Philadelphia are presented in Table ES-1-1.

Table ES-1-1. Citywide Ranking for the City of Philadelphia Hazards of Concern

Hazard of Concern	Hazard Ranking
Building and Structure Collapse	High
Civil Disturbance	Medium
Cyberterrorism	High
Dam Failure	Low
Drought	Medium
Earthquake	Medium
Environmental Hazards - Hazardous Materials Release	High
Extreme Temperature	High
Flood, Flash Flood, Ice Jam	High
Gun Violence and Criminal Activity	High
Hurricane, Tropical Storm, Nor'easter	High
Pandemic and Infectious Disease	High
Subsidence, Sinkhole	Medium
Substance Use Disorder	High
Terrorism	Medium
Tornado, Windstorm	Medium
Urban Fire and Explosion	High

Capability Assessment and Plan Integration into Other Local Mechanisms

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the City, there are many existing plans and programs that support hazard risk management. It is critical that this HMP integrates, complements, and references those plans and programs to the extent practical in order for it to be a comprehensive resource for hazard mitigation.

The HMP includes a capability assessment to review relevant local mechanisms for the City. This assessment identifies where the City is currently able to implement hazard mitigation measures and where each would benefit from improved capabilities for such measures. The capability assessment also provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, and local) that support hazard mitigation in the City.

Mitigation Strategy

Hazard Mitigation Plan Goals and Objectives

It is a federal requirement for hazard mitigation plans to include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards of concern.

2026 City of Philadelphia HMP Goals

Goal 1: Protect all life and reduce risks that exacerbate inequities in health safety.

Goal 2: Build the resilience of community assets, including property, infrastructure, and cultural resources.

Goal 3: Foster an economy that promotes mitigation and reduces impacts from hazards.

Goal 4: Restore and enhance the natural ecology.

Goal 5: Create awareness and demand for mitigation and adaptation as a standard of practice.

The City of Philadelphia HMP planning process included a review and update of mitigation goals and objectives that were previously established to guide the selection of mitigation actions addressing all hazards of concern. Mitigation goals were updated based on the updated risk assessment, discussions, research, and input from plan participants and stakeholders. The goal development process considered the goals expressed in the Pennsylvania State Hazard Mitigation Plan, as well as other relevant local planning documents.

Implementation of the 2022 Plan

The status of the mitigation projects identified in the 2022 HMP was reviewed for this HMP. Numerous projects and programs have been implemented that have reduced hazard vulnerability to assets in the planning area. Uncompleted projects have been reevaluated, modified as necessary, and incorporated into this plan. The Planning Partners' annexes describe these mitigation activities in more detail, and plan maintenance procedures have been developed to encourage thorough integration with local decisions and processes and regular review of implementation progress.

2026 Mitigation Strategy

City actions included in the mitigation strategy had a strong focus on the development, maintenance, and implementation of several plans throughout the jurisdiction, including the existing Department of Public Health's Pandemic Plan and the Water Department's Drought Contingency Plan; the creation and coordination of a Cybersecurity Incident Response and Recovery Plan, Philadelphia Economic Recovery Plan, and Regional Disaster Housing Plan. Actions also identified a need for expansion of existing outreach capabilities and communication with the public. Members of the Public Steering Committee indicated there would be a benefit to having a system for two-way communication with City officials to identify hazards within their communities and which avenues to take to have the risks from those hazards reduced or eliminated. Several actions surrounding trees in the City were included in the mitigation strategy, providing several nature-based projects to be implemented.

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1. INTRODUCTION

The City of Philadelphia has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the City; this HMP updates the 2022 City of Philadelphia HMP. The updated 2026 HMP (also referred to as "the plan") includes citywide analysis and assessment of hazards, risk, and capabilities.

1.1 BACKGROUND

1.1.1 What Is Hazard Mitigation?

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from hazards. The Federal Emergency Management Agency (FEMA) defines a hazard mitigation plan (HMP) as the documentation of a state or local government's evaluation of natural hazards and strategies to mitigate them.

Effective mitigation planning helps people, organizations, and government agencies to better prepare for and respond when disasters occur. It also allows local governments to remain eligible for FEMA grant funding for mitigation projects that will reduce the impact of future disaster events. The long-term benefits of mitigation planning and implementation include the following:

- An increased understanding of hazards faced by local communities
- A more sustainable and disaster-resistant community
- Financial savings through partnerships that support planning and mitigation efforts
- Focused use of limited resources on hazards that have the biggest impact on the community
- Reduced long-term impacts and damage to human health and structures
- Reduced costs associated with response and recovery efforts, including repairs

The **Federal Emergency Management Agency** (FEMA) estimates that for every dollar spent on damage prevention (mitigation), six dollars is saved by not having to perform post-disaster repairs (FEMA 2018).

1.1.2 Previous City of Philadelphia HMPs

The City of Philadelphia has been included in 25 federal hazard-related declarations (major disaster, fire management, and emergency) since the 1950s. The City prepared and adopted its first hazard mitigation plan in 2012. The plan has been regularly updated since then, with updates adopted in 2017 and 2022. The City also conducted hazard and vulnerability assessments in 1998 and 1984. The most recent update identified the following as the hazards of concern in the City of Philadelphia:

- Natural Hazards
  - Drought
  - Earthquake
  - Extreme Temperature
  - Flood, Flash Flood, and Ice Jam
  - Hurricane, Tropical Storm, and Nor'easter

  - Subsidence/Sinkhole
  - Tornado/Windstorm
  - Winter Storm
- Human-caused Hazards
  - Building and Structure Collapse
  - Civil Disturbance
  - Cyber Terrorism
  - Dam Failure
  - Gun Violence and Criminal Activity
  - Environmental Hazards - Hazardous Materials Releases
  - Pandemic and Infectious Disease
  - Substance Use Disorder
  - Terrorism
  - Urban Fire and Explosion

1.2 PURPOSE

In the early 1990s, a new federal policy regarding disasters began to evolve. Rather than simply reacting whenever disasters strike communities, the federal government began encouraging communities to assess their vulnerability to various hazards before disaster strikes and then take actions to reduce or eliminate potential risks. The policy is based on the logic that a disaster-resistant community can rebound from a natural disaster with less loss of property or human injury, at much lower cost and, consequently, more quickly. Moreover, other costs associated with disasters are minimized, such as the time lost from productive activity by businesses and industries.

The federal Disaster Mitigation Act of 2000 (DMA 2000) encouraged states, tribes, and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous law's mitigation planning provisions (Section 409) and replacing them with a new set of requirements (Section 322). Under the new Section 322, communities seeking certain hazard-related federal funding must have a plan that identifies actions to mitigate hazards, risks, and vulnerabilities and establishes a strategy to implement those actions.

Regulations implementing the intent and requirements of DMA 2000 are included in Title 44 of the Code of Federal Regulations, Section 201 (44 CFR 201). In Pennsylvania, responsibility for fulfilling the requirements of DMA 2000 and 44 CFR 201 and administering the FEMA Hazard Mitigation Program has been delegated to the Pennsylvania Emergency Management Agency (PEMA).

The federal regulations require that states and local governmental agencies update HMPs on a 5-year basis to prepare for and reduce the potential impacts of natural hazards. The City must identify potential natural hazards to the health, safety, and well-being of its residents, and identify and prioritize actions that can be taken by the community to mitigate those hazards before disaster strikes. To be eligible for hazard mitigation assistance from the federal government, communities must prepare, maintain, and update an HMP.

One goal of the federal regulations is to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning process enables local and state governments to better articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

1.3 SCOPE

The City of Philadelphia HMP provides a detailed review and analysis of each hazard of concern, resources, and relevant statistical information for the Planning Partners. Volume I includes all information that applies to the entire planning area (City of Philadelphia).

1.3.1 Plan Contents

The HMP is organized into two volumes. Volume I is a resource for ongoing mitigation analysis. It includes a description of the City as well as information on mitigation planning and how the risk assessment and capability assessment were performed. Volume I of the plan includes the following chapters:

- **Chapter 1: Introduction**
- **Chapter 2: City Profile**—An overview of City of Philadelphia, including: general information and physical conditions, land use patterns and trends, population and demographics, economy, general building stock inventory, community lifelines, and natural, historic, and cultural resources
- **Chapter 3: Planning Process**—A description of the plan methodology and development process, committee and stakeholder roles and activities, and how the plan will be incorporated into existing programs. Information regarding the adoption of the plan by the City.
- **Chapter 4: Risk Assessment**—Description of the methodology used to assess hazard risk; the process of identifying the hazards of concern; hazard profiles; findings of the risk assessment (estimates of the impact of hazard events on life, safety, and health; general building stock; critical facilities; the economy, and natural, historic, and cultural resources); and summary of the hazard ranking process.
- **Chapter 25: Capability Assessment**—A summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, and local) that support hazard mitigation within the City.
- **Chapter 26: Mitigation Strategy**—Information regarding the mitigation goals and objectives identified by the Stakeholder Steering Committee in response to priority hazards of concern, and the process by which local mitigation strategies have been developed or updated.
- **Chapter 27: Plan Maintenance Procedures**—A system to continue to monitor, evaluate, maintain, and update the plan.

Volume II: Appendices include the following:

- **Appendix A: Sample Resolution of Plan Adoption**—Documentation that supports the plan approval.
- **Appendix A: Meeting Documentation**—Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.
- **Appendix B: Public and Stakeholder Outreach Documentation**—Documentation of the public and stakeholder outreach effort including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the plan update process.

- **Appendix C: Participation Matrix**
- **Appendix D: Action Worksheet Template and Instructions**
- **Appendix E: Plan Maintenance Tools**—Examples of plan review templates available to support annual plan review and example FEMA Guidance Worksheets (FEMA 386-4).
- **Appendix F:** Critical Facility Inventory
- **Appendix G: Mitigation Action Worksheets and Supplementary Date**—Details for actions identified for the updated mitigation strategy.
- **Appendix H: PEMA Planning Standards**—Includes planning standards and guidelines for hazard mitigation planning.

1.3.2 Key Changes in the Current Update

The following are the most significant changes made between the previous City HMP (2022) and the current (2026) update:

- The 2026 HMP was updated to match the FEMA 2025 Local Mitigation Planning Policy Guide and align with the 2023 Commonwealth of Pennsylvania Hazard Mitigation Plan.
- New methods of public outreach were utilized including the use of two sub-contractors to produce outreach materials and the creation of a Public Steering Committee to represent the various neighborhoods within the City.
- An updated risk assessment was performed using Hazus modeling.
- The hazard history and hazard risk information were updated using new data from the past five years.
- The “Opioid Addiction Response” hazard from the 2022 HMP was renamed to “Substance Use Disorder”.
- The “War and Criminal Activity” hazard from the 2022 HMP was renamed to “Gun Violence and Criminal Activity”.
- Goals and objectives were evaluated by plan stakeholders in a Mitigation Strategy Workshop and updated to reflect new City priorities and capabilities.
- All mitigation actions in the 2022 HMP were updated to reflect changes in status and progress.
- New mitigation actions were identified by plan stakeholders in a Mitigation Strategy Workshop.

1.4 AUTHORITY AND REFERENCES

This HMP was prepared in accordance with the following regulations and guidance:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended
- Title 44 CFR, Part 201, Mitigation Planning
- Disaster Mitigation Act of 2000, as amended
- FEMA Local Mitigation Planning Policy Guide, effective April 2023
- FEMA Local Mitigation Planning Handbook, May 2023
- Pennsylvania Emergency Management Services Code, Title 35, Pa C.S. Section 101
- Pennsylvania Municipalities Planning Code of 1968, Act 247 as reenacted and amended by Act 170 of 1988

- Pennsylvania Hazard Mitigation Planning Standard Operating Guide, 2020
- Commonwealth of Pennsylvania 2023 Hazard Mitigation Plan, approved August 28, 2023

A full list of references used in updating this HMP is provided in Appendix A.

2. CITY PROFILE

The planning area for this HMP is comprised of the entirety of the City of Philadelphia. This chapter presents general information about the land, people, and assets of the City of Philadelphia. This information provides a baseline for understanding the economic, structural, and population assets at risk from the hazards addressed in this HMP.

2.1 GEOGRAPHY AND ENVIRONMENT

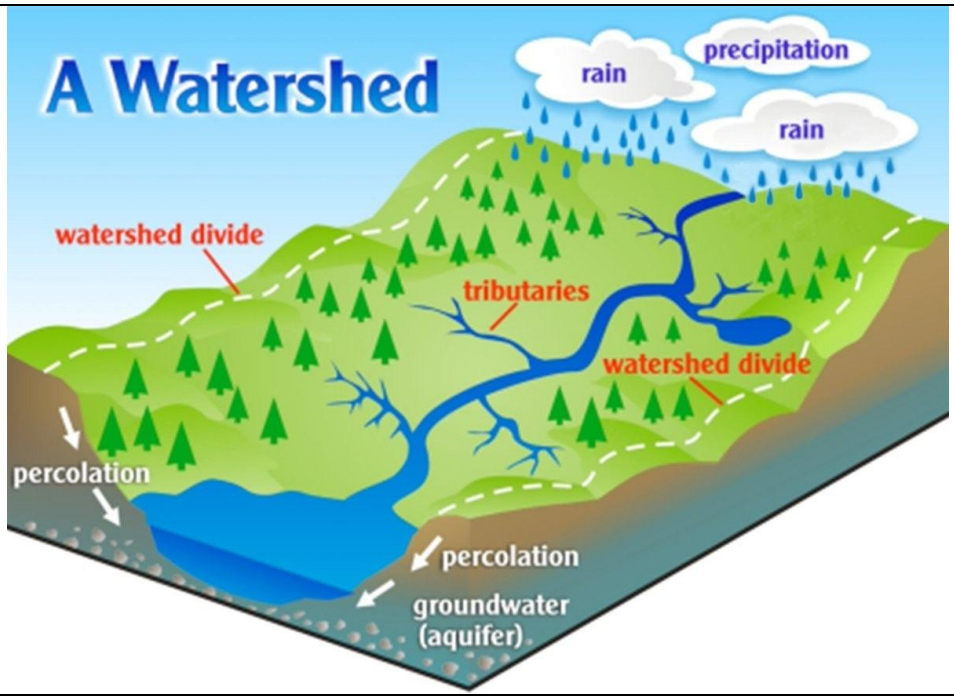
2.1.1 Hydrography and Hydrology

Numerous creeks, rivers, and waterways pass through the City of Philadelphia, including the Delaware River, Schuylkill River, Wissahickon Creek, Pennypack Creek, Frankford Creek, Poquessing Creek, and Cobbs Creek. All the major bodies of water within Philadelphia are part of seven watersheds. Within Philadelphia's watersheds, 54 percent of the surfaces are impervious, which is why many areas of the City are prone to flash flooding (PWD 2011).

2.1.2 Watersheds

A watershed is the area of land that drains into a body of water such as a river, lake, stream, or bay. It is separated from other systems by high points in the area such as hills or slopes. It includes not only the waterway itself but also the entire land area that drains to it. For example, the watershed of a lake would include not only the streams entering the lake but also the land area that drains into those streams. Drainage basins generally refer to large areas that encompass the watersheds of many smaller rivers and streams (NOAA 2024). Figure 2-1 depicts the hydrologic system of a watershed. Watersheds can cross jurisdictional boundaries.

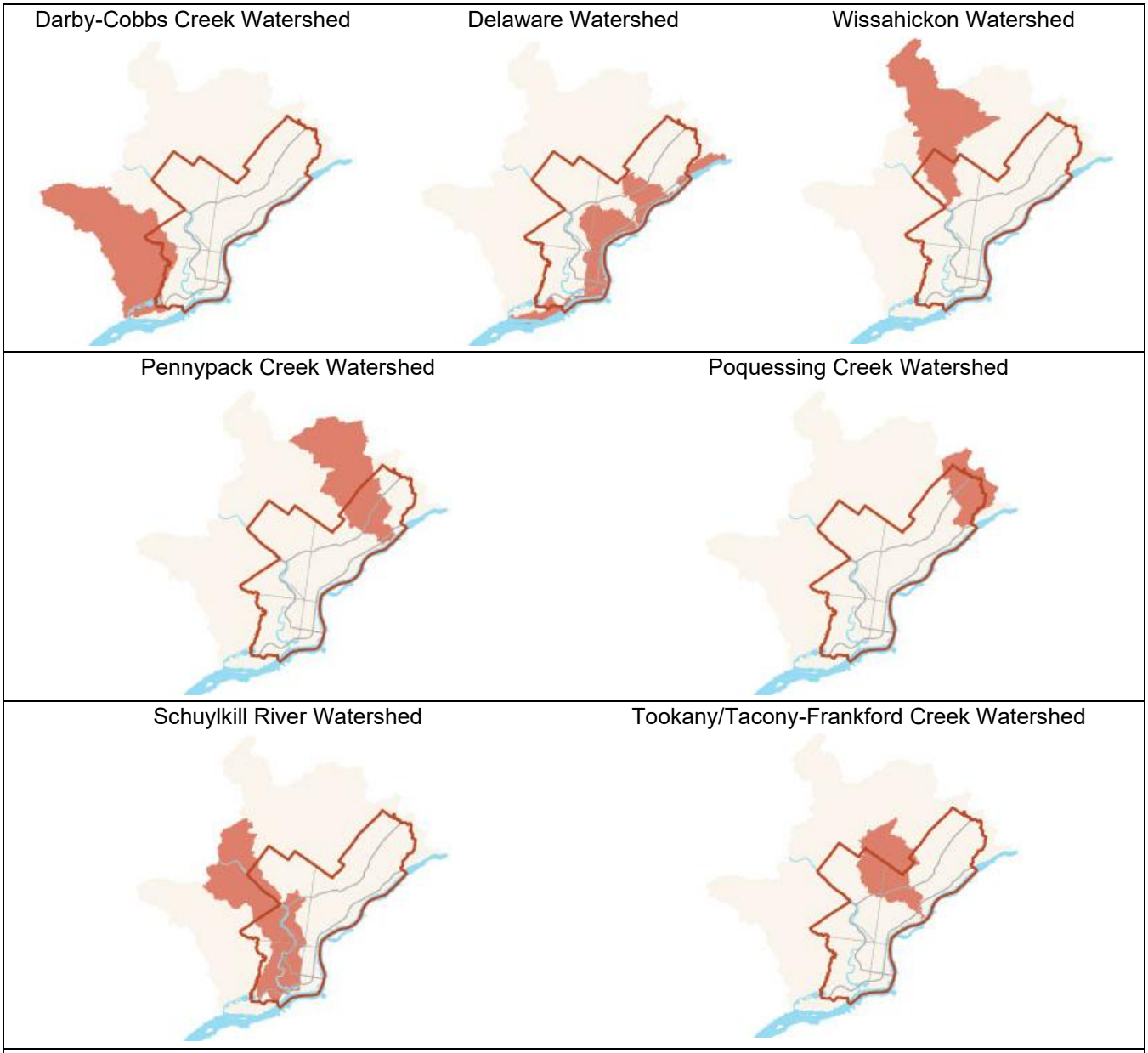
Figure 2-1. Watershed



Source: RCRCD 2019

The City of Philadelphia is located within seven watersheds, as shown in Figure 2-2 (PWD 2022).The City maintains plans for several of these sub-watersheds. These plans are monitored and updated by the Philadelphia Water Department (PWD), who creates or collaborates with watershed stakeholders to create several assessments and planning documents for the sub-watersheds. These documents range from detailed characterization reports summarizing technical information to more holistic conservation plans intended to enhance quality of life for City residents. These plans can be found online at (https://water.phila.gov/reporting/watershed-plans-reports/) (PWD 2024).

Figure 2-2. Watersheds of Philadelphia



Note: The border of the City of Philadelphia is noted in a red outline. The location of the watersheds are filled in with a red background.

Source: PWD 2022; PWD 2022; PWD 2022; PWD 2022; PWD 2022; PWD 2022; PWD 2022

2.1.2.1 Darby-Cobbs Watershed

The Darby-Cobbs Watershed drains approximately 77 square miles. The watershed contains 135 linear miles of streams. The watershed as a whole is home to about 460,000 residents, but population density is much higher in and near the City of Philadelphia. Impervious cover is estimated at 45 percent. The watershed encompasses areas of Chester, Delaware, Montgomery, and Philadelphia counties, with all or parts of 31 municipalities (PWD 2022).

2.1.2.2 Delaware River Watershed

The Delaware River Watershed encompasses areas of four states, 42 counties, and all or parts of 838 municipalities in the Mid-Atlantic region. Philadelphia constitutes approximately 40 square miles of the Delaware River Watershed, which drains 13,000 square miles overall. The watershed contains 23,700 linear miles of streams, 21 of which are located within Philadelphia. An estimated 7.7 million people reside within the watershed, about 500,000 of which live in Philadelphia. The land use composition for this watershed is estimated at roughly 55 percent forest, 26 percent agriculture, and 15 percent developed. The developed area within Philadelphia is estimated to be 72 percent impervious surface and highly susceptible to flash flooding (PWD 2022).

2.1.2.3 Pennypack Watershed

The Schuylkill Watershed drains approximately 56 square miles and contains 125 linear miles of streams. The watershed as a whole is home to about 230,000 million residents, Impervious cover is estimated at 33 percent. The watershed encompasses areas of Montgomery, Philadelphia, and Bucks Counties, with all or part of 12 municipalities (PWD 2022).

2.1.2.4 Poquessing Watershed

The Schuylkill Watershed drains approximately 22 square miles and contains 45 linear miles of streams. The watershed as a whole is home to about 105,000 million residents, Impervious cover is estimated at 38 percent. The watershed encompasses areas of Philadelphia, Bucks, and Montgomery counties, with all or parts of four municipalities (PWD 2022).

2.1.2.5 Schuylkill Watershed

The Schuylkill Watershed drains approximately 2,000 square miles and contains 130 linear miles of streams. The watershed as a whole is home to about 1.5 million residents, the impervious cover is estimated at 10 percent. The watershed encompasses areas of 11 counties, including Schuylkill, Berks, Montgomery, Chester, Philadelphia, Carbon, Lehigh, Lebanon, Lancaster, Bucks, and Delaware (PWD 2022).

2.1.2.6 Tookany/Tacony-Frankford Watershed

The Tookany/Tacony-Frankford Watershed drains approximately 33 square miles and contains 32 linear miles of streams. The watershed as a whole is home to about 360,000 residents, Impervious cover is estimated at 48 percent. The watershed encompasses areas of Montgomery and Philadelphia counties (PWD 2022).

2.1.2.7 Wissahickon Watershed

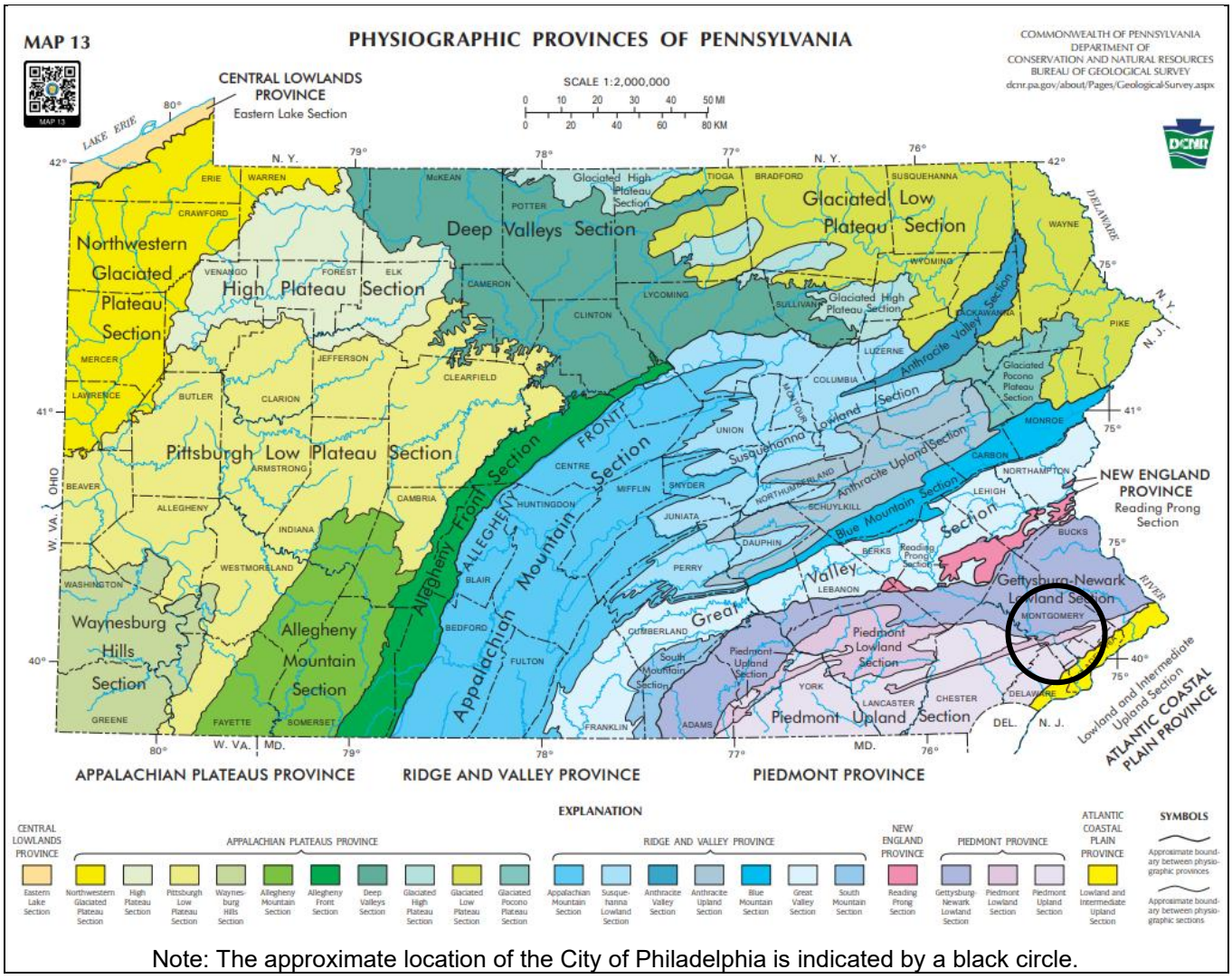
The Wissahickon Watershed drains approximately 64 square miles and contains 134 linear miles of streams. The watershed as a whole is home to about 160,000 residents, Impervious cover is estimated at 24 percent. The watershed encompasses areas of Montgomery and Philadelphia counties (PWD 2022).

2.1.3 Topography and Geology

On average, Philadelphia is 39 feet above sea level. Philadelphia's lowest point is 10 feet below sea level, and the highest point occurs at 445 feet above sea level (Sundek of Pennsylvania n.d.).

According to the Commonwealth of Pennsylvania Department of Conservation and Natural Resources Bureau of Topographic and Geologic Survey, Philadelphia straddles two physiographic provinces. A physiographic province is an area of land that is composed of a particular type(s) of rock. Each province is distinguishable by its physical landforms, unique rock formations, and groundwater characteristics. Philadelphia spans the Atlantic Coastal Plain and the Piedmont Upland Section (otherwise known as the Southern Piedmont Province) (DCNR 2023). Figure 2-3 depicts the physiographic provinces of Pennsylvania and delineates the two physiographic provinces found within Philadelphia.

Figure 2-3. Pennsylvania Physiographic Provinces Map



Note: The approximate location of the City of Philadelphia is indicated by a black circle.

Source: DCNR 2023

The Atlantic Coastal Plain is a narrow strip of sandy, low-lying land immediately adjacent to the Delaware River in southeastern Philadelphia. This province is low-lying, flat, and sandy. The Southern Piedmont province located in

the Northwest portion of the City contains schist, metagraywacke, amphibolite, and associated ultramafic rocks of the Wissahickon Formation overlain by unconsolidated Cretaceous and tertiary sediments. This province is characterized by broad, rounded to flat-topped hills and shallow valleys (DCNR 2023).

2.1.4 Climate

Annual and seasonal temperature and precipitation changes can affect soil moisture, vegetation growth, the water table, and other physical parameters that can magnify or dampen the impacts of extreme weather events. Philadelphia is in a humid continental climate zone. This means the City experiences four distinct seasons, including hot summers and cold winters. Historically, winters have an average temperature of 41.9°F, and summers have an average temperature of 84.5°F (for the years 1961 to 2000). Precipitation is consistent throughout the year, with the greatest amounts occurring during the spring and summer (Philadelphia OOS 2021). Between 1981 and 2010, the City had an average annual temperature of 55.8°F, with monthly averages ranging from just below 33°F in January to above 78°F in July (COP, 2012). Annually, Philadelphia experiences approximately 41.5 inches of precipitation annually plus 20.5 inches of snow accumulation (Philadelphia OOS 2014).

2.1.4.1 Climate Change Projections

The May 2021 Pennsylvania Climate Impact Assessment indicated that Pennsylvania is very likely to undergo increased temperatures and precipitation in the 21st century. Increased average temperatures as a result of climate change make the occurrence of extreme heat more likely (Commonwealth of Pennsylvania 2021). While increased average temperatures would make the occurrence of extreme cold less likely, some climatologists have suggested that warming in the Arctic could impact the position of the jet stream, allowing for more extreme cold weather events to occur. While some research supports this concept, others do not and the impact of climate change on cold weather events is not fully understood (National Geographic 2019). Extreme heat and cold result in greater strain on utilities, increasing the likelihood of utility interruption.

An increase in the intensity of severe weather events is anticipated as the climate continues to change. This will include wind events such as hurricanes, tornadoes, and wind associated with thunderstorms, among other phenomena. More storms with higher winds will increase the chance that the utility infrastructure will be impacted by these storms. Additionally, an increase in precipitation is projected, which could come in the form of heavy downpours or winter weather thus causing additional utility interruptions. Increased risk of drought may also threaten water utilities and increase risk of wildfires (Commonwealth of Pennsylvania 2021). While Philadelphia has historically not faced risk from wildfires, changing climate conditions and prolonged dry periods may elevate the potential for localized wildfire events, which could endanger public safety and critical infrastructure.

2.2 COMMUNITY FACTS

Philadelphia is home to over 1.6 million people and ranks as the six most-populous city in the United States (U.S. Census 2024). The City is located at the confluence of the Delaware and Schuylkill Rivers and has a diverse population that is slowly growing. With numerous universities and colleges, the City is an international education destination. The Philadelphia region has a gross domestic product (GDP) of $518 billion which ranks as the tenth largest metropolitan GDP in the United States (U.S. Bureau of Economic Analysis 2023). In 2015, Philadelphia became the first U.S. World Heritage City. Philadelphia offers many historical destinations and is home to 67 National Historic Landmarks (Philadelphia International Airport n.d.). Philadelphia's cultural strengths, along with increasing development, position Philadelphia for growth in residents, businesses, and industry.

2.2.1 Location

Philadelphia initially encompassed the area between South and Vine Streets, ending at the Delaware and Schuylkill Rivers. In 1854, citizens voted to pass a bill that consolidated settlements that sprang up outside the City's borders (such as Northern Liberties, Spring Garden, and Moyamensing) into what would become the county, and City, of Philadelphia (Independence Hall Association n.d.).

Today, the City encompasses 134.1 square miles of land in the southeastern region of Pennsylvania. The City is bordered by Bucks County to its north, Montgomery County to its west, Delaware County to its south, and the State of New Jersey to its east (the Delaware River separates the City of Philadelphia from the State of New Jersey). Philadelphia is the largest city in Pennsylvania. The City of Philadelphia is coterminous to Philadelphia County, meaning the City and County of Philadelphia share the same boundaries. The U.S. Census Bureau places Philadelphia at the urban center of a four-state "Greater Philadelphia" region, otherwise known as the Delaware Valley, which is comprised of the 11 counties within the Metropolitan Statistical Area of Philadelphia-Camden-Wilmington. The Delaware Valley is home to approximately six million people and is the country's sixth-largest metropolitan area (U.S. Bureau of Economic Analysis 2023). Figure 2-5 displays City of Philadelphia and its Planning Districts.

2.2.2 Planning Districts

The Philadelphia City Planning Commission (PCPC) divided Philadelphia neighborhoods into 18 planning districts, as shown Figure 2-5. The City's current comprehensive plan, Philadelphia 2035 is broken out into plans for each of these planning districts. These districts overlap with 21 police districts, 13 fire battalion districts, and 48 zip codes within the City.

2.2.3 History

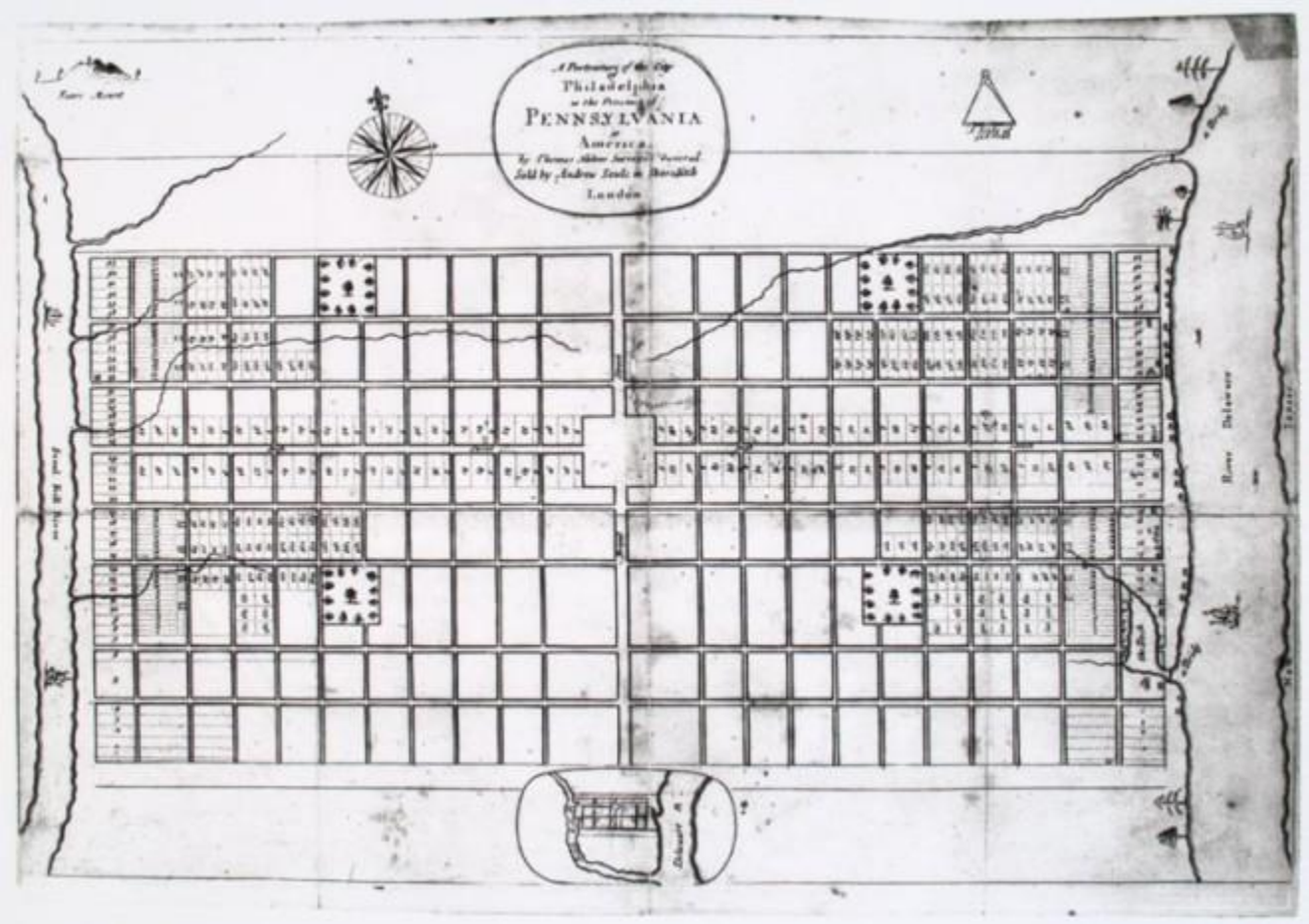
Native American tribes were the first inhabitants of the Philadelphia region. The earliest people, called Paleo-Indians, settled in the vicinity of Philadelphia over 10,000 years ago. When the Swedish settlers arrived in the Delaware Valley in 1638, they referred to the area as Lenapehocking or the "Land of the Lenape" after the members of the Lenni-Lenape tribe that inhabited the region.

Today, the Lenape people maintain a cultural and symbolic presence in the City, despite being previously displaced and forcibly relocated to areas like Oklahoma and Wisconsin in the 19th century. The City has formally initiated a "Land and Life Acknowledgement" to recognize the Lenni-Lenape and other Indigenous peoples' historical and ongoing presence. Traditional Ecological Knowledge (TKE) is integrated into urban agriculture efforts with the Department of Parks and Recreation and the University of Pennsylvania works to educate the public about the Lenape's deep-rooted history in the region.

This enduring legacy continues to shape Philadelphia's identity, even as the City evolved through centuries of colonial expansion and cultural transformation. As European settlers arrived and began renaming the landscape, the Lenape's influence remained embedded in the region's history. The English later renamed the river and the tribe "Delaware," after Lord de la Warr, the governor of the Jamestown colony. In 1682, William Penn arrived with a vision to build a city between the Schuylkill and Delaware Rivers. He made numerous treaties with the Delaware Indians, compensating them for the acquisition of land (Baulis 2006). The City he founded was named Philadelphia, from the Greek words *philos* (loving) and *adelphos* (brother), earning it the enduring title: the City of Brotherly Love (Satullo 2011).

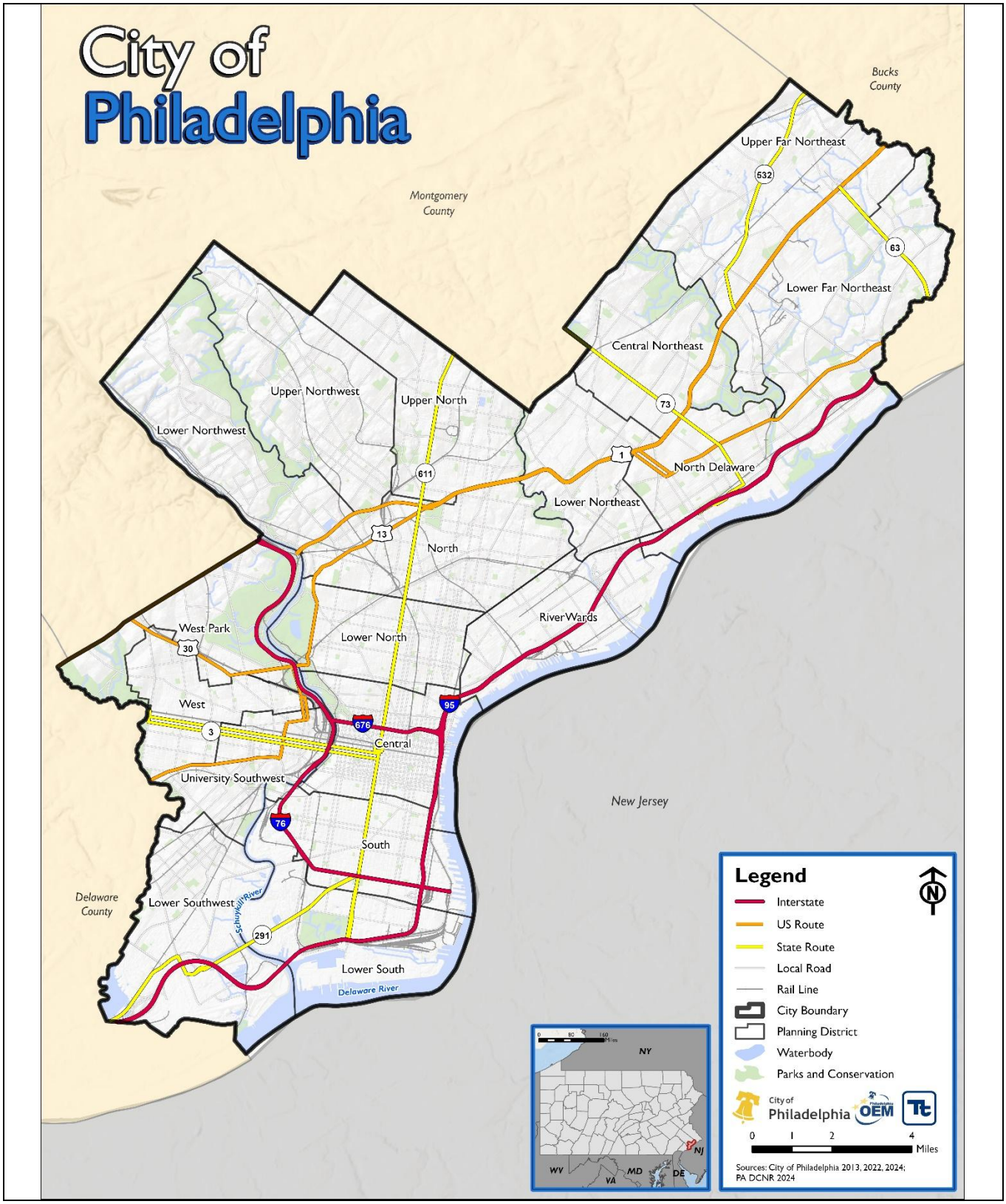
William Penn's early plan with gridded streets interspersed with plazas still defines Philadelphia. Long, straight streets running east-west and north-south were surveyed over the landscape creating a grid of the land between the Delaware and Schuylkill Rivers, see Figure 2-4. The grid was an efficient way of selling real estate and thereby growing the population of Philadelphia. Philadelphia grew rapidly during the first few decades of the City's existence, expanding from a few hundred inhabitants in 1683 to over 2,000 in 1700. Immigration of Germans and Scots-Irish, coupled with growth of the port turned Philadelphia into a major city by the 1750s. During the 1770s, Philadelphia grew into an important colonial city, hosting the First and Second Continental Congresses and the Constitutional Convention (Basile McDaniel 2014). Following the Revolutionary War, Philadelphia was selected to be the temporary capital of the United States. On December 6, 1790, the U.S. Capital officially moved from New York City to Philadelphia. The capital remained in Philadelphia until 1800 when it permanently settled in Washington, D.C. (National Constitution Center 2021).

Figure 2-4 First Map of the City of Philadelphia



Source: (Brin 2015)

Figure 2-5. City of Philadelphia Hazard Mitigation Plan Area



Philadelphia was at the heart of the boom in manufacturing in the late 18th and 19th century. Manufacturing plants, foundries, coal and iron mines were built in the City to support textile, leather, and paper-related industries. From 1800 to 1897, Philadelphia was the leading manufacturing city in the United States. In response, immigrants - mostly from Germany and Ireland - streamed into Philadelphia, increasing the population from 41,220 in 1800 to 565,529 by 1860. Immigrants from eastern and southern Europe, China, Latin America and the Caribbean contributed to the growing diversity of the City (Historical Society of Pennsylvania 2017). By World War I, new jobs led to an increasing African American population from the South. This movement North, known as the Great Migration, caused Philadelphia's black population to nearly double in size. The City's growth continued until the early 1950s (History 2023). As in many Northeast cities, decadeslong de-industrialization resulted in closed factories, population loss, vacant land, and urban decay. By 2010, demographic shifts towards cities and an economic resurgence of urban living began to stabilize and reverse previous decades of population decline (Philadelphia's population increased by 0.6% between 2000 to 2010).

2.2.4 Major Institutions

2.2.4.1 Industries

Economic diversification, the degree to which economic activity is spread across sectors, is one measure of a region's economic resilience (UNFCC n.d.). Philadelphia's economy is made up of a diverse set of industries, with strengths in insurance, law, finance, health, education, utilities, and the arts.

There are three Fortune-500 companies headquartered in Philadelphia (Fortune Media IP 2024). These companies are listed in Table 2-1.

Table 2-1. Fortune 500 and Fortune 100 companies in Philadelphia

Company Headquartered	Industry	Rank
Comcast	Telecommunications	33
Rite Aid	Food and Drug Stores	171
Aramark	Diversified Outsourcing Services	220

Source: Fortune Media IP 2024

In addition to the Fortune-500 companies located in Philadelphia, there are thousands of businesses located within the City's borders. The five largest private employers based in Philadelphia as of 2022 include (Pennsylvania DLI 2024):

- Children's Hospital of Philadelphia
- Thomas Jefferson University and Jefferson Health
- Temple University Hospital
- American Airlines
- Comcast

Like many urban areas in the East and Midwest of the United States, Philadelphia's economy has undergone a major transition in recent decades. Approximately half a century ago, manufacturing dominated the economy, providing almost half of Philadelphia's jobs. As manufacturing employment declined, knowledge-based industries gained prominence with life sciences, information technology, professional services and chemicals ranking among Philadelphia's top industries (Historical Society of Pennsylvania 2017). More recently, sectors such as education

and health services, professional and business services, financial activities, research, and information technology have emerged strongly as principal drivers of the economy. For more information on employment, refer to Section 2.2.5.

2.2.4.2 Colleges and Universities

Philadelphia has many colleges, universities, continuing education institutions, and technical schools within its borders. The City's population of 25- to 34-year-olds with bachelor's degrees more than doubled between 2000 and 2021, growing by 92,500, a 155 percent increase (Campus Philly 2023).

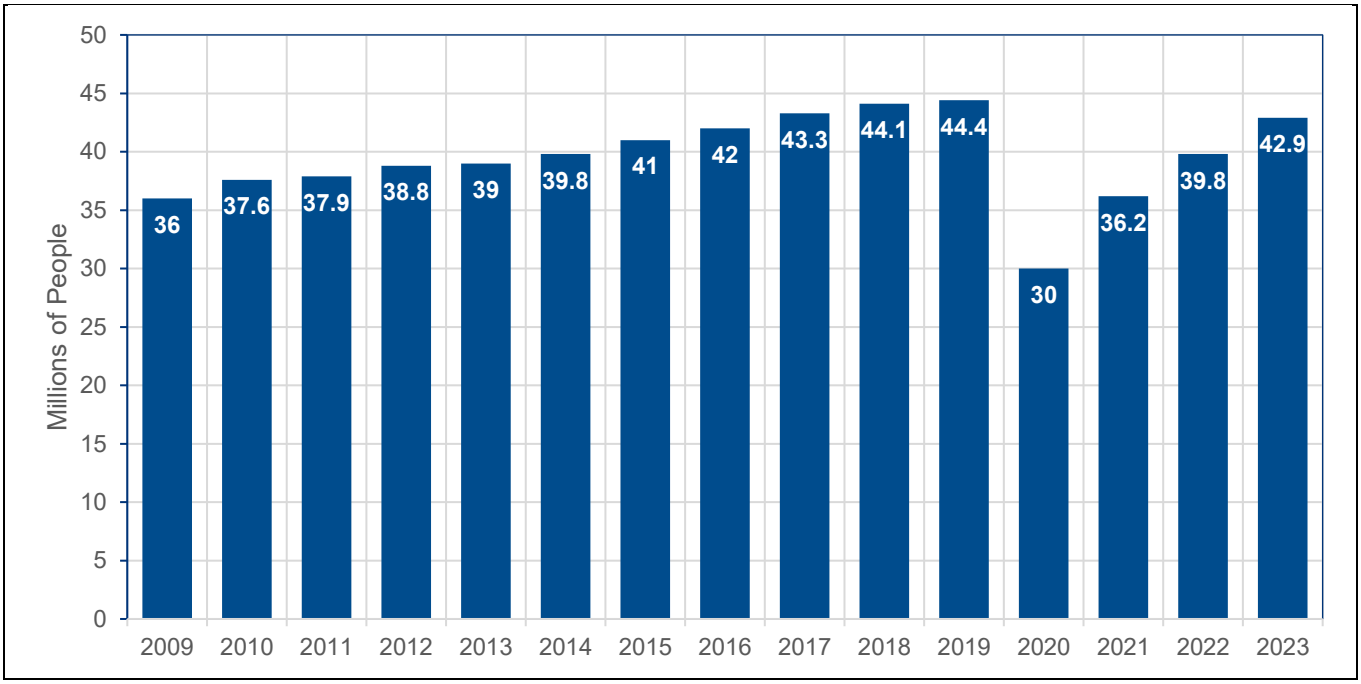
Educational institutions support a stable local economy and generate an educated workforce for the City's various professional industries. Similar to tourists, students attending colleges and universities from outside the City of Philadelphia contribute to a fluctuating City population. Students that commute or only live within the City for a portion of the year may not be as familiar with the City or City services available to them in times of disaster. Colleges and universities in the City include (City of Philadelphia 2022):

- Art Institute of Philadelphia
- Chestnut Hill College
- Community College of Philadelphia
- The Curtis Institute of Music
- Delaware Valley Academy of Medical and Dental Assistants
- Devry University, Center City
- Drexel University
- Harrison Career Institute
- Holy Family University
- Hussain School of Art
- La Salle University
- Lincoln Technical Institute
- Moore College of Art and Design
- Orleans Technical Institute
- Pennsylvania Institute of Technology
- Pennsylvania Academy of the Fine Arts
- Peirce College
- The Restaurant School at Walnut Hill College
- Saint Joseph's University
- Star Technical Institute
- Strayer University, Center City Campus
- Talmudical Yeshiva of Philadelphia
- Temple University
- Thomas Jefferson University
- Thompson Institute
- University of Pennsylvania

2.2.4.3 Tourism

In its 2023 Annual Report, Visit Philadelphia announced that 42.9 million people visited the five-county Greater Philadelphia region in 2023 and contributed to $7.6 billion in visitor spending and supported over 96,300 jobs. This was an increase from 2022's 39.8 million visitors (Visit Philadelphia 2024). Between 2009 and 2019, Philadelphia experienced a 38% growth in overnight visitation and 15% growth in daytime visitation (EConsult Solutions 2020). Figure 2-6 depicts this growth in visitor volume and the impact the COVID-19 pandemic had on tourism in the City, dipping exponentially from 44.4 million visitors in 2019 to just 30 million in 2020.

Figure 2-6. Annual Visitation to Philadelphia, 2009 to 2023



Source: Visit Philadelphia 2024; City of Philadelphia 2022

In addition to tourists visiting the City for its numerous historical landmarks and museums, the City also hosts annual events that draw people to the region, such as the July 4th celebration and the Thanksgiving Day parade. Several recent, high-profile events such as the World Meeting of Families and papal visit in 2015, the Democratic National Convention in 2016, the NFL Draft in 2017, and the 2024 Presidential Debate have created a spotlight on tourism in Philadelphia. The City is set to host the 2026 FIFA World Cup, the 2026 Major League Baseball All-Star Game, and four NCAA Championships during 2027 and 2028.

Tourists will continue to dynamically affect Philadelphia's population over the next five years with the FIFA World Cup and large events celebrating the 250th anniversary of the birth of our nation planned for 2026. As a transient population, tourists may have transportation, language, and accessibility needs during a disaster not captured in city-specific Census data.

2.2.5 Economy

Philadelphia is in the geographical and economic center of the tenth largest Metropolitan Statistical Area (MSA) nationwide, the Philadelphia-Camden-Wilmington MSA (U.S. Bureau of Economic Analysis 2023). A Metropolitan Statistical Area (MSA) is an area defined by the U.S. Office of Management and Budget (OMB) that is linked by significant social and economic interactions and has at least one urbanized area with a minimum population of 50,000 people (U.S. Census 2008).

Gross Domestic Product (GDP) is an estimate of the value of the goods and services produced in an area and can be used to compare the size and growth of a region's economy. The GDP for the Philadelphia-Camden-Wilmington MSA in 2022 was approximately $518 billion (U.S. Bureau of Economic Analysis 2023). Refer to Table 2-2 for the Philadelphia MSA GDP between 2019 and 2023.

Table 2-2. GDP for Philadelphia MSA 2018-2023

2018	2019	2020	2021	2022
$442,000,512	$454,527,770	$444,223,702	$480,905,797	$518,485,094

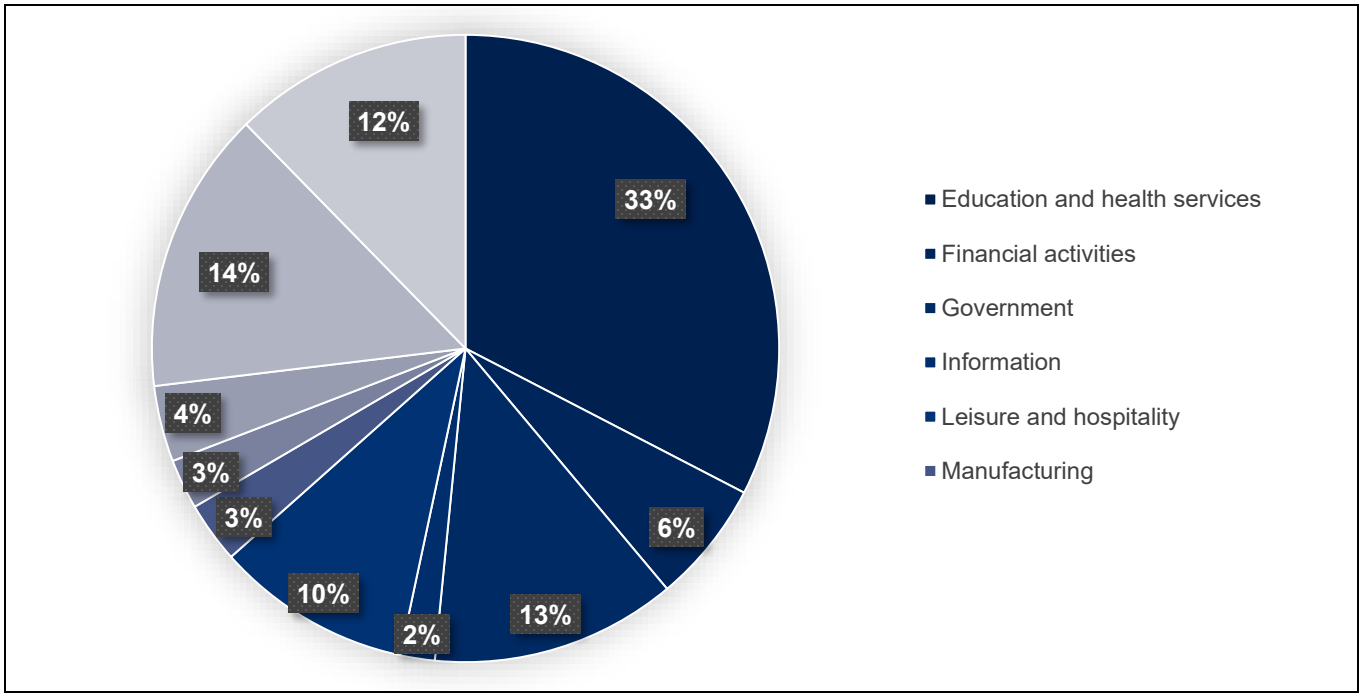
Source: (U.S. Bureau of Economic Analysis 2024)

A healthy economy promotes job growth, high employment rates, and more income, all which give residents and the City the ability to prepare for and quickly recover from disasters when they occur.

2.2.6 Employment

Bureau of Labor Statistics data shows between September 2023 and September 2024, the manufacturing, information, trade, transportation, and utilities sectors all declined in employment. Educational and healthcare services continue to be the leading industry in Philadelphia, making up 32.6 percent of all employment in the City (U.S. Bureau of Labor Statistics 2024). Figure 2-7 displays employment by industry in Philadelphia by percentage. Table 2-3 depicts Philadelphia's employment by industry in both 2019 and in 2024. Table 2-4 summarizes labor force and employment data for the Philadelphia-Camden-Wilmington MSA between 2014 and 2024.

Figure 2-7. Philadelphia Employment by Industry, 2024



Source: U.S. Bureau of Labor Statistics 2024

Table 2-3. Individuals Employed by Industry in 2019 and 2024

Industry	Individuals Employed August 2019	Individuals Employed September 2024
Education and health services	226,300	335,800
Financial activities	42,500	64,800
Government	107,800	130,500
Information	11,600	18,400
Leisure and hospitality	47,400	103,900
Manufacturing	18,100	32,400
Mining, logging, and construction	12,300	26,600
Other services	25,500	40,400
Professional and business services	98,700	150,200
Trade, transportation, and utilities	90,300	127,000

Source: U.S. Bureau of Labor Statistics 2024; City of Philadelphia 2022

Table 2-4. Philadelphia-Camden-Wilmington MSA Labor Force Estimates, 2014-2024

Year	Labor Force	Employment	Unemployment	Unemployment Rate
2014	3,020,379	2,822,213	198,166	6.6
2015	3,046,262	2,874,937	171,325	5.6
2016	3,084,825	2,916,775	168,050	5.4
2017	3,123,352	2,958,719	164,633	5.3
2018	3,128,392	2,982,597	145,795	4.7
2019	3,198,831	3,050,320	148,511	4.6
2020	3,201,564	2,868,310	333,254	10.4
2021	3,169,759	2,967,142	202,617	6.4
2022	3,236,385	3,091,491	144,894	4.5
2023	3,270,822	3,129,620	141,202	4.3
2024	3,276,995	3,126,267	150,728	4.6

Source: U.S. Bureau of Labor and Statistics 2024
Note: The COVID-19 Pandemic reached its peak in 2020, which greatly impacted the unemployment rates in the City.

2.2.7 Income

The median household income in the City, according to the 2022 American Community Survey 5-year estimates, was $ 57,537, which is below the state ($73,170) and national ($75,149) figures (U.S. Census, 2022 American Community Survey 2022). Table 2-5 shows City, state, and national median household incomes between 2018 and 2022, as calculated by the U.S. Census Bureau and Federal Reserve Economic Data.

Table 2-5. Philadelphia Median Household Income, 2018-2022

Year	Philadelphia Median Household Income	Pennsylvania Median Household Income	National Median Household Income
2018	$46,149	$64,520	$61,937
2019	$47,598	$70,580	$68,703
2020	$55,102	$70,790	$67,521
2021	$52,882	$72,630	$76,330
2022	$56,385	$72,210	$74,580

Source: Federal Reserve Bank of St. Louis 2024; Federal Reserve Bank of St. Louis 2023; U.S. Census 2023

75.9 percent of Philadelphia households receive their income through earnings, 28.3 percent receive Social Security, and 18.3 percent receive retirement income other than Social Security. In addition, 9.6 percent of Philadelphians received Supplemental Security Income and 5.9 percent received public assistance income, with a mean cash public assistance income of $2,865 (U.S. Census, 2022 American Community Survey 2022). Some households received income from more than one source.

2.2.8 Natural, Historic and Cultural Resources

2.2.8.1 Natural

As noted in Section 2.4.2, Philadelphia's Parks and Recreation (PPR) oversees over 300 neighborhood parks, recreation centers and playgroups, 166 miles of trails and 22 historic and cultural sites, 60 community gardens, farms, and orchards, 3 environmental education centers, numerous recreational fields, and pools, and 6 golf courses (Philadelphia Parks and Recreation 2024). All contribute to our City's green open space, or land that is partly or completely covered with grass, trees, shrubs, or other vegetation.

2.2.8.2 Historic

Philadelphia is one of the oldest cities in the nation and has numerous historically significant sites. These include the Betsy Ross House, Independence Hall, the Liberty Bell, and the Constitution Center, with additional sites throughout the City.

In 2016, The Pennsylvania State Historic Preservation Office conducted a study to gather up to-date information on historic buildings listed in the National Register of Historic Places) and the Philadelphia Register of Historic Places located in flood prone areas. This study, conducted between January and March 2016, found the following (Pennsylvania Historical and Museum Commission 2024):

- A total of 568 designated historic structures in flood inundation areas throughout the City
- Approximately 289 structures in the 100-year flood hazard area
- Approximately 272 structures within the 500-year flood hazard area
- 160 structures vulnerable to projected sea level rise in the future

Phase II of this study, conducted by the U.S. Army Corps of Engineers (USACE) and completed in April 2018, consisted of a nonstructured assessment of 25 identified structures in Phase I of this study. Nonstructural flood mitigation and adaptive measures were recommended for each of the 25 structures. Phase II of this study only offers potential flood mitigation techniques but does not determine the feasibility of each recommended action

(Pennsylvania Historical and Museum Commission 2024). Findings from this study, and identified gaps in data and information, were referenced when developing the mitigation strategy of the 2022 Hazard Mitigation Plan.

2.2.8.3 Cultural

Philadelphia has some of the best cultural institutions in the world. The following are some of Philadelphia's most visited museums, stadiums, iconic sites, zoos, theaters, and concert halls (City of Philadelphia 2022).

- Museums
  - Philadelphia Museum of Art
  - Polish American Cultural Center Museum
  - The Franklin Institute
  - Historical Society of Pennsylvania
  - Academy of Natural Sciences
  - National Liberty Museum
  - Please Touch Museum
  - Fabric Workshop and Museum
  - Penn Museum
  - Civil War Library and Museum
  - Rodin Museum
  - Wagner Free Institute of Science
  - National Museum of American Jewish History
  - Mummers Museum
  - Mutter Museum
  - Franklin Court
  - African American Museum
  - Fireman's Hall
  - Independence Seaport Museum
  - USS Becuna
  - Simeone Foundation Museum
  - Woodmere Art Museum
  - Rosenbach Museum and Library
- Historic and Cultural Sites
  - Independence Hall
  - Bishop White House
  - Masonic Temple
  - Second Bank of the U.S.
  - Independence National Historical Visitors Center
  - Cathedral Basilica of SS. Peter and Paul
  - Eastern State Penitentiary
  - Pennsylvania Convention Center
  - National Constitution Center
  - Gloria Dei Church
  - City Hall
  - Boathouse Row and Schuylkill River rowing course
  - U.S. Mint
  - Love Park
  - Liberty Bell Center
  - Rittenhouse Square
  - Todd House
  - Washington Square
  - Christ Church
  - Reading Terminal Market
  - Independence Mall
  - Italian Market
  - Congress Hall
  - Betsy Ross House
  - Historic Germantown

- Theaters/Concert Halls
  - Kimmel Center for the Performing Arts
  - Painted Bride Art Center
  - Arden Theatre Company
  - Academy of Music
  - Wilma Theater
  - Curtis Institute of Music
  - Walnut Street Theatre
  - Mann Center for the Performing Arts
  - The Dell Music Center
- Stadiums/Arenas
  - Citizens Bank Park
  - Palestra
  - Lincoln Financial Field
  - Liacouras Center
  - Wells Fargo Center
  - Tom Gola Arena
  - Franklin Field
  - Hagan Arena
  - Zoos/Nature Centers
  - Philadelphia Zoo
  - Shofuso Japanese House and Garden
  - Morris Arboretum
  - Bartram's Garden
  - Fairmount Park
  - John Heinz Wildlife Refuge

2.3 POPULATION AND DEMOGRAPHICS

2.3.1 Current Population

The City of Philadelphia is the sixth most populous city in the United States, and the most populous city in the Commonwealth of Pennsylvania with an estimated population of 1,603,797 as of 2020. According to the U.S. Census Bureau, the City's population increased by approximately 5.06 percent between 2010 and 2020 (Census 2020). Figure 2-8 shows the distribution of population by density (residents per square mile) across the City.

2.3.2 Population Trends

Population trend information was evaluated to estimate future shifts that could significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

Estimated population projections provided by the Center of Rural Pennsylvania indicates that the City's population will continue to increase into 2040, increasing total population to approximately 1,772,833 persons; this is approximately a 10.53 percent increase from the City's 2020 population of 1,603,797 (Center for Rural Pennsylvania 2020).

Philadelphia experienced steady growth between 1860 and 1950, except for a brief lull in 1930, which was in part due to the Great Depression. The City's population peaked in the 1950s and has been steadily declining. However, since 2010, Philadelphia has slowly gained population. Table 2-6 displays the historic and projected population change in the City; Figure 2-9 shows the historic population change.

Figure 2-8. City of Philadelphia Total Population per Square Mile by Census Tract

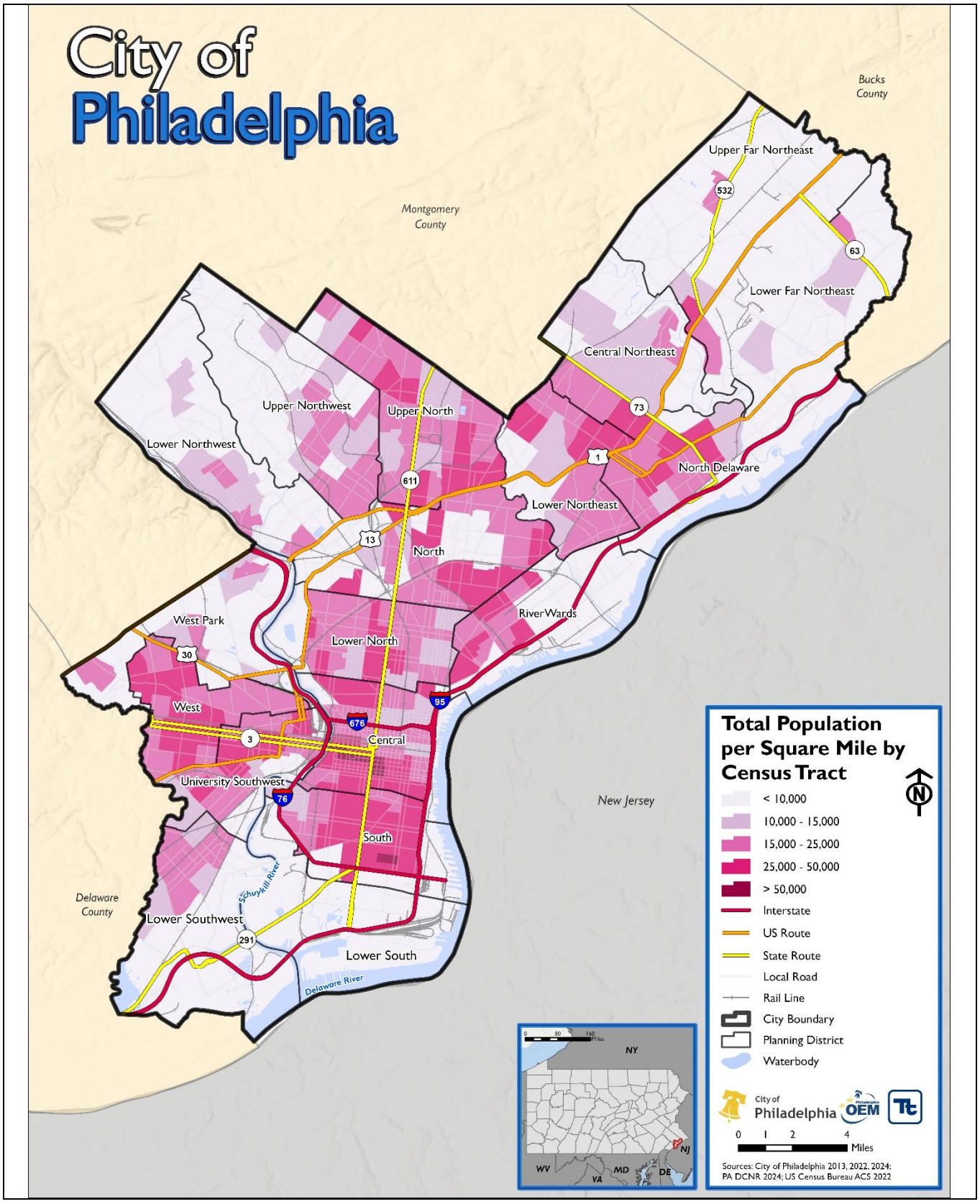
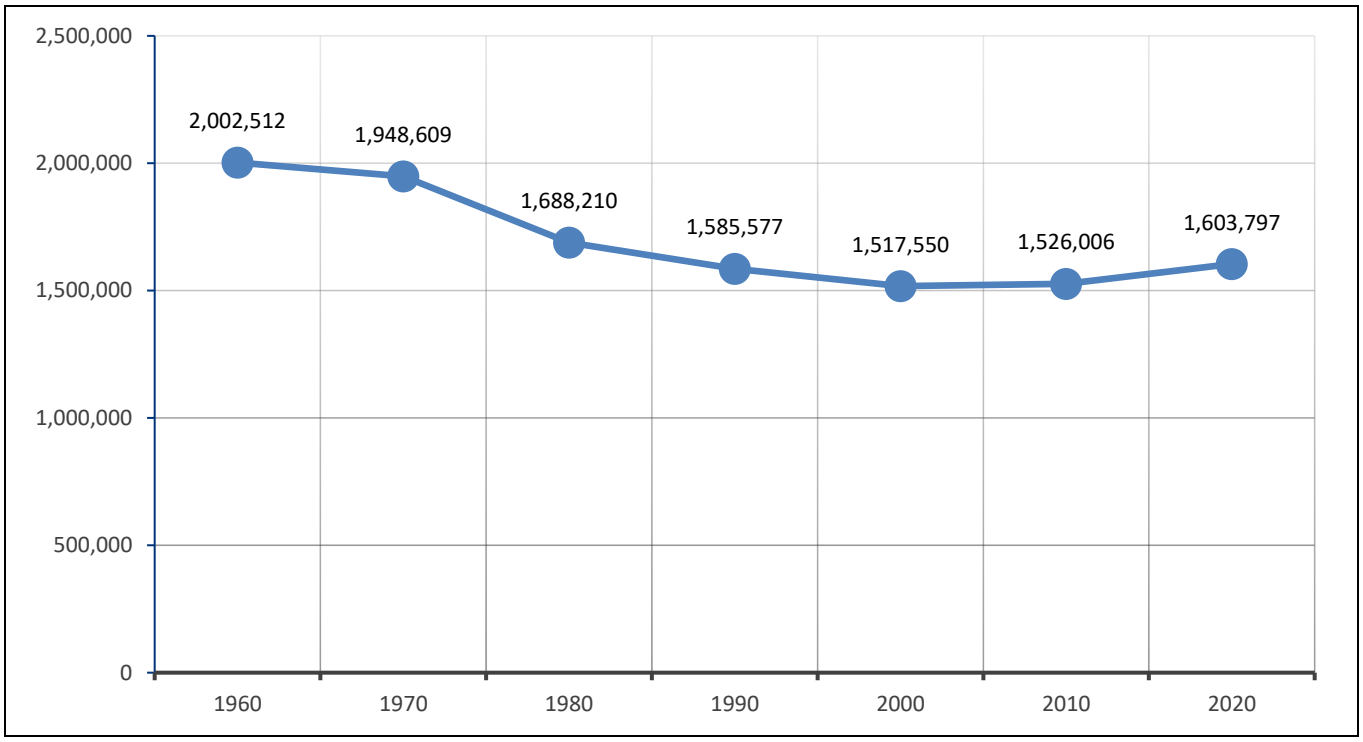


Table 2-6. Historical and Projected Population Change in City of Philadelphia

Historical City of Philadelphia Population							Projected City of Philadelphia Population	
1960	1970	1980	1990	2000	2010	2020	2030	2040
2,002,512	1,948,609	1,688,210	1,585,577	1,517,550	1,526,006	1,603,797	1,706,670	1,772,833

Source: U.S. Census 2023; Center for Rural Pennsylvania 2020; Pennsylvania State Data Center 2021

Figure 2-9. Philadelphia Historic Population Change, 1960 to 2020



Source: U.S. Census 2023; Pennsylvania State Data Center 2021

2.3.2.1 Working Population

Approximately 261,019 people commute into Philadelphia for work, while 175,326 leave the City for employment elsewhere (Pew Charitable Trusts 2024). This leads to an 85,693 net gain in daytime population, increasing the total population of Philadelphia to approximately 1,689,490 during daytime working hours. Table 2-7 details the inbound and outbound population change by county. Transient populations are often more at-risk during disasters because they are less familiar with the City and its hazards. The high number of commuters into the City highlights the importance and necessity of workplace preparedness and emergency response training for employees.

Table 2-7. Average Daily Inbound and Outbound Population by County

County	Inbound to Philadelphia	Outbound from Philadelphia	Net Population Gain
Bucks County, PA	38,922	35,722	3,200
Burlington County, NJ	17,497	2,496	15,001
Camden County, NJ	27,948	3,093	24,855

County	Inbound to Philadelphia	Outbound from Philadelphia	Net Population Gain
Chester Couty, PA	19,708	14,169	5,539
Delaware County, PA	62,359	31,114	31,245
Gloucester County, NJ	14,231	1,889	12,342
Montgomery County, PA	72,250	83,599	-11,349
New Castle County, DE	8,104	3,244	4,860
Total	**261,019**	**175,326**	**85,693**

Source: Pew Charitable Trusts 2024

COVID-19 significantly changed workplace dynamics in Philadelphia and across the nation. Approximately 13.8 percent of workers ages 16 and older reported working from home in 2022 (U.S. Census, 2022 American Community Survey 2022). Based on responses to the U.S. Census Bureau's Household Pulse Survey between August 20, 2024 and September 16, 2024, approximately 13.9 percent of those surveyed reported living in households where at least one adult has teleworked or worked from home five or more times in the last seven days (U.S. Census 2024).

2.3.3 Socially Vulnerable Populations

Social vulnerability refers to the intersectionality of social factors contributing to communities, families, and individuals having existing needs that are intensified when encountering hazards and other community-level stressors. These factors include, but are not limited to, financial circumstances, health, age, functional status, communication barriers, presence of chronic illness, or an access and functional need (AFN) (FEMA 2019). Historic, discriminatory policies such as redlining have also placed communities of color and low-income communities at more risk for experiencing impacts from disasters. These amplified needs often result in increased costs and challenges for individuals or households when responding to unforeseen hazards, thereby complicating recovery efforts. Consequently, certain populations are at greater risk of injury, fatalities, displacement, or economic hardship following a disaster.

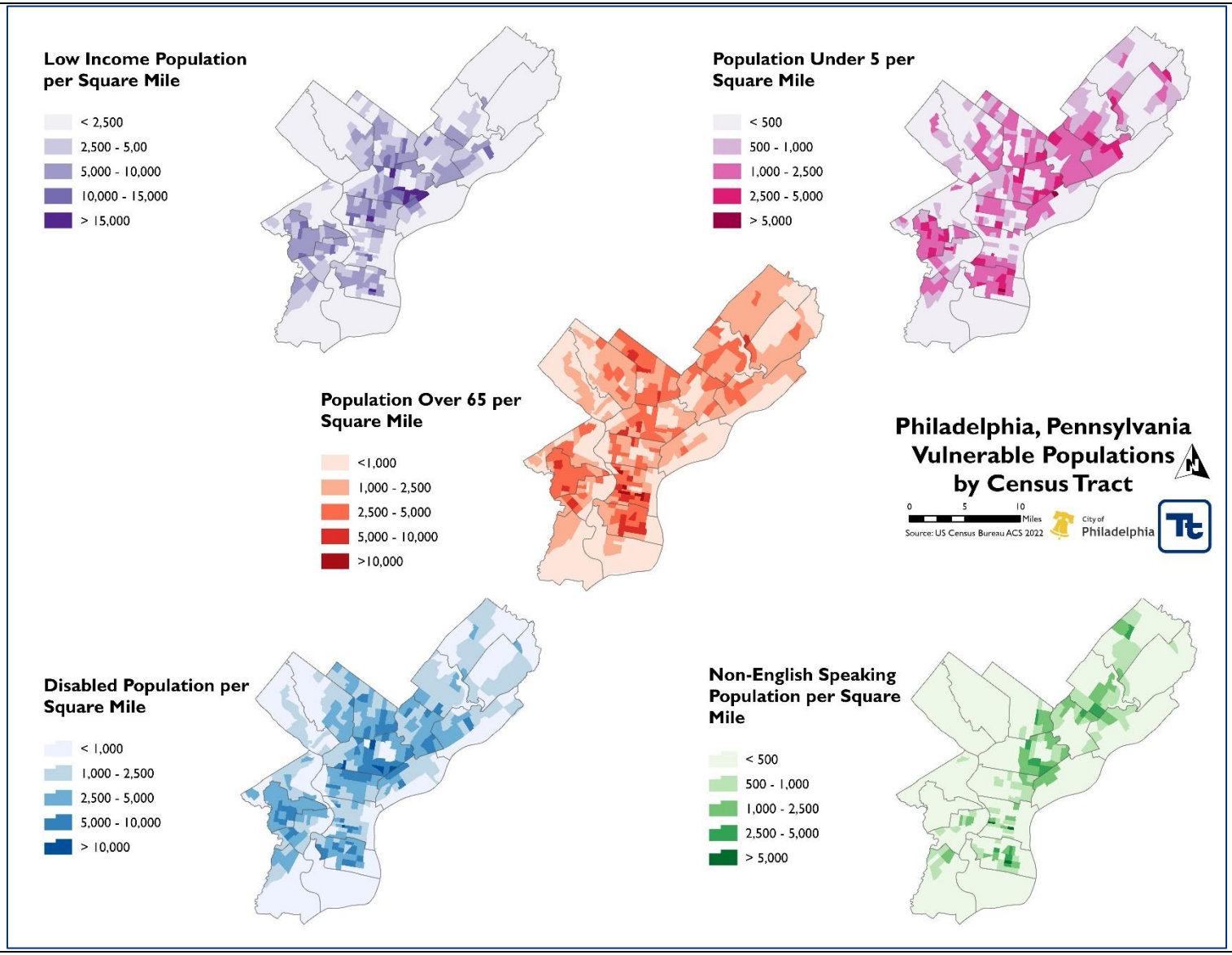
Federal regulations for hazard mitigation plans require that hazard mitigation plans consider socially vulnerable populations. These populations can be more susceptible to hazard events based on a number of factors including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing. Refer to Table 2-8 for population statistics for these socially vulnerable populations, for each Planning District in the City based on the 2022 American Community Survey 5-Year Population Estimate data. Figure 2-10 visualizes the population per square mile of various socially vulnerable populations by census tract.

The following non-exhaustive list outlines populations that are likely to experience both existing and emergent needs during various hazards and emergencies. It is important to recognize that disasters impact diverse groups, and this guidance should be viewed as an initial reference. To accurately identify and address unmet needs during a disaster response, it is essential to engage directly with affected communities and the organizations serving them to obtain real-time information. According to FEMA's Guide to Expanding Mitigation: Making the Connection to Equity (2020), populations who may be disproportionately impacted by disaster include:

- Members of the LGBTQ+ community
- People of color
- Tribal and first nation communities
- Renters
- Service workers and migrant laborers
- Women

- Populations over the age of 65 or under the age of 5
- People with disabilities
- Institutionalized populations, such as those in intermediate care facilities for individuals with disabilities psychiatric residential treatment facilities; programs of all-inclusive care for older adults; religious nonmedical health care institutions; and inpatient hospices
- Historically Underserved Communities including Black, Indigenous, and People of Color (BIPOC)
- Unstable and transient housing

Figure 2-10. City of Philadelphia Socially Vulnerable Populations by Census Tract



2.3.3.1 Age

Children are especially vulnerable during disasters due to their developing organs and lower immunity, which increase their risk of dehydration, asthma, heat-related illnesses, and stress-induced health issues. Their dependence on adults for access to resources and services further heightens this vulnerability, especially when standard safeguarding measures may be disrupted.

Older adults face increased risks during disasters due to weaker immune systems, greater susceptibility to dehydration, and longer recovery times from physical and mental health impacts. Disruptions to Activities of Daily Living (ADL) services can lead to worsening of existing health conditions, especially for those with mobility, sensory, or cognitive impairments. Older adults may lack the economic resources necessary for response to hazard events and may have difficulty evactuating their homes. Additionally, some older adults may be hesitant to seek support due to stigma or a strong desire to remain self-reliant, further complicating their ability to access needed care.

According to the 2022 American Community Survey 5-year estimates, the median age in the City was 34.8 years. The 2022 American Community Survey reports 6.2 percent of the population of Philadelphia is under the age of 5 and 14 percent is 65 or older.

2.3.3.2 Low Income

Individuals living below the federal poverty line are inherently more at risk of experiencing debilitating impacts from the natural and human-caused hazards and threats identified in this plan because they may not have the financial means to adequately prepare, respond and recover. For example, FEMA recommends that families and individuals keep a small cash reserve in case of disaster. For those that struggle to put food on the table, this can be a difficult, or even impossible, feat. Insurance – such as home insurance or flood insurance - is another positive indicator of faster recovery from disasters. However, many living in poverty may not have the resources to prioritize insurance. The U.S. Census Bureau identifies households with two adults and two children with an annual household income below $30,900 per year as *low income* (U.S. Census 2023). The 2022 American Community Survey 5-year estimates indicates that 22.1 percent of persons live below the poverty level within the City.

The spatial U.S. Census data for household income provided in Hazus includes two income ranges (less than $10,000 per year and $10,000 to $20,000 per year) that were totaled to provide the low-income data used in this study. This does not correspond exactly with the poverty thresholds based on U.S. Census Bureau data, but the difference is not believed to be significant for the purposes of this planning effort.

While the poverty threshold is typically used as a standard for identifying low-income populations, the Steering Committee noted that households may be above the poverty threshold but still struggle financially, making them socially vulnerable to hazard events. The City also used data available from United for Asset Limited, Income Constrained, Employed (ALICE) households. This dataset is meant to identify households with income above the federal poverty threshold but below the basic cost of living. This represents the growing number of families who are unable to afford the basics of housing, childcare, food, transportation, health care, and technology (United For ALICE 2024). Costs associated with hazard events could exceed the financial capacity of these households, making them highly vulnerable to hazard events.

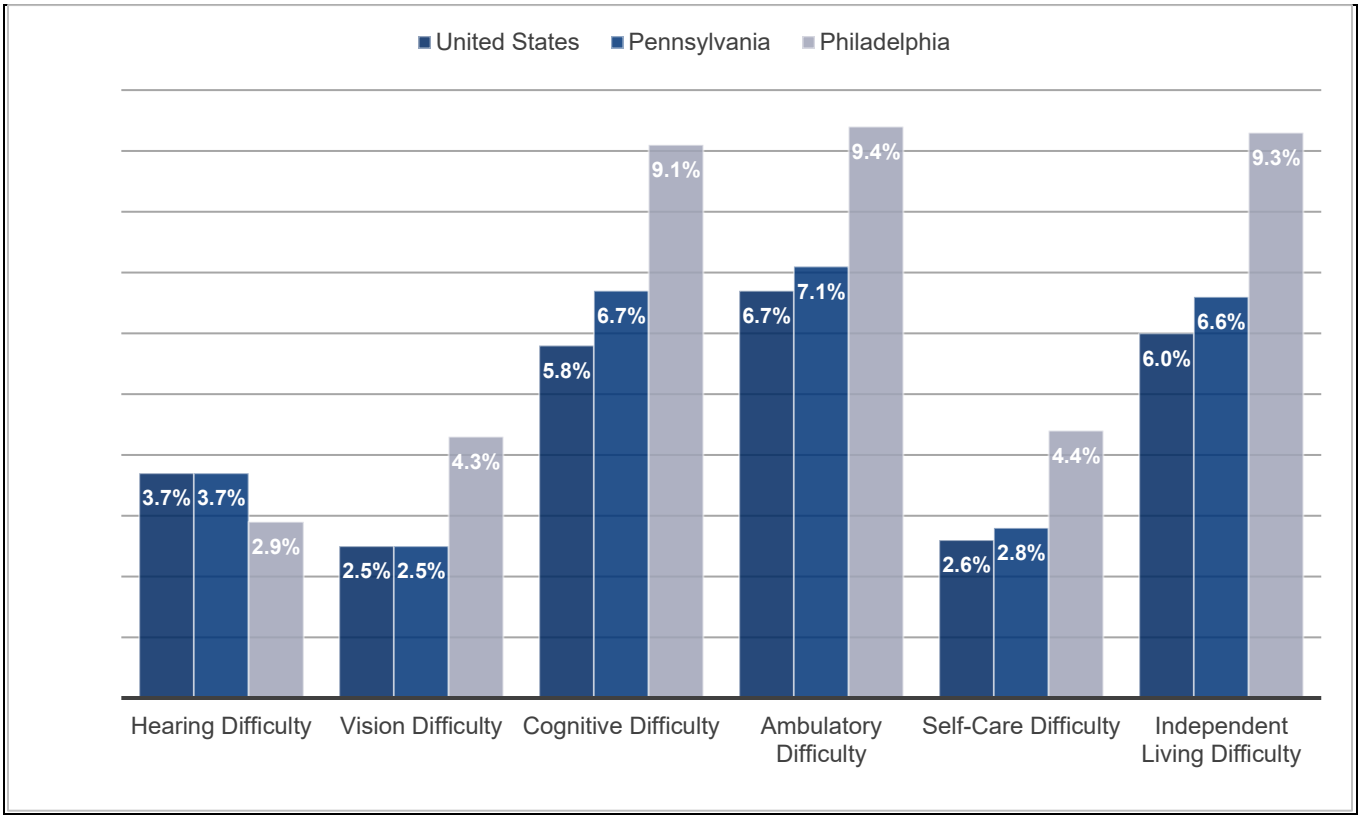
According to 2022 data, 26 percent of the 695,320 households in the City of Philadelphia are ALICE households (compared to the state average of 28 percent). The median household income in the City is $56,517 and sees a labor force participation rate of 64 percent (compared to the state average of 63 percent). The City faces a lower-than-average household income compared to the state average of $79,557 and suffers from a higher-than-average poverty rate at 21 percent (compared to the state average of 12 percent).

2.3.3.3 People With Disabilities

Disability exists when there is a difference between society's expectation of what the body should do and what an individual's body is capable of doing. There is an important difference between impairments and disabilities. Impairments are the functional limitations an individual might face (i.e., not being able to walk). Disabilities, on the other hand, are the disadvantages imposed on individuals by a society that is not built for the individual's functional limitations and their resulting impairment, leading to difficulties navigating the existing social and built environment.

Cognitive impairments can increase the level of difficulty that individuals might face during an emergency and reduce an individual's capacity to receive, process, and respond to emergency information or warnings. Individuals with a physical or sensory disability can face issues of mobility, sight, hearing, or reliance on specialized medical equipment. Additional accommodations may be necessary for individuals with disabilities and access and functional needs during the response and recovery phases of a disaster. According to the 2022 American Community Survey 5-year estimates, 267,675 residents in Philadelphia are living with a disability. This includes individuals with hearing, vision, cognitive, ambulatory, self-care, and independent living difficulties. Figure 2-11 details the percentage of Philadelphia residents who reported having one or more disabilities in Philadelphia, Pennsylvania, and the United States.

Figure 2-11. Percentage of Philadelphia's Population with a Disability Compared to the State and Nation



Source: U.S. Census 2023 American Community Survey, 1-Year Estimate 2023

2.3.3.4 Non-English Speakers

Individuals who lack a working proficiency in English are vulnerable because they can have difficulty with understanding information being conveyed to them. Cultural differences also can add complexity to how information

is being conveyed to populations with limited proficiency of English. According to the 2022 American Community Survey 5-year estimates, 358,940 individuals over the age of 5 primarily speak a language other than English at home; within that group 165,902 individuals are reported as speaking English "less than very well." Of the population speaking a language other than English at home, 167,355 speak Spanish, 81,080 speak Asian and Pacific Island languages, and 80,211 speak other Indo-European languages (U.S. Census, 2022 American Community Survey 2022). When distributing information on hazard risk and preparedness measures, materials should be translated into multiple languages. Emergency responders should also be equipped with tools and resources that allow them to communicate with non-English speaking residents on scene.

2.3.3.5 Individuals Who Are Unhoused

Individuals who are unhoused are at greater risk for many of the hazards identified in this plan. Natural hazards such as extreme temperatures and severe weather leave unsheltered individuals exposed to the elements and without adequate resources to shelter-in-place, access food, and access healthcare when needed (CDC 2024). Individuals who are unhoused face heightened vulnerability during sanitation system disruptions, such as flooding, which can lead to unsafe living conditions and increased exposure to contaminated water. These conditions significantly raise the risk of waterborne diseases and other hygiene-related illnesses due to limited access to clean water, sanitation facilities, and medical care. The lack of stable shelter further complicates efforts to manage and contain outbreaks, placing both unhoused individuals and the broader community at greater public health risk.

According to the Philadelphia Office of Homeless Services (OHS), as of 2024 there were approximately 5,191 persons in Philadelphia who are unhoused. This number represents a "point-in-time count" (PIT) of people who are unhoused as defined by the U.S. Department of Housing and Urban Development. This was a 15.6 percent increase since 2022 (4,489). The 2024 Winter PIT Count revealed a total of 4,215 persons were sheltered in Emergency Shelter, Safe Haven, or Transitional Housing programs and 976 persons remained unsheltered (Philadelphia Office of Homeless Services 2024).

The COVID-19 Pandemic highlighted the increased risk of those individuals who are unhoused. Unhoused individuals are more likely to have a higher risk of exposure to infectious diseases and often lack adequate access to resources, healthcare, and treatment needed to prevent and treat infectious diseases (CDC 2024).

2.3.3.6 Social Vulnerability Index

FEMA's National Risk Index incorporates the Social Vulnerability Index published by the University of South Carolina's Hazards and Vulnerability Research Institute into its overall hazard risk calculation for each county and census track. This social vulnerability score represents the relative level of vulnerability of a location in comparison to other communities across the nation. Philadelphia received an overall social vulnerability rating of "very high," indicating higher vulnerability in comparison to other communities across the nation and the State. Figure 2-12 shows the City Social Vulnerability Index from the FEMA National Risk Index (FEMA 2019).

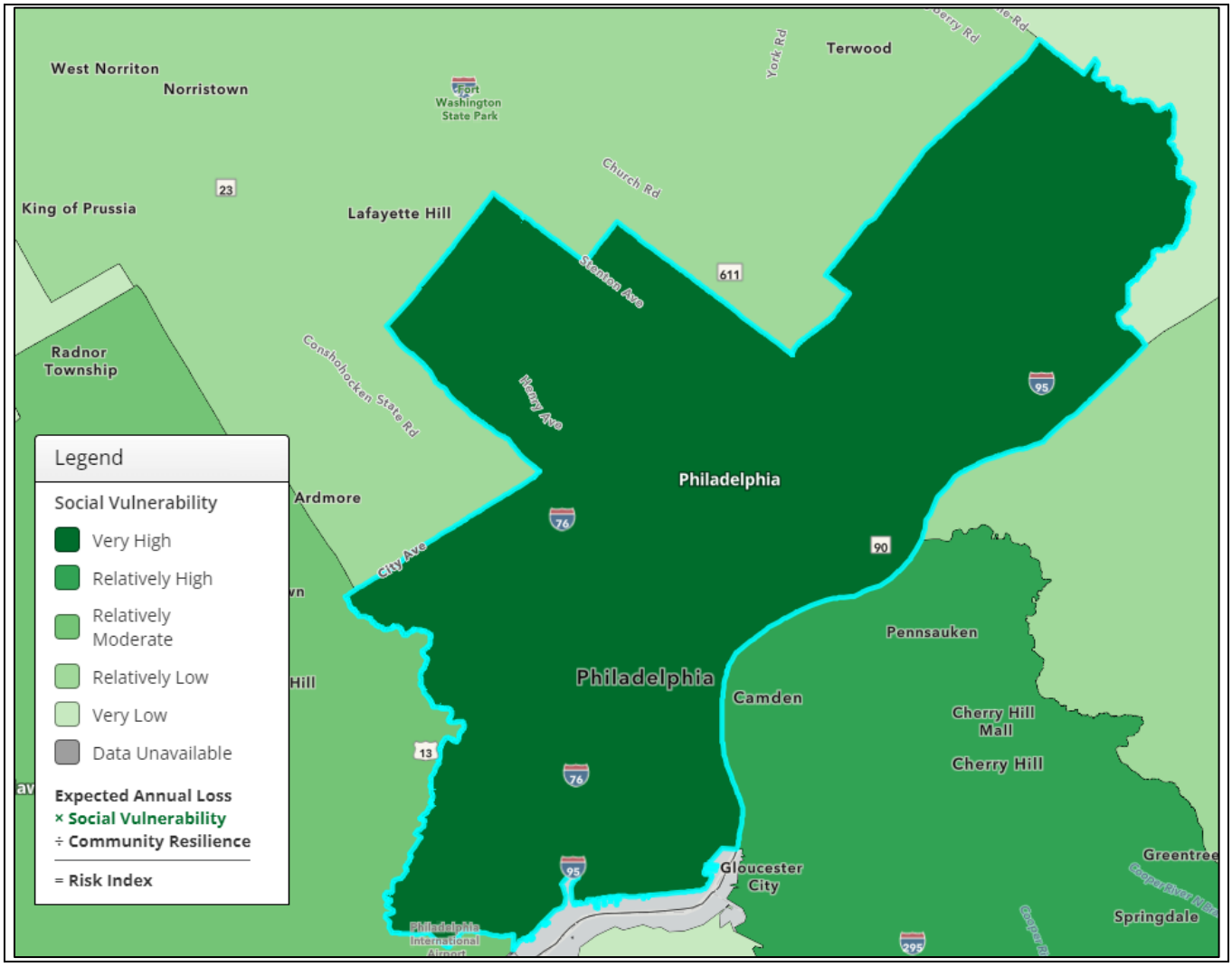
Social vulnerability can be considered and analyzed in a variety of ways. The Center of Disease Control (CDC) Social Vulnerability Index is a database to help emergency response planners and public health officials identify and map communities that will most likely need support before, during, and after a hazardous event. The CDC Social Vulnerability Index uses U.S. Census data to examine social vulnerability at the census tract level for 15 social factors, including poverty, lack of vehicle access, and crowded housing. Figure 2-13 shows the social vulnerability index score from the CDC by Planning District.

Table 2-8. Socially Vulnerable Populations in the City of Philadelphia

Planning District	American Community Survey 5-Year Population Estimates (2022)									
	Population Over 65		Population Under 5		Non-English-Speaking Population		Population with Disability		Population Below Poverty Level	
	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total
Central	20,572	15.1%	5,033	3.7%	5,649	4.1%	11,714	8.6%	14,340	10.5%
Central Northeast	15,291	17.8%	6,332	7.4%	11,499	13.4%	12,956	15.1%	15,582	18.2%
Lower Far Northeast	11,898	16.5%	5,141	7.1%	3,915	5.4%	9,621	13.4%	5,889	8.2%
Lower North	10,055	10.1%	4,936	5.0%	5,361	5.4%	19,685	19.8%	32,707	33.0%
Lower Northeast	11,245	10.5%	8,865	8.3%	8,735	8.2%	20,526	19.2%	28,876	27.0%
Lower Northwest	7,850	14.4%	2,798	5.1%	624	1.1%	6,867	12.6%	4,835	8.9%
Lower South	1,230	19.0%	375	5.8%	413	6.4%	792	12.3%	378	5.9%
Lower Southwest	4,640	10.8%	2,672	6.2%	3,721	8.7%	6,452	15.0%	11,439	26.7%
North	16,712	12.3%	10,450	7.7%	19,405	14.3%	38,514	28.4%	51,673	38.2%
North Delaware	12,094	12.3%	6,769	6.9%	7,104	7.2%	15,527	15.7%	20,072	20.4%
River Wards	6,811	9.8%	5,008	7.2%	4,465	6.4%	13,317	19.1%	16,999	24.4%
South	18,100	13.7%	7,551	5.7%	9,311	7.1%	18,849	14.3%	23,271	17.7%
University Southwest	6,943	8.5%	2,825	3.5%	2,652	3.2%	11,389	13.9%	20,113	24.6%
Upper Far Northeast	15,831	22.9%	4,283	6.2%	12,900	18.7%	10,246	14.8%	8,520	12.3%
Upper North	25,546	16.8%	8,929	5.9%	6,221	4.1%	27,791	18.3%	36,558	24.1%
Upper Northwest	15,417	17.0%	6,172	6.8%	1,347	1.5%	15,619	17.2%	16,825	18.5%
West	15,573	13.6%	8,888	7.7%	1,288	1.1%	19,933	17.4%	33,513	29.2%
West Park	7,411	16.5%	2,073	4.6%	1,150	2.6%	7,876	17.6%	10,221	22.8%
City of Philadelphia (Total)	**223,219**	**14.0%**	**99,102**	**6.2%**	**105,761**	**6.6%**	**267,675**	**16.8%**	**351,811**	**22.1%**

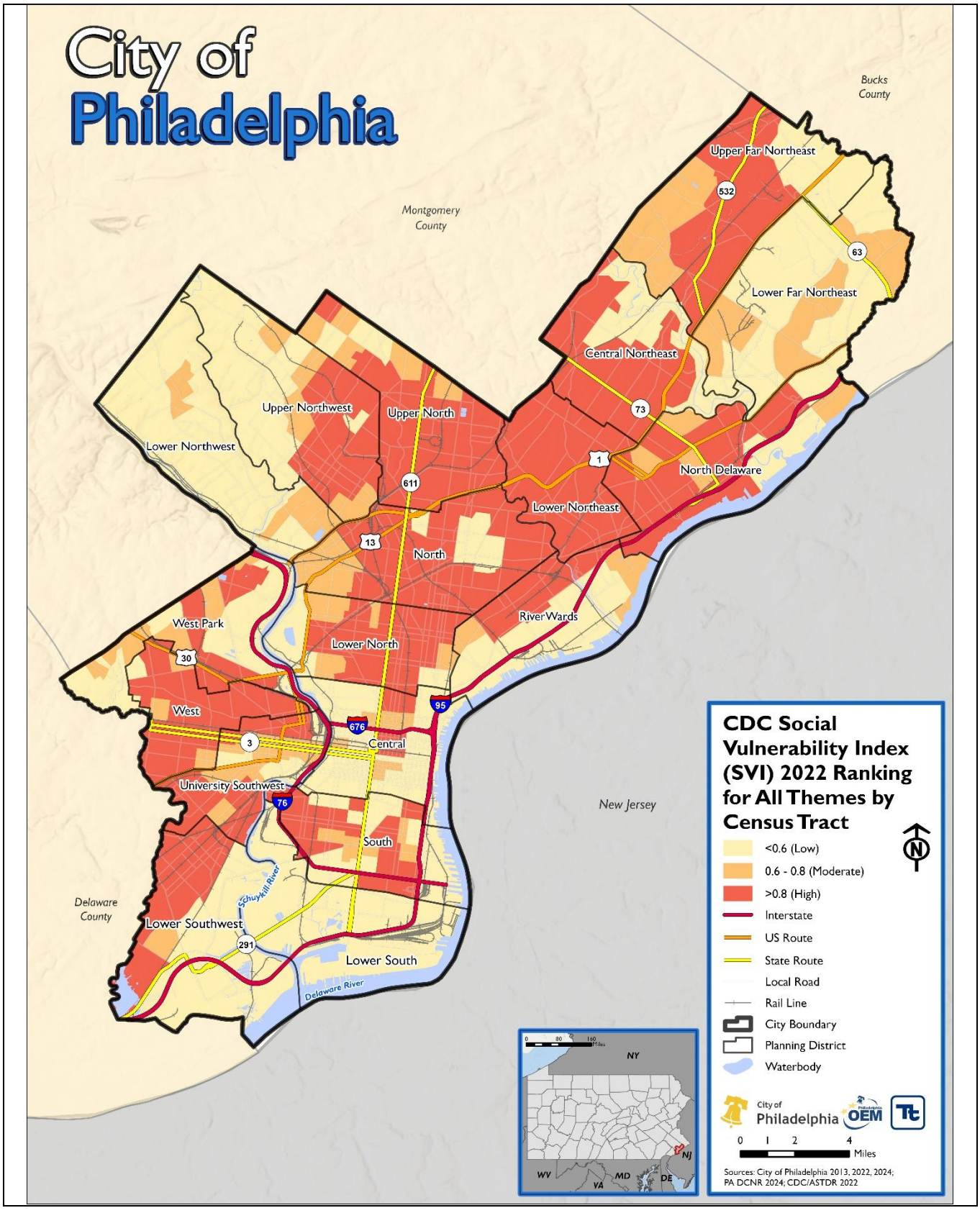
Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals
Note: 2.34 persons per household. This number was used to calculate the Non-English-Speaking populations.

Figure 2-12. City of Philadelphia Social Vulnerability Index, FEMA



Source: FEMA 2019
Note: Philadelphia is indicated by a boldened, blue outline

Figure 2-13. City of Philadelphia Social Vulnerability Index, CDC



2.4 LAND USE AND DEVELOPMENT

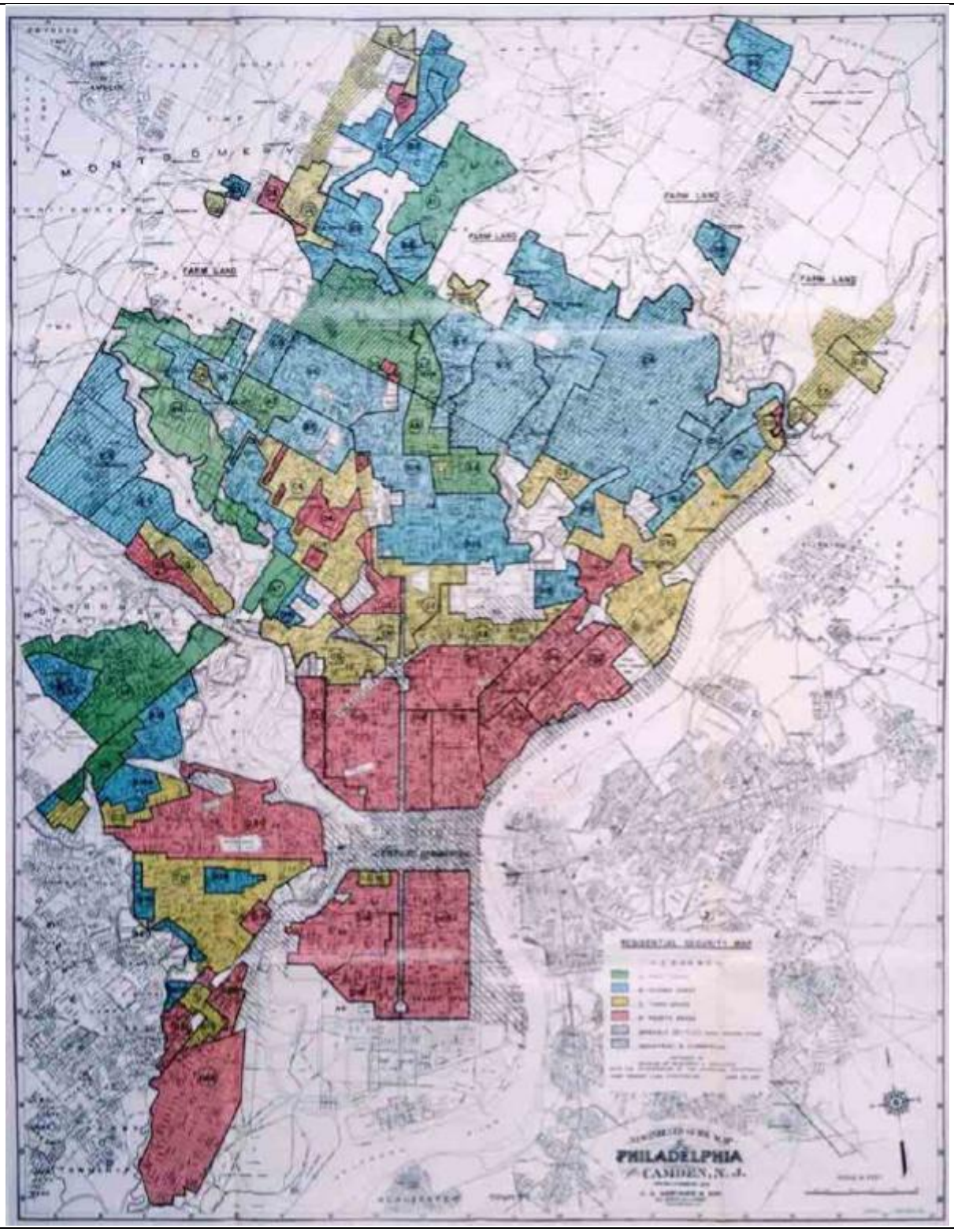
2.4.1 Past Land Use

Past land use in Philadelphia was heavily influenced by industrial growth in Philadelphia before WWII, when industrial areas developed along the riverfronts of the Schuylkill and Delaware River and the freight rail lines through older sections of the City. Industrial output peaked in the 1950s and then declined, leading to abandoned and underutilized industrial areas. Many of these areas, referred to as Industrial Legacy Areas in the Philadelphia2035 Comprehensive Plan, are seen as opportunities for modern industrial or other land uses in Philadelphia in the years to come. It is important to note that many of these areas overlap with FEMA designated flood zones, which should be a key consideration when planning for future development in these areas (Philadelphia City Planning Commission 2011).

Redlining in the early 20th century contributed to significant racial segregation in Philadelphia. Redlining is the discriminatory historical practice of discouraging investment in neighborhoods designated financial risky due to the presence of racial and ethnic minorities. Discriminatory federal mortgage programs and appraisal maps created barriers for African Americans and other minority populations to own homes (City of Philadelphia, Office of the Comptroller 2020).

Studies show redlining and other discriminatory policies have lasting impacts on hazard vulnerability today, leaving geographic areas within Philadelphia at higher risk to hazards such as heat, flooding, and gun violence (Lathan 2023). Mapping the Impact of Structural Racism in Philadelphia, a 2020 exploration into the present impacts of historical redlining undertaken by the City of Philadelphia Controller's Office, showed that most historically redlined neighborhoods are also areas where there is a higher poverty rate. Additionally, historically redlined neighborhoods are more likely to experience a higher level of violence and homicides (City of Philadelphia, Office of the Comptroller 2020). Philadelphia recognizes the impact these discriminatory policies have on Philadelphians today and is committed to grounding the Hazard Mitigation Planning process in equity, with a focus on populations and geographic areas disproportionately impacted by disaster. Figure 2-14 displays classifications of different neighborhoods by the Homeowners' Loan Corporation (HOLC) in the 1930's. Areas in red were deemed "hazardous" due to the presence of racial and ethnic minorities in the neighborhood.

Figure 2-14. Map of Areas Relined by HOLC in the 1930s



Source: City of Philadelphia 2022

2.4.2 Current Land Use

Philadelphia has a diverse and growing population and an expanding commercial and industrial sector. Between 1970 and 2020, vacant land decreased in the neighborhoods bordering surrounding counties. Vacant land decreased in the Center City and University City region in the early part of the 21st Century as the area experienced redevelopment. Outside of industrial uses and open space, land uses are mixed throughout the City and varies greatly block-to-block within the City. Table 2-9 and Figure 2-15 summarize the land use categories.

Table 2-9. City of Philadelphia 2021 Land Use Classification

Land Use Category	Acreage	Percent of City
Agriculture	721	0.8%
Barren Land	103	0.1%
Forest	6,315	6.9%
Rangeland	414	0.5%
Urban Area	77,791	85.3%
Water	4,377	4.8%
Wetland	1,437	1.6%
Total	**91,157**	**100.0%**

Source: USGS National Land Cover Database 2021

2.4.2.1 Green Space

Philadelphia's Parks and Recreation (PPR) oversees over 300 neighborhood parks, recreation centers and playgroups, 166 miles of trails and 22 historic and cultural sites, 60 community gardens, farms, and orchards, 3 environmental education centers, numerous recreational fields, and pools, and 6 golf courses (Philadelphia Parks and Recreation 2024). All contribute to our City's green open space.

Green space is land that is partly or completely covered with grass, trees, shrubs, or other vegetation. Green space includes parks, community gardens, and cemeteries (U.S. EPA 2024). Philadelphia has one of the oldest and largest metropolitan park systems in the United States. Fairmount Park was originally created in the 1850s with the purpose of preserving a clean water supply for the City and preserving green space. Philadelphia was one of the first big cities to acquire land ideal for industrial development and convert it for public recreational space (Milroy 2016). As a result, flood prone land surrounding the Fairmount Park section of the Schuylkill River and Wissahickon Creek are still park land and open space to this day.

2.4.2.2 Housing

Philadelphia's housing units are largely single unit attached homes, commonly referred to as "row homes." This style of housing contributes to the population density and distribution in the City (Philadelphia City Planning Commission 2013). Figure 2-16 shows the varied types of housing structures built in Philadelphia. Philadelphia housing units are largely aging structures, with most units built prior to 1939. These features, along with high vacancy rates in specific neighborhoods, cause greater risk of fire to housing units (City of Philadelphia 2022).

2.4.2.3 Commercial Corridors

Philadelphia's major commercial corridors serve as vital economic and cultural arteries across the City. In West Philadelphia, 52nd Street, often called "West Philly's Main Street", is undergoing revitalization to enhance safety and support local businesses. Center City remains the core of commerce, with bustling retail and office spaces along Market, Chestnut, and Walnut Streets. University City thrives as a hub for education, tech, and life sciences, while Fishtown and Northern Liberties have emerged as trendy destinations with boutique shops and creative industries. Historic Old City blends tourism with commerce, and Rittenhouse Square offers upscale retail and dining, making these corridors essential to Philadelphia's urban identity and growth. There are many other commercial corridors around the City that function as the center of the neighborhood, providing resources, jobs, and cultural anchors for the surrounding neighborhoods.

2.4.2.4 Industrial Land Uses

The City's major industrial land uses are centered around logistics, warehousing, and light manufacturing. The City has experienced a surge in industrial development, with an increase of 4 million square feet since 2022 in areas along the I-95 corridor, Navy Yard, and parts of Northeast and Southwest (Wolf Commercial Real Estate 2025). These industrial land uses support regional distribution, e-commerce fulfillment, and urban manufacturing.

Figure 2-15. City of Philadelphia Land Use and Land Cover

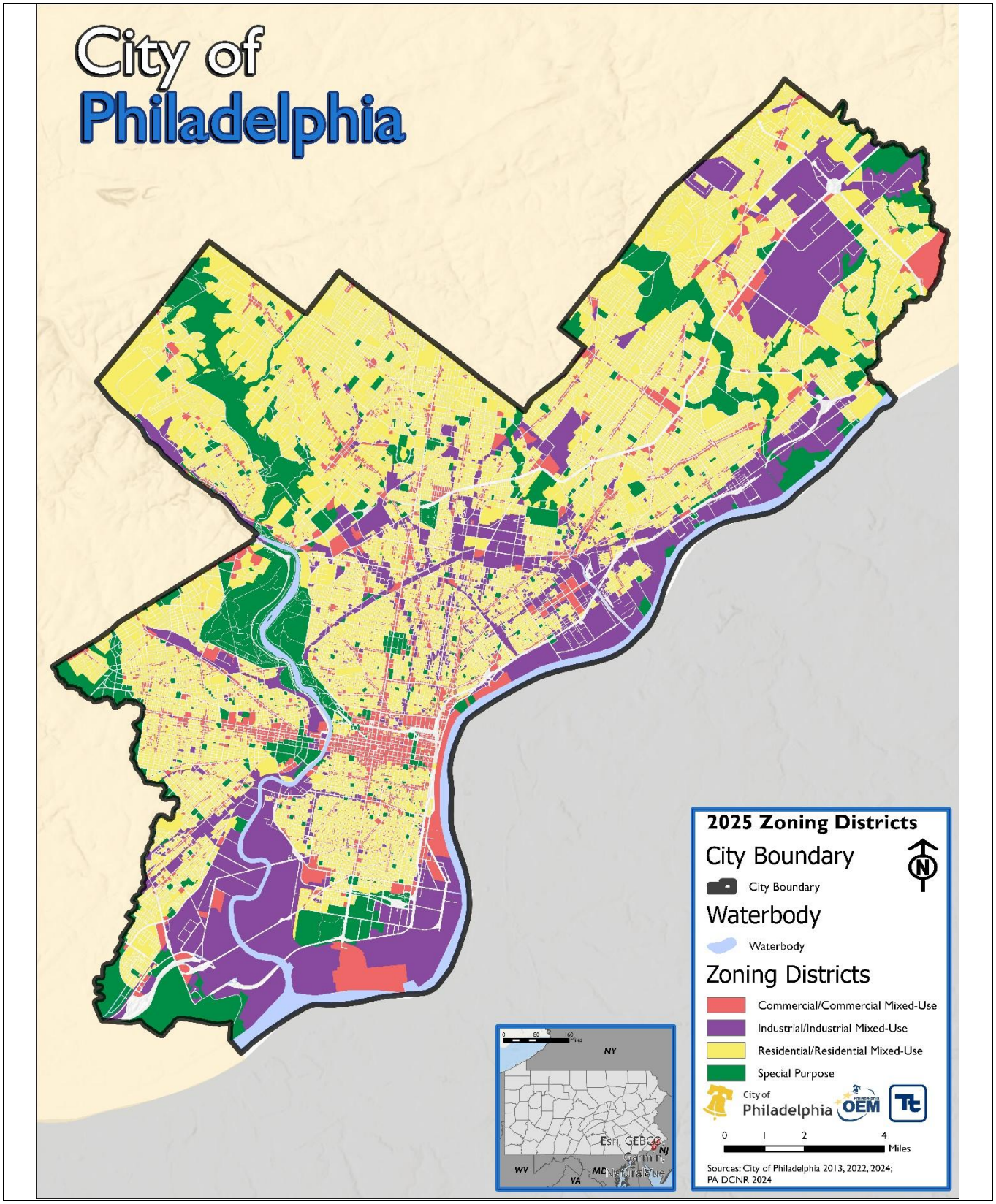
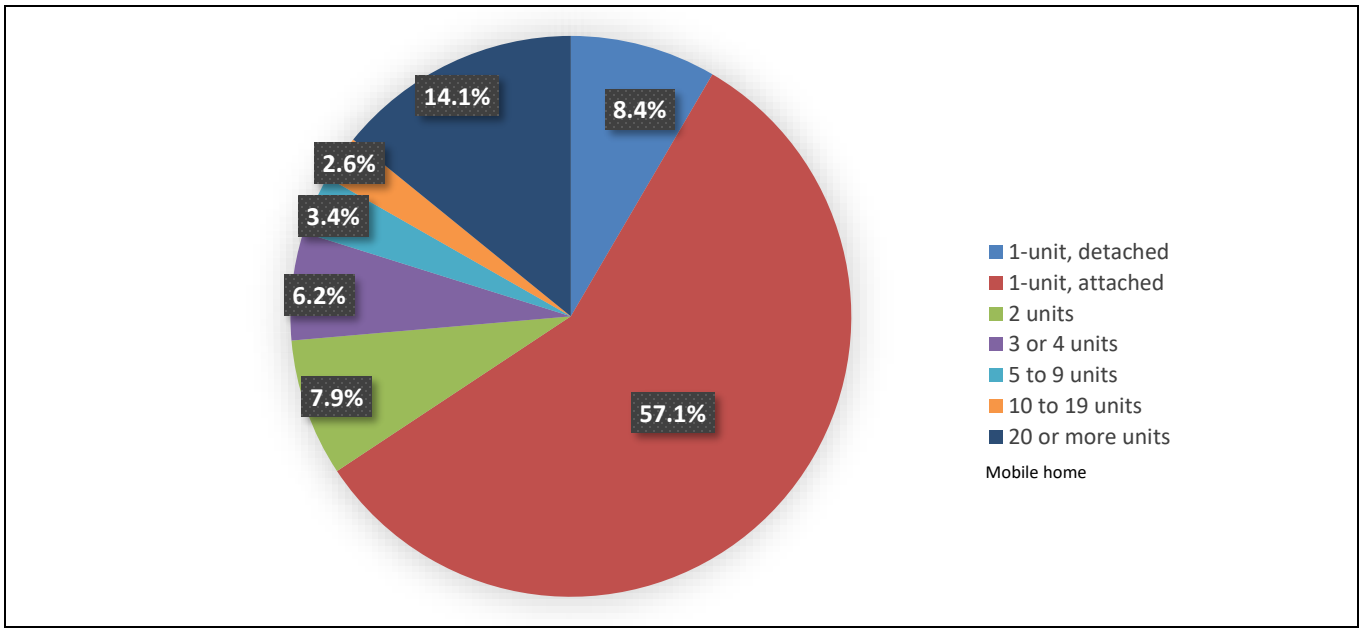


Figure 2-16. Philadelphia's Housing Structure by Number of Units



Source: U.S. Census Bureau, 2022 American Community Survey 5-year Estimates 2022
Note: Mobile home units (0.3%) are not shown.

2.4.3 Land Use Trends

Land use trends can also significantly affect vulnerability to various hazards and the potential impacts from hazard events. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

As part of the creation and implementation of the Phila2035 comprehensive planning process, the Philadelphia City Planning Commission (PCPC) worked with communities and stakeholders to develop district plans with recommendations on future land use, development opportunities, urban design scenarios, and proposed zoning. PCPC adopted these plans on a district-by-district basis (Philadelphia City Planning Commission 2011).

With anticipated, continued growth in population, households, and employment between now and 2050, Philadelphia will see a high-level of development activity, a need for new infrastructure, and a potential decrease in the amount of open space available in Philadelphia and the surrounding counties (DVPRC 2021).

2.4.4 General Building Stock

2.4.4.1 Existing Development

For the purposes of this plan, approximately 503,815 structures were identified by the tax data and spatial data available. These structures account for a replacement cost value of approximately $211 billion. Estimated content value was calculated by using 50 percent of the residential replacement cost value, and 100 percent of the non-residential replacement values. Using this methodology, approximately $140 billion in contents exist within these properties. Approximately 93.5 percent of the total buildings in the City are residential, which make up 63.1 percent of the total building stock value. Table 2-10 presents building stock statistics by occupancy class for City of Philadelphia.

Table 2-10. Building Stock Count and Replacement Cost Value (RCV) by Occupancy Class

Planning District	All Occupancies				Residential		Commercial		Industrial	
	Count	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value	Count	Total Replacement Cost Value	Count	Total Replacement Cost Value	Count	Total Replacement Cost Value
Central	29,150	$61,934,167,904	$42,564,693,579	$104,498,861,483	25,024	$57,282,744,684	3,574	$39,510,270,710	299	$2,371,356,264
Central Northeast	23,691	$7,728,030,815	$4,596,001,638	$12,324,032,453	22,795	$9,731,809,565	805	$1,933,699,413	19	$54,783,729
Lower Far Northeast	21,899	$9,063,476,224	$6,419,803,213	$15,483,279,437	21,485	$9,624,157,454	279	$2,007,768,971	89	$2,284,546,911
Lower North	31,876	$10,508,579,002	$6,737,868,461	$17,246,447,463	29,133	$11,865,203,729	1,996	$2,414,425,974	383	$861,812,538
Lower Northeast	31,140	$6,362,193,245	$3,952,305,605	$10,314,498,850	29,467	$7,534,280,413	1,340	$1,715,776,574	232	$477,175,552
Lower Northwest	18,020	$8,474,590,636	$5,140,476,526	$13,615,067,162	17,183	$10,260,808,691	696	$2,434,816,150	75	$311,639,885
Lower South	1,963	$4,191,753,538	$4,016,619,358	$8,208,372,896	1,731	$1,381,926,567	112	$5,378,873,635	113	$1,420,086,291
Lower Southwest	14,503	$3,874,062,915	$2,966,474,235	$6,840,537,150	13,596	$3,071,719,846	709	$2,504,959,852	135	$691,701,393
North	48,796	$7,532,654,609	$5,521,620,580	$13,054,275,189	44,841	$7,003,607,660	2,975	$3,225,143,729	678	$1,327,712,384
North Delaware	32,565	$8,338,867,552	$5,213,216,096	$13,552,083,648	30,940	$10,064,437,141	1,248	$1,906,974,826	284	$1,018,240,898
River Wards	29,313	$8,607,226,016	$5,660,075,073	$14,267,301,089	26,585	$9,788,208,634	1,849	$2,274,163,724	771	$1,560,089,496
South	55,342	$17,942,166,375	$10,872,599,865	$28,814,766,240	51,624	$22,164,326,983	3,128	$4,530,564,580	390	$1,202,386,229
University Southwest	18,972	$16,057,670,041	$12,646,975,613	$28,704,645,654	17,722	$11,520,522,414	958	$9,469,040,233	94	$265,731,101
Upper Far Northeast	18,078	$8,628,215,713	$5,467,961,681	$14,096,177,394	17,531	$10,163,386,430	361	$1,808,449,103	135	$1,076,148,835
Upper North	48,866	$9,855,035,861	$5,699,895,001	$15,554,930,862	46,575	$12,621,690,047	1,932	$1,730,011,765	129	$168,445,100
Upper Northwest	26,636	$10,549,209,223	$6,070,082,282	$16,619,291,505	25,050	$13,641,376,389	1,247	$1,771,261,071	122	$120,359,736
West	40,683	$6,778,263,055	$3,996,054,010	$10,774,317,065	38,193	$8,463,345,494	2,151	$1,399,102,346	86	$99,029,548
West Park	12,322	$4,633,387,286	$2,860,853,907	$7,494,241,193	11,717	$5,453,826,762	470	$1,299,210,346	42	$95,965,920
City of Philadelphia	**503,815**	**$211,059,550,010**	**$140,403,576,723**	**$351,463,126,733**	**471,192**	**$221,637,378,903**	**25,830**	**$87,314,513,002**	**4,076**	**$15,407,211,810**

Source: City of Philadelphia 2022, 2024; RS Means 2024

2.4.4.2 New Development

For new development, the City uses the best available data to avoid potential exposure of development to hazard events where possible. Additionally, the City intends to (1) discourage development within vulnerable areas, areas with high population density, and the Special Flood Hazard Area; and (2) encourage higher regulatory standards.

The Department of Licenses and Inspections reviews construction plans and conducts building inspections to ensure the safety of the workers and the public. Building permits are required before the start of a specific construction activity to enlarge, repair, change, add to or demolish a structure, and to install equipment or systems in a structure. Depending on the scale or type of construction activity, it may need to be first authorized via a zoning permit. Zoning permits are issued to authorize new construction or additions to a building or to authorize the change of use in a building or ground. The Department of Licenses and Inspections has shared their permitting database on the City of Philadelphia's Open Data Base. Table 2-11 displays the number of permits issued for new construction residential and commercial properties by year.

Table 2-11. New Development Permits for Residential and Commercials Properties in the City of Philadelphia (2020-2024)

Construction Type	Number of New Construction Permits Issued				
	2020	2021	2022	2023	2024
Residential	1,129	1,386	544	251	646
Commercial	305	729	168	212	145

Source: City of Philadelphia 2025

Note: The number of permits issues is inclusive of only those permits which were indicated as "complete" or "issued." Amended, expired, or cancelled permits were not included in the listed totals.

Additionally, large-scale developments, such as the Navy Yard, are planned. The 2022 Navy Yard Plan outlines the long-term, 20-year development strategy for the 1,200-acre waterfront site. The site is designated as a comprehensive mixed-use area supporting both commercial and residential growth. Currently, key property types include office space, retail, educational institutions, industrial facilities, and research and development activities. The long-term vision for Navy Yard aims to support increased densities across all uses, with an emphasis on expanding residential development to establish a sustainable residential population. (PIDC 2022)

The site is located within the FEMA designated special flood hazard area (SFHA), commonly known as the floodplain, and remains vulnerable to flooding and sea-level rise. Over the past 25 years, only limited flooding has been recorded. However, approximately 15 percent of stakeholders identify flood risk as a significant concern for Navy Yard. The 2022 Navy Yard Plan incorporates considerations for projected sea-level rise and includes proactive site planning and building design measures to mitigate potential impacts. (PIDC 2022)

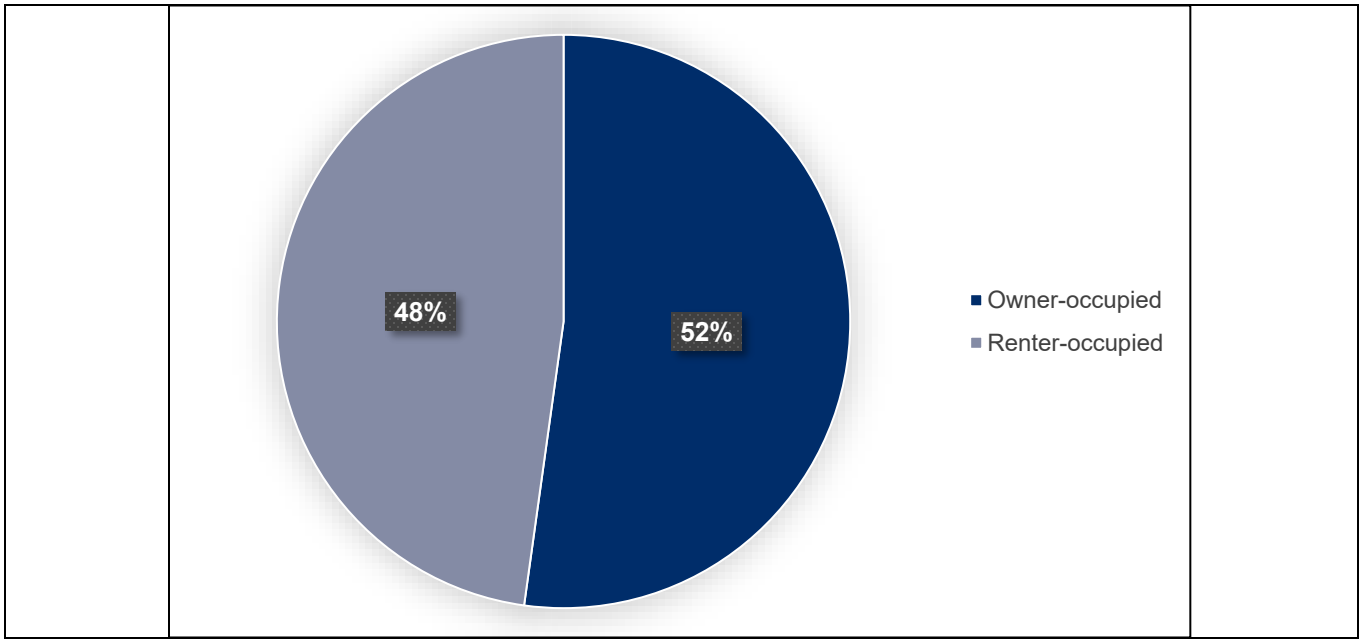
Additional notable areas of significant growth and development include the Philadelphia Super Region, Southwest Philadelphia (comprising neighborhoods surrounding the airport and Eastwick), and North Philadelphia (including the Hunting Park and Nicetown-Tioga neighborhoods). These regions serve as key centers for industrial activity and major transportation infrastructure.

Overall, development within the City and its surrounding areas is anticipated to continue increasing. The economic forecast for the Greater Philadelphia region suggests that 42 percent of businesses plan to expand their physical footprint (Chamber of Commerce for Greater Philadelphia 2025).

2.4.4.3 Housing and Home Ownership

According to 2022 American Community Survey 5-year estimates, 659,129 households are located in City of Philadelphia (U.S. Census 2023). A household includes all the people who occupy a housing unit as their usual residence. The 2022 American Community Survey 5-year estimates data identified 730,630 housing units in the City. A housing unit is a house, apartment, mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters (or if vacant, intended for occupancy as separate living quarters). About 90 percent are occupied. As illustrated in Figure 2-17, 52 percent are owner occupied, and 48 percent are renter occupied. Of the owner-occupied homes in Philadelphia, 40.3 percent own their homes and do not have a mortgage or loan on the house (U.S. Census Bureau, 2022 American Community Survey 5-year Estimates 2022).

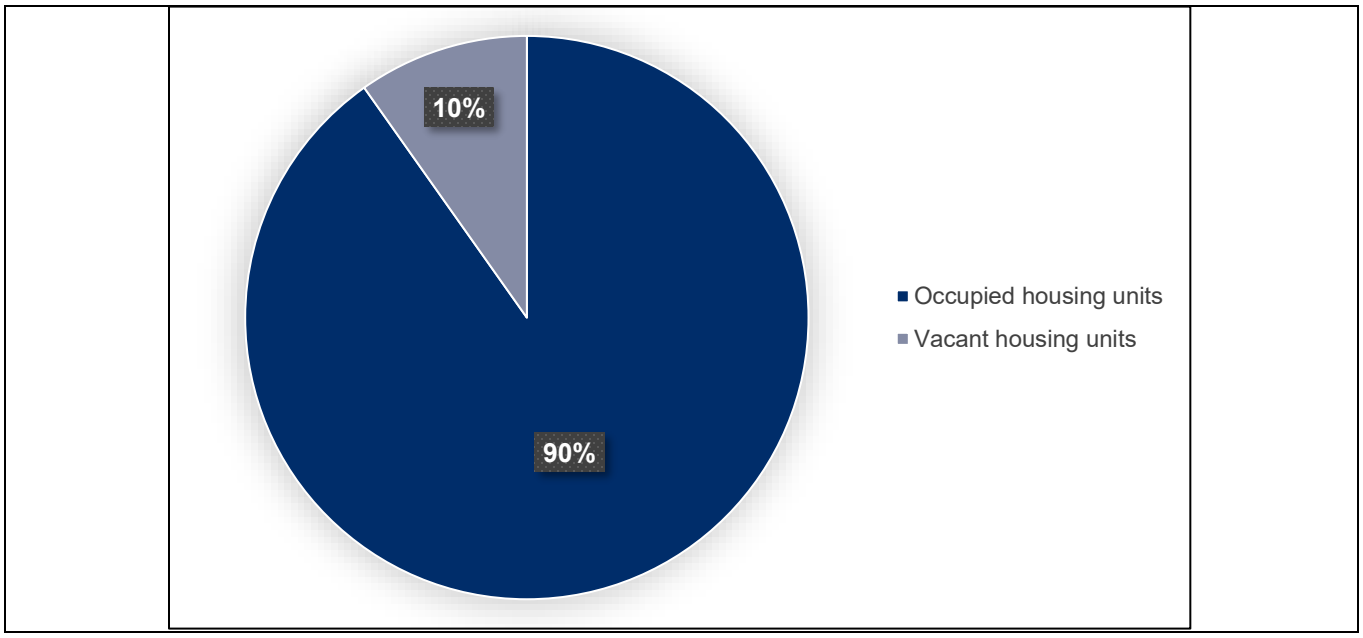
Figure 2-17. Percentage of Owner vs. Renter Occupied Housing Units in Philadelphia



Source: U.S. Census Bureau, 2022 American Community Survey 5-year Estimates 2022

According to the 2022 American Community Survey 5-year estimates, there are 71,501 vacant housing units in the City. Vacant homes without insurance can also impact risk and long-term recovery. Unoccupied or vacant homes pose a greater risk for both fires and collapse than occupied homes. Vacant properties that are also uninsured or under-insured greatly increases the likelihood of a longer recovery time. Figure 2-18 shows a breakdown of vacant vs. occupied homes in Philadelphia.

Figure 2-18. Percentage of Occupied vs. Vacant Housing Units in Philadelphia



Source: U.S. Census Bureau, 2022 American Community Survey 5-year Estimates 2022

Philadelphia's housing stock is among the oldest of any city in the country. The numerous vacant and ill maintained homes in the City increases our risk for urban fire. However, the City's recent growth in population has spurred new construction and investment into housing in many neighborhoods. Research shows that home prices increased in every Philadelphia neighborhood, but household incomes did not keep pace. As a result, the share of Philadelphia households that could afford an entry-priced home dropped from 70 percent in 2000 to 58 percent in 2021 (Pew Charitable Trusts 2024). Higher cost burdens can contribute to increased poverty rates and increased poverty rates directly impact a community's ability to withstand and recover from disaster.

Within Philadelphia, 2,740 households (0.4 percent) lack complete plumbing facilities. Housing units without sufficient plumbing pose additional challenges in emergency situations where sheltering-in-place, or staying in your home throughout the emergency, is required. About 8,160 households (1.2 percent) have no telephone (home and/or cell phones) service available, 4.8 percent of homes do not have a computer, and 8.9 percent of homes do not have an internet subscription (U.S. Census, 2023 American Community Survey 1-year estimates 2023, U.S. Census, 2023 America Community Survey 1-year estimates 2023). Those households without a phone, computer, and/or internet may be harder to reach with emergency notifications in times of disaster and crisis and should be accounted for when designing alert and warning systems and outreach.

Figure 2-19 through Figure 2-21 show the distribution and value density of residential, commercial, and industrial buildings in City of Philadelphia. Value density is the dollar value of structures per unit area, including building content value. The densities are shown in units of $1,000 ($K) per square mile. Viewing value distribution maps can assist communities in visualizing areas of high loss potential and in evaluating aspects of the study area in relation to the specific hazard risks.

Figure 2-19. Distribution of Residential Building Stock and Value Density in City of Philadelphia

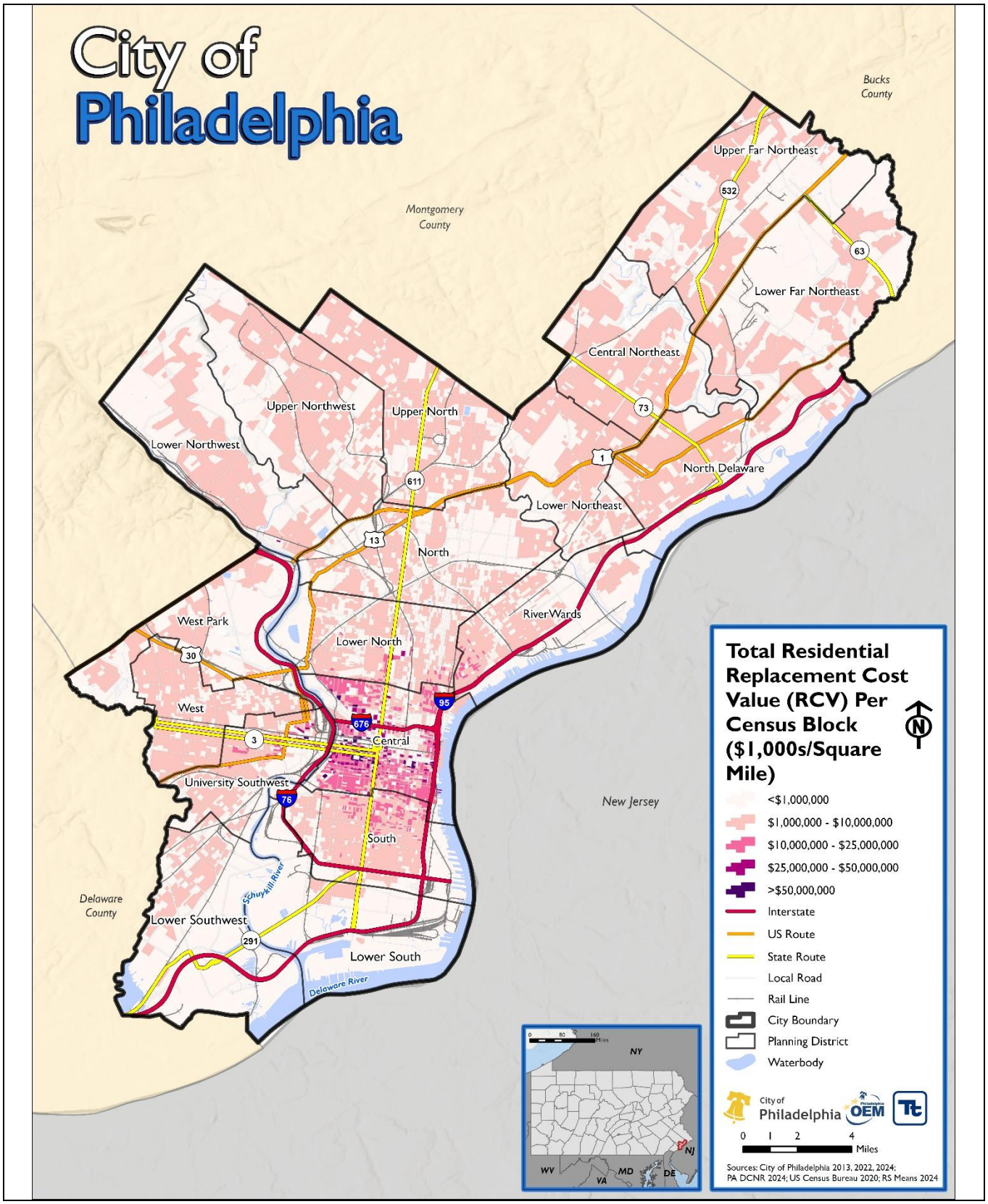


Figure 2-20. Distribution of Commercial Building Stock and Value Density in City of Philadelphia



Figure 2-21. Distribution of Industrial Building Stock and Value Density in City of Philadelphia



2.4.5 Community Lifelines

Critical facilities are those that are essential to the health and welfare of the population. These facilities are especially important after any hazard event. Critical facilities are those that maintain essential and emergency functions and are typically defined to include police and fire stations, schools, and emergency operations centers. They also include infrastructure such as roads and bridges that provide access to those in need and utilities that provide water, electricity, and communication services. Also included are facilities that use or store hazardous materials (FEMA 1997).

Critical facilities include services that FEMA defines as “community lifelines.” These represent the fundamental services in a community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize lifelines. Lifelines are divided into eight categories (FEMA 2023):

- Safety and Security
- Food, Hydration, Shelter
- Health and Medical
- Energy
- Communications
- Transportation
- Hazardous Materials
- Water Systems

A comprehensive inventory of community lifelines in City of Philadelphia was developed from various sources, including input from the Steering Committee, All-Stakeholders Workgroup, and Public Steering Committee. The following sections describe the inventory of community lifelines that was used for the risk assessment in this HMP. Although many lifeline facilities could fall within numerous categories, the lifeline facilities identified for this planning effort have been categorized according to their primary function.

2.4.5.1 Safety and Security



The safety and security community lifeline category includes law enforcement, security, fire services, search and rescue services, government services, and community safety (e.g., dams). Table 2-12 lists the number of each facility type. Figure 2-22 shows the location of safety and security facilities.

Figure 2-22. Safety and Security Facilities in the City of Philadelphia

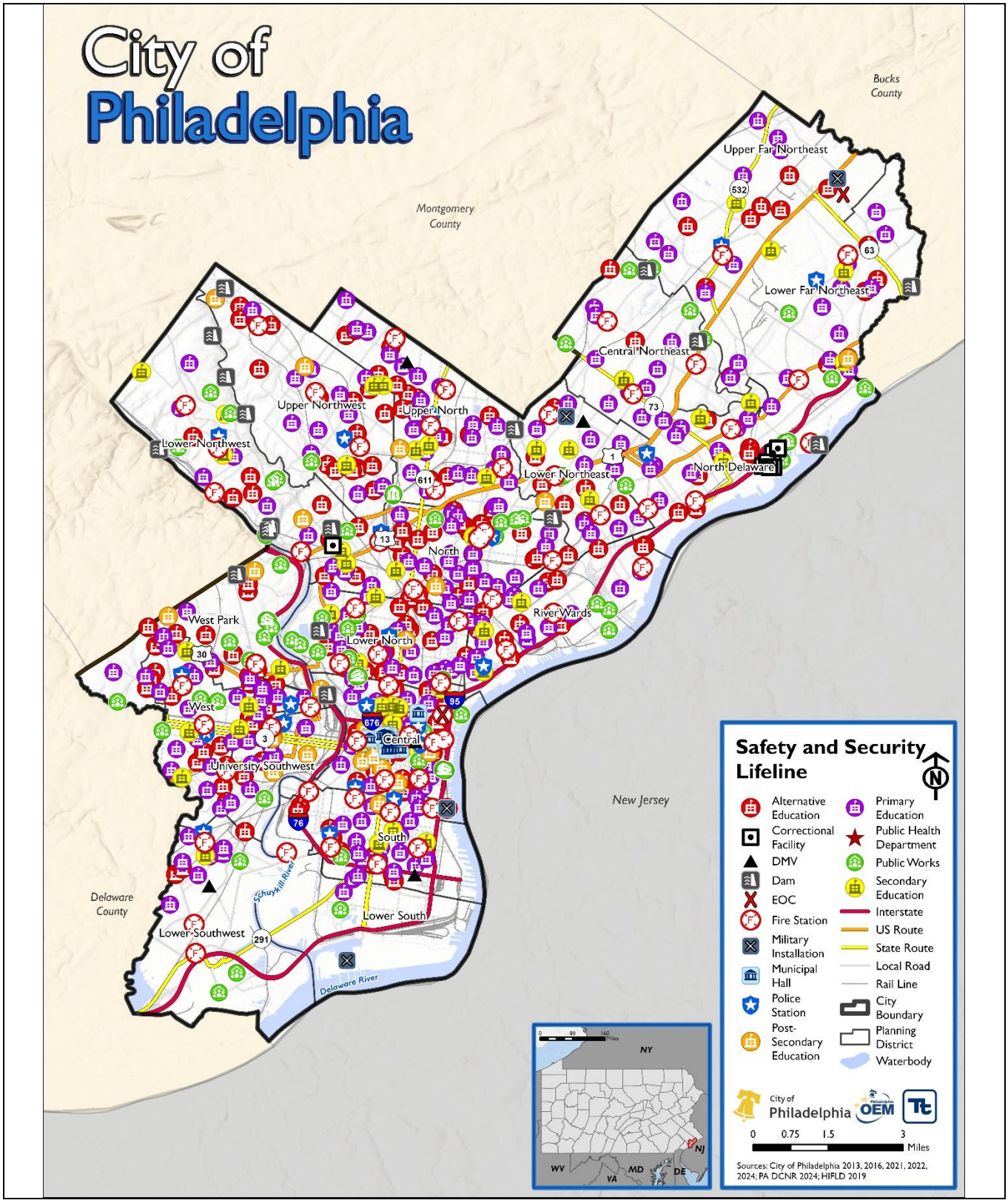


Table 2-12. Safety and Security Community Lifelines in the City of Philadelphia

Facility Type	Number of Facilities
Alternative Education	213
Correctional Facility	8
Dam	7
DMV	5
Emergency Operations Center	2
Fire Station	66
Military Installation	4
Municipal Hall	11
Police Station	24
Post-Secondary Education Facility	23
Primary Education	228
Public Health Department	1
Public Works Facility	75
Secondary Education	50
Total	**717**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

Emergency Facilities

OEM pursues this mission through three divisions and 17 programs. The Planning Division includes human services, health and medical, homeland security, infrastructure, hazard mitigation, and regional preparedness planning programs. These programs lead interagency planning initiatives, critical infrastructure protection projects, and regional planning efforts.

The Operations Division includes programs that focus on operational coordination, response, geographic information systems (GIS), information technology, emergency management technology, and logistics. These programs provide the City with 24/7 watch desk coordination services, response planning, mapping products, logistics coordination, and advanced facilities and systems to promote operational coordination.

The Strategy, Engagement, and Administration Division leads preparedness programming and performs public information functions during emergencies. This program area promotes individual and community preparedness through workshops and other initiatives, develops plans and other activities to support public information service, and leads training and exercise activities. This division also includes the finance and administration program that manages homeland security grants on behalf of a number of city departments and agencies.

The OEM Administration team provides executive-level leadership to the OEM Divisions, supports the City's executives during disasters and complex events, and engages with local, state, and federal leadership during emergencies.

The Philadelphia Police Department (PPD) is structured to support both strategic and operational functions across the city with 24 police department locations. It includes divisions such as Patrol Operations, Investigations, Homeland Security, and Support Services. The department also emphasizes community engagement and data-

informed policing strategies, supported by ongoing reviews and recommendations from oversight bodies like the City Controller's Office.

The Philadelphia Fire Department (PFD) provides fire suppression, emergency medical services (EMS), and specialized rescue operations across the city. It is organized into divisions such as Fire Operations, Emergency Medical Services, Fire Prevention, and Training. The department also plays a critical role in disaster response and public safety coordination, often working alongside OEM and other city agencies. PFD maintains a fleet of fire apparatus and ambulances and operates out of dozens of fire stations strategically located throughout Philadelphia to ensure rapid response times. There are 66 fire department facilities in City of Philadelphia.

Dams

The Pennsylvania Department of Environmental Protection (DEP) Division of Dam Safety holds responsibility for dam safety (DEP n.d.). Hazard Potential Category 1 dams are those "where its failure could result in significant loss of life, excessive economic losses, and significant public inconvenience." Hazard Potential Category 2 dams are those "where its failure could result in the loss of a few lives, appreciable property damage, and short-duration public inconvenience". Owners of dams classified as Hazard Categories 1 or 2 ("high-hazard" dams) are required to create an Emergency Action Plan (EAP) that describes the dam, the inundation area if the dam were to catastrophically fail, and procedures for responding to the dam failure (such as notification to the vulnerable population) (Commonwealth of Pennsylvania 2011). Table 2-13 is a complete list of dams in the City of Philadelphia with high-hazard dams listed first. For additional information on dams within the City, refer to Chapter 1.1.1.

Table 2-13. Dams in the City of Philadelphia

Dam Name	Stream	Class	Permittee	Primary Purpose
High-Hazard Dams				
Philadelphia Mills	Poquessing Creek	C-1	Frankin Mills Associates	Flood Risk Reduction
Belmont Raw Water Basin	Schuylkill River	C-1	Philadelphia Water Department	Water Supply
Queen Lane Raw Water Basin	Schuylkill River	B-1	Philadelphia Water Department	Water Supply
Other Dams				
Baxter Raw Water Basin	Delaware River	C-4	Philadelphia Water Department	Water Supply
Flat Rock	Schuylkill River	B-4	Pennsylvania Department of Environmental Protection	Recreation
Fairmount	Schuylkill River	B-3	Philadelphia Water Department	Water Supply
Water Control Structure	Darby Creek	C-4	Tinicum National Environmental Center	Other

Source: USACE 2024

Military Installations

The following military installations are located in the City:

- Naval Support Activity Philadelphia and the Philadelphia Navy Yard Annex have a mission to provide an operationally ready, secure shore infrastructure committed to offering support services and team work, balanced quality of life to military and civilian members, and community collaboration through coordinated engagement, in a safe and healthful environment. Naval Support Activity Philadelphia has its own

emergency management services who will facilitate contact with the City to inform them of emergencies (NSA Philadelphia n.d.).

- The Philadelphia Southampton Readiness Center is owned and operated by the Commonwealth of Pennsylvania's Department of Military and Veterans Affairs. This 135,000 square foot structure sits off Roosevelt Boulevard. The Readiness Center is available for rental for unofficial uses subject to availability. The Readiness Center is ideal for many unofficial uses such past rentals include wedding receptions, baby showers, gun shows, boxing events, circuses, expos, food conventions, blood drives, etc. (PA DMVA n.d.)
- The U.S. Coast Guard Sector Delaware Bay was established in 2005. Sector Delaware Bay operates as an Integrated Operations Command, responsible for almost 570 active-duty personnel and 195 reservists, in that all operational missions are combined under one command. Sector Delaware Bay has a tri-state area of responsibility that encompasses portions of the states of Pennsylvania, New Jersey, and Delaware and includes the busy commercial ports of Philadelphia and Wilmington. The unit's area of responsibility extends 200 nautical miles out from the coastline (USCG n.d.).

2.4.5.2 Food, Hydration, Shelter

The food, hydration, and shelter community lifeline category includes agricultural lifelines. Table 2-14 lists the number of each facility type. Figure 2-23 shows the location of food, hydration, and shelter facilities.

Table 2-14. Food, Hydration, and Shelter Community Lifelines in the City of Philadelphia

Facility Type	Number of Facilities
Commercial Food Distribution	28
Emergency Food	19
Emergency Shelter	84
Grocery Store	63
Total	**201**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

Shelters

With support and cooperation of the American Red Cross, the School District of Philadelphia, places of worship, and non-profits, the City references an inventory of suitable shelter locations and can assist with the coordination and communication of shelter availability as necessitated by the execution of emergency operation plans. City-wide sheltering policies and procedures are documented in the following plans, which are maintained by the City of Philadelphia OEM (City of Philadelphia OEM 2024):

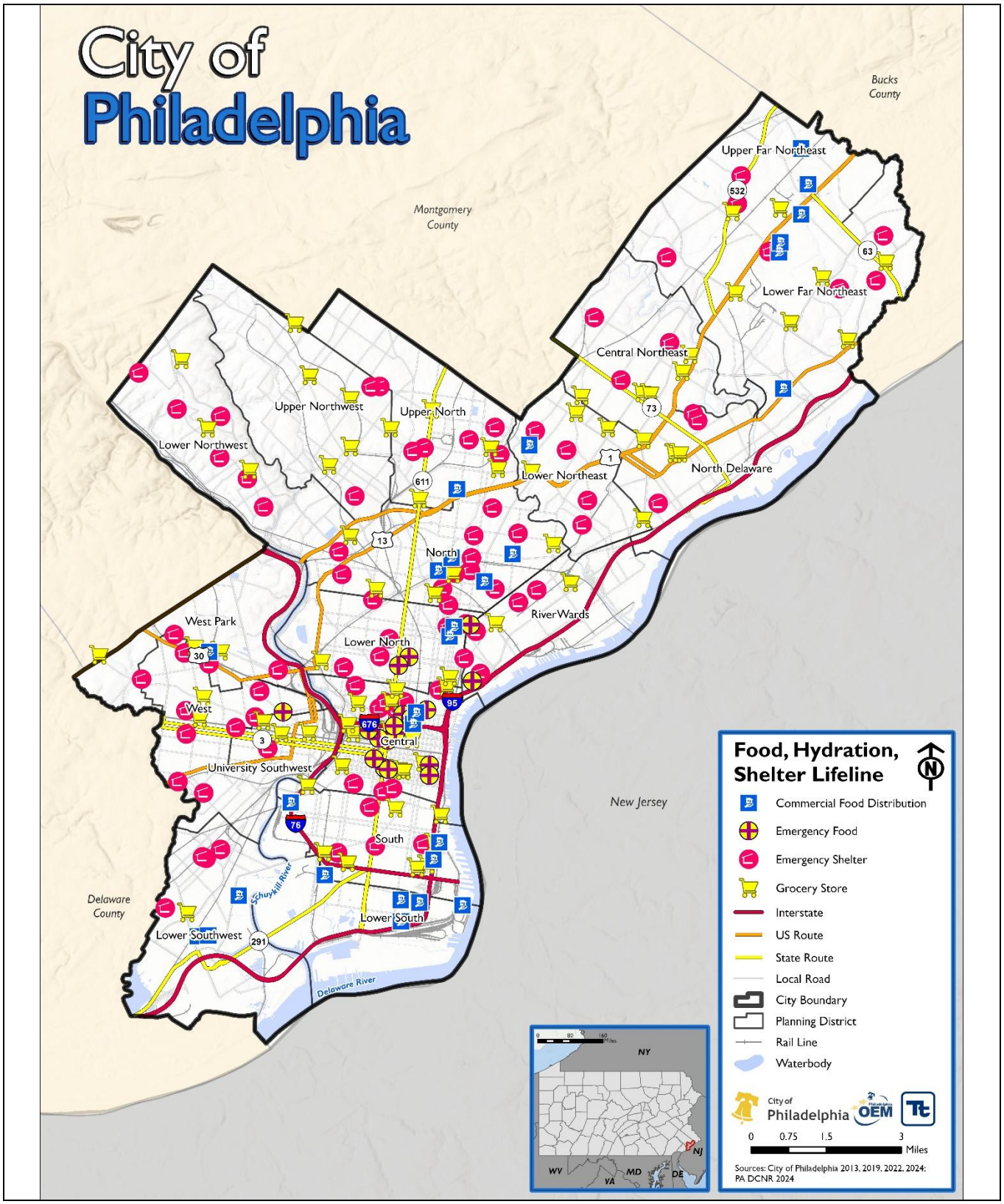
- City of Philadelphia Emergency Operations Plan
- City of Philadelphia Mass Care and Shelter Plan

The Office of Homeless Services (OHS) provides specialized programs to assist individuals who are unhoused, offering shelter availability, mental health counseling, employment assistance, and substance use programs. OHS collaborates with non-profit organizations to enhance service delivery, aiming to address the root causes of homelessness and support positive life changes (City of Philadelphia 2024).

The City issues Code Blue and Code Red during extreme cold or heat conditions, respectively. When issued, the City takes special measures to keep people who are unhoused safe. These measures include (City of Philadelphia 2024, City of Philadelphia 2024):

- 24-hour outreach to find people who are unhoused and transport them to safe indoor spaces.
- Additional shelter beds.
- Allowing unhoused individuals to stay inside emergency housing throughout the day.

Figure 2-23. Food, Hydration, and Shelter Facilities in the City of Philadelphia



Schools

There are 213 alternative educational facilities (state, charter, and independent schools), 228 public and private primary educational facilities (elementary, middle, and high schools), and 73 secondary and post-secondary educational facilities (colleges and universities) located in the City of Philadelphia. In times of need, schools can function as shelters and are an important resource to the community. For information regarding shelters, see the Shelters subsection of this document above.

Socially Vulnerable Populations and Undeserved Community Support Facilities

Philadelphia agencies offer assistance to socially vulnerable populations and underserved communities, often working directly with the populations. City agencies may also partner with outside private, non-profit, and places of worship entities for additional outreach to socially vulnerable populations. Refer to Chapter 5 for more information on each City agency listed below:

- Department of Behavioral Health and Intellectual disAbility Services
- Division of Housing and Community Development
- Department of Public Health
- Mayor's Commission on Aging
- Mayor's Office for People with Disabilities
- Mayor's Office of Public Engagement
- Office of Arts, Culture, and the Creative Economy
- Office of Children and Families
- Office of Community Empowerment and Opportunity
- Office of Diversity, Equity, and Inclusion
- Office of Emergency Management
- Office Homeless Services
- Office of Immigrant Affairs
- Office of LGBT Affairs
- Office of Policy and Strategic Initiatives for Criminal Justice and Public Safety
- Office of Sustainability

2.4.5.3 Health and Medical



The health and medical community lifeline category includes medical care, public health, patient movement, medical supply chain, and fatality management. Table 2-15 lists the number of each facility type. Figure 2-24 displays the location of health and medical facilities.

Figure 2-24. Health and Medical Facilities in the City of Philadelphia

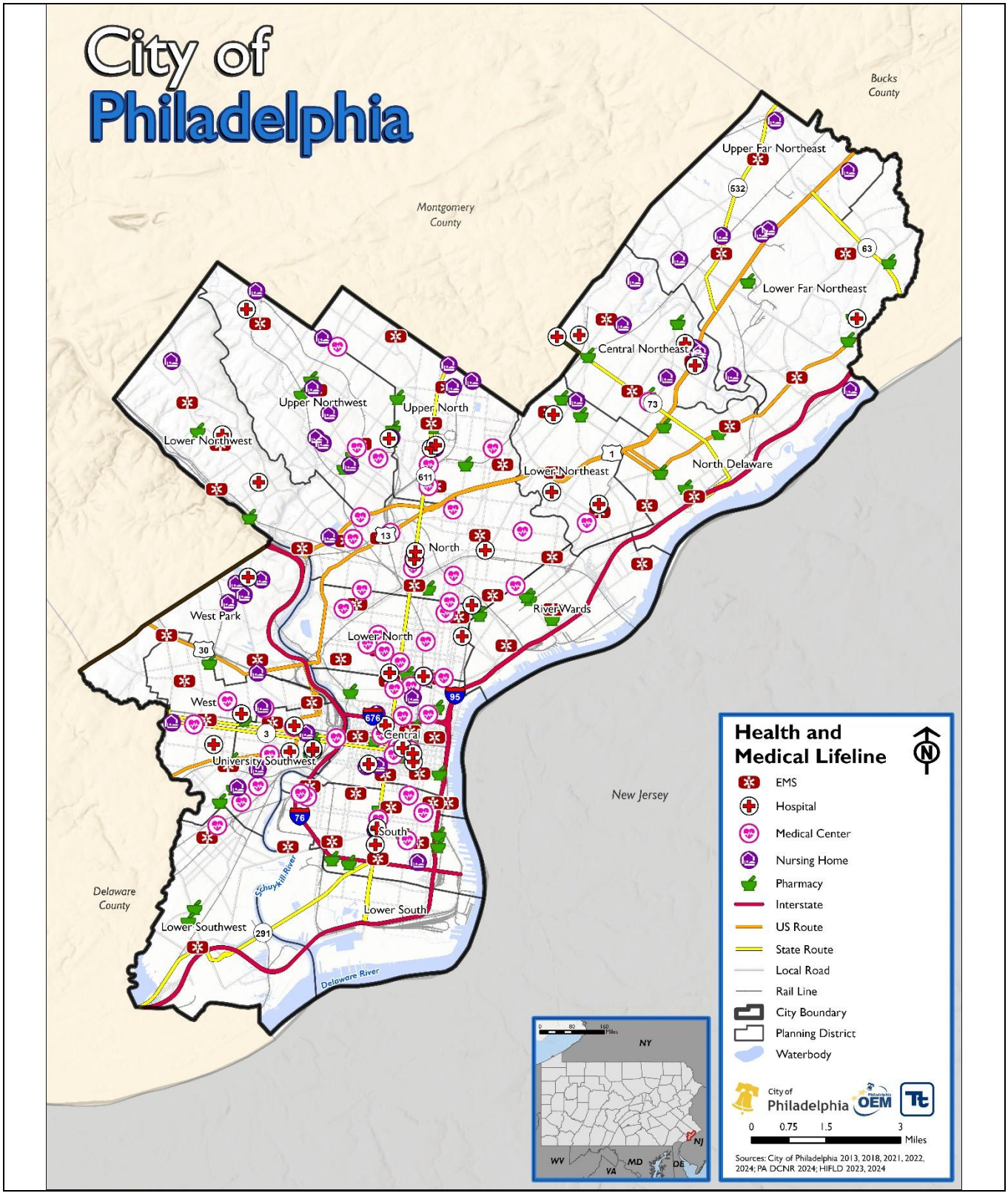


Table 2-15. Health and Medical Community Lifelines in the City of Philadelphia

Facility Type	Number of Facilities
EMS	63
Hospital	36
Medical Center	55
Nursing Home	46
Pharmacy	54
Total	**254**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

Hospitals and Medical Facilities

Philadelphia is one of the United States' leading major metropolitan areas in healthcare. The City is home to several hospitals dedicated to high-quality patient care and service, as shown in Table 2-16. For non-emergency health care needs, a number of "urgent care centers" are located throughout the City. Some of these clinics are open 24 hours per day, and most have evening and weekend hours. There are 21 urgent care facilities in the City.

Table 2-16. Hospitals and Healthcare Facilities in Philadelphia

Hospital Name	Emergency Department	Trauma Center	Burn Center	Pediatric
Angela Jane Pavilion Rehabilitation Hospital				
Jefferson Health – Frankford Campus	X			
Jefferson Health - Torresdale Campus	X	Level 2		
Belmont Center for Comprehensive Treatment				
Chestnut Hill Hospital	X			
Children's Hospital of Philadelphia	X	Level 1		X
Jefferson Einstein Philadelphia Hospital	X	Level 1		
Fairmount Behavioral Health Systems				
Fox Chase Cancer Center				
Friends Hospital				
Germantown Community Health Services				
Girard Medical Center				
Good Shepherd Penn Partners				
Hospital of the University of Pennsylvania	X			
Jeanes Hospital	X			
Kensington Hospital				
Kindred Hospital of Philadelphia				
Kirkbride Center				
Magee Rehabilitation Hospital				
Mercy Philadelphia Hospital	X			
Moss Rehab				
Nazareth Hospital	X			

Hospital Name	Emergency Department	Trauma Center	Burn Center	Pediatric
Penn Medicine at Rittenhouse				
Penn Presbyterian Medical Center	X	Level 1		
Pennsylvania Hospital	X			
Philadelphia VA Medical Center	X			
Roxborough Memorial Hospital	X			
Saint Agnes Long Term Care Hospital				
Shriner's Hospital for Children – Philadelphia				X
St. Christopher's Hospital for Children	X	Level 1	X	X
Temple University Hospital	X	Level 1	X	
Temple University Hospital – Episcopal Campus	X			
Thomas Jefferson University Hospital	X	Level 1	X	
Thomas Jefferson University Hospitals Methodist	X			
Wills Eye Hospital				

Source: (City of Philadelphia 2022)

2.4.5.4 Energy



The energy community lifeline category includes power grids and fuel supplies. Table 2-17 lists the number of each facility type. Figure 2-25 displays the location of energy facilities.

Table 2-17. Energy Community Lifelines in the City of Philadelphia

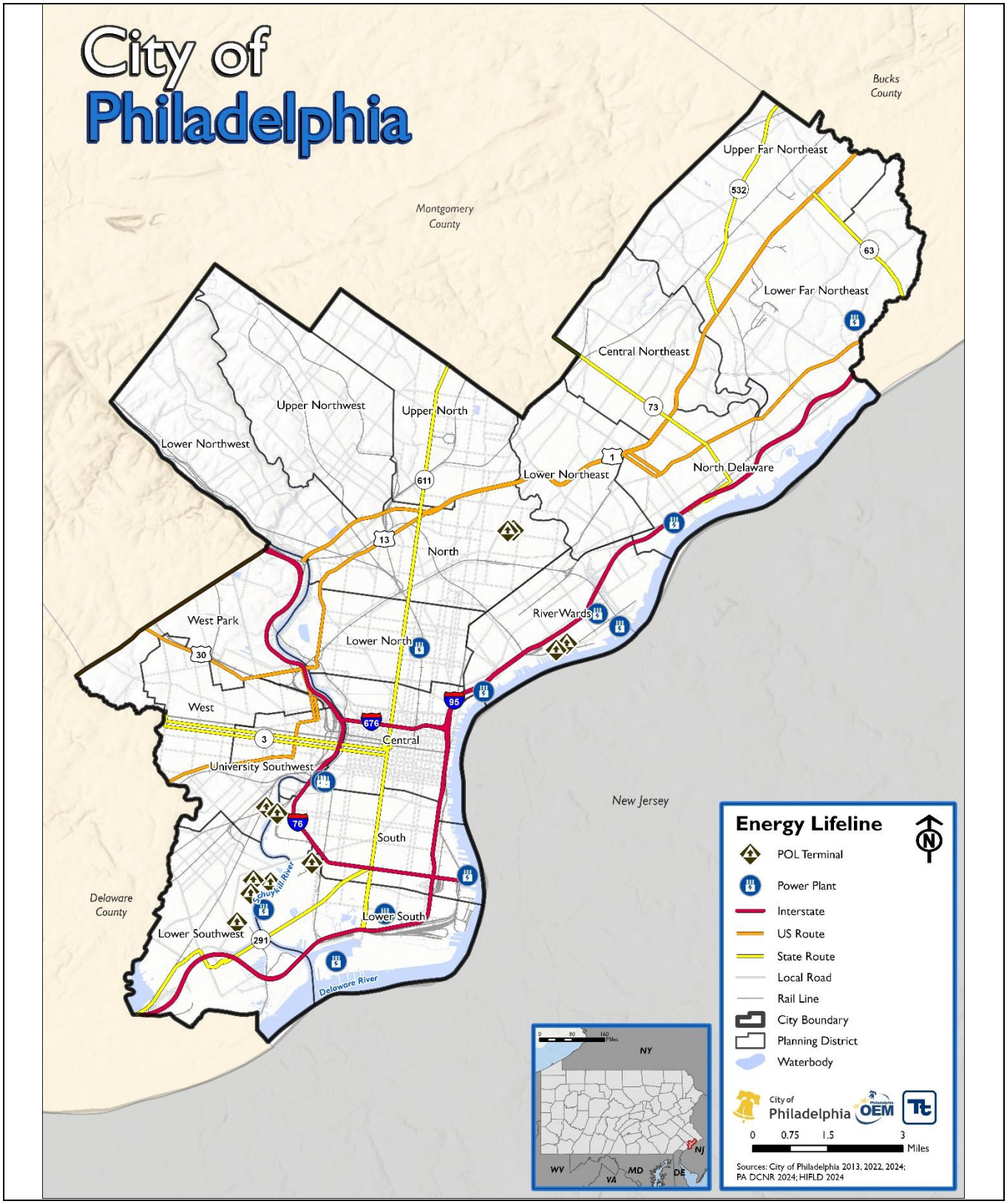
Facility Type	Number of Facilities
POL Terminal	11
Power Plant	12
Total	**23**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

PECO Energy Company operates in southeastern Pennsylvania and provides electricity to about 1.6 million customers and natural gas to over 511,000 customers. The company's electric service area covers all of the City of Philadelphia and Delaware County; most of Bucks, Chester, and Montgomery counties; and the southeastern corner of York County. The company's natural gas service area does not include Philadelphia. Instead, Philadelphia Gas Works (PGW) offers natural gas services in the City.

The City of Philadelphia's Municipal Energy Master Plan 2022 Progress Update, recaps how the City is working towards its institutional commitments to reduce energy use, expand renewable energy, lower carbon pollution, and reduce energy costs in municipal operations (City of Philadelphia 2023):

Figure 2-25. Energy Facilities in the City of Philadelphia



The 2022 report highlights how the City has demonstrated a 44 percent reduction in greenhouse gas emissions from the 2006 baseline, due in part to a cleaner energy grid and ongoing improvements to buildings. Other notable updates include (City of Philadelphia 2023):

- In partnership with the Department of Streets and the Philadelphia Energy Authority, the Philly Streetlight Improvement Project (PSIP) has moved into the design phase after completing an audit of more than 130,000 streetlights in 2022. PSIP aims to improve nighttime visibility and lighting operations by converting 120,000 streetlights across the City into a network of energy efficient LED lights on a lighting management system. The cost neutral project has also completed trial installations and public surveys gathering input from stakeholders.
- The City has broken ground on the Adams Solar project, which will provide 22 percent of electricity needed to power all municipal buildings upon completion. The construction of this new 70WM solar array was created through a power purchase agreement with the Philadelphia Energy Authority and Energix Renewables.
- Since the citywide Building Energy Performance Program launched in 2020, the City has worked with tune-up specialists to make low-to-no cost changes that save energy, lower utility costs, and achieve program compliance in eight large municipal buildings. Follow along with our progress towards compliance using the new Building Energy Performance Program dashboard.
- In 2022, the City joined the U.S. Department of Energy's Better Climate Challenge, committing to reducing portfolio-wide greenhouse gas emissions by at least 50 percent within the next ten years and to work with the Department of Energy to share successful decarbonization strategies.
- The Energy Office is growing. The new Program Manager for Capital Improvements and Program Manager for Renewable Energy will help accelerate the progress of the Municipal Energy Master Plan and help the City to achieve its goals.

2.4.5.5 Communications



The communications community lifeline category includes communications infrastructure; responder communications; alerts, warnings, and messages; finance; 911; and dispatch. Table 2-18 lists the number of each facility type. Figure 2-26 displays the location of communications facilities.

Table 2-18. Communications Community Lifelines in the City of Philadelphia

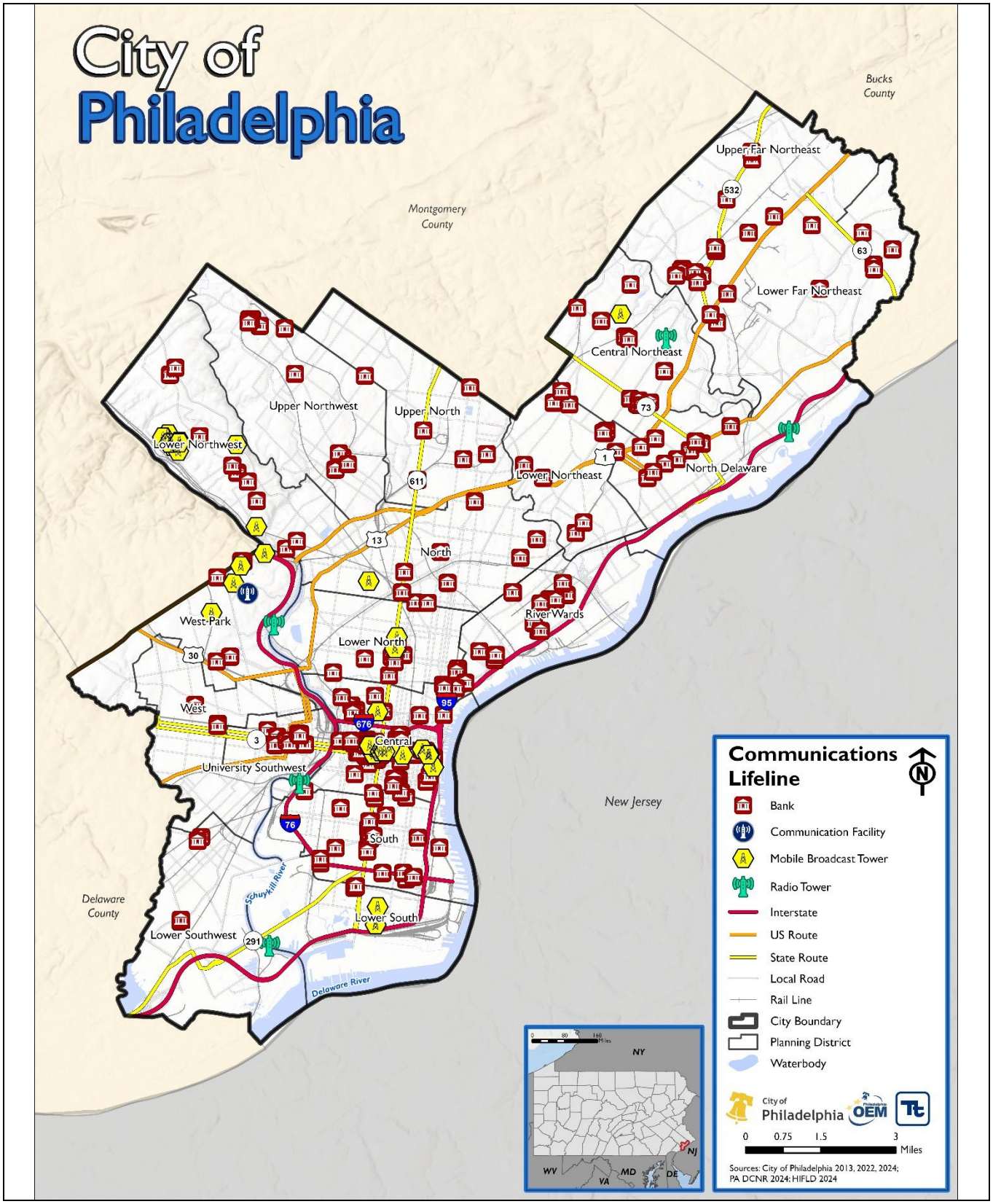
Facility Type	Number of Facilities
Bank	247
Communication Facility	1
Mobile Broadcast Tower	22
Radio Tower	5
Total	**275**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

Emergency Warnings and Responder Communications

City of Philadelphia OEM operates an Emergency Operations Center (EOC). The EOC is the City's primary venue for interagency coordination and decision-making. The EOC is staffed by liaisons from City, State, and Federal governments; the private sector; and non-governmental organizations. OEM, in consultation with the Managing Director, will activate the EOC to one of three staffing levels depending on the requirements of a given incident.

Figure 2-26. Communications Facilities in the City of Philadelphia



The EOC supports and coordinates incident command by (City of Philadelphia OEM 2023):

- Collecting, analyzing, and sharing information
- Coordinating interagency operations
- Providing decision-making support
- Establishing citywide priorities
- Managing resource requests and logistics support

Communications

The City of Philadelphia is served by a variety of communications systems, including traditional land line, fiber optic, and cellular service provided by multiple companies, such as Verizon, Direct TV, Time Warner, Comcast, and AT&T. Each carrier has individual plans for emergency situations during hazard events and post-disaster recovery efforts. In addition to land line, fiber optic, and cellular communications systems, City of Philadelphia has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation, and other supporting organizations. There are 275 communication facilities in City of Philadelphia identified as critical facilities.

2.4.5.6 Transportation

The transportation community lifeline category includes highway, roadway, and motor vehicle networks; mass transit; railways; aviation; and maritime facilities. Table 2-19 lists the number of each facility type. Figure 2-27 displays the location of transportation facilities in City of Philadelphia.

Table 2-19. Transportation Lifelines in the City of Philadelphia

Facility Type	Number of Facilities
Airport	2
Bridge	245
Bus Facility	8
Ferry Terminal	1
Heliport	18
Port	1
Subway Station	50
Train Station	52
Trolley Station	10
Total	**267**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

The Philadelphia Streets Department (Streets), the Philadelphia Department of Parks and Recreation, and the Pennsylvania Department of Transportation (PENNDOT) manage roadway travel in Philadelphia. The streets system in Philadelphia totals 2,575 miles: 2,180 miles of city streets, 35 miles of Fairmount Park roads, and 360 miles of state highways. The Streets Department is responsible for the construction and maintenance of 320 bridges in the City (City of Philadelphia 2024).

Figure 2-27. Transportation Facilities in the City of Philadelphia



Many major highways and roadways serve Philadelphia. Interstate 95 (I-95) is an interstate highway which runs from Miami, Florida to Houlton, Maine. The highway provides northern and southern access to the United States' eastern seaboard. In Philadelphia, the route is commonly referred to as the Delaware Expressway. It runs for approximately 19.89 miles along the eastern boundary of Philadelphia, parallel to the Delaware River. An estimated 169,000 motorists utilize the highway daily within Philadelphia. Interstate 76 (I-76) is an interstate highway running 435 miles from Akron, Ohio to Camden, New Jersey. The stretch of I-76 close to Philadelphia is more commonly known as the Schuylkill Expressway. The Schuylkill Expressway is 25 miles in length, extending from the Pennsylvania Turnpike at Valley Forge, through Center City Philadelphia, to the Walt Whitman Bridge. The highway runs 10.33 miles through Philadelphia and is located along the southwest side of the Schuylkill River.

Interstate 676 (I-676), or the Vine Street Expressway, also serves as an essential part of Philadelphia's highway system. Completed in 1991, I-676 runs seven miles between I-76 and I-95, crossing the Ben Franklin Bridge into Camden, New Jersey. U.S.-1 (also known as the Roosevelt Expressway/Roosevelt Boulevard) runs from Florida to Maine along the east coast. Construction crews completed the portion in Philadelphia in 1961 after three years of construction. In Philadelphia, U.S.-1 is an 18.43-mile stretch of road, connecting northeast Philadelphia with Center City.

Bus and Other Transit Facilities

Philadelphia has three major public transportation lines running through the City that conduct hundreds of millions of trips annually. Public transit systems provide transportation beyond the borders of Philadelphia, extending to surrounding counties and across state borders. 16.7 percent of Philadelphian's commute to work via public transportation, excluding taxicab (U.S. Census, 2023 American Community Survey 1-year estimates 2023). Public transit providers in Philadelphia include:

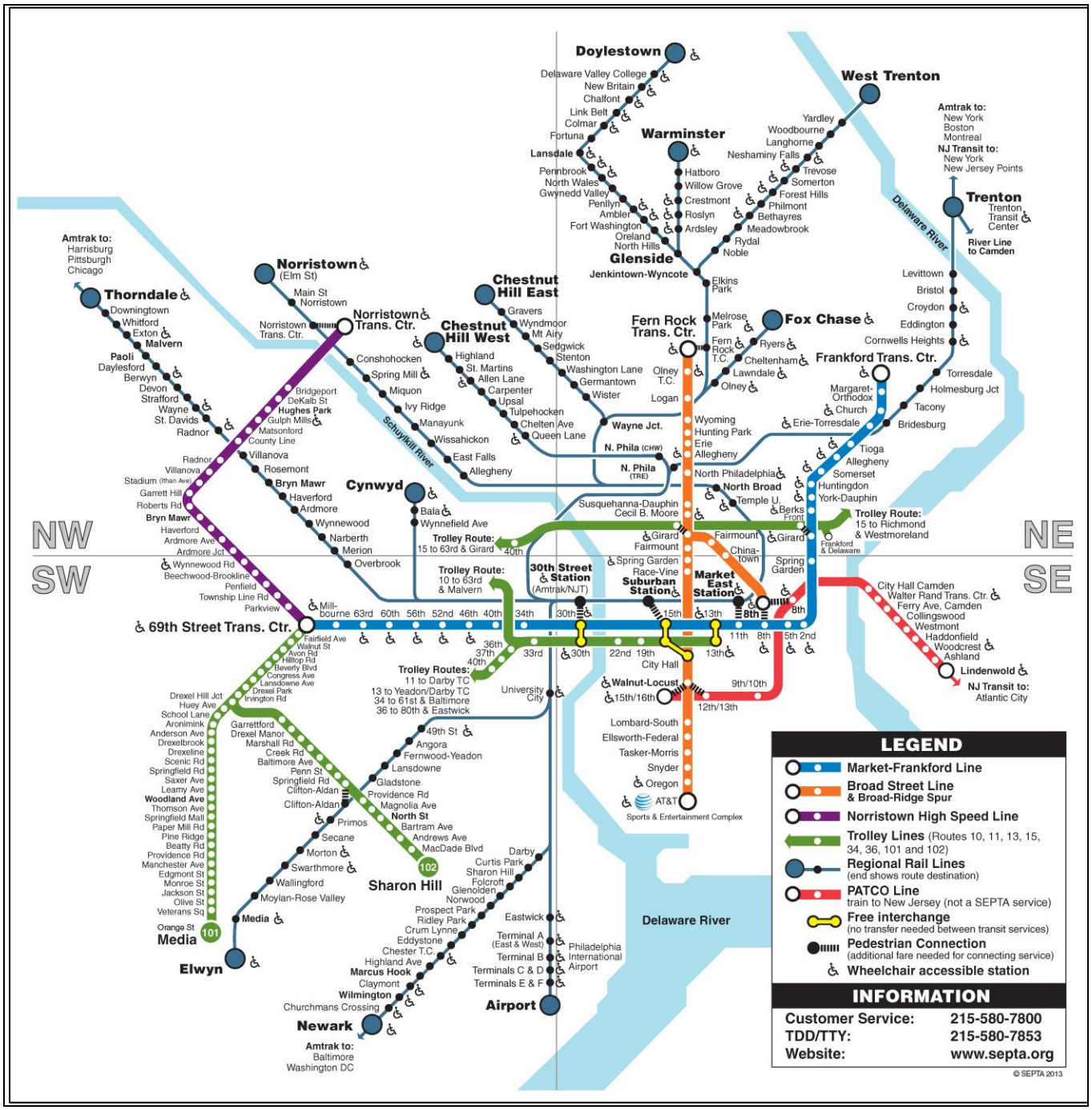
- Southeastern Pennsylvania Transportation Authority (SEPTA)
- Amtrak
- Port Authority Transit Corporation (PATCO)
- New Jersey Transit

SEPTA

Philadelphia's primary public transit provider is the Southeastern Pennsylvania Transportation Authority (SEPTA). SEPTA is the nation's 6th largest transit system and operates public buses, trolleys, trackless trolleys, Broad Street Subway, and Market-Frankford Elevated subway. In addition, SEPTA operates regional rail lines and regional bus services throughout Philadelphia, Bucks, Montgomery, Chester, Delaware counties, as well as service to and from parts of southern New Jersey (SEPTA n.d.).

SEPTA's 2023 ridership trends revealed ridership was at 64 percent of the pre-COVID 2019 ridership. Overall, ridership increased 13 percent from 2022. On average, there were roughly 77,893 more riders per day in 2023 than in 2022. Figure 2-28 illustrates the regional rail, subways, elevated rail, and trolley lines throughout the greater Philadelphia area associated with SEPTA operations (SEPTA 2023).

Figure 2-28. Map of SEPTA System



Source: SEPTA 2023

PATCO

More than 34,000 people ride the PATCO high-speed line every day. PATCO runs a single line with 13 stations from 15th to 16th St. station in Center City to Lindenwold, New Jersey (PATCO n.d.). To meet increasing demand, PATCO has teamed up with NJ Transit, SEPTA and AMTRAK on several projects meant to expand and improve public transportation in the Philadelphia region, including the re-opening of Franklin Square Station, which is

anticipated to be completed in early 2025 (PATCO 2024). Figure 2-29 illustrates the regional PATCO high-speed rail line throughout the greater Philadelphia area.

Figure 2-29. Map of PATCO Stops



Source: PATCO n.d.

NJ Transit

Covering a service area of 5,325 square miles, NJ Transit is the nation's third largest provider of bus, rail, and light rail transit, linking major points in New Jersey, New York, and Philadelphia. The agency operates a fleet of 2,221 buses, 1,231 trains and 93 light rail vehicles (NJ TRANSIT 2024). In Philadelphia, NJ Transit provides a train line service from Philadelphia to Atlantic City, New Jersey.

Amtrak

Amtrak is a major semi-national railroad company that serves Philadelphia at 30th Street Station. As the third busiest station in Amtrak's national system, 30th Street Station serves Amtrak's high-speed Acela, Northeast Regional, Keystone and long-distance train services and Thruway Bus Service, serving over 4 million Amtrak rail passengers and over 12 million SEPTA and NJ TRANSIT rail commuters annually (Amtrak n.d.).

Railroad Facilities

Amtrak, CSX, and Norfolk Southern each operate Class I railroads in the City of Philadelphia, while CSX also maintains intermodal terminal. Amtrak is the only operator of intercity passenger trains in Pennsylvania. The rest of the Class I railroads are freight railroads, hauling everything from automobiles and farm equipment to raw materials such as coal (PennDOT 2023).

The Federal Railroad Administration (FRA) categorizes railroad tracks into six classes based on maximum speed limits (Keefe 2023):

- **Class 1:** 10 mph for freight, 15 mph for passenger. Much yard, branch line, short line, and industrial spur trackage falls into this category.
- **Class 2:** 25 mph for freight, 30 mph for passenger. Branch lines, secondary main lines, many regional railroads, and some tourist operations frequently fall into this class.
- **Class 3:** 40 mph for freight, 60 mph for passenger. This commonly includes regional railroads and Class 1 secondary main lines.

- **Class 4:** 60 mph for freight, 80 mph for passenger. This is the dominant class for mainline track used in passenger and long-haul freight service.
- **Class 5:** 80 mph for freight, 90 mph for passenger. This is the standard for most high-speed track in the U.S.
- **Class 6:** 110 mph for freight, 110 mph for passenger. This is found in the U.S. exclusively on Amtrak's Northeast Corridor between New York and Washington, D.C, Brightline Services, and some Amtrak Midwest lines.
- **Excepted track.** In addition to the six numbered classes, FRA track standards also provide for something called "excepted" track, which carries a 10-mph speed limit for freight but cannot be used by revenue passenger trains. FRA permits excepted track under very narrowly defined conditions.

The Pennsylvania freight rail system comprises three general categories established by the FRA (PennDOT 2023):

- Three Class I railroads, comprising 47 percent of the route-miles in Pennsylvania
- Three regional (Class II) railroads, with 14 percent of the route-miles
- 57 short-line (Class III) railroads, including local (29 percent of the route-miles) and terminal/switching railroads (10 percent of the route-miles)

Airports

Philadelphia is the home of two airports: Philadelphia International Airport (PHL) and Northeast Philadelphia Airport (PNE). Both are owned by the City of Philadelphia and operated by the Division of Aviation. PHL operates under the jurisdiction of the 77th Philadelphia Police Department (PPD) district, a police district solely responsible for PHL. PNE operates under the 8th PPD district.

Philadelphia International Airport

Philadelphia International Airport is the only major airport serving Philadelphia. In a typical year, 30 airlines offer approximately 500 daily departures to approximately 28.1 million passengers annually, as reported in 2023. This is a decrease in the 32.24 million passengers reported in the 2022 HMP (Philadelphia International Airport 2024).

PHL has a $18.7 billion economic impact on the region and accounts for 102,600 full-time jobs, making it one of the largest economic engines in Pennsylvania. Philadelphia International Airport (PHL) has 6 active cargo facilities. There was approximately 10,934 tons of mail and 185,416 tons of freight, totaling 282,904 tons of total cargo transported by PHL in 2024, between the months of January and August (Philadelphia International Airport 2024).

Located in a FEMA designated floodplain, The Philadelphia International Airport conducted a Climate Vulnerability Assessment in 2019 to better understand and prepare for impacts from climate change. This assessment identified and assessed key vulnerabilities based on climate trends and projects for the City of Philadelphia. It also developed a set of key recommendations and next steps for the airport, including the development of an airport-specific Climate Adaption and Resiliency Plan (CARP) which is underway today (Figueroa Emanuelli 2020). Implementation of this plan is included as a mitigation action in the 2022 HMP. The Airport is also updating their Master Plan, which has an anticipated completion year of 2024. While the plan update is not yet completed as of November 2024, portions of the plan are available for view (https://www.phl.org/masterplanupdate/resources). This Master Plan update will guide future development of the airport moving forward (Philadelphia International Airport n.d.).

Philadelphia Northeast Airport

Philadelphia Northeast Airport is located on 1,118 acres of land in the northeast part of the City. It is the sixth busiest airport in Pennsylvania and provides "on-call" support to U.S. Customs, Immigrations and United States Department of Agriculture. The airport does not provide commercial service. In 2024, between the months of January and August, PNE managed approximately 79,133 airport flight operations (Philadelphia International Airport 2024).

Ferry Service and Ports

RiverLink Ferry System

The Delaware River Waterfront Corporation (DRWC) operates the RiverLink Ferry System, which provides service between the Camden and Philadelphia Waterfronts. It provides daily transportation for visits to local attractions and all major waterfront festivals and events. The ferry is certified to carry a maximum of 300 guests (regular ferry service) with ample interior and exterior seating on the main and upper deck; and a maximum of 500 guests for concert and event service (RiverLink Ferry 2023).

Port of Philadelphia

The Port of Philadelphia is both the fastest growing and the largest refrigerated port in the United States. The Philadelphia Regional Port Authority (PRPA) reported approximately 2.7 million metric tons of cargo moved through the Port in 2021. The Port is a top-ranked port in the United States for fruit and nut imports, and imports a significant amount of meat, cocoa beans, bananas and plantains, and other food products (U.S. Department of Transportation 2023).

In 2022, the Port of Philadelphia was awarded $20.3 million from the U.S. Department of Transportation 2022 Infrastructure for Rebuilding America grant program to construct a new 100,000 square-foot warehouse at the Tioga Marine Terminal, as well as safety and efficiency upgrades with the modernization of the terminal's main gate (U.S. Department of Transportation 2023).

Recently in October 2024, the Philadelphia Regional Port Authority recently unveiled an outlined a new 15-year plan that will lead to exponential future growth. The plan includes deepening the Delaware River, buying up more land, and a potential joint venture with the developer. Officials noted that the projects identified in the plan would result in nearly 9,000 new direct jobs, such as warehouse positions, thousands of additional indirect jobs in industries linked to the port, and $170 million in new annual state and local tax revenues within the next 15 years (Philadelphia Today 2024).

2.4.5.7 Hazardous Materials



The hazardous materials community lifeline category includes hazardous materials facilities, pollutants, and contaminants. Table 2-20 lists the number of each facility type. Figure 2-30 displays a 0.5-mile buffer surrounding the hazardous material facilities in the City of Philadelphia.

Table 2-20. Hazardous Materials Lifelines in the City of Philadelphia

Facility Type	Number of Facilities
Landfill	4
Sanitation Convenience Center	6
Tier II Facility	415

Facility Type	Number of Facilities
Transfer Station	5
Total	**430**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

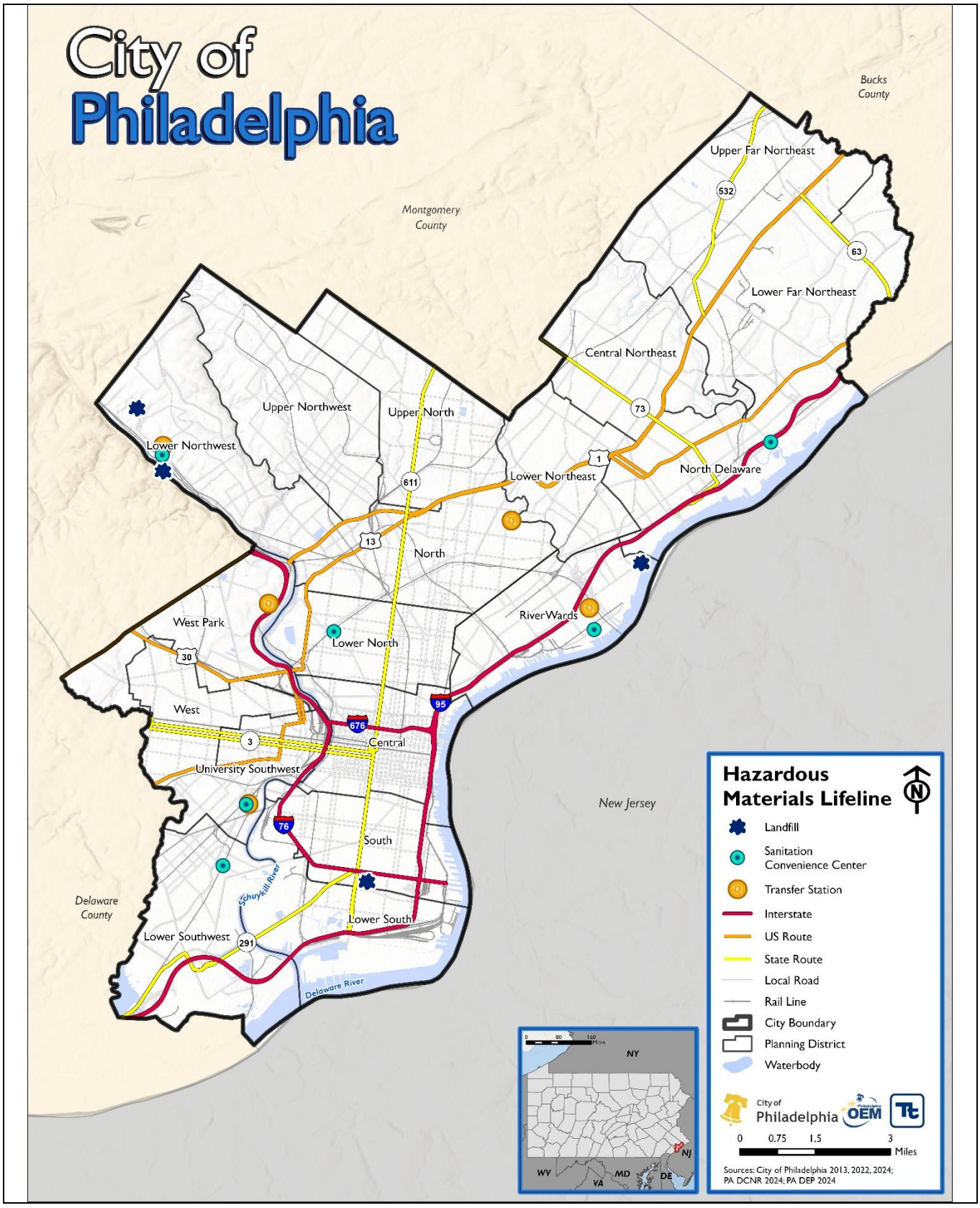
Hazardous Materials Facilities

The U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation and Liability Information System (Superfund) Public Access Database reports that there are currently no Superfund sites in City of Philadelphia. Superfund sites are polluted locations requiring a long-term response to clean up hazardous material contaminations.

Abandoned hazardous waste sites placed on the federal National Priorities List (NPL) include those that the EPA has determined present "a significant risk to human health or the environment," with the sites being eligible for remediation under the Superfund Trust Fund Program. As of 2024, the database indicates there are four Superfund sites in the City, two of which are on the NPL (EPA 2024). Interested parties can research this information at: https://www.epa.gov/superfund/search-superfund-sites-where-you-live.

The EPA Hazardous Waste Report provides detailed data on the generation of hazardous waste from large quantity generators and on the waste management practices of treatment, storage, and disposal facilities. The 2021 report lists 50 facilities in the City (EPA 2024). Interested parties can research this information at: https://rcrapublic.epa.gov/rcrainfoweb/action/modules/br/search/view

Figure 2-30. Hazardous Materials Facilities in the City of Philadelphia



2.4.5.8 Water Systems



The water system community lifeline category includes potable water and wastewater infrastructure. Table 2-21 lists the number of each facility type. Figure 2-31 displays the location of water system facilities in City of Philadelphia.

Table 2-21. Water System Community Lifelines in the City of Philadelphia

Facility Type	Number of Facilities
Wastewater Processing Facility	2
Water Tower	1
Water Treatment Plant	82
Well	214
Total	**299**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

Potable Water

The City of Philadelphia operates three drinking water facilities, which treat an average of more than 300 million gallons of water a day, ensuring residents and businesses have reliable access to clean, safe drinking water. The Philadelphia Water Department (PWD) uses proven treatment practices and participates in groundbreaking research to provide drinking water that consistently exceeds EPA standards, as shown in Figure 2-32. Philadelphia's drinking water sources are the Delaware and Schuylkill rivers (PWD 2021).

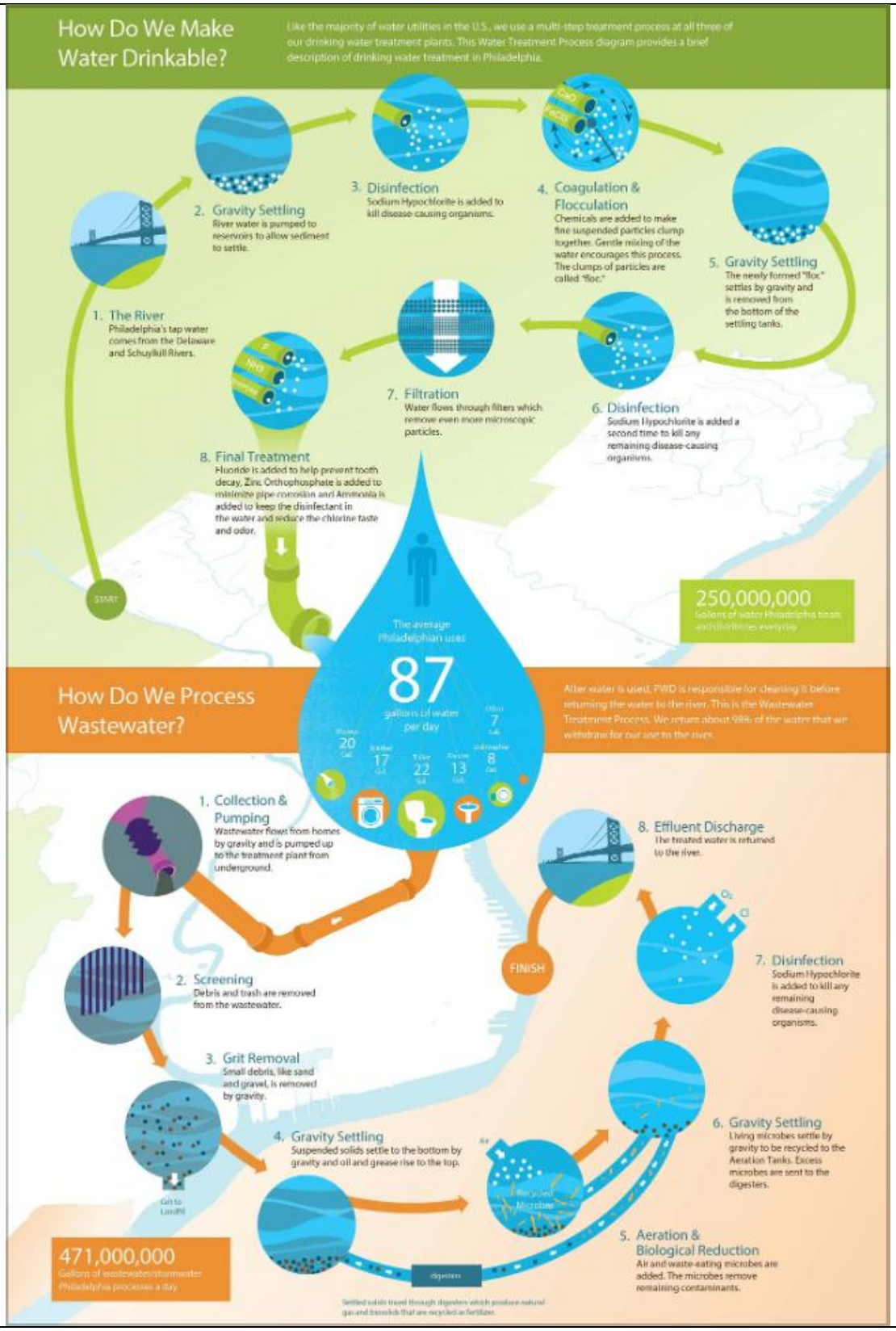
Wastewater Facilities

The Philadelphia Water Department (PWD) manages and treats Philadelphia wastewater, which includes the upkeep of more than 3,000 miles of sewer, by using a system of combined sewers in approximately half of the City's neighborhoods and a separate sewer system in the other half. In areas with combined sewers, a single pipe carries both stormwater from streets, houses, and businesses as well as wastewater from houses and businesses to a wastewater treatment plant. Many of the older sections of the City are served by a combined sewer system. In areas with separate sewers, one pipe carries stormwater to the City's streams while another carries wastewater to a wastewater treatment plant. The wastewater treatment process used by PWD can be viewed in Figure 2-32 (PWD 2021).

Figure 2-31. Water System Facilities in the City of Philadelphia



Figure 2-32. City of Philadelphia Water Treatment Process



Source: PWD 2021

2.4.6 Additional Critical facilities

Some facilities that are identified as critical for hazard mitigation in City of Philadelphia do not fit in any of FEMA's community lifeline categories. These include affordable housing, daycare facilities, green infrastructure, historic sites, libraries, places of worship, and polling places. Table 2-22 lists the number of each facility type.

Table 2-22. Additional Community Lifelines in the City of Philadelphia

Facility Type	Number of Facilities
Affordable Housing	382
Daycare	1,117
Green Infrastructure	124
Historic Site	128
Library	57
Place of Worship	1,384
Polling Place	688
Total	**3,880**

Note: This table may not include all facilities in the City. Some facilities may have been missed in the data collection process.

2.5 DATA SOURCES AND LIMITATIONS

Table 2-23 summarizes the data sources used to define populations and asset inventories for this plan, along with the sources for assessing the risk associated with hazards of concern.

Table 2-23. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; American Community Survey 5-Year Estimates	2022	Digital (GIS) format
Building Inventory	City of Philadelphia, Tetra Tech	2022, 2024	Digital (GIS) format
Critical Facilities and Lifelines	City of Philadelphia; DEP; SEPTA; ESRI; HIFLD	2012, 2016, 2018,2019, 2021, 2024; 2024; 2023; 2023; 2019, 2023, 2024	Digital (GIS) format
Land Use	USGS, National Land Cover Database	2021	Digital (GIS) format
Digitized Effective FIRM maps	FEMA	2015	Digital (GIS) format
1-Meter Digital Elevation Model	USGS	2020	TIFF
Dam Failure	City of Philadelphia	2024	Digital (GIS) format
Sea Level Rise	NOAA	2019	TIFF
Rail Network	City of Philadelphia	2024	Digital (GIS) format
Road Network	City of Philadelphia	2022	Digital (GIS) format

Data	Source	Date	Format
Tier II Sites	City of Philadelphia	2024	Digital (GIS) format

Note: DOT = Department of Transportation; ESRI = Environmental Systems Research Institute, Inc; FEMA = Federal Emergency Management Agency; HIFLD = Homeland Infrastructure Foundation-Level Data; NOAA = National Oceanic and Atmospheric Administration; NRCS = Natural Resources Conservation Service; SEPTA = Southeastern Pennsylvania Transportation Authority; USDA = U.S. Department of Agriculture; USGS = U.S. Geological Survey

Loss estimates, vulnerability analyses, and hazard-specific impact evaluations rely on the best-available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct such a study
- Incomplete or dated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed by the City
- The amount of advance notice residents have to prepare for a specific hazard event
- Uncertainty of climate change projections

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential vulnerability and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, City of Philadelphia will collect additional data and update and refine existing inventories to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock using best-available data. The City acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.

3. PLANNING PROCESS

3.1 UPDATE PROCESS AND PARTICIPATION SUMMARY

3.1.1 Summary of Updates

Philadelphia has been performing Hazard Risk and Vulnerability Assessments since at least 1984. There was an updated hazard risk and vulnerability assessment in Spring 1998. Following new laws and regulations, Philadelphia developed and adopted its first Hazard Mitigation Plan (HMP) in 2012. The 2012 plan differed from previous hazard risk and vulnerability assessments by including a mitigation strategy that will reduce the long-term risks that the City faces. The plan was then updated and adopted by City Council 5 years later in May 2017. In November 2019, Philadelphia OEM hired a permanent Hazard Planning Coordinator to oversee the development and coordination of Philadelphia's third HMP and to focus on the implementation of the plan in between plan updates. The coordinator has continued to be responsible for plan implementation and helped to release the 2022 Hazard Mitigation Plan in May 2022 and conduct annual reviews every year since the 2022 Plan was released. In September 2023, the Hazard Mitigation Program was separated into a separate program area from the infrastructure program, and a dedicated Hazard Mitigation Program Manager was hired. A kickoff for this new plan was held in June 2024 (see Figure 3-1).

Figure 3-1. June 2024 Annual Review Kickoff Event Presentation



The 2026 HMP planning process was led by Philadelphia OEM with support from Tetra Tech, Inc. and the Hazard Mitigation Plan Steering Committee. Stakeholders were engaged throughout the planning process starting with a kickoff in June 2024, six all-stakeholders workshops, seven steering committee meetings, six public steering committee meetings, and numerous public events, one-on-one meetings, and workgroup meetings.

Philadelphia's 2026 HMP was updated following the process outlined by the *Pennsylvania Hazard Mitigation Plan Standard Operating Guide* (PA SOG) and FEMA's Local Mitigation Plan Review Guide (2023). The top priorities for this plan included:

- Focusing on Social Equity and reaching underrepresented populations
- More advanced Hazus analyses and Risk Assessments
- Increased Public engagement that focused on the quality of the interactions rather than the number
- Inclusion of Community-Driven Solutions
- Ensuring alignment of the plan with the FEMA community lifelines

3.2 THE PLANNING TEAM

Philadelphia OEM was the primary City lead for the 2026 Hazard Mitigation Plan. In 2022, OEM was awarded funding through FEMA's post-disaster Hazard Mitigation Grant Program (HMGP) to assist with the 2026 Hazard Mitigation Plan. Tetra Tech was hired to support the following:

- Development of the executive summary,
- Updating the Community Profile,
- Updating the Capability Assessment,
- Updating the Mitigation Strategy,
- Updating the Risk and Vulnerability Assessment including advanced Hazus and GIS analysis,
- Reviewing the Planning Process and Plan maintenance chapters that were written by OEM,
- Providing technical assistance integrating equity and new climate change data throughout the plan, and
- Support with reviewing, compiling, and finalizing the final plan for submission to PEMA and FEMA.

3.2.1 Stakeholder Steering Committee

A Stakeholder Steering Committee made up of subject matter experts from across City departments was originally formed to guide the development of the 2022 plan. This Committee was then continued as a standing committee to help guide the implementation of the 2022 plan following its adoption. This includes serving as the decision-making body for mitigation action selection and prioritization, and project selection for mitigation grant opportunities, such as FEMA's various mitigation grant programs. This group was then used to guide the development of the 2026 plan. Table 3-1 lists committee members for 2026 update process. The committee met roughly monthly from June 2024 to February 2026 to oversee the update process, guide the development of City mitigation goals and objectives, and assist with the prioritization of mitigation actions.

Table 3-1. Steering Committee Members

Member	Title	Organization
Karen Fegely	Deputy Commerce Director	Commerce
Adrienne Moore	Executive Director	Mayor's Office for People w/ Disabilities
Julian Gavino	ADA Coordinator, Mayor's Commission on People	Mayor's Office for People w/ Disabilities
Carolyn Caton	First Deputy Director	Office of Emergency Management (primary)

Member	Title	Organization
Emma Giardina*	Hazard Mitigation Program Manager	Office of Emergency Management (alternate 1)
Noah Palau	Hazard Planning Coordinator	Office of Emergency Management (alternate 2)
Elizabeth Lankenau	Director, Philadelphia Office of Sustainability	Office of Sustainability (primary)
Abby Sullivan	Interim Chief Resilience Officer	Office of Sustainability (alternate 1)
Elaine Montes*	Program Manager, Flood Resilience and Compliance Strategy	Office of Sustainability (alternate 2)
C/I John Przepiorka	Chief Inspector, Special Operation Bureau	Philadelphia Police Department
Capt. Michael Browne	Planning	Philadelphia Fire Department
Lt. Lisa Desamour*	Planning	Philadelphia Fire Department (alternate)
Meg Cavanagh	Environmental Planner	Philadelphia City Planning Commission (primary)
Ian Hegarty*	City Planner Supervisor	Philadelphia City Planning Commission (alternate)
Terra Luke	Program Manager	Philadelphia Department of Public Property
Jessica Caum	Division Director, Division of Disease Control	PhiladelphiaDepartment of Public Health
Patrick Clark	CDBG-DR Director	Office of Budget & Program Evaluation
Megan Clarkin	Interim Director of Infrastructure Program	OTIS (primary)
Lily Reynolds	Director of Federal Infrastructure Strategy	OTIS (primary)
Samantha Lopez	Infrastructure Planning Coordinator	OTIS (alternate)
Leigh Ann Campbell	Director of Planning, Preservation and Property Management	Philadelphia Parks and Recreation
Betsy Baldwin	Chief Code Official	**Philadelphia Department of Licenses and Inspections**
Jeffrey Tan	Senior Code Analyst/ Staff Engineer 2	**Philadelphia Department of Licenses and Inspections**
Birdie Lawall	GIS Specialist	**Department of Public Property**
Elizabeth Svekla	Strategic Planning Manager	Philadelphia Water Department

* *Denotes Stakeholder Steering Committee Members who are no longer a part of the Stakeholder Steering Committee due to position changes within the City or leaving City service.*

As with the 2022 HMP update, the Steering Committee will meet regularly after the 2026 plan is complete to provide guidance on plan implementation and the annual review process. This will ensure the HMP remains a living document in between 5-year updates. The members of the committee will also be updated to reflect changes in position as well as departments regularly involved in hazard mitigation work.

See Section 3.3 for more details on the Steering Committee Meetings.

3.2.2 Participants

Philadelphia OEM began engaging partners in January 2024 as part of the 2024 Annual Review of the 2022 Hazard Mitigation Plan. An emphasis was placed on expanding the number of stakeholders involved in the planning process, including regional partners, private-sector partners, universities and academic institutions, and the

community. The 5-year timeframe for this plan update allowed for extensive and targeted one-on-one outreach to educate and engage stakeholders. Over 87 different agencies and organizations were directly or indirectly involved in the two-year planning process, an increase in two entities since the 2022 plan update. Table 3-2 lists the participants.

Stakeholders were engaged through one-on-one meetings and presentations, a series of stakeholder planning workshops, and one-on-one meetings. Invitations for meetings and workshops were sent to a wide variety of different agencies and organizations to promote involvement from as many different entities as possible. Participants represented a range of different levels of experience and areas of expertise.

Participants were also able to track progress and upcoming meetings via an online portal created on Microsoft SharePoint.

Table 3-2. Participants in the 2025 HMP Planning Process

Participant	Position	Agency or Organization
Kara Angotti*	Senior Sustainability Manager	Amtrak
Emily Costello	Real Estate Asset Manager	Amtrak
Brian McDonough	Regional Emergency Manager	Amtrak
George Wilson	Director	Bucks County Emergency Management Agency
Matthew Walters	Senior Planner	Bucks County Planning Commission
Evan Stone	Executive Director	Bucks County Planning Commission
Deanna Miller	Planner/Recycling Coordinator	Bucks County Planning Commission
Joe Goldschmidt	Property Mgt, Navy Yard	CBRE
Poe Leggette	Property Mgt, Navy Yard	CBRE /Philadelphia Industrial Development Corporation
Scott McLaughlin	Health and Human Services Coordinator	Chester County Department of Emergency Services
Carrie Bamper	Community Resilience Coordinator	Chester County Department of Emergency Services
Brian Barth	Manager of Emergency Preparedness	Children's Hospital Of Philadelphia
Michael Darmiento	Associate Vice President Corporate Security	Comcast
Karen Fegely	Deputy Commerce Director	Commerce
Randolph Merced	Director, Safety and Security	Community College of Philadelphia
Marguerite Anglin	Public Art Director	Creative Philadelphia
Val Gay	Director of Arts and Culture	Creative Philadelphia
Danielle Koerner	Chief of Special Operations	Delaware County Emergency Management
Sara Senkow	Emergency Management Specialist, Access and Functional Needs Coordinator	Delaware County Emergency Services
Kristen Kavanagh	Deputy Executive Director	Delaware River Basin Commission
Avery Lentini	Community Engagement Specialist, External Affairs and Communications	Delaware River Basin Commission
William Shanahan	Project Manager, Homeland Security and Emergency Management	Delaware River Port Authority
Stacy Irving	Senior Advisor	Delaware Valley Intelligence Center (DVIC)

Participant	Position	Agency or Organization
Amy Verbofsky	Manager, Healthy and Resilient Communities	Delaware Valley Regional Planning Commission
Douglas Trahey	Emergency Preparedness and Response Coordinator	Department of Human Services
Ceena Jenkins	Disaster Disability Specialist	Department of Human Services
Jeffrey Tan	Senior Code Analyst/ Staff Engineer 2	Department of Licenses and Inspections
Betsy Baldwin	Chief Code Official	Department of Licenses and Inspections
Sarah Adamo	Civil Engineer 2	Department of Licenses and Inspections
Terra Luke	Senior GIS Analyst	Department of Public Property
Joe Misko	Building Services Manager	Department of Public Property
James Lowe	Project Director- Health and Human Services	Department of Public Property- Capital Projects Division
David Hollinger	Director, Fire and Emergency Services	Drexel University
Michelle Feldman	Executive Director	East Falls Development Corporation
Allison Schapker	Capital Projects Director	Fairmount Park Conservancy
Margaret Dunn*	Mitigation Outreach Coordinator	FEMA
Alyssa Fico*	Operations Research Analyst	FEMA
Mari Radford*	Region 3 Community Planning Lead	FEMA
Sarah Wolfe	Branch Chief, Floodplain Management and Insurance Branch	FEMA
Stacey Blankin	Hazard Mitigation Planning Unit Supervisor	FEMA
Matthew McCollough	Mitigation, Pennsylvania	FEMA Region III
William Melville	GIS Analyst	FEMA Region III
Helen Longhead	Assistant to the Director of Finance	Finance
Ty Dupass	Property Management Director	Free Library of Philadelphia
Ruffian Tittmann*	Executive Director	Friends of Wissahickon
John Wierzbowski	Chair	Healthcare Coalition
Matthew Butler	Chair	Healthcare Coalition
Lamar Gore	Refuge Manager	John Heinz Wildlife Refuge
Angel Rodriguez	Senior Vice President, Land Management	Land Bank
Angie Dixon	Deputy Director of Design and Construction	Managing Director's Office - Rebuild
Luigi Sebastiani	Director of Construction	Managing Director's Office - Rebuild
Michelle Shuman	Director of Design	Managing Director's Office - Rebuild
Sophie Keane	Institutional Relations Manager	MannaPA
Julian Gavino	ADA Coordinator	Mayor's Office for People w/ Disabilities
Adrienne Moore	Executive Director	Mayor's Office for People w/ Disabilities
Amy Nieves*	Executive Director	Mayors Office for People with Disabilities
Aviva Tevah*	Director, Philadelphia Reentry Coalition	MDO - Philadelphia Reentry Coalition
Jason Wilson	Deputy Director of Emergency Management	Montgomery County Dept of Public Safety

Participant	Position	Agency or Organization
Jillian Lopez*	Volunteer Engagement Manager	Office of Community Empowerment
Adrienne Ewing	ADA Coordinator	Office of Diversity, Equity and Inclusion
Matthew Breidenstein	Regional Preparedness Program Manager	Office of Emergency Management
Emma Giardina*	Hazard Mitigation Program Manager	Office of Emergency Management
Dominick Mireles	Director	Office of Emergency Management
Dave Natale	Human Services Program Manager	Office of Emergency Management
Angel Roebuck	Deputy Director	Office of Emergency Management
Gary Sector	Homeland Security Program Manager	Office of Emergency Management
Ajay Persaud	Infrastructure Program Manager	Office of Emergency Management
Allison Miller	Communications Coordinator	Office of Emergency Management
Zorina Morton	Infrastructure Planning Coordinator	Office of Emergency Management
Gretchen Shanfeld	Health and Medical Program Manager	Office of Emergency Management
Adina Karten*	Disability/Access and Functional Needs Planning Coordinator	Office of Emergency Management
Sean Grasso-McClain	Homeland Security Planning Coordinator	Office of Emergency Management
Carolyn Caton	Deputy Director of Planning	Office of Emergency Management
Noah Palau	Hazard Mitigation Program Manager	Office of Emergency Management
Olivia Garcia	Program Coordinator, Capital Improvements	Office of Sustainability
Genevieve LaMarr LeMee	Senior Advisor for Environmental Justice	Office of Sustainability
Elizabeth Lankenau	Director, Philadelphia Office of Sustainability	Office of Sustainability
Elaine Montes*	Program Manager, Infrastructure & Floodplain Resilience	Office of Sustainability
Taylor Quinland	Program Strategist for Place-Based Initiatives	Office of Sustainability
Genevieve LaMarr LeMee	Deputy Director, Environmental Justice	Office of Sustainability
Dominique Smiley	Program Manager, Grants Management	Office of Sustainability
Abby Sullivan	Chief Resilience Officer	Office of Sustainability
Korin Tangtrakul	Senior Manager of Place-based Initiatives Manager	Office of Sustainability
Jospeh Sullivan	Project Manager, Flood Resilience and Compliance Strategy	Office of Sustainability
Charlotte Shade	Program Manager, Building Energy Programs	Office of Sustainability
Jordan Pares-Kane	Climate Resilience Planning and Engagement Specialist	Office of Sustainability
Lily Reynolds	Director of Federal Infrastructure Strategy	Office of Transportation and Infrastructure Systems
Janaye Evans	Executive Coordinator of Federal Infrastructure Strategy	Office of Transportation and Infrastructure Systems

Participant	Position	Agency or Organization
Samantha Lopez	Infrastructure Planning Coordinator	Office of Transportation and Infrastructure Systems
Richard Quodomine*	Project Manager, Clean Waters Task Force	Office of Transportation and Infrastructure Systems
Megan Clarkin*	Interim Director of Infrastructure Program	Office of Transportation and Infrastructure Systems
Jessica Miller	Access and Functional Needs Administrator	PA Department of Health
Peter Barnard	Planner Supervisor	PDPD/PCPC
Michele Sanchez*	External Affairs Manager	PECO
William Kelbaugh*	Manager, Emergency Preparedness	PECO
Victoria Corradina	Senior Emergency Preparedness Specialist	PECO
Richard Deal	State Hazard Mitigation Officer	PEMA
Tom Hughes	Director, Emergency Management Mitigation, Insurance and resilient Communities Office	PEMA
Ernie Szabo	Hazard Mitigation Planner	PEMA
David Adams	Traffic Operations Manager	PennDOT
Matt Elliott	Traffic Incident management Coordinator	PennDOT 6-0 RTMC
John Gardosik	Disaster Planning Project Manager	Pennsylvania State Historic Preservation Office
Patrick Clark	CDBG-DR Project Director	Philadelphia Budget Office
Tracy P. Glova	CDBG-DR Project Analyst	Philadelphia Budget Office
Jeremy Sanford*	CDBG-DR Project Analyst	Philadelphia Budget Office
Sarah Banh	South District Planner	Philadelphia City Planning Commission
Donna Carney	Citizens Planning Institute Director	Philadelphia City Planning Commission
Meg Cavanagh	Environmental Planner	Philadelphia City Planning Commission
Laura DiPasquale Zupan*	Historic Preservation Planner	Philadelphia City Planning Commission
John Haak*	City Planner	Philadelphia City Planning Commission
Aaron Holly	District Planner - Lower Northwest	Philadelphia City Planning Commission
Kacie Liss	City Planner II - Urban Design Division	Philadelphia City Planning Commission
Laura Spina*	Community Planning Director	Philadelphia City Planning Commission
Jametta Johnson*	Senior Planner	Philadelphia City Planning Commission
Nina Solomonic	City Planner II	Philadelphia City Planning Commission
David Kanthor	Transportation Planner	Philadelphia City Planning Commission
Katherine Liss	City Planning Supervisor	Philadelphia City Planning Commission
Peter Barnard	City Planner Supervisor	Philadelphia City Planning Commission
Camilla Lizundia	Riverwards District Planner	Philadelphia City Planning Commission
Martine DeCamp	Deputy Director of City Planning	Philadelphia City Planning Commission
Jon Farnham	Executive Director- Historical Commission	Philadelphia Department of Planning and Development

Participant	Position	Agency or Organization
James Stiving*	Grants Manager	Philadelphia Department of Planning and Development
Ian Hegarty*	City Planner	Philadelphia Department of Planning and Development
Rhona Cooper	Clinical Coordinator-Public Health Preparedness	Philadelphia Department of Public Health
Liam Dougherty	Access and Functional Needs Coordinator	Philadelphia Department of Public Health
Laura Feingold	Pandemic Planner	Philadelphia Department of Public Health
Alexandra Skula	Public Preparedness Program Manager	Philadelphia Department of Public Health
Jessica Caum	Division Director, Division of Disease Control	Philadelphia Department of Public Health
Cassie Peña	Planning Manager	Philadelphia Department of Public Health
Capt. Michael Browne	Captain, Planning Unit	Philadelphia Fire Department
Lisa Desamour	Planning	Philadelphia Fire Department
Cpt Michael Kirby	Fire Prevention Operations Captain	Philadelphia Fire Department
Mark Lee	Manager Corporate Preparedness	Philadelphia Gas Works
Shannon Garrison	Historic Preservation Planner 2	Philadelphia Historic Commission
Kristin Hankins	Preservation Planner I	Philadelphia Historic Commission
Natasha Tabachnikoff*	Sustainability Coordinator	Philadelphia Housing Authority
John Glass	Airport Operations Superintendent	Philadelphia International Airport - Dept. of Aviation
Amy Liu	Sustainability Planner	Philadelphia International Airport - Dept. of Aviation
Jessica Noon	Sustainability Manager	Philadelphia International Airport - Dept. of Aviation
Angel Rodriguez	Executive Director	Philadelphia Land Bank
Sophia Gray*	VISTA	Philadelphia Opioid Response Unit
Noelle Foizen	Associate Director Health and Human Services	Philadelphia Stat 360
Michelle McLoyd	Deputy Director	Philadelphia Opioid Response Unit
Aparna Palantino	Deputy Commissioner for Capitol Infrastructure	Philadelphia Parks and Recreation
Joshua Bell	Operations & Landscape Management	Philadelphia Parks and Recreation
Leigh Ann Campbell	Director of Planning, Preservation and Property Management	Philadelphia Parks and Recreation
Stephanie Craighead	Director of Planning, Preservation and Policy (&property management?)	Philadelphia Parks and Recreation
Doug Robinson	Special Events Office	Philadelphia Parks and Recreation
Erica Smith	Community Forestry Manager	Philadelphia Parks and Recreation
Marisa Wilson	Community Initiative Specialist	Philadelphia Parks and Recreation
Theresa Stuhlman	Planning Preservation and Development Administrator	Philadelphia Parks and Recreation

Participant	Position	Agency or Organization
Elizabeth Svekla	Director of Planning, Preservation, and Property Management	Philadelphia Parks and Recreation
Mali Skotheim	Public Private Partnerships Grant Manager	Philadelphia Parks and Recreation
Lt. Brian Gress	Counter Terrorism Operations	Philadelphia Police Department
Lt. Kevin Long	Lt. Police	Philadelphia Police Department
Capt. Thomas McLean	Counterterrorism Operations	Philadelphia Police Department
Sgt. Monasse*	Aid to C/I Cram	Philadelphia Police Department
Lt. Brian Sprowal	Intelligence	Philadelphia Police Department
Chief Inspector Michael Cram	Homeland Security	Philadelphia Police Department
Sgt. Kevin Robinson	SGT Homeland Security	Philadelphia Police Department
C/I John Przepiorka	Chief Inspector, Special Operation Bureau	Philadelphia Police Department
Kelly Anderson	Watershed Protection Program Manager	Philadelphia Water Department
Marc Cammarata	Deputy Commissioner	Philadelphia Water Department
Mark Doncic	Finance	Philadelphia Water Department
Nusaybah Estes	Civil Engineer	Philadelphia Water Department
Barabra Heintz*	City Planner II	Philadelphia Water Department
Isabella Kitchen	Graduate Environmental Engineer	Philadelphia Water Department
Susan Patterson	Engineering Specialist	Philadelphia Water Department
Patrick Perhosky	Engineering Supervisor	Philadelphia Water Department
Julia Rockwell	Climate Change Adaptation Program Manager	Philadelphia Water Department
Kristen Snuck	Grants	Philadelphia Water Department
Erik Haniman	Environmental Engineer	Philadelphia Water Department
Mustafa Haweejah	Graduate Civil Engineer	Philadelphia Water Department
Alllison Lau	Graduate Civil Engineer	Philadelphia Water Department
David Weld	Water Engineering Assistant Projects Manager	Philadelphia Water Department
Maksym Szpilczak	Design and Construction Project Manager	Philadelphia Water Department
Joseph Mellon	Water Utility Emergency Specialist	Philadelphia Water Department
Pamela Drake	Deputy Director, Healthcare Emergency Management	Philadelphia HMC
Douglas Wo	Regional Manager	PHMC
Julia Cohen	Project Manager	Philadelphia Industrial Development Corporation
Thomas Dalfo	Senior Vice President, Real Estate Services	Philadelphia Industrial Development Corporation
Troy Mandy	Director, Real Estate Services	Philadelphia Industrial Development Corporation
Alicia Santiago	Project Manager, Navy Yard	Philadelphia Industrial Development Corporation

Participant	Position	Agency or Organization
Rudy Terry	Energy Business Partners	Philadelphia Industrial Development Corporation
Monica Trudeau	Senior Project Manager, Infrastructure Projects	Philadelphia Industrial Development Corporation
Kate McNamara	Executive Vice President, Navy Yard	Philadelphia Industrial Development Corporation
Angie Fredrickson	Vice President of Real Estate Services	Philadelphia Industrial Development Corporation
Zoe Linder Baptie	Senior Research Specialist	Rutgers
John Mulligan	Fire Marshall	School District of Philadelphia
Emma Melvin	Green Infrastructure Program Manager	School District of Philadelphia
Megan Garner	Sustainability Program Manager	School District of Philadelphia
Tricia London	Emergency Management Liaison, Office of School Safety	School District of Philadelphia
John Mulligan	Fire & Safety Specialist	School District of Philadelphia
Teresa Fleming	Chief Operating Officer	School District of Philadelphia
Oz Hill	Deputy Superintendent for Operations	School District of Philadelphia
Philip Asabere	Civil Design & Coordination	SEPTA
Aleta Evans*	Chief Control Center Officer	SEPTA
Charles Graham	Chief Supervisor	SEPTA
David Montvydas*	Chief Engineer	SEPTA
Dennis Stefanski*	Senio Program Manager	SEPTA
Mark Lashley	Director	SEPTA
Jonathan Miller	Chief Operating Officer	Share Food Program
George Matysik	Executive Director	Share Food Program
Dana Dobson*	City Planner IV	Streets Department
Nate Dorfman	Transportation Grants Coordinator	Streets Department
Steve Lorenz	Chief Highway Engineer	Streets Department
Kyra Lowie*	Transportation Grants Coordinator	Streets Department
Scott McGrath	City Planner	Streets Department
Daniel Sommerville*	Acting City Planner Supervisor	Streets Department
Nick Baker*	City Planner V	Streets Department
Len Clark	Director, Emergency Management	Temple University
Julie Ulrich	Director of Urban Conservation	The Nature Conservancy
Richard Johnson*	Urban Climate Resilience Manager	The Nature Conservancy
Sara Santamaria Aguilar	Postdoctoral Scholar	University of Central Florida
Janice Barnes	Professor	University of Pennsylvania
Hillary Nelson	Faculty Director of the MPH Program	University of Pennsylvania
Eugene Janda	Chief, Fire and Emergency Services	University of Pennsylvania
Jerry Conrad*		US Coast Guard
Glena Tredinnick*		US Coast Guard

Participant	Position	Agency or Organization
LCDR Josh McElhaney	Emergency Management Division Chief- Sector Delaware Bay	US Coast Guard
LT Malia Hindle	Emergency Management Assistant Division Chief- Sector Delaware Bay	US Coast Guard
Andrew Kennedy*		US Coast Guard
Todd Wardwell	Port Recovery Specialist	US Coast Guard
Jeannie Morris	Director, Government Affairs	Vicinity Energy
Vinnie Voiro	Distribution-Metering Manager	**Vicinity Energy**

* *Denotes stakeholders who have left their positions within their organization or agency*

3.3 MEETINGS AND DOCUMENTATION

Philadelphia's 2026 HMP required extensive outreach to subject matter experts, City agencies, state partners, federal partners, private sector partners, nonprofits, businesses, and the public to gather feedback and generate buy-in. Stakeholders and the public were engaged through:

- Stakeholder Planning Workshops
- Steering Committee meetings
- Trainings
- Presentations offered to existing workgroups and committees
- One-on-one meetings
- Public workshops and events

A major change from the 2022 Plan was that many meetings could be hosted in person again as COVID-19 has subsided. Some of the meetings, such as the All-Stakeholders Meetings, were still held virtually for flexibility and the convenience of our partners. For meeting agendas, notes, sign-in sheets, presentation slides, and distributed handouts, please see Appendix C**.**

3.3.1 Stakeholder Planning Workshops

Between June 2024 and December 2026, stakeholders were invited to participate in workshops focused on the overall planning strategy, the capability assessment, and the mitigation strategy. Participants represented a wide array of organizations, expertise, experience levels, and backgrounds. Community leaders were invited to join this kickoff meeting. Table 3-3 presents summary information about these meetings. For more information on stakeholder participants, see Section 3.4.

Table 3-3. Dates, Locations, and Descriptions of Stakeholder Planning Workshops

Workshop	Meeting Date	Meeting Location	Description
2026 Plan Kickoff Meeting	June 26, 2024	Virtual, Zoom	The purpose of this meeting was to kick off the 2026 HMP planning process and outline the next steps in the planning process. In this virtual meeting, participants were asked to provide feedback on the initial planning schedule, data needs, and what the role of the various partners would be moving forward through the plan update process. Feedback was documented in meeting notes and used to inform the additional steps in the planning process.
Capability Assessment Planning Workshop	September 30, 2024	Virtual, Microsoft Teams	This meeting was held to provide stakeholders with the updates that had occurred over the previous months which includes the solicitation of interest for public steering committee members, public survey release, and data collection efforts. The bulk of the meeting was training partners on what capabilities OEM was looking for in the capability assessment portion of the plan and how the work that partners were working on would help make the plan stronger and connect the HMP update to their work as well.
Mitigation Strategy Workshop	November 25, 2024	Virtual, Microsoft Teams	The Mitigation Strategy Workshop brought together the all-stakeholders group again to begin discussing what mitigation action from 2022 should be brought forward into the 2026 plan and what new actions should be created to help reduce the risks that the City faces from the new and more prevalent hazards that have cropped up since the release of the 2022 plan.
Mitigation Action Ranking Meeting	January 27, 2025	Virtual, Microsoft Teams	The Mitigation Action Ranking Workshop brought together the all-stakeholders group again to begin discussing how the 2025 HMP will be ranking the mitigation actions based on updated guidance from PEMA as well as new information from the stakeholders.
First Draft Review Workshop	February 20, 2025	Virtual, Microsoft Teams	In the First Draft Review workshop for the Plan Stakeholders, the outline of the full plan was discussed as well as the tools and feedback that partners would be expected to give once they got the full plan draft. This kicked off the internal review portion of the planning process.
Final All-Stakeholders Workshop	December 9, 2025	Virtual Microsoft Teams	This was the final review of the HMP. This meeting covered the changes that had been made over the previous 10 months, reviewed past hazard mitigation work, and provided time for partners to discuss how they would implement the plan and what would be required to do so.

3.3.2 Steering Committee Meetings

The Steering Committee met regularly between July 2022 and January 2026 to guide the planning process. Table 3-4 presents summary information about the meetings. After the plan is updated, the Steering Committee will be meeting quarterly to focus on the implementation of the 2026 Plan. For more information on each of these meetings along with a list of participants, agendas, and meeting notes, please see Appendix C.

Table 3-4. Date, Locations, and Descriptions of Steering Committee Meetings

Meeting Date	Meeting Location	Description
June 4, 2024	Virtual Microsoft Teams	OEM and Tetra Tech hosted a kickoff meeting for the Stakeholder Steering Committee to go over the 2025 planning process, the review of the 2022 plan, and what is to be expected from the steering committee over the next 12 months
August 1, 2024	Virtual Microsoft Teams	The Hazard Mitigation Steering Committee met to discuss and finalize the hazards of concern, cover the community engagement plan, and review and edit the goals and objectives of the previous plan.
September 16, 2024	Virtual Microsoft Teams	The Committee met to review the progress made to the plan since the previous meeting in early August, however, the primary reason for the meeting was to make the final selections for the public steering committee. The committee successfully made the selections and offers of acceptance were sent out to the members that were selected following the meeting.
November 14, 2024	Virtual Microsoft Teams	The Stakeholder Steering Committee was convened again to discuss the preliminary risk assessment results that had been published by Tetra Tech as well as the 2024 Building Resilient Infrastructure & Communities/Flood Mitigation Assistance cycle as it had been delayed by FEMA. The committee identified that certain hazards such as Gun Violence were significantly lower than expected and most if not all hazards were ranked lower than they had been in the 2022 plan. Tetra Tech and OEM agreed to revise the rankings to reflect the committee's concerns.
February 6, 2025	Virtual, Microsoft Teams	The Stakeholder Steering Committee met to discuss the mitigation action ranking meeting as well as to get an update on the status of the plan development. This meeting also covered the content that was to be covered in the Draft Plan Review meeting later in February. Additionally, Hazard Mitigation grants such as BRIC and FMA were discussed.
May 6, 2025	Virtual, Microsoft Teams	The May 2025 Hazard Mitigation Steering Committee meeting focused on the 2025 plan timeline, upcoming City Council adoption, and updates on BRIC/FMA projects aimed at flood resilience. Members also reviewed Arcadis funding support and upcoming training sessions before closing with a discussion on improving contract and training resources.
September 23, 2025	Virtual, Microsoft Teams	In this meeting. members reviewed the updated timeline for the Hazard Mitigation Plan, including extended deadlines and upcoming engagement milestones Progress on mitigation projects, identified gaps in the current strategy, and explored funding opportunities, including federal grants and future options beyond the Arcadis contract were discussed. The session also highlighted stakeholder engagement efforts and planned outreach activities.
November 7, 2025	Virtual, Microsoft Teams	The meeting provided updates on the Hazard Mitigation Plan, including preparations for the December 9 All-Stakeholders Meeting and the upcoming 30-day public comment period. Members also discussed outreach initiatives such as relaunching the newsletter, a proposed webinar series, and intern-led projects focused on housing and higher education.

3.3.3 Other Meetings & Presentations

3.3.3.1 FEMA's Managing Floodplain Development through the NFIP

To align with the City's 2026 HMP update and work on becoming a CRS community, FEMA Region 3 and OEM offered a FEMA course on managing floodplain development through the NFIP to Philadelphia hazard mitigation planning partners. The class was attended by members of the Department of Licenses and Inspections, with others from the Philadelphia Water Department, and the Department of Planning and Development. This course is designed to equip local officials with the knowledge and skills to understand the importance of floodplain management and effectively administer and enforce floodplain management regulations. It is also intended to provide communication techniques to explain the impact of floodplain management decisions on insurance, public safety, and health. The course covers NFIP minimum floodplain management regulations, their link to building codes, flood hazard mapping, flood insurance, Substantial Improvement (SI), Substantial Damage (SD), and an

overview of the local permitting process. There was also a two-hour module on the Hazard Mitigation Plan (HMP) and how HMPs can be leveraged to capture the work being done to reduce the risk to structures in the floodplain and catalog the improvements done by departments who work in the floodplain.

3.3.3.2 One-on-one Meetings

In between focus group meetings, stakeholder planning workshops, and various other presentations and planning meetings, Philadelphia OEM hosted one-on-one meetings with stakeholders to educate them on the planning process, generate buy-in, discuss mitigation priorities, and gather feedback on the plans specific to their organization. Organizations that participated in virtual, one-on-one meetings are listed in Table 3-5.

Table 3-5. One-on-One Meetings

Meeting Name	Attendees	Meeting Date
OEM Office of Sustainability (OOS) Substantial Damage Monthly	OEM, OOS	Wednesday, June 12, 2024
Hazard Mitigation Plan Community Engagement Discussion	OEM	Monday, June 17, 2024
High Hazard Potential Dams and the Hazard Mitigation Plan	OEM, PWD	Friday, June 21, 2024
HMP/Climate/Comp Plan Coordination Meeting	OEM, CDBG-DR, PCPC	Wednesday, June 26, 2024
ULI Presentation Chat	OEM, OOS	Thursday, August 8, 2024
HMP/Climate/Comp Plan Coordination Meeting	OEM, PCPC, OOS	Wednesday, July 24, 2024
Temple Class Presentation	OEM, OOS, Temple	Monday, July 29, 2024
Tree Philly Community Engagement Plan	PPR, OEM	Tuesday, August 13, 2024
Prep for GIS meeting with Tetra Tech	OEM	Thursday, August 15, 2024
Cultural Resources and the HMP meeting	OEM, PCPC, Creative Philadelphia	Friday, August 16, 2024
Managing Director's Office OEM Philadelphia Voices	OEM, Philadelphia Voices	Monday, August 19, 2024
Philadelphia OEM HMP Update and Feedback Meeting	OEM, PEMA, FEMA, Tetra Tech	Tuesday, August 20, 2024
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, August 28, 2024
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, September 25, 2024
Delaware Valley Regional Planning Commission Regional Resilience Discussion with City of Phila and Interface Studio	Delaware Valley Regional Planning Commission, OEM, Interface Studio, OOS	Thursday, October 10, 2024
Hazard Mitigation Plan Philadelphia Department of Public Health (PDPH) Substance Abuse Prevention and Harm Reduction (SUPHR)	OEM, PDPH SUPHR	Tuesday, October 15, 2024
Philadelphia Local Emergency Planning Meeting	Local Emergency Planning Committee, OEM	Thursday, October 24, 2024
OEM High Intensity Drug Trafficking Area Meeting	OEM, Liberty Mid-Atlantic High Intensity Drug Trafficking Area	Monday, November 25, 2024

Meeting Name	Attendees	Meeting Date
Community College of Philadelphia (CCP) and OEM Zoom Meeting	OEM, CCP	Thursday, December 5, 2024
Class Collaboration: OEM and Penn	OEM, UPenn Penn Center for Community Health Workers Class	Monday, December 9, 2024
CDBG-DR/ OEM Meeting	OEM, CDBG-DR	Monday, December 9, 2024
OEM/ CDBG-DR Meeting	OEM, CDBG-DR	Friday, December 13, 2024
Philadelphia HMP: PEMA/FEMA Meeting	OEM. PEMA, FEMA. Tetra Tech	Wednesday, December 18, 2024
Philadelphia Local Emergency Planning Meeting	Local Emergency Planning Committee, OEM	Thursday, January 9th, 2025
Washington Square West Civic Association	Washington Square West Civic Association, OEM	Tuesday, January 14th, 2025
Hazard Mitigation Plan Meeting with PPD	OEM, PPD	Thursday, January 23rd, 2025
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, May 28th, 2025
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, June 25th, 2025
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, July 23rd, 2025
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, August 27th, 2025
Elected Officials Open House	OEM	Monday, September 15th, 2025
Comp/Haz Mit/Resilience Plan Alignment	OEM	Wednesday, September 24th, 2025
CCAHA and OEM Conversation	CCAHA, OEM	Monday, September 29th, 2025
OEM Operational Coordination Internal Project Discussion	OEM	Thursday, October 9th, 2025
OEM Community Engagement Internal Project Discussion	OEM	Tuesday, October 14th, 2025
Philadelphia Local Emergency Planning Meeting	Local Emergency Planning Committee, OEM	Thursday, October 16th, 2025
OEM Internal Projects Discussion	OEM	Monday, May 20th, 2025
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, October 22nd, 2025
DRBC- Philadelphia OEM Meeting	OEM, DRBC	Friday, October 24th, 2025
Infrastructure Steering Committee Meeting	OEM, Utility Partners	Monday, November 3rd, 2025
OOS Mitigation Action Review Meeting	OEM, OOS	Wednesday, November 12th, 2025
OEM- School District of Philadelphia Meeting	OEM, SDP	Thursday, November 20th,
PWD Mitigation Action Review Meeting	OEM, PWD	Monday, November 24th, 2025
Comp/Haz Mit/Resilience Plan Alignment	OEM, PCPC, OOS	Wednesday, November 26th, 2025
Streets Mitigation Action Review Meeting	OEM, Streets	Tuesday, December 2nd, 2025

3.3.3.3 Regional Coordination

OEM continued its practice of inviting regional partners to the Hazard Mitigation Plan All-Stakeholders Meetings. OEM worked with Bucks, Chester, and Delaware Counties in Pennsylvania which surround Philadelphia. Additionally, Philadelphia conducted additional outreach to the New Jersey Office of Emergency Management and

other surrounding counties located in New Jersey to start testing the waters of cross-state collaboration and working as a whole region rather than just the Pennsylvania side of the Delaware River. OEM will look to continue regional collaboration through the alignment of the annual Threat Hazard Identification and Risk Assessment (THIRA) and Stakeholder Preparedness Review (SPR) process as well as through regional hazard mitigation meetings.

3.3.4 Public Meetings and Outreach

3.3.4.1 Hazard Mitigation Public Meetings

OEM hosted two HMP Public draft plan review meetings that provided opportunities for residents to provide feedback on the completed plan and the goals and mitigation actions that are contained within it. Public feedback from the draft plan review meetings was compiled and responded to.

These draft plan review meetings were advertised via social media, blog posts, newsletters, radio, news outlets, and through individual outreach to community leaders, and City partners.

3.3.4.2 OEM Hazard Mitigation Plan Public Steering Committee Meetings

To bolster the Public Engagement and foster enhanced community engagement, OEM worked to set up and host a Public Steering Committee comprised of 18 members who provided direct and consistent feedback during the HMP update process. These 18 members came from each of the City's 18 planning districts to ensure a geographically representative group. Additionally, OEM had goals to make sure that the committee was a representative cross-section of the City, including race, age, length of time living in the City, and knowledge of hazard mitigation. This group's meetings were held from 6 to 7:30 pm to ensure that a greater selection of the community would be able to join if they were selected to be a part of the committee. Summary information about the meetings is presented in Table 3-6.

Table 3-6. OEM Hazard Mitigation Plan Public Steering Committee Meetings

Date	Title	Topics Covered
October 21, 2024	Kickoff Meeting	The purpose of this meeting was to kickoff the Public Steering Committee and introduce the committee to the 2026 HMP planning. In this virtual meeting, participants were updated on what had occurred so far in the planning process, the role of the committee, and hazard mitigation training. Feedback was documented in meeting notes and used to inform the additional steps in the planning process.
November 18, 2024	Capability Assessment Meeting	This meeting was held to provide updates to the committee on the work that had been completed as well as to discuss community capabilities to respond to and recover from disasters. The Steering Committee provided valuable information on what communities are capable of recovering from and helping to ground truth the information in the plan.
December 16, 2024	Mitigation Action Generation Meeting	The Mitigation Action Generation Meeting was the meeting where the steering committee took what it had learned about Hazard Mitigation and community capabilities and crafted their own mitigation strategies that address what their communities are most concerned about.
January 13, 2025	Mitigation Action Ranking Meeting	The Mitigation Action Rankin Meeting brought the Committee together to discuss how mitigation actions are ranked. In addition, the committee worked to rank the mitigation actions that it created and understand how they fit into the broader mitigation action strategy.

Date	Title	Topics Covered
February 24, 2025	Draft Plan Review Meeting	The Draft Plan Review Meeting was the first introduction that the Public Steering Committee had to see the full draft plan and how their work directly impacted what was put into the plan as well as the language that was used. There was also some time for additional comments and feedback from the committee as they had been talking with neighbors and other members of the public about the plan.

3.3.4.3 University Collaborations

Temple University Planning and Community Development CTRP 8860-001: Hazard Mitigation Planning: Principles and Practice

The Office of Emergency Management (OEM) and the Office of Sustainability (OOS) were invited to present at this class by the professor, Steve Nelson. This class taught students the principles of hazard mitigation, what hazard mitigation planning looks like in the United States. It brought in speakers from various levels of government, including local (both City and surrounding counties), state, and federal to provide an overview of the topic and how hazard mitigation planning is both similar and different at all levels of government. OEM was brought in to discuss the past and current updates to the City of Philadelphia All-Hazard Mitigation Plan. OOS was brought in to discuss how hazard mitigation is implemented with the City. This two-pronged approach gave the students an excellent introduction to hazard mitigation planning at the City level.

University of Pennsylvania Public Health and Climate Change in Cities Course

This course was designed to bring together master's students from public health, architecture, city planning, and engineering to understand how cities can mitigate climate changes and its impacts through public health. This is done using the City of Philadelphia's hazard mitigation plan as a framing device. The Office of Emergency Management most recently presented to this class on February 4, 2025 and worked with the students and professors over the course of the semester by bringing practical experience to the projects that the class is working on. This collaboration was formed after the release of the 2022 Hazard Mitigation Plan as a way to foster better relations with students.

3.3.4.4 READYPhiladelphia Workshops

Throughout the year, Philadelphia OEM's Community Engagement program offers READYPhiladelphia emergency preparedness workshops for residents, businesses, and community organizations. In addition to hazard mitigation-specific outreach and events, OEM also discussed the HMP in many community workshops from Summer 2024 on.

READYHome is a basic, emergency preparedness workshop offered to community organizations, school groups, and civic organizations. Throughout the latter half of 2024, the HMP and public survey were added to the standard READYHome and READYBusiness presentation to help spread the word. A copy of this READYHome presentation can be found in Appendix C: Meeting Documentation. Table 3-7 provides summary information on these presentations.

Table 3-7. Dates, Locations, and Attendance for OEM's READYHome and READYBusiness Presentations

Date	Type	Name of Event
8/15/2024	READYHome	Davita
8/21/2024	READYHome	Marconi Older Adult Program
9/7/2024	READYHome	Germantown Residents for Economic Alternatives

Date	Type	Name of Event
9/7/2024	READYHome	East Falls Development Corp
9/21/2024	READYHome	Eastwick Workshop Session 2
9/28/2024	READYHome/READYBusiness	Deaf-Hearing Communication Centre
10/16/2024	READYHome	Casa Farnese
10/17/2024	READYHome	7th Police District Advisory Council
10/17/2024	READYHome	Port Richmond Neighborhood Action

3.3.4.5 Mitigation Station Table Events

To reach populations that may not have access to online platforms like Zoom and Facebook, OEM planned pop-up table events called strategic locations around the City. At the pop-ups, residents had the opportunity to fill out the HMP Public Survey using a provided QR code and ask questions about the plan update to staff members, and they also received important emergency preparedness information and resources. events were heavily advertised via social media and through one-on-one outreach to community leaders and organizations in the area. Figure 3-2 shows a typical table setup. Table 3-8 summarizes outreach results for the mitigation station events. For these Mitigation Stations and other public outreach events, Tetra Tech, their subcontractors, and OEM collaborated to create new Hazard Profiles and Neighborhood Profiles that outlines the hazard or neighborhood, the impacts that hazards have, and some resources for the public to check out. These were very popular with community members and will continue to be used at various other OEM tabling and outreach events.

Figure 3-2. Mitigation Station hosted at the East Falls Farmer's Market, 4100 Ridge Avenue



Table 3-8. Mitigation Station Events

Date	Location	Number of people
12/14/2024	East Falls Farmer's Market; 4100 Ridge Avenue	15
02/04/2025	Casarez Elementary School	5
03/12/2025	Penn Health Community Event	100
03/22/2025	2025 Philadelphia More Beautiful Committee Block Captain Rally	250
04/03/2025	FY 26 Budget Town Hall @ St. Athanasius Church	10
05/15/2025	FY 26 Budget Town Hall @ Cityreach Church	10
08/23/2025	National Preparedness Month Kickoff Event	50
09/26/2025	PennReady Safety Fair	30

Date	Location	Number of people
10/01/2025	Drexel Public Safety Fair	30
TOTAL:		**500 people reached**

3.4 PUBLIC AND STAKEHOLDER PARTICIPATION

3.4.1 Outreach Tools

To facilitate public and stakeholder outreach, Philadelphia OEM built on existing relationships with agencies and organizations, including Temple University, the University of Pennsylvania, and City Community Development Corporations (CDCs); partnered with other City planning initiatives, including the updates to the Climate Action Plan, Shade Tree Plan, and Comprehensive Plan; and utilized existing City events, such as Budget Town Hall's, fairs, and farmer's markets to inform the public and detail how to get involved in the plan update. Conducting public and stakeholder outreach also allowed Philadelphia OEM to begin to build new relationships with community organizations and academia.

3.4.1.1 Newsletter

To keep plan stakeholders engaged in the planning process in between planning workshops and meetings, Philadelphia OEM started distributing monthly newsletters during the 2022 Hazard Mitigation Plan update to update partners on the status of the plan update, upcoming trainings and meetings, and mitigation funding opportunities. Approximately **240 stakeholders** are on the newsletter distribution list and OEM recently opened it up to the public to get direct information from the office and to keep the public informed about Hazard Mitigation efforts across the City. Philadelphia OEM will keep stakeholders and the public engaged after the plan update by continuing to distribute this newsletter quarterly. OEM has also undated the format as of January 2026 to use MailChimp for a friendlier format that allows for more dynamic content.

3.4.1.2 Social Media

Philadelphia OEM advertised the plan update, public survey, and public workshops through social media channels such as X (formerly known as Twitter), Facebook, and Nextdoor. To reach a larger following, OEM created a social media toolkit with pre-scripted messages in English which was distributed to partner agencies to help spread the word. Table 3-9 provides a sampling of the social media outreach efforts.

Table 3-9. A Sampling of Posts about the HMP on City of Philadelphia Social Media Accounts

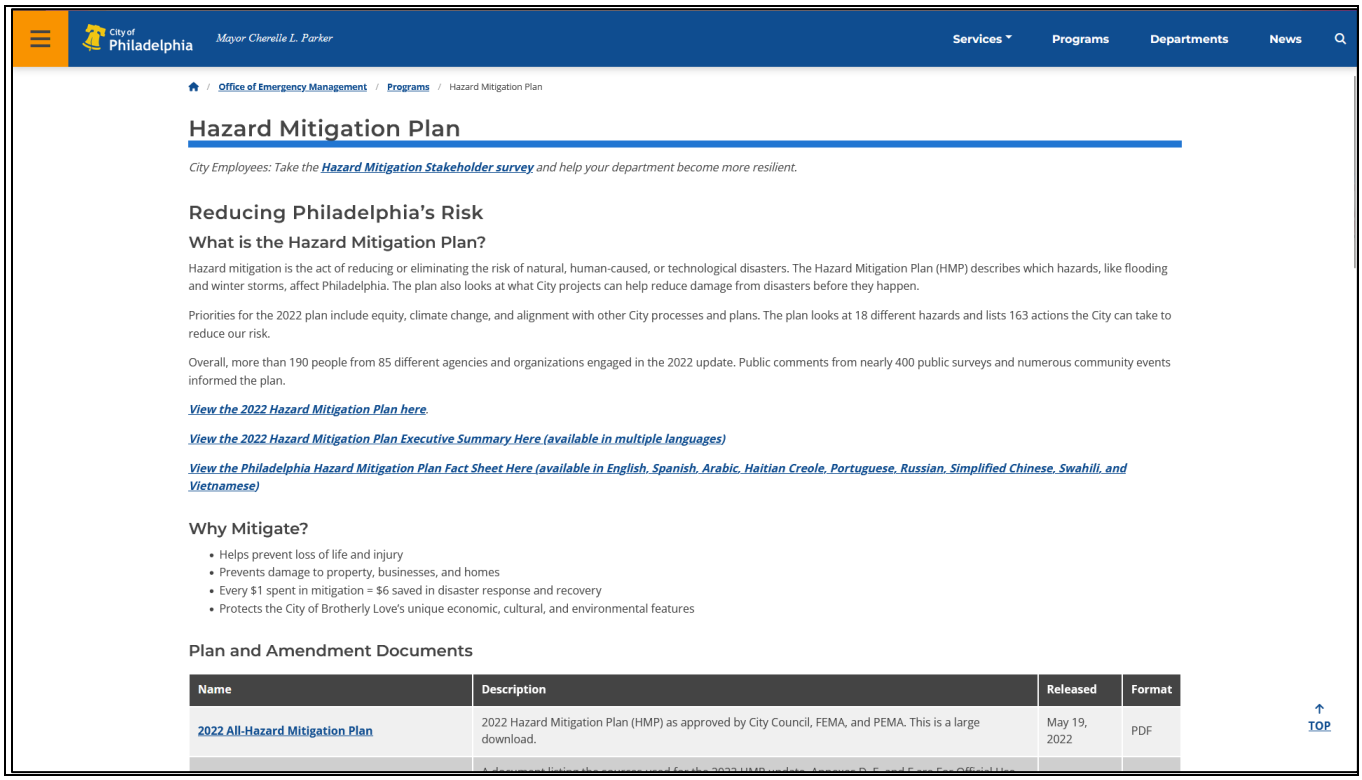
Date of Post	Content Promoted	Website	Views/Impressions
August 15, 2024	Public Steering Committee	X	1,400
August 15, 2024	Public Steering Committee	Facebook	917
August 15, 2024	Public Steering Committee	LinkedIn	251
August 15, 2024	Public Steering Committee	Nextdoor	5,080
August 20, 2024	In Case You Missed It	Twitter	1,038
August 20, 2024	In Case You Missed It	Facebook	169
August 20, 2024	In Case You Missed It	Nextdoor	5160
September 5, 2024	Survey	Nextdoor	1,892
September 5, 2024	Survey	X	1,000

Date of Post	Content Promoted	Website	Views/Impressions
September 5, 2024	Survey		527
December 10, 204	Survey	X	2,280
December 9, 2024	HMP info	X	785
December 4, 2024	Survey	X	1,000
December 3, 2024	Survey	Nextdoor	3,848
October 23, 2024	Survey	Nextdoor	5,575
December 19, 2024	Survey	Facebook	696
December 4, 2024	Survey	Facebook	275
December 14, 2024	HMP info	X	778
Totals:			**32,671**

3.4.1.3 Website

The City of Philadelphia's Hazard Mitigation Plan Webpage (see Figure 3-3) was updated to include information on the 2026 Hazard Mitigation Plan, Building Resilient Infrastructure & Communities (BRIC) and Flood Mitigation Assistance (FMA) funding opportunities, and a description of how the public and planning partners could get involved and submit feedback on the plan update. Plain language on the website was used to make sure that the information was accessible to all members of the public. The 2026 Plan has been posted on the HMP website for review and feedback.

Figure 3-3. Screenshot of the City of Philadelphia's Hazard Mitigation Plan website



3.4.1.4 Public Survey

On September 5, 2024, Philadelphia OEM released a public survey to gather information on general emergency preparedness and community concerns. The survey was created and advertised in English and later released in the 10 languages in Philadelphia with the most amount of identified need, which were: Spanish, French, Simplified Chinese, Arabic, Russian, Swahili, Portuguese, Vietnamese, and Haitian Creole. The public survey was tailored to address topics most concerning and relevant to the public. Optional questions capturing the demographics of survey respondents helped OEM to assess whether the survey was being distributed equitably and reaching populations representative of Philadelphia's diverse population. This survey was open until February 28, 2025, and feedback received from the survey directly informed us of the update of the plan.

In addition to the regular survey, Philadelphia OEM was able to get two questions in the Philadelphia Voices survey. This survey is a representative sample of about 800 Philadelphians who answer questions related to policy decisions. The unique aspect of the survey is that about 255 of the respondents were from telephone calls to the public, which helped to bridge the digital divide.

In total, zero unique survey responses were received (zero completed surveys), a decrease from the 400 survey responses received during the 2022 planning process for public comments on the draft plan. Based on a comparison of the completed survey demographic questions and U.S. Census Data, these survey results are not representative of Philadelphia's diverse community. The skewed results of this survey align with historical trends of survey non-response among communities that are either harder for the government to reach, less able to commit time to respond to a survey, or less likely to trust the government to represent their interests. These challenges are likely exacerbated because of challenges with survey distribution. These results indicate that a greater focus is needed on partnering with communities that are underrepresented during the next plan update. See Chapter 7- Plan Maintenance for more details on future plan updates.

For more detailed information on public survey results, please see Section 3.4.2.

3.4.1.5 Blog Posts

Philadelphia OEM posted a blog post Risks Facing Philadelphia: What to Know and How to Get Involved which provides background information on what the HMP is, and how the community can get involved. This blog post served as an additional resource to help raise awareness with the public about this plan. Between July 1,2024, when the blog was created and as of May 27th, the link to the blog was clicked 277 times.

Additionally, OEM posted a blog titled "Your Voice Matters: Comment on the City of Philadelphia's 2026 Draft Hazard Mitigation Plan!" to encourage the public to participate in the comment period for the Haard Mitigation Plan. This blog post garnered 337 clicks. While the ability to point to a condensed overview of the HMP and the need for public feedback. The blog post and other digital, traditional media, and in-person strategies was not enough to encourage people to participate in the survey and provide their feedback.

3.4.2 Stakeholder Participation

The Hazard Mitigation is used to generate public discussion and awareness of the City's greatest threats and hazards and is also used as an informational tool and resource by city, state, and federal partner agencies that plan for and implement hazard mitigation projects. Engaging and obtaining feedback from all stakeholders, including the public, throughout the update process strengthens the value of the plan and validates the City's commitment to mitigation strategies that address the needs of the whole community.

Philadelphia OEM began engaging partners in the planning process starting in January 2024 with the 2024 Annual Review of the 2022 Hazard Mitigation Plan. An emphasis was placed on expanding the number of stakeholders involved in the planning process, with a focus on engaging more regional partners, private-sector partners, universities and academic institutions, and the community. This 5-year timeframe allowed for extensive and targeted one-on-one outreach to educate and engage stakeholders in the planning process. Over 87 agencies and organizations were engaged at some point during this two-year process, an increase in 2 entities since the 2022 plan update, as summarized in Table 3-10.

Table 3-10. Participation in the Planning Process by Sector

Sectors for Engagement	Count of agencies/organizations by Sector	
	2022	2026
City or Quasi-City Agencies	36	36
State Agencies	7	6
Federal Agencies	2	4
Regional Partners	10	9
Utilities	3	3
Transportation Agencies	6	2
Educational Institutions	7	6
Non-profits	6	10
Hospital & Healthcare Partners	2	4
Other Private-Sector Partners	6	8
TOTAL	**85**	**88**

Stakeholders were engaged through one-on-one meetings and presentations, a series of planning workshops, and workgroup meetings. Invitations for meetings and workshops were sent to a wide variety of different agencies and organizations to promote involvement from as many different entities as possible. For partners that were unable to attend stakeholder workshops, one-on-one meetings were offered. Worksheets and surveys were distributed to partners to allow for feedback in a variety of different ways. Worksheets and surveys included:

- **Risk Assessment Data Collection Survey**: This survey collected information on local data sources to inform the Risk and Vulnerability Assessment for hazards in the plan.
- **Capability Assessment Survey**: This survey collected information on capability strengths and gaps in Philadelphia to inform the Capability Assessment Chapter of the plan.
- **Mitigation Action Form**: The Mitigation Action form was used to collect key details on new mitigation actions from stakeholders to include in the Mitigation Strategy.

For more information on meetings, workshops, and copies of surveys and worksheets distributed, please see Section 3.3.

3.4.3 Public Participation

Philadelphia is a City of neighborhoods, and the goal for the 2026 HMP was to engage meaningfully with each part of the City during this process. By presenting information in a way that was accessible, the community was able to provide us with input on hazards that most concerned them. The public engagement strategy helped us listen to and learn from a diverse representation of residents and businesses, creating a plan that reflects the goals and objectives of the community.

The Public Engagement Strategy for the 2026 Plan included:

- Two public HMP workshops designed to capture feedback from members of the public with lived experiences.
- Eight *Mitigation Station* pop-up table events at different locations around the City and at different times of the day.
- Outreach via a public access television interview on LaSalleTV.
- One-on-one outreach to community organizations, community leaders, and City Agencies and Commissions with direct ties to populations who are underrepresented in government processes and are who are more at risk of hazards due to exposure, health factors, or historical inequities.
- An updated HMP landing page on the City website, featuring additional information on the planning process in a public-friendly, accessible format.
- An updated public survey receiving 0 responses that included optional demographic questions to determine if the survey was reaching sections of the public representative of Philadelphia's diverse community.
- Initial public surveys available in the 10 languages of most need in Philadelphia.
- A social media toolkit with pre-scripted messages was distributed to various partners to help spread the word about the plan update and the public survey.
- The addition of an online, executive summary designed to continually provide the public with opportunities to engage in the hazard mitigation planning process beyond the 2026 update.
- Two public review and comment periods.

Table 3-11 shows a comparison of public outreach events and public participation during the 2022 plan vs the 2026 plan update. OEM succeeded in offering more varied opportunities for engagement with the plan.

Table 3-11. Comparison of Public Outreach and Participation Results During the 2022 Plan update and 2025 Plan Update

Metric	2022 Plan	2026 Plan
# of Community Workshops	6	9
# of Table Events	5	4
# of Radio Shows	3	0
# of Television Interviews	0	1
# of Public Survey Responses	397	0
# of community members engaged via workshops and table events*	686	Unknown

*Note: The number of community members was not tracked as there were significant amounts of informal events that were held as well as many events where the number of attendees greatly exceeded OEM's capability to count and interact meaningfully with the public.

In total, 0 unique public survey responses (0 complete responses) were received from residents and business owners, a decrease from the 407 survey responses received during the 2022 planning process. Based on a comparison of the completed survey demographic questions and U.S. Census Data, these survey results alone are not representative of Philadelphia's diverse community. The skewed results of this survey align with historical trends of survey non-response among communities that are either harder for the government to reach, less able to commit time to respond to a survey, or less likely to trust the government to represent their interests.

For future updates, there will be a continued focus placed on partnering with community organizations and community leaders throughout Philadelphia to gather survey results from populations underrepresented in the 2026 public survey process. Philadelphia OEM will also work to ensure greater public participation from a wider variety of neighborhoods in the next plan update.

Please note that these survey results were not the only means for collecting community feedback throughout this planning process. A variety of options for participation in the planning process were available including one-on-one workshops for community organizations upon request, pop-up table events, and direct outreach to community leaders and organizations.

For more detailed information on public survey results, please see Appendix C.

3.4.4 Public and Stakeholder Feedback

Feedback was gathered from all plan stakeholders, including the public, in a variety of different ways including through the public survey, virtual workshops, and meetings throughout the plan update. During the first and second 30-day public review and comment periods, questions, comments, and feedback were gathered during the Draft Review Workshop, via OEM's email, and through a Survey posted on OEM's website.

Respondents generally found the plan helpful and expressed that a one-page summary sheet would improve accessibility. Feedback highlighted several areas for enhancement, including expanding the narrative on green spaces and urban greenery—particularly with attention to thoughtful cost–benefit considerations related to tree maintenance. Participants also emphasized the need for stronger support for unhoused residents, with some suggesting a housing-first approach. Finally, some participants recommended prioritizing low-maintenance mitigation measures to help reduce long-term costs for taxpayers.

Feedback received during the two 30-day review periods was documented and incorporated into the 2026 Plan prior to final submission to the Pennsylvania Emergency Management Agency (PEMA) and the Federal Emergency Management Agency (FEMA). For more detailed information on feedback and comments received during the 30-day public review and comment period, please see Appendix E.

4. RISK ASSESSMENT

FEMA defines risk as the potential for damage, loss, or other impacts created by the interaction of natural hazards with community assets. This section describes risk assessment for the City of Philadelphia, as follows:

- Section 4.1 outlines the process for updating risk assessment.
- Section 4.2 outlines the hazard identification process for both natural and human-caused hazards of concern for further profiling and evaluation.
- Section 4.3 profiles the hazards of concern (location and extent, range of magnitude, past occurrence, and future occurrence) and assesses the community's vulnerability to each of them.
- Section 4.4 summarizes the risk ranking results, potential losses, and future development and vulnerability.

4.1 UPDATE PROCESS SUMMARY

To ensure the updated HMP reflects the most accurate and comprehensive understanding of local risks, the City undertook a methodical and collaborative approach to revising the risk assessment. This process was led by the CPT and supported by the Stakeholder Steering Committee and a broad network of stakeholders and technical experts.

The City identified and obtained a wide range of updated data sources to inform the identification of hazards of concern, critical City assets, and the most current hazard modeling information. These data sources are detailed in Section 4.4.1. This data-driven approach allowed the City to refine the hazard profiles and better understand the potential impacts on both physical infrastructure and community systems.

4.2 HAZARD IDENTIFICATION

To provide a strong foundation for mitigation actions in this plan, the City of Philadelphia considered a full range of hazards that could impact the area and then identified and ranked those that present the greatest concern. These hazards of concern were identified based on the following factors:

Hazards of Concern are those hazards that are considered most likely to impact a community. These are identified using available data and local knowledge.

Natural Hazards are those hazards that are a source of harm or difficultly created by a meteorological, environmental, or geological event.

Human-caused Hazards are those hazards that are the results of human intent, error, or as a result of failed systems.

- Input from the Stakeholder Steering Committee All-Stakeholder Work Group, and Public Steering Committee
- Review of the Commonwealth of Pennsylvania 2023 HMP
- Review of the 2022 City of Philadelphia HMP
- Research on the frequency, magnitude, and costs associated with hazards that have previously or could feasibly impact the region
- Qualitative information regarding natural (not human-caused) hazards and the perceived vulnerability of the study area's assets to them

4.2.1 Disaster Declarations

In reviewing and updating the City's hazards of concern, the Core Planning Team reviewed historical records and other information from a wide range of sources. This section discusses the federal major disaster (DR) and emergency (EM) declarations that have affected the City of Philadelphia.

Federal DR and EM declarations are issued when it has been determined that state and local governments need assistance in responding to a disaster event. Since 1953, declarations have been issued for various hazard events, including hurricanes or tropical storms, severe winter storms, and flooding. The City has been included in 23 disaster declarations from 1953 to 2024. Table 4-1 lists the declarations that affected the City from 1953 through 2024. Additional declarations can be found on the Federal Emergency Management Agency (FEMA) website at: https://www.fema.gov/disasters.

Table 4-1 Federal Disaster and Emergency Declarations Affecting the City of Philadelphia

Declaration Number	Date	Event
DR-206	August 18, 1965	Drought
DR-312	September 18, 1971	Flood
DR-340	June 23, 1972	Flood
EM-3105	March 16, 1993	Snowstorm
DR-1015	March 10, 1994	Severe Storm
DR-1085	January 13, 1996	Snowstorm
DR-1093	January 21, 1996	Flood
DR-1294	September 18, 1999	Hurricane
EM-3180	March 14, 2003	Severe Storm
DR-1538	August 6, 2004	Severe Storm
DR-1557	September 19, 2004	Hurricane
EM-3235	September 10, 2005	Hurricane
DR-1898	April 16, 2010	Snowstorm
EM-3339	August 29, 2011	Hurricane
DR-4025	September 3, 2011	Hurricane
EM-3340	September 8, 2011	Flood
DR-4030	September 12, 2011	Flood
EM-3356	October 29, 2012	Hurricane
EM-3367	February 6, 2014	Severe Ice Storms
DR-4267	March 23, 2016	Snowstorm
DR-4506	March 30, 2020	Biological
DR-4618	September 10, 2021	Hurricane
DR-4099	January 10, 2023	Hurricane

Source: FEMA 2024

4.2.2 Summary of Hazards

4.2.2.1 Review of Hazards from Previous HMP

Table 4-2 documents the process of identifying the hazards of concern for further profiling and evaluation.

During the kickoff of the planning process, stakeholders on the Stakeholder Steering Committee and All-Stakeholder Work Group were asked to provide information on whether hazards had increased, decreased, or remained the same over the course of the past several years. In addition, participants were asked if there were hazards not identified in the 2022 HMP that should be considered for inclusion in the 2026 update. In total, 37 responses were received.

Table 4-2. Identification of Hazards of Concern for City of Philadelphia

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Building and Structure Collapse	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies building and structure collapse as a hazard of concern for the Commonwealth. Buildings constructed before 1961 in the Commonwealth were built before modern building requirements were adopted in the Pennsylvania Uniform Construction Code. Older buildings and structures that are not built to standard codes or have been weakened or degraded over time are more susceptible to being affected by these hazards. The City of Philadelphia has the highest percentage (68.4 percent) of housing units in the Commonwealth built prior to 1960. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, building and structure collapse is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Civil Disturbance	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies civil disturbance as a hazard of concern for the Commonwealth. The concentration of federal buildings in the City of Philadelphia may be targets of civil disturbance. Furthermore, the City has four correctional facilities, two community corrections centers, and nine contract facilities. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, civil disturbance is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Coastal Erosion	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies coastal erosion as a hazard of concern for the Commonwealth. Erosion can impact all the Commonwealth's coastal counties along Lake Erie and the Delaware Estuary. Although City of Philadelphia has a coastline along the coastal zone of the Delaware Estuary, coastal erosion was not identified as a significant concern by the Planning Committee. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, coastal erosion was not identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Cyberterrorism	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies cyberterrorism as a hazard of concern for the Commonwealth. Cyberattacks have been more frequent in recent years, impacting individuals, businesses, institutions, local governments, and state agencies. Since 2021, there have been four occurrences of cyberterrorism within the City. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, cyberterrorism is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Dam Failure	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies dam failure as a hazard of concern for the Commonwealth. According to the Pennsylvania Department of Environmental Protection (DEP) and USACE, there are seven dams within City of Philadelphia, as shown in Chapter 14. Of these seven dams in: two low hazard, one significant hazard, three high hazard, and one negligible or no hazard classification code. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, dam failure is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee DEP USACE

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Drought	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies drought as a hazard of concern for the commonwealth. City of Philadelphia has been impacted by several drought events that have occurred in the Commonwealth. The Commonwealth was included in one FEMA drought-related disaster declaration, which included City of Philadelphia: DR-206; August 18, 1965; Pennsylvania Water Shortage Since 2015, the City of Philadelphia was included in nine drought-related U.S. Department of Agriculture (USDA) disaster declarations: S3930—2015 Drought S3932—2015 Drought S4071—2016 Drought S4165—2016 Drought S4425—2018 Drought S4602—2019 Drought S5338—2022 Drought S5347—2022 Drought S5348—2022 Drought Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, drought is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FEMA USDA NOAA NCEI NRCC
Earthquake	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies earthquake as a hazard of concern for the Commonwealth. The Commonwealth has not been included in an earthquake-related disaster declaration. There have been no significant earthquakes with epicenters in City of Philadelphia; however, earthquakes have been felt in the City. Philadelphia is located on the North American plate and is far from the plate boundary, which is 2,000 miles east in the Atlantic Ocean. The closest fault line to Philadelphia is the Ramapo Fault, located in Northern New Jersey. Pennsylvania's strongest earthquakes with in-state epicenters have persistently occurred in an area near Lancaster, which is approximately 65 miles from the City. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, earthquake is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee U.S. Geological Survey (USGS) – Earthquake Hazards Program, Review of USGS Seismic Maps

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Environmental Hazard – Coal Mining	No	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies environmental hazard – coal mining as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, environmental hazard – coal mining was not identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Environmental Hazard – Conventional Oil and Gas Wells	No	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies environmental hazard – conventional oil and gas wells as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, environmental hazard – conventional oil and gas wells was not identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Environmental Hazard – Gas and Liquid Pipeline	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies environmental hazard – gas and liquid pipeline as a hazard of concern for the Commonwealth. While the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify environmental hazard – gas and liquid pipeline as a hazard of concern, it is discussed within the environmental hazard – hazardous materials release hazard.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Environmental Hazard – Hazardous Materials Release	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies environmental hazard – hazardous materials release as a hazard of concern for the Commonwealth. Between January 2018 and September 2021 there were a total of 175 occurrences of hazardous materials release, according to PEMA. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, environmental hazard – hazardous materials release is identified as a hazard of concern for City of Philadelphia. Also discussed in this hazard is environmental hazard – gas and liquid pipeline.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Environmental Hazard – Unconventional Wells	No	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies environmental hazard – unconventional wells as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, environmental hazard – unconventional wells was not identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Extreme Temperature	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies extreme temperature as a hazard of concern for the Commonwealth. Since 2015, the City of Philadelphia has been included in seven USDA disaster declarations related to extreme temperature events: S3930—2015 Excessive Heat S3932—2015 Excessive Heat S4071—2016 Excessive Heat, Frost/Freeze S4425—2018 Excessive Heat S4748—2020 Frost/Freeze S5347—2022 Excessive Heat S5348—2022 Excessive Heat Since 2019 the City has issued several Heat Health Emergencies including: July 15 – 17, 2024 June 20 – 24, 2024 July 27 – 29, 2023 August 8 – 9, 2022 July 21 – 25, 2022 July 10 – 22, 2020 July 7 – 21, 2019 Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, extreme temperature is identified as a hazard of concern for City of Philadelphia. Also discussed in this hazard is invasive species and smoke from wildfire.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee Philadelphia Public Health NOAA NCEI USDA

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Flood, Flash Flood, Ice Jam	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies flood, flash flood, ice jam as a hazard of concern for the Commonwealth. Between 1956 and 2024, the City of Philadelphia was included in seven FEMA flood, flash flood, ice jam-related declarations: DR-312; September 18, 1971; Floods DR-340; June 23, 1972; Tropical Storm Agnes DR-1093; January 19 – February 1, 1996; Flooding DR-1358; July 27 – August 25, 2004; Severe Storms and Flooding DR-1555; September 8-9, 2004; Severe Storms and Flooding Associated with Tropical Depression Frances DR-4030; September 3 – October 15, 2011; Tropical Storm Lee EM-3340; September 3 – October 15, 2011; Remnants of Tropical Storm Lee Since 2015, the City of Philadelphia has been included in three USDA disaster declarations related to flood, flash flood, ice jam events: S3712—2014 Flood/Flash Flooding, Excessive Rain S3931—2015 Flood/Flash Flooding, Excessive Rain S4519—2019 Flood/Flash Flooding, Excessive Rain Ice jams were reported on the Susquehanna, Delaware, and Schuylkill Rivers on January 21, 1996. These jams caused severe flooding, evacuations, and deaths across the Delaware Valley region. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, flood, flash flood, and ice jam is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FEMA USDA NOAA-NCEI USACE Ice Jam Database
Hailstorm	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies hailstorm as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, hailstorm was not identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Hurricane, Tropical Storm, and Nor'easter	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies hurricane, tropical storm, nor'easter as a hazard of concern for the Commonwealth. Between 1956 and 2024, the City of Philadelphia was included in eleven FEMA hurricane, tropical storm, nor'easter-related declarations: DR-340; June 23, 1972; Tropical Storm Agnes DR-1294; September 16-29, 1999; Hurricane Floyd DR-1555; September 8-9, 2004; Severe Storms and Flooding Associated With Tropical Depression Frances DR-1557; September 17 – October 1, 2004; Tropical Depression Ivan EM-3235; August 25 – October 1, 2005; Hurricane Katrina Evacuation EM-3339; August 26 – September 14, 2011; Hurricane Irene DR-4025; August 26-30, 2011; Hurricane Irene DR-4030; September 3 – October 15, 2011; Tropical Storm Lee EM-3340; September 3 – October 15, 2011; Remnants of Tropical Storm Lee EM-3356; October 26 – November 8, 2012; Hurricane Sandy DR-4099; October 26 – November 8, 2012; Hurricane Sandy DR-4618; August 31 – September 5, 2021; Remnants of Hurricane Ida While not a declared disaster, Hurricane Isaias (2021) significantly flooded the Eastwick neighborhood of the City. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, hurricane, tropical storm, nor'easter is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FEMA
Invasive Species	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies invasive species as a hazard of concern for the Commonwealth. The All-Stakeholder Work Group considers invasive species to be a potential hazard to the City. While the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify invasive species as a hazard of concern, it is discussed within the extreme temperature hazard.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Landslide	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies landslide as a hazard of concern for the Commonwealth. Between 1954 and 2022, the City was not included in any landslide-related federal declarations. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, landslide was not identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FEMA USGS
Levee Failure	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies levee failure as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, levee failure was not identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee USACE
Lightning Strike	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies lightning strike as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify lightning strike as a hazard of concern.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Mass Food and Animal Feed Contamination	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies mass food and animal feed contamination as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify mass food and animal feed contamination as a hazard of concern.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Nuclear Incident	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies nuclear incident as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, the Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify nuclear incident as a hazard of concern.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Pandemic, Emerging, Zoonotic, and Infectious Disease	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies pandemic, emerging, zoonotic, and infectious disease as a hazard of concern for the Commonwealth. The City has been impacted by various diseases (influenza, COVID-19). Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, pandemic, emerging, zoonotic, and infectious disease is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee CDC
Opioid Addiction Response	Yes	Yes	Refer to the Substance Use Disorder hazard.	
Radon Exposure	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies radon exposure as a hazard of concern for the Commonwealth. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify radon exposure as a hazard of concern.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Subsidence/ Sinkhole	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies subsidence/sinkhole as a hazard of concern for the Commonwealth. Since 2015, the City of Philadelphia Streets Department received more than 17,000 reports of sinkholes. In December 2020, a major sinkhole formed in South Philadelphia after a water main break at 2nd and Fitzwater Street in Queen Village. In July 2021, "The Great Philly Sinkhole" appeared when a 130-year-old water main failed. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, subsidence/sinkhole is identified as a hazard of concern for City of Philadelphia.	PEMA, Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee, FEMA, NOAA NCEI Storm Prediction Center
Substance Use Disorder	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies substance abuse disorder as a hazard of concern for the Commonwealth. Of the 4,717 overdose deaths in the Commonwealth in 2023 82.7 percent were opioid-related, and 76.2 percent involved fentanyl. The City of Philadelphia had 1,314 of those overdose deaths. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, substance abuse disorder was identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee
Terrorism	Yes	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies terrorism as a hazard of concern for the Commonwealth. As a major city, Philadelphia is at an increased risk of terrorism hazards. The City contains corporate and government buildings; national landmarks, such as the Liberty Bell, the Philadelphia International Airport, many critical facilities such as police stations, hospitals, fire stations, schools, and water treatment plants; critical infrastructure such as bridges, tunnels, and public water supplies. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, terrorism is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FBI

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Transportation Incidents	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies transportation accidents as a hazard of concern for the Commonwealth. While the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify transportation accidents as a hazard of concern, it is discussed within the building and structure collapse hazard.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee PennDOT FHWA
Tornado/ Windstorm	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies tornado and windstorm as a hazard of concern for the Commonwealth. Between 1954 and 2024, the City of Philadelphia was included in two FEMA tornado, windstorm-related declarations: DR-1358; July 27 – August 25, 2004; Severe Storms and Flooding DR-1555; September 8-9, 2004; Severe Storms and Flooding Associated with Tropical Depression Frances City of Philadelphia was included in two recent tornado, windstorm-related U.S. Department of Agriculture (USDA) disaster declarations: S3712—2014 High Winds S3931—2015 High Winds Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, tornado and windstorm is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FEMA USDA
Urban Fire and Explosion	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies urban fire and explosion as a hazard of concern for the Commonwealth. Between Fiscal Years 2021 and 2023 (i.e., July 2020 through June 2023) there have been 150,651 fire incidents, 9,536 structure fires, 791,327 EMS incidents, and a total of 1,117,117 calls received. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, urban fire and explosion is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee NOAA NCEI PFD

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Utility Interruption	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies utility interruption as a hazard of concern for the Commonwealth. City of Philadelphia experiences utility failures (generally power outages) several times each year. These failures are usually due to severe storms or winter storms that affect the City. The Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group consider utility failure a cascading impact of hurricane, tropical storm, nor'easter, winter storm, tornado, windstorm and flooding events and included discussion of utility failure in those hazard profiles.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee NOAA NCEI
War and Criminal Activity	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies war and criminal activity as a hazard of concern for the Commonwealth. The City experiences numerous occurrences of gun violence and considers it to be a public health epidemic. The City has opted to change the hazard name to "Gun Violence and Criminal Activity."	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FBI PPD
Wildfire	No	No	The 2023 Pennsylvania State Hazard Mitigation Plan identifies wildfire as a hazard of concern for the Commonwealth. City of Philadelphia was not included in any FEMA wildfire-related disaster declarations. Due to its urban nature, wildfires are not common within City of Philadelphia. Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group did not identify wildfire as a hazard of concern. However, a small discussion on wildfire smoke is presented in the extreme temperature hazard.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee

Hazard	May Occur in the City?	Significant Threat to the City?	Why was this determination made?	Sources
Winter Storm	Yes	Yes	The 2023 Pennsylvania State Hazard Mitigation Plan identifies winter storm as a hazard of concern for the Commonwealth. Between 1954 and 2024, the City of Philadelphia was included in seven FEMA severe storm-related declarations: EM-3105; March 13-17, 1993; Severe Snowfall and Winter Storm DR-1015; January 4 – February 25, 1994; Winter Storm, Severe Storm DR-1085; January 6-12, 1996; Blizzard EM-3180; February 14-19, 2003; Snowstorm DR-1898; February 5-10, 2010; Severe Winter Storms and Snowstorms EM-3367; February 4-20, 2014; Severe Winter Storm DR-4267; January 22-23, 2016; Severe Winter Storm and Snowstorm Based on previous occurrences and input from the Planning Team, Stakeholder Steering Committee, and All-Stakeholder Work Group, winter storm is identified as a hazard of concern for City of Philadelphia.	PEMA Input from Planning Team, Stakeholder Steering Committee, All-Stakeholder Work Group, and Public Steering Committee FEMA NOAA NCEI

CDC = Centers for Disease Control and Prevention; DR = Presidential Disaster Declaration Number; EM = Presidential Disaster Emergency Number; FEMA = Federal Emergency Management Agency; FHWA = Federal Highway Administration; NCEI = National Centers for Environmental Information; NOAA = National Oceanic and Atmospheric Administration; NRCC = Northeast Regional Climate Center; DEP = Pennsylvania Department of Environmental Protection; PennDOT = Pennsylvania Department of Transportation; PEMA = Pennsylvania Emergency Management Agency; PFD = Philadelphia Fire Department; PGA = Peak ground acceleration; USACE = United States Army Corps of Engineers; USDA = United States Department of Agriculture; USGS = United States Geologic Survey

For most of the hazards profiled in the previous plan, respondents indicated that all had increased or did not change in frequency, magnitude, and geographic extent. For Winter Storm and Pandemic/Infectious Disease some respondents noted these hazards had decreased. For hazards not previously profiled, the following were the top 3 responses for things that may impact the community:

- Natural: Other (stating none), Wildfire, and Invasive Species
- Human-cause: Transportation Accident, Utility Interruption, and Gas and Liquid Pipelines

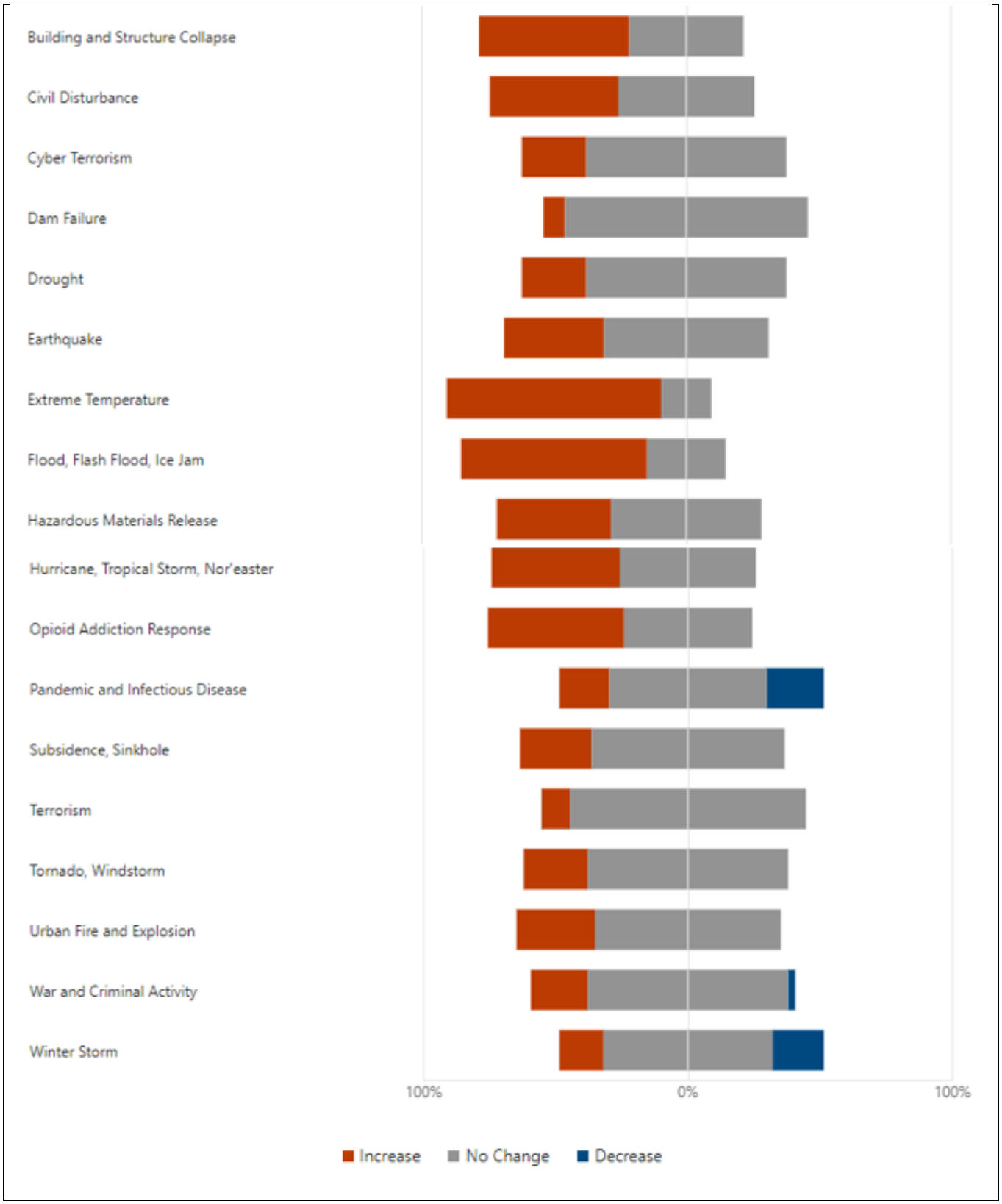
A summary of results is provided in Figure 4-1.

Based on the review of potential hazards of concern, 18 hazards of concern were identified as significant hazards affecting the entire City, to be addressed at the City-level in this plan (shown here separated by natural and human-caused hazards):

- Natural Hazards
  - Drought
  - Earthquake
  - Extreme Temperature
  - Flood, Flash Flood, and Ice Jam
  - Hurricane, Tropical Storm, and Nor'easter
  - Tornado/Windstorm
  - Winter Storm
- Human-caused Hazards
  - Building and Structure Collapse
  - Dam Failure
  - Environmental Hazards - Hazardous Materials Releases
  - Terrorism
  - Urban Fire and Explosion
  - Civil Disturbance
  - Cyber Terrorism
  - Pandemic and Infectious Disease
  - Subsidence/Sinkhole
  - Substance Use Disorder
  - Gun Violence and Criminal Activity

Other natural and human-caused hazards of concern have occurred within City of Philadelphia, but have a low potential to occur, are addressed by other planning mechanisms, and/or do not result in significant impacts within the City. Therefore, these hazards are not addressed in this update. If deemed necessary by the City, these hazards may be considered in future plan updates.

Figure 4-1. Hazard Identification and Risk Evaluation Survey Results



4.2.2.2 Hazard Groupings

The Stakeholder Steering Committee approved use of the following hazard event groupings outlined in this section. Hazard definitions from the Pennsylvania Hazard Mitigation plan Standard Operating Guide are used to describe hazards within this plan.

Natural Hazards

- A drought is a period characterized by long durations of below normal precipitation. Drought is a temporary irregularity that can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.
- An earthquake is the sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge of the earth's tectonic plates, a volcanic eruption, or a human-caused activities that cause geologic stresses.
- The extreme temperature hazard includes both heat and cold events, which can have a significant impact to human health, commercial businesses, and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country based on what the population is accustomed to. The 2026 HMP considers the heat island effect that occurs within developed areas. The 2026 HMP also discusses impacts invasive species have on tree mortality and cascading impacts that reduced tree canopy have related to extreme heat. It also addresses wildfire smoke in relation to extreme heat and air quality.
- The flood hazard includes riverine flooding, flash flooding, and ice jam flooding. Inclusion of the various forms of flooding under a general Flood hazard is consistent with that used in FEMA's Multi-Hazard Identification and Risk Assessment guidance and the 2023 Pennsylvania State HMP.
- The hurricane, tropical storm, and nor'easter hazard focuses on the cyclonic storms which move along the eastern coast of the United States. Hurricanes and tropical storms generally occur between June and November, while nor'easters can occur any time of the year but are most frequent and strongest between September and April.
- The pandemic and infectious disease hazard exists when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time. An aggregation of cases in a given area over a particular period, regardless of the number of cases, is called a cluster. In an outbreak or epidemic, it is presumed that the cases are related to one another or that they have a common cause.
- The subsidence/sinkhole hazard focuses on just the two hazards. Subsidence occurs when groundwater is withdrawn from an area characterized predominantly of fine-grained sediment rocks. Sinkholes form from natural processes, including eroded ground surfaces by both ground and rainwater, or artificial processes, such as the collapse of an abandoned mine or salt cavern.
- The tornado and windstorm hazard focuses on just the two hazards. This hazard is inclusive of severe storms, which the tornado and windstorm hazards generally stem from.
- The winter storm hazard includes blizzards, ice storms, snowstorms, sleet, and freezing rain.

Human-caused Hazards

- The building and structure collapse hazard identifies how buildings and other engineered structures, including bridges, may collapse if their structural integrity is compromised, especially due to effects from other natural or human-caused hazards. Older buildings or structures, structures that are not built to standard codes, or structures that have been weakened are more susceptible to be affected by these

hazards. This hazard also addresses impacts from transportation incidents, specifically the transportation accident resulting in the collapse of I-95.

- The civil disturbance hazard identifies the various forms of the hazard, including demonstrations, riots, strikes, or an activity that disrupts a community and requires intervention to maintain public safety. The scale and scope of civil disturbance events varies widely.
- The cyberterrorism hazard discusses the methods forms of cyberterrorism, its repercussions, and how the City is at risk to the hazard.
- The dam failure hazard addresses the risk of dam failure within the City. A dam is a structure built across a river or stream to hold back water. The materials used for construction of dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, miscellaneous materials (such as plastic or rubber) and any combination of these materials. Dam failures occur when the dam is damaged, destroyed or otherwise overtopped, releasing water or other liquid stored behind the dam.
- The environmental hazards - hazardous materials release hazard includes materials and wastes that are considered severely harmful to human health and the environment, as defined by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (also known as Superfund). Many hazardous materials are commonly used substances, which are harmless in their normal uses but are quite dangerous if released. This hazard also addresses impacts from gas and liquid pipelines that may impact potable water.
- Substance use disorder occurs when an individual becomes physically dependent on opioids, which include opiates and narcotics. Opioids are a synthetic substance found in certain prescription pain medications: morphine, codeine, methadone, oxycodone, hydrocodone, fentanyl, and hydromorphone, and street drugs like heroine and Xylazine. The substance use disorder hazard discusses overdose deaths within the City caused by the use of opioids and other drugs in the drug supply.
- Terrorism is use of force or violence against persons or property with the intent to intimidate or coerce. Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyber-attacks (computer-based); and the use of chemical, biological, nuclear and radiological weapons. Cyber-attacks have become an increasingly pressing concern. This hazard profile identifies the different forms and tactics of terrorism and where they may occur.
- The urban fire and explosion hazard occurs in denser, more urbanized areas statewide and most often occurs in residential structures. Urban fires can more easily spread from building to building in denser areas. Furthermore, urban fires are a more significant threat in the many areas of the Commonwealth with a significant proportion of buildings built before 1970.
- The gun violence and criminal activity hazard includes intentional acts of violence, damage to property, and other criminal activities. This category specifically includes war, enemy attack; disinformation, espionage; criminal activity; physical or information security breach; workplace, school violence; harassment; and discrimination.

These groupings are the same as those provided by FEMA (*FEMA 386-2 Understanding Your Risks, Identifying Hazards and Estimating Losses*; *Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy*; *Local Mitigation Planning Handbook*) and take into consideration the hazard grouping in the Commonwealth of Pennsylvania 2023 Hazard Mitigation Plan.

4.3 HAZARD PROFILES

4.3.1 Drought

4.3.1.1 Hazard Profile

Hazard Description

This section provides a profile and vulnerability assessment of the drought hazard in City of Philadelphia. Drought is defined by the Pennsylvania Emergency Management Agency (PEMA) as a deficiency of precipitation experienced over an extended period of time, usually a season or more (PEMA 2023). Drought conditions occur in virtually all climatic zones, yet the characteristics of droughts vary significantly from one region to another, relative to normal precipitation within respective regions. Droughts can occur any time of year but have the greatest impact to society during the warm summer months. Drought and water supply deficiencies can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. Drought is a temporary irregularity in typical weather patterns and differs from aridity, which reflects low rainfall within a specific region and is a permanent feature of the climate of that area.

Drought can be defined or grouped into four categories (NDMC 2023):

- *Meteorological drought* is a measure of departure of precipitation from normal, defined solely by reference to relative degree of dryness. Because of climatic differences, dryness considered a drought at one location of the country may not be considered drought at another location.
- *Agricultural drought* links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced groundwater or reservoir levels, and other parameters. Agricultural drought occurs when not enough water is available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life, primarily crops.
- *Hydrological drought* is associated with below-normal surface or subsurface water supply resulting from periods of precipitation shortfalls (including snowfall). Hydrological drought is related to effects of precipitation shortfalls on stream flows and water levels in reservoirs, lakes, and groundwater.
- *Socioeconomic drought* is associated with supply and demand of an economic good, with elements of meteorological, hydrological, and agricultural drought categories. This differs from the aforementioned types of drought because its occurrence depends on supply and demand to identify or classify droughts. Supplies of many economic goods such as water, silage, food grains, fish, and hydroelectric power depend on weather. Socioeconomic drought occurs when demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.

Drought can affect many sectors of an economy and can reach beyond an area undergoing physical drought. Because water is essential for producing goods and providing services, drought can reduce crop yield, increase fire hazard, lower water levels, and damage wildlife and fish habitats. Further consequences include reductions in crop yields, rangeland, and forest productivity that may lower incomes of farmers and agribusinesses; increase in prices of food and timber; increase in unemployment; reduction of tax revenues as expenditures decline; increase in crime, foreclosures, and migration; and depletion of disaster relief funds. The many impacts of drought can be categorized as economic, environmental, or social.

Location and Extent

Droughts and water supply deficiencies are regional in scope and may affect the entirety of City of Philadelphia. Droughts and water supply deficiencies may also concurrently affect counties near City of Philadelphia or even the entire Commonwealth and neighboring states. Generally, areas along waterways will reveal drought conditions later than areas away from waterways.

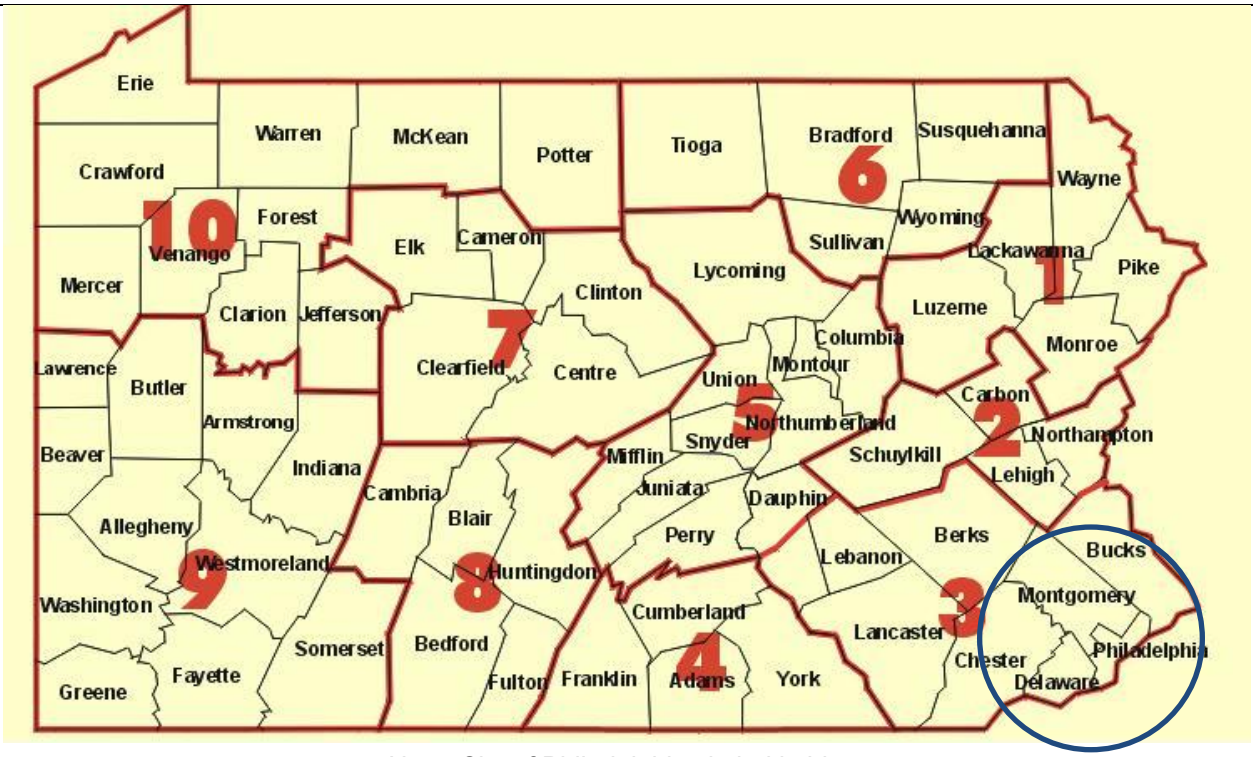
The impact of a drought is generally felt first by the agricultural sector, which depends on precipitation and groundwater. In locations where citizens rely on surface water for drinking water, drought impacts may manifest sooner or have a larger impact since water supplies will be vulnerable. Residents depending on well water can more easily handle short-term droughts without major inconveniences than can populations that rely on surface water. However, longer-term droughts inhibit groundwater aquifers from recharging and can thus extend the problems of well owners for an indeterminate amount of time. City of Philadelphia residents who depend on private domestic wells have this greater “hidden vulnerability” to droughts. According to the United States Geological Survey (USGS) National Water Information System, the average daily domestic self-supplied groundwater withdrawals of fresh water in Pennsylvania was 501 million gallons per day to 1 billion gallons per day in 2015 (USGS 2019).

City of Philadelphia has over 7,180 reported domestic wells. The well data was obtained from the Pennsylvania Groundwater Information System, which is maintained by the Pennsylvania Department of Conservation and Natural Resources (DCNR) and relies on voluntary submissions of well record data by well drillers; as a result, it is not a complete database of all domestic wells in the City. It is, however, the most complete data set of domestic wells available (DCNR 2023).

Climate divisions are regions within a state that are climatically homogenous. The National Oceanic and Atmospheric Administration (NOAA) has divided the United States into 344 climate divisions (NOAA NCEI n.d.).The boundaries of these divisions typically coincide with county boundaries, except in the western United States where they are based largely on drainage basins.

According to NOAA, Pennsylvania includes 10 climate divisions: Pocono Mountains, East Central Mountains, Southeastern Piedmont, Lower Susquehanna, Middle Susquehanna, Upper Susquehanna, Central Mountains, South Central Mountains, Southwest Plateau, and Northwest Plateau Climate Division (NOAA PSL n.d.). Figure 4-2 shows the climate divisions of Pennsylvania. The City of Philadelphia is located within the Southeastern Piedmont climate division, which features a transitional climate characterized by elements of both humid subtropical and continental conditions. This results in the region experiencing moderate to high levels of precipitation, along with hot, humid summers and cool to cold winters. The variability in seasonal rainfall within this climate division may also lead to short-term drought conditions, particularly in late summer and early fall.

Figure 4-2. Climate Divisions for Pennsylvania



Note: City of Philadelphia circled in blue.

The climate divisions for Pennsylvania are: 1 = Pocono Mountains; 2 = East Central Mountains; 3 = Southeastern Piedmont; 4 = Lower Susquehanna; 5 = Middle Susquehanna; 6 = Upper Susquehanna; 7 = Central Mountains; 8 = South Central Mountains; 9 = Southwest Plateau; 10 = Northwest Plateau

Source: PA State Climatologist n.d.

Range of Magnitude

Effects of droughts vary depending on their severity, timing, duration, and location. Some droughts may exert their greatest impact on agriculture, while others may have stronger effects on water supply or recreational activities. Droughts can adversely affect the following significantly:

- Public water supplies for human consumption.
- Rural water supplies for livestock consumption and agricultural operations.
- Water quality.
- Natural soil water or irrigation water for agriculture.
- Water for forests and for fighting forest fires.
- Water for navigation and recreation.

PA Department of Environmental Protection (DEP) and PEMA manage water supply droughts according to the following three stages to describe and manage droughts, as defined in the Commonwealth of Pennsylvania 2023 Standard Hazard Mitigation Plan (PEMA 2023):

- Drought Watch: This is a period to alert government agencies, public water suppliers, water users, and the public regarding potential for future drought-related problems. Drought watches are invoked when three or more drought indicators are present for a county or group of counties. The focus is on increased monitoring,

awareness, and preparation for response in the event that conditions worsen. A request for voluntary water conservation is issued. The objective of voluntary water conservation measures during a drought watch is to reduce water use by 5 percent within the affected areas. Because of varying conditions, individual water suppliers or municipalities may propose more stringent conservation actions.

- Drought Warning: This is a drought stage involving a coordinated response to imminent drought conditions and potential water supply shortages through concerted voluntary conservation measures to avoid or reduce shortages; relieve stressed sources; develop new sources; and, if possible, forestall the need to impose mandatory water use restrictions. The objective of voluntary water conservation measures during a drought warning is to reduce overall water use by 10 to 15 percent within the affected areas. Because of varying conditions, individual water suppliers or municipalities may propose more stringent conservation actions.
- Drought Emergency: During this drought stage, water management entities assemble all available resources to respond to actual emergency conditions, avoid depletion of water sources, ensure at least minimum water supplies to protect public health and safety, support essential and high-priority water uses, and avoid unnecessary economic upsets. If deemed necessary and if ordered by the Governor during this stage, imposition of mandatory restrictions on nonessential water usage could occur, as provided for in 4 *Pa. Code,* Chapter 119. Objectives of water use restrictions (mandatory or voluntary) and other conservation measures during a drought emergency are to reduce consumptive water use within the affected areas by 15 percent and to reduce total use to the extent necessary to preserve public water system supplies, avoid or mitigate local or area shortages, and ensure equitable sharing of limited supplies.

Although not a drought phase, a public water supplier or local municipality may, with the approval of the PEMA Council, implement local water rationing to share a rapidly dwindling or severely depleted water supply within designated water supply service areas. These individual water rationing plans, authorized through provisions of 4 *Pa. Code* Chapter 120, require specific limits on individual water consumption to achieve significant reductions in use. Under both mandatory restrictions imposed by the Commonwealth and local water rationing practices, procedures are specified for granting variances in consideration of individual hardships and economic dislocations (PEMA 2023).

Pennsylvania uses five parameters to assess drought conditions: precipitation deficits, stream flows, groundwater level, soil moisture, and reservoir storage levels. These parameters are detailed below:

- Precipitation Deficits: Because rainfall provides the basis for ground surface water resources, measuring the difference in precipitation from the normal (30-year average) tends to be the earliest indicator that a drought is possible in an area. The DEP will compare the cumulative precipitation for varying time periods (minimum of 3 months, maximum of 12 months) each month against the normal, 30-year average value for each same time period. Any period that has less than the normal is considered to have had a deficit, represented by a percentage less than the normal precipitation. Table 4-3 shows what the deficit values need to be for each time period in order to qualify for each drought stage (PEMA 2023).

Table 4-3. Precipitation Deficit Drought Indicators for Pennsylvania

Duration of Deficit Accumulation (Months)	Drought Watch (deficit as percent of normal precipitation)	Drought Warning (deficit as percent of normal precipitation)	Drought Emergency (deficit as percent of normal precipitation)
3	25%	35%	45%
4	20%	30%	40%
5	20%	30%	40%
6	20%	30%	40%

Duration of Deficit Accumulation (Months)	Drought Watch (deficit as percent of normal precipitation)	Drought Warning (deficit as percent of normal precipitation)	Drought Emergency (deficit as percent of normal precipitation)
7	18.5%	28.5%	38.5%
8	17.5%	27.5%	37.5%
9	16.5%	26.5%	36.5%
10	15%	25%	35%
11	15%	25%	35%
12	15%	25%	35%

Source: PEMA 2023

- Stream Flows: The next earliest indicator that a drought is developing is stream flow measurements. There are 61 USGS stream gages that the DEP currently uses to monitor droughts across the state. The DEP calculates and maintains 30-day average values for stream flow based on the entire period of recording for each gage. Compared to precipitation, stream flow measurements lag by about a month or two when signaling a drought. Drought status is determined from stream flows based on percentiles, or exceedances, rather than percentages. Exceedances are similar to percentiles; a 75 percent exceedance flow value means that the current 30-day average flow is exceeded in the stream 75 percent of the time; in other words, the 30-day average flow in the stream is less than that value only 25 percent of the time. Similarly, with a 90 percent exceedance flow value, the 30-day average flows in the stream would be less than that value only 10 percent of the time, and only 5 percent of the time for a 95 percent exceedance. For stream flows, the 75, 90, and 95 percent exceedance 30-day average flows are used as indicators for drought watch, warning, and emergency, respectively.
- Groundwater Levels: There is about 80 trillion gallons of groundwater stored in the soil beneath the Commonwealth of Pennsylvania. Groundwater levels for each day are used to calculate the average level of the preceding 30 days. This 30-day value is compared to the values derived from historical records yielding a percentile indicating how much time the groundwater levels have been below the historical average levels. The USGS also maintains a network of groundwater monitoring wells, just recently upgraded to at least one well in each county. Groundwater is used to indicate drought status in a manner similar to stream flows. Groundwater level exceedances of 75, 90, and 95 percent are used to indicate watch, warning, and emergency status. In this case, it is the 30-day average depth to groundwater that is measured and monitored, again in relation to long-term 30-day averages based on the period of record for each county well.
- Soil Moisture: Soil moisture is measured using an algorithm calibrated for relatively homogeneous regions which measures dryness based on temperature and precipitation in the area, information which is provided by NOAA. This generates a value called the Palmer Drought Severity Index (PDSI), which is compiled by the Climate Prediction Center of the National Weather Service on a weekly basis. Table 4-4 lists PDSI classifications. The PDSI uses 0 to reflect normal status, and negative numbers indicate droughts. For example, 0 is no drought, -2 is moderate drought, and -4 is extreme drought. Positive numbers signify excess precipitation (NASA 2000).
- Reservoir Storage Levels: Water level storage in several large public water supply reservoirs (especially three New York City reservoirs in the Upper Delaware River Basin) is the fifth indicator that the DEP uses for drought monitoring. Depending on the total quantity of storage and the length of the refill period for the various reservoirs, DEP uses varying percentages of storage draw-down to indicate the three drought stages for each of the reservoirs (PEMA 2023).

Table 4-4. PDSI Classifications

Severity Category	PDSI Value	Drought Status
Extremely wet	4.0 or more	None
Very wet	3.0 to 3.99	None
Moderately wet	2.0 to 2.99	None
Slightly wet	1.0 to 1.99	None
Incipient wet spell	0.5 to 0.99	None
Near normal	0.49 to -0.49	None
Incipient dry spell	-0.5 to -0.99	None
Mild drought	-1.0 to -1.99	None
Moderate drought	-2.0 to -2.99	Watch
Severe drought	-3.0 to -3.99	Warning
Extreme drought	-4.0 or less	Emergency

Source: NDMC 2023

The availability and management of water supply is discussed in the 2021 Pennsylvania State Water Plan (DEP 2023), a joint effort by the Statewide Water Resources Committee and DEP. In 2023, the DEP Secretary approved an updated State Water Plan to guide management of Pennsylvania's water resources over a 15-year planning horizon. As a functional planning tool for all Pennsylvania municipalities, counties, and regional planning partnerships, the State Water Plan profiles drought and resource constraints and encourages implementation of new technology and use policies to facilitate reduced water uses and resource demands at critical peak times. The State Water Plan provides inventories of water availability, and an assessment of current and future water use demands and trends. It also offers strategies for improving management of water resources and waterway corridors that aim to reduce damage from extreme drought and flooding conditions (DEP 2023).

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, City of Philadelphia was included in one major disaster (DR) or emergency (EM) declarations for drought-related events (FEMA 2024). Table 4-5 lists these declarations.

Table 4-5. FEMA Declarations for drought Events in City of Philadelphia (1954 to 2024)

Event Date	Declaration Date	Declaration Number	Description
August 18, 1965	August 18, 1965	DR-206	Pennsylvania Water Shortage

Source: FEMA 2024

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was included in four USDA drought-related agricultural disaster declarations, as shown in Table 4-6 (USDA 2024).

Table 4-6. USDA Declarations for Drought Events in City of Philadelphia (2021 to 2024)

Event Date	USDA Declaration Number	Description
April 7 to October 3, 2022	S5338	Drought
June 18 to September 5, 2022	S5347	Drought and Excessive Heat
July 1, 2022	S5348	Drought and Excessive Heat

Source: USDA 2024

Previous Events

Known drought events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-7. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-7. Drought Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
April 7 to October 3, 2022	City of Philadelphia	Drought. City of Philadelphia was included in a USDA drought-related agricultural disaster declaration.
June 18 to September 5, 2022	City of Philadelphia	Drought and Excessive Heat. Prolonged southwest flow and upper ridging lead to a period of temperatures in the mid to upper 90s with dewpoints in the low to mid 70s. Resulting heat index values rose to the mid to upper 100s across the region. City of Philadelphia was included in two USDA drought-related agricultural disasters during this timeframe. declaration S5347.

Source: USDA 2024, NOAA NCEI 2024

Probability of Future Occurrences

Information on previous drought occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-8. Based on historical records and input from the Steering Committee, the probability of occurrence for drought in the City is considered “likely.”

Future occurrences of drought in the City would have the possibility of impacting the entire population via water infrastructure. During periods of drought, water availability may be decreased due to a lack or strain on the City’s potable water source(s). Further, water scarcity due to drought can impact the availability of farm-fresh food, which is a staple at several farmer’s markets across the City. The lack of produce grown by farmer’s due to drought conditions can impact the livelihood of the farmers.

Table 4-8. Probability of Future Drought Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Drought	46	100%

Source: NOAA NCEI 2024

Note: Due to limitations in data, not all drought events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2024

Climate Change Projections

Climate is defined not simply as average temperature and precipitation but also by type, frequency, and intensity of weather events. Both globally and at the local level, climate change can alter prevalence and severity of weather extremes, such as droughts. Climate change is projected to intensify short-term drought risk across most of the United States (EPA 2024).

According to the Pennsylvania Climate Impacts Assessment 2021 Update, the likelihood of drought is expected to occur more frequently due to extreme and unpredictable precipitation patterns seen throughout the United States (DEP 2021). However, the extent of drought conditions still remains uncertain as heightened temperatures are also projected to increase causing evaporative demand which may reduce water availability (DEP 2021).

The number of days without rain will rise over the century. The annual maximum in consecutive dry days is projected to increase from 12.5 days historically to 13.4 days by midcentury and 13.9 days by end-of-century. This increase represents a 7% increase by mid-century and 11% increase by end-of-century. These findings of fewer rainy days and longer periods without rain are consistent with prior assessments (DEP 2021).

Cascading Impacts on Other Hazards

Drought increases conditions that may trigger fires in the City, such as dead and dying trees, and grasses. Drought can lead to increasing temperatures and evaporation of moisture, which are ideal dry conditions for wildfire events to occur. Dry, hot, and windy weather combined with dry vegetation makes some areas more susceptible to sparking wildfires when met with a spark created by humans or natural events, including lightning. Additionally, droughts can lead to the following (NIDIS 2019):

- Long-term damage to crop quality and crop losses.
- Insect infestation leading to crop losses and reduced tree canopy.
- Reduction in the ability to perform outdoor activities, which could result in loss of tourism and recreation opportunities.

4.3.1.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the drought hazard, all the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the City Profile (Chapter 3) are potentially vulnerable to a drought. The following text evaluates and estimates the potential impact of the drought and water supply deficiency hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

Drought conditions can cause a shortage of water available for human consumption and can reduce local firefighting capabilities. Social impacts of a drought include mental and physical stress, public safety threats (increased threat from forest/grass fires), health threats, conflicts among water users, reduced quality of life, and inequities in distribution of impacts and disaster relief. Individuals with chronic health conditions, children, and older adults are particularly susceptible to drought and extreme temperatures, sometimes associated with drought conditions, because of their age; health conditions; and limited ability to mobilize to shelters, cooling centers, and medical sources. Impacts on the economy and environment may have social implications as well. For the purposes of this plan, the entire population of the City is considered vulnerable to drought events.

Socially Vulnerable Population

Groups that are more vulnerable to the impacts of drought include those with limited financial capacity to adapt to a changing environment and those in rural areas with poorly maintained or aging public infrastructure that cannot keep pace with increased water demand from the population. Drought can often result in impacts on food systems that will decrease food quality and availability. Some communities of color and low-income populations struggle to obtain nutritious food in ideal conditions; severe drought conditions are likely to further exacerbate this issue. (U.S. EPA 2023).

Populations identified as having ongoing access and functional needs, as well as those facing emerging challenges related to drought, include older adults, low-income individuals, individuals who are unhoused, individuals with chronic illnesses, linguistically isolated populations, and individuals who have limited access to water. These groups may require extra water supplies or need assistance to obtain water and are more likely to need medical attention.

General Building Stock

A drought is not expected to directly cause significant impacts to any structures, and all are expected to be operational during a drought event. There is the potential for droughts to result in brick or stone facades cracking or shifting and for foundations to be impacted from clay-rich soils in the region shrinking. This is especially problematic for rowhomes and low-rise structures with shallow foundations.

Community Lifelines and Other Critical Facilities

A drought is not expected to directly affect many structures, and almost all are expected to be operational during a drought event. Philadelphia is affected by droughts both within the City and in the nearby Poconos and Catskills Mountains, which are the headwaters of the Delaware River Watershed. The Baxter Water Treatment Plant, managed by the Philadelphia Water Department (PWD), is the largest drinking water intake facility in Philadelphia, supplying about 60% of the City's water (PWD n.d.). Droughts in these mountains can impact the available water supply in the lower Delaware River. When water flows are reduced, the lower Delaware River has an increased susceptibility to higher levels of salinity. This, in turn, can impact community lifelines by compromising the availability and quality of drinking water for a significant portion of Philadelphia's population. The Baxter Water Treatment Plan sources its water supply from the Delaware River and could significantly have impacts on the potable water for the City. The Philadelphia Water Department has explored climate change issues due to concerns about salt line movement and water quality changes in the Delaware River, which may result from the combined impact of potential droughts and projected sea level rise (ICF International 2014).

Droughts also contribute to conditions conducive to wildfires. Drought conditions can lead to drier soil and vegetation, creating the ideal fuel for wildfire spread. Due to the City's urbanized environment, the risk posed by wildfires is low, but areas near parklands such as Fairmount Park, Pennypack Park, etc. may be impacted.

Economy

A prolonged drought can have a serious economic impact on a community. When drought conditions persist with little to no relief, water restrictions may be put into place by local or state governments. These restrictions may include placing limitations on when or how frequent lawns can be watered, car washing services, or any other recreational/commercial outdoor use of water supplies. In exceptional drought conditions, watering of lawns and crops may not be an option. If crops are not able to receive water, farmland will dry out and crops will die. This can lead to crop shortages, which, in turn, increases the price of food (North Carolina State University 2013).

Increased demand for water and electricity can also result in shortages and higher costs for these resources. Industries that rely on water for business could be impacted the most (e.g., landscaping businesses). Although most businesses will still be operational, they may be impacted aesthetically. These aesthetic impacts are most significant within the recreation and tourism industry. Moreover, droughts within another area could impact the food supply and price of food for residents within the City.

Natural, Historic and Cultural Resources

Natural

Droughts can impact the environment because these events can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (Intergovernmental Panel on Climate Change 2016). Droughts will also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought periods because they are dependent on steady water levels and soil moisture availability to sustain growth. As a result, these types of habitats can be negatively impacted after long periods of dryness (New Jersey Department of Environmental Protection 2017).

Droughts also have the potential to lead to water pollution due to the lack of rainwater to dilute any chemicals in water sources. Contaminated water supplies may be harmful to plants and animals. If water is not getting into the soils, the ground will dry up and become unstable. Unstable soils increase the risk of erosion and loss of topsoil (North Carolina State University 2013).

Historic

Drought can have several detrimental effects on historic resources. It can cause soil desiccation, leading to the destabilization of foundations and structures. This can result in cracks and other structural damage to historic buildings. Additionally, drought can increase the risk of wildfires, which can threaten historic sites and artifacts. The lack of moisture can also accelerate the deterioration of materials such as wood, stone, and adobe, further compromising the integrity of historic resources (NIDIS n.d.).

Cultural

Drought can significantly impact cultural resources in various ways. It can lead to the deterioration of historic buildings and archaeological sites due to soil desiccation and increased erosion. Water shortages can also affect the preservation of cultural landscapes and traditional agricultural practices. Additionally, drought can force communities to relocate, leading to the loss of traditional knowledge and cultural practices (UN SDGS 2008).

4.3.1.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Areas targeted for potential future growth and development within the next five years have been identified across the City, further discussed in Chapter 3 (City Profile). It is anticipated that any new development and new residents will be exposed to the drought hazard. Future growth could increase water usage, place more strain on water systems during periods of drought.

Projected Changes in Population

Any changes in the distribution of the population can impact the source of water resources required to sustain the user demand of each household, agricultural operation, and business operation.

Climate Change

Climate is defined not simply as average temperature and precipitation but also by type, frequency, and intensity of weather events. Both globally and at the local level, climate change can alter prevalence and severity of weather extremes, such as droughts. Climate change is projected to intensify short-term drought risk across most of the United States (EPA 2024).

According to the Pennsylvania Climate Impacts Assessment 2021 Update, the likelihood of drought is expected to occur more frequently due to extreme and unpredictable precipitation patterns seen throughout the United States (DEP 2021). However, the extent of drought conditions still remains uncertain as heightened temperatures are also projected to increase causing evaporative demand which may reduce water availability (DEP 2021).

Additional Data and Next Steps

The assessment above identifies vulnerable populations and potential structural and economic losses associated with this hazard of concern. Collection of additional information and actual loss data specific to the plan participants will further enhance the City of Philadelphia's vulnerability assessment.

4.3.2 Earthquake

4.3.2.1 Hazard Profile

Hazard Description

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10 to 20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause property damage in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area (PEMA 2023).

Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); less than 10 percent of earthquakes occur within plate interiors. As plates continue to move and plate boundaries change geologically over time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes, which are a response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser 1996).

According to the U.S. Geological Survey (USGS) Earthquake Hazards Program, an earthquake hazard is any disruption associated with an earthquake that may affect residents' normal activities. This category includes surface faulting, ground motion (shaking), landslides, liquefaction, tectonic deformation, tsunamis, and seiches. Each of these terms is defined below (NOAA 2024):

- Surface faulting: Displacement that reaches the Earth's surface during a slip along a fault. This commonly occurs with shallow earthquakes—those with an epicenter of less than 20 kilometers (km).
- Ground motion (shaking): Movement of the Earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source, and the waves travel through the Earth and along its surface.
- Landslide: Movement of surface material down a slope.
- Liquefaction: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like the wet sand near the water at the beach. Earthquake shaking can cause this effect.
- Tectonic deformation: Change in the original shape of a material caused by stress and strain.
- Tsunami: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major sub-marine slides, or exploding volcanic islands.
- Seiche: Sloshing of a closed body of water, such as a lake or bay, from earthquake shaking.

Ground shaking is the primary cause of earthquake damage to man-made structures. Damage can be increased when soft soils amplify ground shaking. Soils influence damage in different ways. Soft soils can amplify the motion of earthquake waves, producing greater ground shaking and increasing stresses on built structures on the land surface. Loose, wet, sandy soils also can cause damage when they lose strength and flow as a fluid when shaken, causing foundations and underground structures to shift and break (AGI n.d.).

The National Earthquake Hazard Reduction Program (NEHRP) developed five soil classifications (A to E) distinguished by soil shear-wave velocity that alters severity of an earthquake; each classification is listed in Table 4-9. Class A soils (hard rock) reduce ground motion from an earthquake, and Class E soils (soft soils) amplify and magnify ground shaking and increase building damage and losses.

Table 4-9. NEHRP Soil Classifications

Soil Classification	Description
A	Hard rock
B	Rock
C	Very dense soil and soft rock
D	Stiff soils
E	Soft soils

Source: FEMA n.d.

Location and Extent

Focal depth and geographic position of the epicenter of an earthquake commonly determine its location. Focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter. Earthquakes usually occur without warning, and their effects can be felt in areas at great distances from the epicenter.

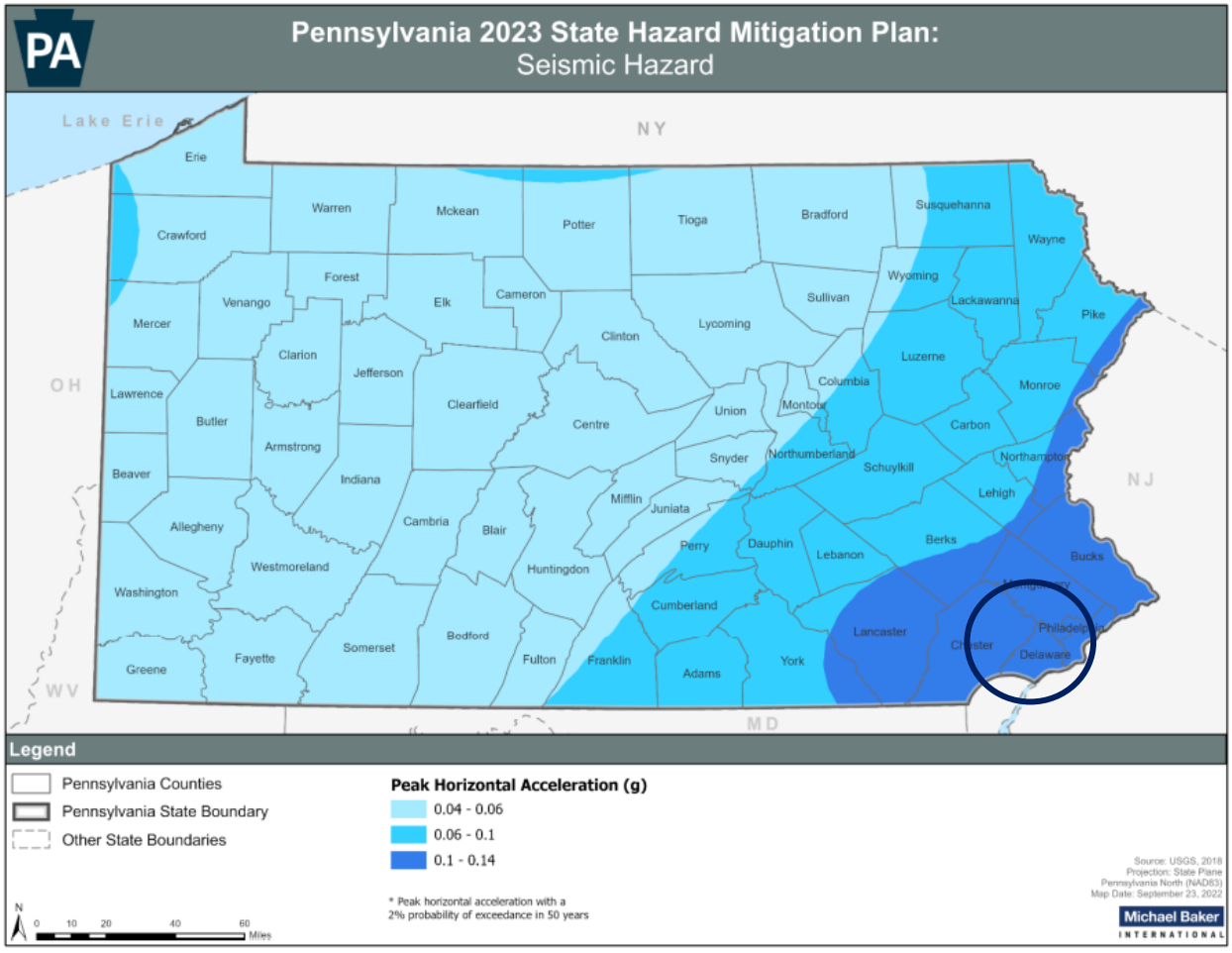
Earthquakes in Pennsylvania primarily occur in the northwestern and southeastern regions of the state. This activity is largely attributed to the Ramapo Fault System, which is part of a network of northeast-trending, southeast-dipping faults extending from southeastern New York to eastern Pennsylvania (Pennsylvania State Seismic Network n.d.). Although Philadelphia is not situated directly on the fault, it is sufficiently close for seismic activity along the fault to be felt within the City. The geology of the northeastern U.S., characterized by dense, solid bedrock, facilitates the transmission of seismic energy over greater distances compared to other regions. Consequently, even moderate earthquakes occurring along the Ramapo Fault or nearby fault lines can often be felt in Philadelphia.

Earthquake events in Pennsylvania typically do not impact areas greater than 100 km from the epicenter. Pennsylvania's strongest earthquakes with in-state epicenters have persistently occurred in an area near Lancaster (PEMA 2023). Areas of Pennsylvania, including City of Philadelphia, may be subject to the effects of earthquakes with epicenters outside the Commonwealth.

Figure 4-3 shows relative seismic hazard zones in Pennsylvania, as determined by the USGS National Seismic Hazard Mapping Project. Earthquake hazards are highest in the southeastern region and far northwestern region of the Commonwealth (PEMA 2023). Areas are mapped based on the maximum change in velocity of horizontal movement of the earth's surface over time during an earthquake's peak; this phenomenon is also called peak horizontal acceleration (PHA). Regions that can expect much larger and faster changes in earth movement face a higher risk to earthquake impacts. The City of Philadelphia and the surrounding region have the highest PHA rates, making these areas relatively more vulnerable to earthquake impacts than the rest of the Commonwealth (PEMA 2023).

Figure 4-4 and Figure 4-5 show geographic distributions of the Modified Mercalli Scale based on PGA across the City for 500 year and 2,500-year mean return period (MRP) events.

Figure 4-3. Pennsylvania Earthquake Hazard Zones



Note: City of Philadelphia is within the blue circle on the map.

Source: PEMA 2023

Figure 4-4. 500-Year Earthquake PGA (%)



Figure 4-5. 2,500-Year Earthquake PGA (%)



The USGS provides the website *Did You Feel It?* (http://earthquake.usgs.gov/earthquakes/dyfi/) for citizens to report earthquake experiences and to share information regarding the earthquake and its effects. The website is intended to gather citizens' experiences during an earthquake and incorporate the information into detailed maps to illustrate shaking intensity and damage assessments (USGS n.d.).

Earthquakes above a magnitude 5.0 can cause damage near their epicenters, and larger-magnitude earthquakes can cause damage over larger, wider areas. A discussion of previous occurrences of earthquakes in City of Philadelphia appears in the Previous Occurrence section (Chapter 7.1.4) of this profile.

Range of Magnitude

Seismic waves are vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude or extent of an earthquake is a given value of the earthquake size, or amplitude of the seismic waves, as measured by a seismograph.

The Richter magnitude scale (Richter scale) was developed in 1932 as a mathematical device to compare sizes of earthquakes. The Richter scale is the most widely known scale that measures magnitude of earthquakes. It has no upper limit and is not used to express damage. An earthquake in a densely populated area that results in many deaths and considerable damage may have the same magnitude and shock in a remote area that did not undergo any damage. The Richter scale is the most cited unit for measuring earthquake severity and can be used to communicate hazard risk to non-technical audiences; however, it has since been replaced by more accurate scales described later in this section.

Table 4-10 lists Richter scale magnitudes and corresponding earthquake effects associated with each magnitude. Based on historical data of earthquakes with a recorded intensity, little damage is expected from earthquake events. However, since the worst earthquake recorded in the Commonwealth of Pennsylvania was a magnitude 5.2, a worst-case scenario for this hazard would be if an earthquake of similar magnitude occurred in the City of Philadelphia or near the border in an adjacent county, causing mild damage in populated areas.

Table 4-10. Richter Scale Magnitudes

Richter Magnitude	Earthquake Effects
A	Generally not felt, but recorded
3.5 or less	Often felt, but rarely causes damage
3.5 to 5.4	At most, slight damage to well-designed buildings; can cause major damage to poorly constructed buildings over small regions
Under 6.0	Can be destructive up to about 100 kilometers from epicenter
6.1 to 6.9	Major earthquake; can cause serious damage over large areas
7.0 to 7.9	Great earthquake; can cause serious damage in areas several hundred kilometers across
8.0 or greater	Devastating over large areas; catastrophic

Source: PEMA 2023

The intensity of an earthquake is based on observed effects of ground shaking on people, buildings, and natural features and varies with location. The Modified Mercalli Intensity (MMI) scale expresses the intensity of an earthquake and is a subjective measure that describes the strength of a shock felt at a particular location. The MMI scale records intensity of an earthquake's effects in a given locality according to a scale from I to XII. Descriptions of MMI scales appear in Table 4-11. Earthquakes that occur in the Commonwealth originate deep within the Earth's

crust and not on an active fault. No injury or severe damage from earthquake events has been reported in the City of Philadelphia.

Table 4-11. Modified Mercalli Intensity Scale with Associated Impacts

Scale	Intensity	Description Of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	<4.2
II	Feeble	Felt only by a few persons at rest, especially on upper floors of buildings.	
III	Slight	Felt quite noticeably indoors, especially on upper floors. Most people do not recognize it as an earthquake (i.e., a truck rumbling).	
IV	Moderate	Can be felt by people walking; dishes, windows, and doors are disturbed.	
V	Slightly Strong	Sleepers are awoken; unstable objects are overturned.	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves; damage is slight.	<5.4
VII	Very Strong	Damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, and considerable in poorly built or badly designed structures; some chimneys are broken.	<6.1
VIII	Destructive	Damage is slight in specially designed structures; considerable in ordinary, substantial buildings. Moving cars become uncontrollable; masonry fractures, poorly constructed buildings damaged.	<6.9
IX	Ruinous	Some houses collapse; ground cracks; pipes break open; damage is considerable in specially designed structures; buildings are shifted off foundations.	
X	Disastrous	Some well-built wooden structures are destroyed; most masonry and frame structures are destroyed along with foundations. Ground cracks profusely; liquefication and landslides are widespread.	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes, and cables are destroyed.	<8.1
XII	Catastrophic	Total destruction: trees fall; lines of sight and level are distorted; ground rises and falls in waves; objects are thrown upward into the air.	>8.1

Source: PEMA 2023

Seismic hazards are often expressed in terms of Peak Ground Acceleration (PGA) and Spectral Acceleration (SA). USGS defines PGA and SA as the following: “PGA is what is experienced by a particle on the ground. SA is approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building” (USGS 2019). Both PGA and SA can be measured in *g* (the acceleration caused by gravity) or expressed as a percent acceleration force of gravity (percent g). For example, at 100 percent g PGA (equivalent to 1.0 g) during an earthquake (an extremely strong ground motion), objects accelerate sideways at the same rate as when they drop from a ceiling. PGA and SA hazard maps provide insight into location-specific vulnerabilities.

PGA is a common earthquake measurement that indicates three factors: (1) geographic area affected, (2) probability of an earthquake at each level of severity, and (3) strength of ground movement (severity) expressed

in percent g. In other words, PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes (or accelerates) in a given geographic area. Damage levels from an earthquake vary with intensity of ground shaking and with seismic capacity of structures, as noted in Table 4-12 (USGS 2019).

Table 4-12. Damage Levels Experienced in Earthquakes

Ground Motion Percentage	Explanation of Damages
1-2% g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10% g	Usually causes only slight damage, except in unusually vulnerable facilities.
10-20% g	May cause minor-to-moderate damage in well-designed buildings, with higher levels of damage in poorly designed buildings. At this level of ground shaking, only unusually poor buildings would be subject to potential collapse.
20-50% g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50% g	May cause higher levels of damage in many buildings, even those designed to resist seismic forces.

Source: USGS 2019
Note: % g Peak Ground Acceleration

Previous Occurrences

The historical record of earthquakes goes back approximately 200 years. In Pennsylvania, about 35 earthquakes have caused light damage since the Colonial period. Nearly one-half of these damaging events had out of state epicenters (PEMA 2023). Very few earthquakes having a maximum intensity of IV or higher have been centered in areas outside the southeastern part of the Commonwealth (PEMA 2023). Figure 4-6 is a map of earthquake epicenters in Pennsylvania from 1937 to 2022.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City of Philadelphia was not included in any major disaster (DR) or emergency (EM) declarations for earthquake-related events (FEMA 2024).

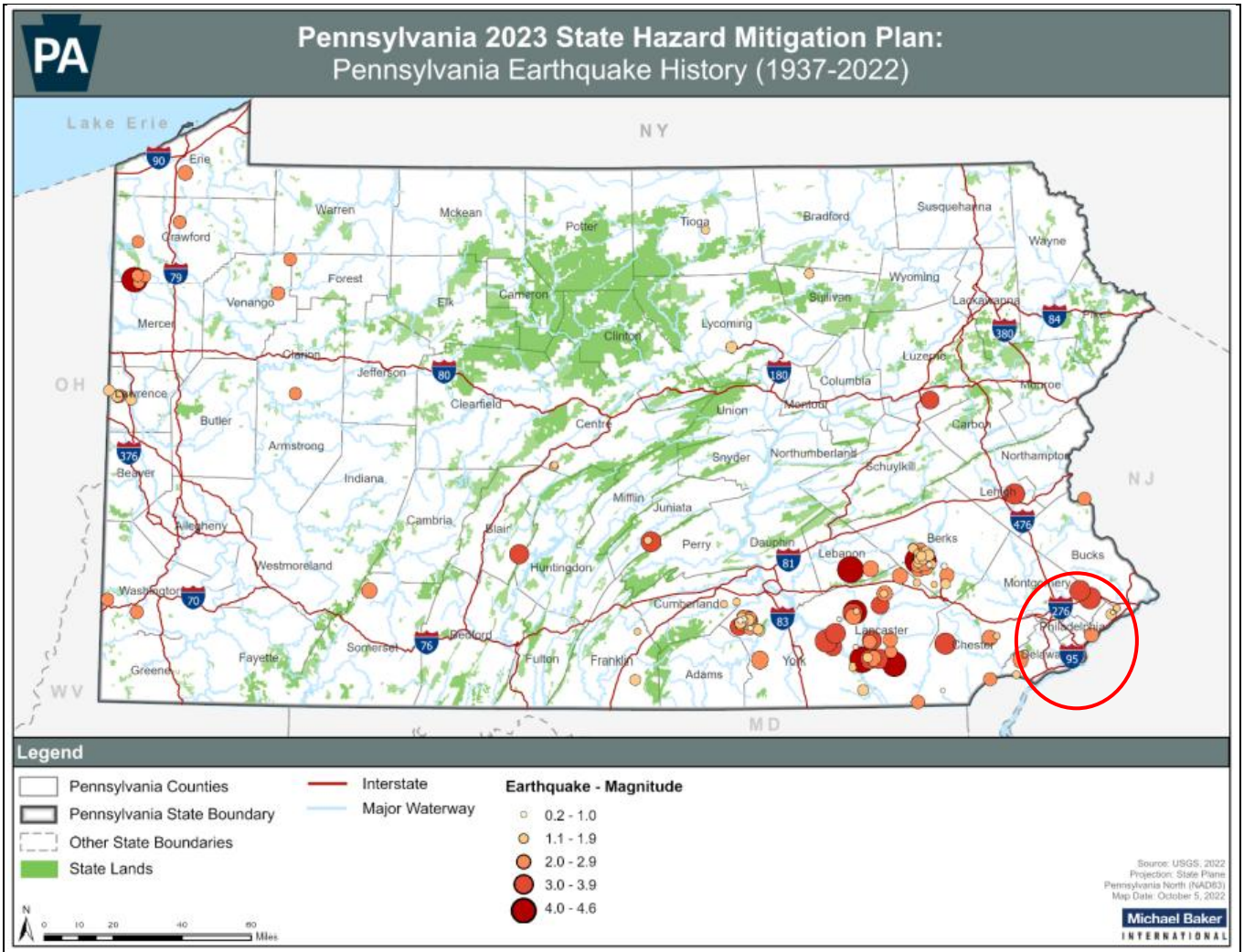
USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, the City of Philadelphia was not included in any USDA earthquake-related agricultural disaster declarations (USDA 2024).

Previous Events

On April 5, 2024, a magnitude 4.8 earthquake occurred near Whitehouse Station, NJ, that was felt in the City. The City did not sustain any damages from this event. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Figure 4-6. Earthquake Epicenters in Pennsylvania



Note: City of Philadelphia is within the red circle.

Source: PEMA 2023

Probability of Future Occurrences

Information on previous earthquake occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-13. Based on historical records and input from the Steering Committee, the probability of occurrence for earthquakes in the City is considered "possible."

Future occurrences of earthquakes in the City would primarily have impacts to buildings constructed prior to 1960. These structures are considered at a higher risk, as it was not until after 1961 when modern building codes were adopted in the Pennsylvania Uniform Construction Code. Imminently dangerous buildings in the City, which are concentrated in North and West Philadelphia, coincide with the location of the most socially vulnerable populations in the City (City of Philadelphia 2022).

Table 4-13. Probability of Future Earthquake Events in the City of Philadelphia

Hazard Type	Number of Occurrences Between 1950 and 2024	Percent Chance of Occurring in Any Given Year
Earthquake	10	13.5%

Source: USGS 2024

Note: Due to limitations in data, not all earthquake events occurring between 1950 and 2024 are accounted for in the tally of occurrences. Data was reviewed for earthquakes occurring with the City and surrounding region with a 2.5 magnitude or greater.

Climate Change Projections

Impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the Earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity, according to research into prehistoric earthquakes and volcanic activity. National Aeronautics and Space Administration (NASA) and USGS scientists found that retreating glaciers in southern Alaska might be opening the way for future earthquakes (NASA, USGS 2023).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could undergo liquefaction during seismic activity as a result of the increased saturation. Dams storing increased volumes of water, as a result of changes in the hydrograph, could fail during seismic events. No current models are available to estimate these impacts.

Cascading Impacts on Other Hazards

Earthquakes can cause large and sometimes disastrous landslides and mudslides. Any steep slope is vulnerable to slope failure, often because of loss of cohesion in clay-rich soils. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

Earthen dams and levees are highly susceptible to seismic events. The impacts of their eventual failures can be considered secondary risks for earthquakes. The most common mode of earthquake-induced dam failure is slumping or settlement of earth-fill dams where the fill has not been properly compacted. If the slumping occurs when the dam is full, then overtopping of the dam is possible, with rapid erosion leading to dam failure. Dam failure is also possible if strong ground motions heavily damage concrete dams. Earthquake-induced landslides into reservoirs have also caused dam failures. Dam failures are further discussed in Chapter 14 (Dam Failure) of this Plan update.

Another secondary effect of earthquakes that are often observed in low-lying areas near water bodies is ground liquefaction. Liquefaction is the conversion of water-saturated soil into a fluid-like mass. This can occur when loosely packed, waterlogged sediments lose their strength in response to strong shaking.

Secondary impacts can include train derailments, roadway damage, spillage of hazardous materials (HazMat), and utility interruption. Roadways will sustain damages primarily from surface displacements, liquefaction, slope instability and earthquake induced flooding from broken levees during high water events. Pavements can crack due to ground failure. The railroad system is vulnerable to earthquakes and can sustain damages to bridges, embankment failures, vertical and horizontal track misalignments, tunnel misalignments, failure of tunnel linings, structural damage to railroad buildings, and overturned rail cars and locomotives (Central U.S. Earthquake Consortium 2000).

4.3.2.2 Vulnerability and Impact Assessment

A probabilistic assessment was conducted for City of Philadelphia for the 500-year and 2,500-year mean return period events through a Level 2 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historical earthquakes and inferred faults, locations, and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract. The following text evaluates and estimates the potential impact of the earthquake hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time

Life, Health, and Safety

Overall Population

Overall, the entire population of the City of Philadelphia is exposed to the earthquake hazard event. The impact of an earthquake on life, health, and safety would depend on the severity of the event. First responder safety may be at risk as well responding to earthquake hazard events. First responders may have difficulty traveling to earthquake incidents due to limited access to roads. Risks to public safety and loss of life from an earthquake in the City of Philadelphia are minimal, with higher risk occurring in buildings as a result of damage to the structure or people walking below building ornamentation and chimneys that may be shaken loose and fall as a result of the earthquake.

Hazus conducted an analysis to estimate the number of people who might be injured or killed by an earthquake, categorizing casualties into severity levels based on the extent of injuries. The analysis provided casualty estimates for three specific times of day—2:00 AM, 2:00 PM, and 5:00 PM—to reflect peak occupancy in different community sectors. The 2:00 AM estimate considers maximum residential occupancy, the 2:00 PM estimate accounts for peak occupancy in educational, commercial, and industrial sectors, and the 5:00 PM estimate represents peak commute time. This approach helps to understand the varying impact of an earthquake depending on the time of day and the corresponding occupancy levels in different sectors. The Hazus analysis was conducted for the 500-Year and 2,500-Year Mean Return Period and both represented below in Table 4-14.

Table 4-14. Estimated Casualties from 500-Year and 2,500-Year Mean Return Period Earthquake Events

Time of Day Event Occurs	Non-Hospitalized Injuries	Hospitalizations	Deaths
500-Year Mean Return Period			
2:00 a.m.	7	0	0
2:00 p.m.	32	3	0
5:00 p.m.	11	1	0
2,500-Year Mean Return Period			
2:00 a.m.	109	7	0
2:00 p.m.	352	56	9
5:00 p.m.	143	18	3

Source: Hazus v6.1

Socially Vulnerable Population

Populations considered most vulnerable are located in the built environment, particularly near unreinforced masonry construction. In addition, the vulnerable population includes older adults (persons over the age of 65) and individuals living below the Census poverty threshold. These socially vulnerable populations are most susceptible based on several factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Additionally, individuals who access sidewalks and other routes via curb cuts and ramps may face additional barriers due to the destruction of existing accessible infrastructure and will require additional support following an earthquake.

Imminently dangerous buildings in the City, which are concentrated in North and West Philadelphia, coincide with the location of the most socially vulnerable populations in the City (City of Philadelphia 2022).

Residents may be displaced or require temporary to long-term sheltering as a result of the event. The number of people requiring shelter is generally less than the number displaced, as some displaced persons use hotels or stay with family or friends after a disaster event. After running Hazus v6.1 it is estimated that there is one person with sheltering needs for the City of Philadelphia for any earthquake event with a 500-Year Mean Return Period and for the 2,500-Year Mean Return Period there is 283 persons who would require sheltering needs as shown in Table 4-15.

Table 4-15. Persons Seeking Sheltering, 500-Year and 2,500-Year Mean Return Period Earthquake Event

Planning District	500-Year Mean Return Period Earthquake Event		2,500-Year Mean Return Period Earthquake Event	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Central	3	1	157	52
Central Northeast	0	0	20	11
Lower Far Northeast	0	0	10	4
Lower North	0	0	39	35
Lower Northeast	0	0	17	13
Lower Northwest	0	0	3	1
Lower South	0	0	4	1
Lower Southwest	0	0	8	6
North	0	0	41	37
North Delaware	0	0	16	9
River Wards	0	0	19	10
South	0	0	31	16
University Southwest	0	0	24	19
Upper Far Northeast	0	0	8	4
Upper North	0	0	28	19
Upper Northwest	0	0	19	10
West	0	0	40	29

Planning District	500-Year Mean Return Period Earthquake Event		2,500-Year Mean Return Period Earthquake Event	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
West Park	0	0	13	7
City of Philadelphia (Total)	**3**	**1**	**497**	**283**

Source: Hazus v6.1; U.S. Census Bureau ACS 2022
Note: Population results are rounded down

According to the 2022 5-year ACS estimates, shown in Table 4-16, there are 351,811 total persons living below the poverty level, 223,219 persons over the age of 65 years, 99,102 persons under the age of 5 years, 105,761 non-English speakers, and 267,675 persons with a disability in the City (U.S. Census Bureau 2022).

Table 4-16. Socially Vulnerable Populations in the City of Philadelphia

Planning District	American Community Survey 5-Year Population Estimates (2022)									
	Population Over 65		Population Under 5		Non-English-Speaking Population		Population with Disability		Population Below Poverty Level	
	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total
Central	20,572	15.1%	5,033	3.7%	5,649	4.1%	11,714	8.6%	14,340	10.5%
Central Northeast	15,291	17.8%	6,332	7.4%	11,499	13.4%	12,956	15.1%	15,582	18.2%
Lower Far Northeast	11,898	16.5%	5,141	7.1%	3,915	5.4%	9,621	13.4%	5,889	8.2%
Lower North	10,055	10.1%	4,936	5.0%	5,361	5.4%	19,685	19.8%	32,707	33.0%
Lower Northeast	11,245	10.5%	8,865	8.3%	8,735	8.2%	20,526	19.2%	28,876	27.0%
Lower Northwest	7,850	14.4%	2,798	5.1%	624	1.1%	6,867	12.6%	4,835	8.9%
Lower South	1,230	19.0%	375	5.8%	413	6.4%	792	12.3%	378	5.9%
Lower Southwest	4,640	10.8%	2,672	6.2%	3,721	8.7%	6,452	15.0%	11,439	26.7%
North	16,712	12.3%	10,450	7.7%	19,405	14.3%	38,514	28.4%	51,673	38.2%
North Delaware	12,094	12.3%	6,769	6.9%	7,104	7.2%	15,527	15.7%	20,072	20.4%
River Wards	6,811	9.8%	5,008	7.2%	4,465	6.4%	13,317	19.1%	16,999	24.4%
South	18,100	13.7%	7,551	5.7%	9,311	7.1%	18,849	14.3%	23,271	17.7%
University Southwest	6,943	8.5%	2,825	3.5%	2,652	3.2%	11,389	13.9%	20,113	24.6%
Upper Far Northeast	15,831	22.9%	4,283	6.2%	12,900	18.7%	10,246	14.8%	8,520	12.3%
Upper North	25,546	16.8%	8,929	5.9%	6,221	4.1%	27,791	18.3%	36,558	24.1%
Upper Northwest	15,417	17.0%	6,172	6.8%	1,347	1.5%	15,619	17.2%	16,825	18.5%
West	15,573	13.6%	8,888	7.7%	1,288	1.1%	19,933	17.4%	33,513	29.2%
West Park	7,411	16.5%	2,073	4.6%	1,150	2.6%	7,876	17.6%	10,221	22.8%
City of Philadelphia (Total)	**223,219**	**14.0%**	**99,102**	**6.2%**	**105,761**	**6.6%**	**267,675**	**16.8%**	**351,811**	**22.1%**

Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals
Note: 2.34 persons per household. This number was used to calculate the Non-English-Speaking populations.

General Building Stock

The entire building stock of the City of Philadelphia is exposed to the earthquake hazard. The most vulnerable areas of the City are those with the highest concentration of deteriorating structures. Buildings constructed prior to 1960 are considered at a higher risk, as it was not until after 1961 when modern building codes were adopted in the Pennsylvania Uniform Construction Code. Unfortunately, there is limited information on the structure types due to the age of most structures.

There is a strong correlation between PGA and damage a building might undergo (FEMA 2022). The Hazus model is based on best available earthquake science and aligns with these statements. The Hazus probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in the City. Refer to Figure 4-4 and Figure 4-5 earlier in this profile which illustrate the geographic distribution of PGA (%g) across the City for 500-year and 2,500-year MRP events.

A building's construction determines how well it can withstand the force of an earthquake. FEMA indicates that unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy (FEMA 2023). Additional attributes that affect a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. Hazus considers building construction and age of building as part of the analysis. Because a custom general building stock was used for this Hazus analysis, the building ages and building types from the inventory were incorporated into the Hazus model.

Potential building damage was evaluated by Hazus using the following damage categories: none, slight, moderate, extensive, and complete. Table 4-17 provides definitions of these categories of damage for a light wood-framed building; definitions for other building types are included in the Hazus technical manual documentation.

Table 4-17. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Minor	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Severe	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.
Destruction	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse because of the crippled wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Source: FEMA 2022

The entire general building stock of the City is exposed to the earthquake hazard. Table 4-18 provides an analysis of the expected damage to various building types during earthquakes with 500-year and 2,500-year Mean Return Periods. For residential buildings, the majority are expected to sustain no damage, with 99.5% undamaged in the 500-year period and 93.0% in the 2,500-year period. Minor damage is expected in a small percentage, increasing from 0.5% to 6.1% as the return period lengthens. Moderate to severe damage and destruction are rare across all building types, with slightly higher percentages in the 2,500-year period. Commercial, industrial, and other buildings

show similar trends, with most buildings remaining undamaged, and minor damage percentages increasing with longer return periods. Severe damage and destruction remain minimal across all categories. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with building standards in place at times of construction.

Table 4-18. Damage Severity by Occupancy Class

Total Number of Buildings in Occupancy	Severity of Expected Damage	500-Year Mean Return Period		2,500-Year Mean Return Period	
		Building Count	% Buildings in Occupancy Class	Building Count	% Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)					
471,179	NONE	468,600	99.5%	438,120	93.0%
	MINOR	2,422	0.5%	28,633	6.1%
	MODERATE	157	<0.1%	4,223	0.9%
	SEVERE	0	0.0%	203	<0.1%
	DESTRUCTION	0	0.0%	3	<0.1%
Commercial Buildings					
25,830	NONE	25,504	98.7%	23,078	89.3%
	MINOR	279	1.1%	2,097	8.1%
	MODERATE	44	0.2%	594	2.3%
	SEVERE	4	<0.1%	53	0.2%
	DESTRUCTION	0	0.0%	8	<0.1%
Industrial Buildings					
4,089	NONE	4,046	98.9%	3,707	90.7%
	MINOR	33	0.8%	255	6.2%
	MODERATE	9	0.2%	113	2.8%
	SEVERE	1	<0.1%	12	0.3%
	DESTRUCTION	0	0.0%	2	0.1%
Other Buildings[a]					
2,717	NONE	2,674	98.4%	2,420	89.1%
	MINOR	34	1.2%	214	7.9%
	MODERATE	9	0.3%	70	2.6%
	SEVERE	1	<0.1%	12	0.4%
	DESTRUCTION	0	0.0%	1	0.1%

Source: Hazus v6.1; City of Philadelphia 2022, 2024

a. Other = Government, Religion, Agricultural, and Education

Estimated Cost of Damage

Table 4-19 and Table 4-20 provide an overview of the estimated damage to structures and contents in various planning districts of the City of Philadelphia during earthquakes with a 500-Year and 2,500-Year Mean Return Period. The first table shows that the total replacement cost value (RCV) for the City is approximately $351.5 billion, with estimated damages to residential, commercial, and other buildings totaling around $58.1 million, which is less than 0.1% of the RCV. The second table presents details indicating that the total estimated damage for the 2,500-

Year period is about $1.37 billion, or 0.4% of the RCV. This includes significant damages across residential, commercial, and other buildings, with the Central planning district experiencing the highest total damage at approximately $355 million.

Table 4-19. Estimated Damage Costs Due to 500-Year Mean Return Period Earthquake Events

Planning District	Total Replacement Cost Value (RCV)	Estimated Damage to Structure and Contents				
		Residential	Commercial	Other[a]	Total	
					Damage	% of RCV
Central	$104,498,861,483	$6,516,406	$4,210,827	$1,699,748	$12,426,980	<0.1%
Central Northeast	$12,324,032,453	$2,168,057	$492,406	$366,841	$3,027,305	<0.1%
Lower Far Northeast	$15,483,279,437	$1,625,513	$337,392	$755,499	$2,718,405	<0.1%
Lower North	$17,246,447,463	$1,753,794	$437,612	$1,297,993	$3,489,398	<0.1%
Lower Northeast	$10,314,498,850	$1,654,166	$465,365	$416,313	$2,535,844	<0.1%
Lower Northwest	$13,615,067,162	$569,922	$144,904	$117,625	$832,451	<0.1%
Lower South	$8,208,372,896	$378,550	$1,401,924	$490,904	$2,271,379	<0.1%
Lower Southwest	$6,840,537,150	$714,071	$705,030	$482,481	$1,901,582	<0.1%
North	$13,054,275,189	$1,263,391	$764,900	$1,175,322	$3,203,612	<0.1%
North Delaware	$13,552,083,648	$2,186,794	$522,787	$526,864	$3,236,445	<0.1%
River Wards	$14,267,301,089	$1,755,495	$513,378	$778,419	$3,047,291	<0.1%
South	$28,814,766,240	$3,682,781	$1,089,342	$658,641	$5,430,765	<0.1%
University Southwest	$28,704,645,654	$1,130,972	$664,932	$1,948,723	$3,744,627	<0.1%
Upper Far Northeast	$14,096,177,394	$1,122,910	$196,617	$543,827	$1,863,355	<0.1%
Upper North	$15,554,930,862	$2,041,824	$396,063	$550,439	$2,988,325	<0.1%
Upper Northwest	$16,619,291,505	$1,395,452	$228,098	$380,077	$2,003,626	<0.1%
West	$10,774,317,065	$1,615,241	$374,429	$346,303	$2,335,973	<0.1%
West Park	$7,494,241,193	$633,459	$153,435	$252,620	$1,039,514	<0.1%
City of Philadelphia	**$351,463,126,733**	**$32,208,798**	**$13,099,442**	**$12,788,639**	**$58,096,879**	**<0.1%**

Source: Hazus v6.1; City of Philadelphia 2022,2024; RS Means 2024

a. Other = Government, Religion, Agricultural, and Education

Table 4-20. Estimated Damage Costs Due to 2,500-Year Mean Return Period Earthquake Events

Planning District	Total Replacement Cost Value (RCV)	Estimated Damage to Structure and Contents				
		Residential	Commercial	Other[a]	Total	
					Damage	% of RCV
Central	$104,498,861,483	$188,561,638	$131,155,346	$35,280,324	$354,997,308	0.3%
Central Northeast	$12,324,032,453	$43,534,527	$9,592,089	$4,932,754	$58,059,370	0.5%
Lower Far Northeast	$15,483,279,437	$36,966,081	$8,007,121	$17,280,433	$62,253,635	0.4%
Lower North	$17,246,447,463	$44,971,807	$11,396,915	$19,674,037	$76,042,759	0.4%

Planning District	Total Replacement Cost Value (RCV)	Estimated Damage to Structure and Contents				
		Residential	Commercial	Other[a]	Total Damage	Total % of RCV
Lower Northeast	$10,314,498,850	$33,772,978	$8,916,033	$6,539,665	$49,228,676	0.5%
Lower Northwest	$13,615,067,162	$23,811,177	$6,630,279	$3,157,947	$33,599,403	0.2%
Lower South	$8,208,372,896	$7,154,324	$31,219,148	$8,568,109	$46,941,581	0.6%
Lower Southwest	$6,840,537,150	$15,480,338	$14,615,279	$7,994,129	$38,089,745	0.6%
North	$13,054,275,189	$29,171,334	$16,216,663	$18,251,761	$63,639,758	0.5%
North Delaware	$13,552,083,648	$44,181,041	$10,070,626	$8,904,508	$63,156,176	0.5%
River Wards	$14,267,301,089	$40,276,905	$11,181,989	$13,091,958	$64,550,852	0.5%
South	$28,814,766,240	$87,500,346	$22,481,532	$11,629,269	$121,611,147	0.4%
University Southwest	$28,704,645,654	$34,862,615	$24,719,692	$37,311,597	$96,893,904	0.3%
Upper Far Northeast	$14,096,177,394	$31,348,695	$6,288,561	$10,192,836	$47,830,092	0.3%
Upper North	$15,554,930,862	$48,871,621	$8,466,819	$8,099,691	$65,438,131	0.4%
Upper Northwest	$16,619,291,505	$41,336,830	$6,713,123	$6,554,892	$54,604,846	0.3%
West	$10,774,317,065	$37,112,060	$7,869,272	$5,719,417	$50,700,749	0.5%
West Park	$7,494,241,193	$17,078,227	$4,668,827	$4,342,977	$26,090,030	0.3%
City of Philadelphia	**$351,463,126,733**	**$805,992,543**	**$340,209,315**	**$227,526,303**	**$1,373,728,162**	**0.4%**

Source: Hazus v6.1; City of Philadelphia 2022,2024; RS Means 2024
a. Other = Government, Religion, Agricultural, and Education

Community Lifelines and Other Critical Facilities

All critical facilities in the City of Philadelphia are considered exposed to the earthquake hazard. Refer to subsection "Critical Facilities" in Chapter 3 (City Profile) of this HMP for a complete inventory of critical facilities in the City. In the case of bridges, this involves the number and location of structurally deficient bridges throughout the City of Philadelphia. PennDOT defines the overall conditions of a bridge based on the bridge's overall status in terms of structural soundness and ability to service traveling public (PennDOT 2018):

- Good - A numeric score greater than, or equal to, seven on primary component conditions rating.
- Fair - A numeric score of five or six on primary component conditions rating.
- Poor - Previously referred to as Structurally Deficient indicates that the bridge has deterioration to one or more of its major components. A numeric score of four or less on primary components conditions rating.

The Hazus earthquake model was used to assign the range or average probability of each damage state category to the critical facilities in the City of Philadelphia for the 500-Year and 2,500-Year Mean Return Period events. In addition, Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as a probability of being functional at specified time increments (days after the event). For example, Hazus might estimate that a facility has 5-percent chance of being fully functional at Day 3, and a 95-percent chance of being fully functional at Day 90. For percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type is presented.

Table 4-21 provides an analysis of the average percent probability of sustaining damage and the average percent functionality of various lifeline systems during a 500-year mean return period earthquake. The lifelines assessed

include communications, energy, food, hydration, shelter, hazardous materials, health and medical, safety and security, transportation, and water systems.

For most lifelines, the probability of sustaining no damage is very high, ranging from 97.7% to 99.8%. Slight damage is expected in a small percentage of cases, while moderate, extensive, and complete damage are rare. For instance, the communications system has a 97.9% chance of sustaining no damage and less than a 0.1% chance of extensive or complete damage.

In terms of functionality, most lifelines are expected to recover quickly. By Day 1, functionality ranges from 97.6% to 99.8%, and by Day 7, it improves to between 99.4% and 99.9%. By Day 30 and Day 90, nearly all lifelines are expected to be fully functional, with percentages close to or at 100%.

Table 4-21. Average Percent Probability of Sustaining Damage, 500-Year Mean Return Period

Name	Average Percent Probability of Sustaining Damage					Average Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Communications	97.9%	1.6%	0.5%	<0.1%	0.0%	98.2%	99.5%	99.9%	99.9%
Energy	98.0%	1.2%	0.7%	0.1%	0.0%	99.1%	99.6%	99.9%	99.9%
Food, Hydration, Shelter	97.7%	1.8%	0.5%	<0.1%	0.0%	97.6%	99.4%	99.9%	99.9%
Hazardous Materials	97.7%	1.8%	0.5%	<0.1%	0.0%	97.6%	99.4%	99.9%	99.9%
Health and Medical	99.8%	0.2%	<0.1%	0.0%	0.0%	99.7%	99.9%	99.9%	99.9%
Safety and Security	97.8%	1.7%	0.5%	<0.1%	0.0%	97.8%	99.4%	99.9%	99.9%
Transportation	99.4%	0.5%	<0.1%	<0.1%	0.0%	99.8%	99.9%	100.0%	100.0%
Water Systems	97.7%	1.4%	0.8%	0.1%	0.0%	98.9%	99.8%	99.9%	99.9%

Source: Hazus v6.1; City of Philadelphia 2012, 2016,2018,2019,2021,2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024; DEP 2024

Table 4-22 provides an analysis of the average percent probability of sustaining damage and the average percent functionality of various lifeline systems during a 2,500-year mean return period earthquake. The lifelines assessed include communications, energy, food, hydration, shelter, hazardous materials, health and medical, safety and security, transportation, and water systems.

For most lifelines, the probability of sustaining no damage is high, though lower than in a 500-year event, ranging from 83.9% to 95.8%. Slight to moderate damage is more likely, with slight damage probabilities ranging from 7.2% to 10.5% and moderate damage probabilities from 0.7% to 6.1%. Extensive and complete damage remain rare but are slightly more probable than in less severe events.

In terms of functionality, most lifelines are expected to recover significantly within the first week. By Day 1, functionality ranges from 83.8% to 98.8%, improving to between 94.3% and 99.6% by Day 7. By Day 30 and Day 90, nearly all lifelines are expected to be fully functional, with percentages close to or at 100%.

Table 4-22. Average Percent Probability of Sustaining Damage 2,500-Year Mean Return Period

Name	Average Percent Probability of Sustaining Damage					Average Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Communications	84.8%	9.7%	4.7%	0.8%	0.1%	86.9%	95.6%	99.3%	99.9%

Name	Average Percent Probability of Sustaining Damage					Average Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Energy	85.7%	7.2%	5.7%	1.4%	0.0%	92.8%	97.0%	99.3%	99.9%
Food, Hydration, Shelter	83.9%	10.5%	4.7%	0.8%	0.1%	83.8%	94.3%	99.1%	99.9%
Hazardous Materials	84.0%	10.4%	4.7%	0.8%	0.1%	83.9%	94.3%	99.1%	99.9%
Health and Medical	95.8%	3.4%	0.7%	<0.1%	<0.1%	95.8%	99.1%	99.9%	99.9%
Safety and Security	84.5%	10.1%	4.5%	0.8%	0.1%	84.4%	94.4%	99.1%	99.5%
Transportation	95.5%	3.8%	0.7%	0.0%	<0.1%	98.8%	99.6%	99.9%	99.9%
Water Systems	84.6%	7.7%	6.1%	1.6%	<0.1%	92.7%	98.8%	99.7%	99.9%

Source: Hazus v6.1; City of Philadelphia 2012, 2016,2018,2019,2021,2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024; DEP 2024

Economy

Earthquakes impacts on the economy include loss of business function, damage to inventory, relocation costs, wage loss, and rental costs during the repair or replacement of buildings. Roads and railroad tracks would undergo damage due to ground failure, resulting in interruptions of regional transportation and of distribution of materials. Losses to the community that would result from damage to lifelines could exceed costs of repair. Earthquake events can significantly affect bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses are particularly vulnerable. Potential impacts on facilities and infrastructure will depend on their age, which correlates with standards in place at times of construction.

Hazus estimates the volume of debris that may be generated as a result of an earthquake event to enable the study region to manage debris removal and disposal. Debris estimates are divided into two categories: reinforced concrete and steel that require special equipment to break up before being transported, and brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2022).

Table 4-23 outlines the estimated debris generated in various planning districts of the City of Philadelphia during earthquakes with 500-Year and 2,500-Year Mean Return Periods. For the 500-Year period, the total debris includes 25,840 tons of brick/wood and 4,045 tons of concrete/steel. In the 2,500-Year period, these amounts significantly increase to 205,442 tons of brick/wood and 78,588 tons of concrete/steel. The Central planning district is projected to generate the most debris, with 36,843 tons of brick/wood and 26,674 tons of concrete/steel in the 2,500-Year period. Other districts also show substantial increases in debris generation as the return period lengthens, reflecting the greater impact of more severe earthquakes.

Table 4-23. 500-Year and 2,500-Year Mean Return Period Earthquake Event Debris

Planning District	Debris Generated (tons)			
	500-Year Mean Return Period		2,500-Year Mean Return Period	
	Brick/Wood	Concrete/Steel	Brick/Wood	Concrete/Steel
Central	4,397	991	36,843	26,674
Central Northeast	767	86	6,422	1,432
Lower Far Northeast	537	55	5,730	1,364
Lower North	3,086	436	23,362	7,359

Planning District	Debris Generated (tons)			
	500-Year Mean Return Period		2,500-Year Mean Return Period	
	Brick/Wood	Concrete/Steel	Brick/Wood	Concrete/Steel
Lower Northeast	1,029	158	7,958	2,835
Lower Northwest	219	22	2,642	510
Lower South	451	92	3,124	1,851
Lower Southwest	723	114	5,468	2,168
North	3,352	555	22,946	8,271
North Delaware	922	135	7,417	2,291
River Wards	1,640	259	11,411	3,968
South	1,354	212	10,715	3,898
University Southwest	2,208	250	19,125	4,959
Upper Far Northeast	511	59	5,283	1,190
Upper North	1,545	218	11,842	3,168
Upper Northwest	1,100	130	9,269	2,217
West	1,098	155	8,833	2,563
West Park	901	118	7,054	1,871
City of Philadelphia	25,840	4,045	205,442	78,588

Source: Hazus v6.1; City of Philadelphia 2022, 2024

Natural, Historic and Cultural Resources

Natural

According to USGS, earthquakes can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event. Surface faulting is one of the major seismic components to earthquakes that can create wide ruptures in the ground. Ruptures can have a direct impact on the landscape and natural environment because it can disconnect habitats for miles isolating animal species or tear apart plant roots (USGS n.d.).

Furthermore, ground failure as a result of soil liquefaction can have an impact on soil pores and retention of water resources. The greater the seismic activity and liquefaction properties of the soil, the more likely drainage of groundwater can occur which depletes groundwater resources. In areas where there is higher pressure of groundwater retention, the pores can build up more pressure and make soil behave more like a fluid rather than a solid increasing risk of localized flooding and deposition or accumulation of silt (USGS n.d.).

Earthquakes can cause large and sometimes disastrous landslides and mudslides. Any steep slope is vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolong periods of time due to landslides.

Historic

Depending on the magnitude, earthquake events affecting the City could damage property in the area in and around historical landmarks. Many historical buildings and homes which may not be built to withstand earthquakes and are more vulnerable than other infrastructure.

Cultural

Depending on the magnitude, earthquake events affecting the City could bring damages to property to the area in and around cultural landmarks.

4.3.2.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Any increases in development in the City would increase the overall risk from the earthquake hazard, though new development is likely to be better protected than older building stock due to meeting modern building code requirements. Refer to Chapter 3 (City Profile) for more information about the potential new development in the City of Philadelphia.

Projected Changes in Population

Development in areas with softer NEHRP soil classes, liquefaction, and landslide-susceptibility may experience shifting or cracking in the foundation during earthquakes because of loose soils. However, seismic provisions in current building codes should render new construction less vulnerable to seismic impacts than older construction that may have been built to lower construction standards.

Climate Change

Impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the Earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity, according to research into prehistoric earthquakes and volcanic activity. National Aeronautics and Space Administration (NASA) and USGS scientists found that retreating glaciers in southern Alaska might be opening the way for future earthquakes (NASA, USGS 2023).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could undergo liquefaction during seismic activity as a result of the increased saturation. Dams storing increased volumes of water, as a result of changes in the hydrograph, could fail during seismic events. No current models are available to estimate these impacts.

Additional Data and Next Steps

Additional data is needed to further refine and enhance the City's vulnerability assessment, which includes identifications of unreinforced masonry critical facilities and privately owned buildings (i.e., residences) via local

knowledge and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts for these properties can be established.

Ground shaking is the primary cause of earthquake damage to man-made structures, and soft soils amplify ground shaking. One contributor to site amplification is velocity at which rock or soil transmits shear waves (S-waves). The NEHRP developed five soil classifications defined by their shear-wave velocity that alter severity of an earthquake. These soil classifications range from A to E, whereby A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. When this soil information becomes available, it may be incorporated into Hazus to further refine the City's vulnerability assessment.

4.3.3 Extreme Temperature

4.3.3.1 Hazard Profile

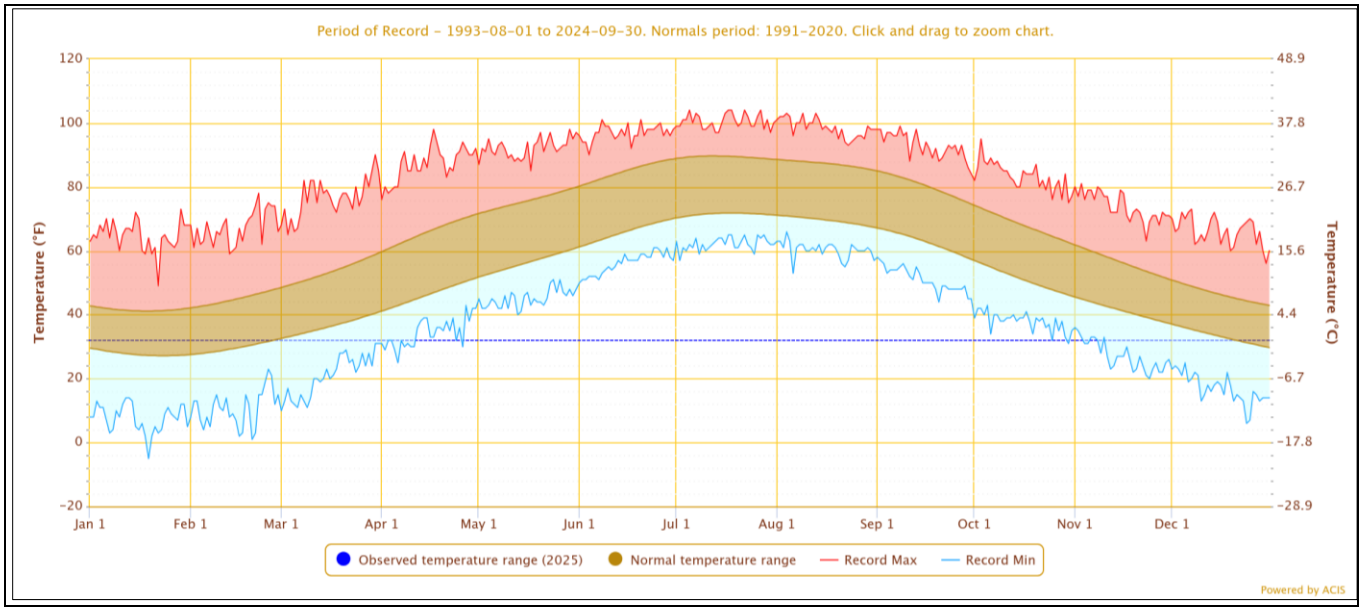
Hazard Description

Extreme temperatures across the Commonwealth of Pennsylvania can vary widely, with annual temperatures generally remaining between 0°F and 100°F each year (PEMA 2023). Closer to the Philadelphia area, average temperatures fluctuate between 24°F and 41°F during the winter months and between 72°F and 90°F during the summer (NRCC n.d.). For about twelve days during July, Philadelphia's normal daytime high temperature can exceed 90°F. Conversely, average low temperatures can dip below 32°F for about 70 days beginning in late December (NRCC n.d.).

While average temperatures can take decades of data into account, it is the extreme temperatures that can be most problematic for the City and those who live there. Both extreme heat and cold events in Philadelphia are influenced by a variety of factors, including the City's urban environment, geography, and changing climate. These events have significant impacts on public health, infrastructure, and the local economy.

The SC-ACIS (Applied Climate Information System) provides access to climate data from daily U.S. weather stations. Products include climate normals, daily almanac, first/last dates, graphs, and daily and monthly summaries of temperature, precipitation, snowfall, snow depth, and degree days. Using this toolkit, annual temperatures are summarized in Figure 4-7 for the City of Philadelphia. The brown band represents a range of daily temperatures labeled as "normal," or average, for the City over the course of a year. Red shading represents above-average temperatures while the red line represents the record high temperatures. Blue shading are areas of below-average temperatures while the darker blue line is the record minimum temperatures for that day. These data points will serve as the foundation for the 2026 City of Philadelphia Extreme Temperatures hazard profile.

Figure 4-7. Daily Temperatures Climatology for Philadelphia, PA



Source: SC ACIS 2024

Extreme Heat

Extreme heat events in Philadelphia are defined as periods when high temperatures exceed 90°F for multiple days, many times referred to as heat waves. High humidity during these periods exacerbates the heat's impact, with heat indices sometimes exceeding 100°F. Extreme heat events are becoming more frequent and prolonged due to climate change, and on average, Philadelphia experiences an average of 25 to 30 days of temperatures above 90°F each year. Projections suggest this could increase to over 50 days by mid-century.

Heat waves can also place a significant strain on infrastructure, particularly the energy grid, as demand for air conditioning surges. This can lead to power outages, which exacerbate the risks for residents without access to cooling. The City's transportation systems, particularly rail and road surfaces, can also suffer from heat-related degradation.

Extreme heat also plays a significant role once the sun sets. Urban areas do not cool off as quickly as more rural locations, and for this reason, overnight low temperatures remains higher than those in surrounding regions. A warmer overnight low temperature then creates conditions for a repeat the following day once the sun rises again. Research has shown that some urban neighborhoods can remain up to 20°F warmer at night than surrounding rural areas, disproportionately affecting low-income communities without air conditioning. Nighttime temperatures that remain high prevent the body from cooling down, which is critical for recovering from daytime heat exposure resulting in heat exhaustion, heat stroke, dehydration and increased heat-related mortality. Research shows that for every 1°C increase in nighttime temperatures, the risk of cardiovascular mortality increases significantly, particularly in older adults. A study published in Science Advances (2017) linked high nighttime temperatures to poor sleep quality, with individuals losing up to 6 hours of sleep per month during heatwaves. Chronic sleep deprivation due to heat is associated with higher risks of hypertension, mental health disorders, and reduced cognitive function (L. H. Schinasi 2022).

Extreme Cold

Extreme cold events, on the other hand, are characterized by temperatures dropping below freezing, often accompanied by wind chills that make the air feel even colder. In Philadelphia, extreme cold events occur when temperatures dip below 20°F (-6°C), and wind chill values can make it feel like temperatures are below 0°F (-18°C). Extreme cold events are less frequent than in some northern cities, but they still pose a serious hazard. Philadelphia experiences several cold snaps each winter, particularly during polar vortex events when Arctic air masses push south into the region.

Location and Extent

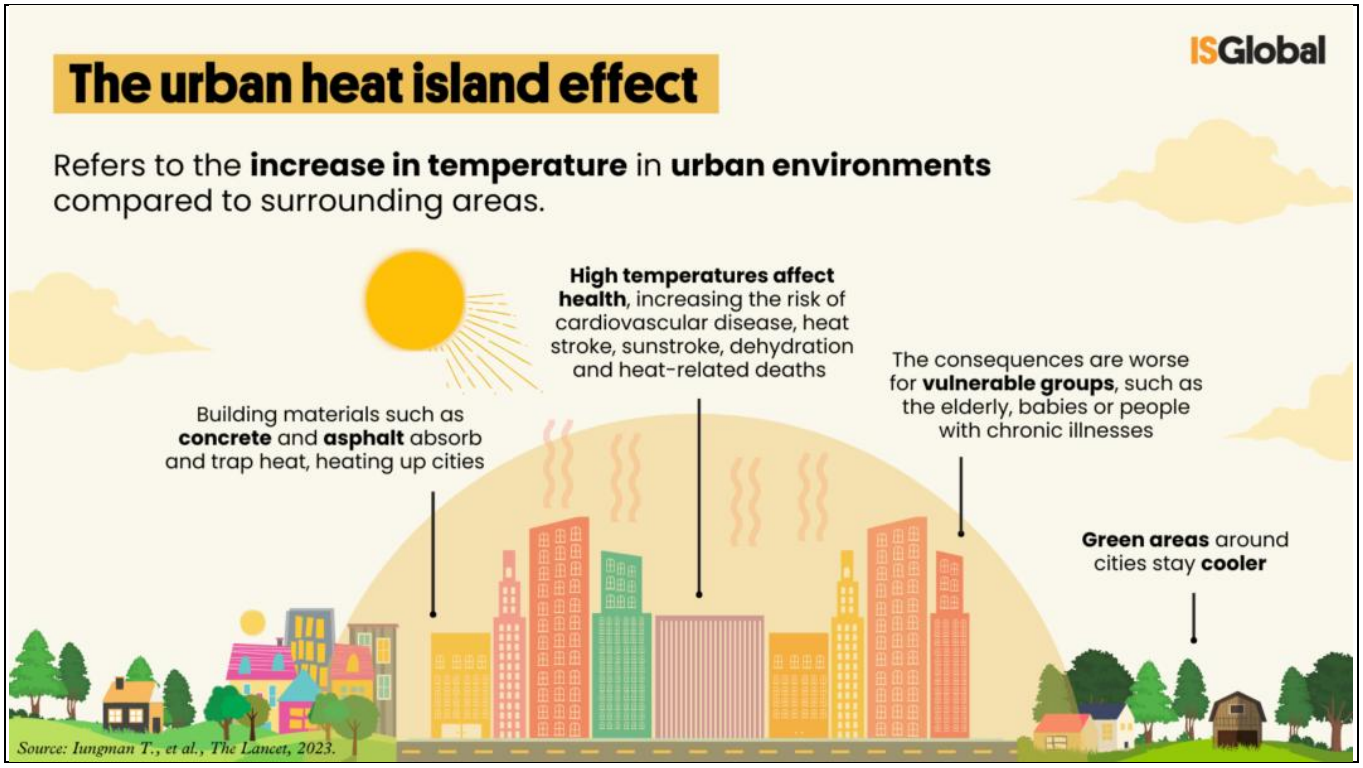
Extreme Heat

Excessive heat hazards in the City of Philadelphia are not confined to a specific location but are generally more intense in certain areas due to the urban heat island (UHI) effect (see Figure 4-8). In densely built areas, such as Center City, the pavement in these areas absorbs and retains more heat, leading to higher temperatures compared to surrounding rural or suburban regions. The UHI effect is particularly severe at night, as built-up areas cool down more slowly, and overall, cities can frequently create their own microclimates because they greatly alter the local landscape due to several factors. The amount of dark surfaces (like asphalt) retain energy more efficiently, and the absorbed energy is radiated upwards in the form of heat. Urbanized areas also lack coverage of trees and other vegetation which helps release moisture and combats high temperatures.

Figure 4-9 shows the UHI severity for central Philadelphia. Color scales range from 1 to 5, with 1 being a relatively mild heat area and 5 being those that are significantly hotter than the mean temperature for the City (ESRI 2024).

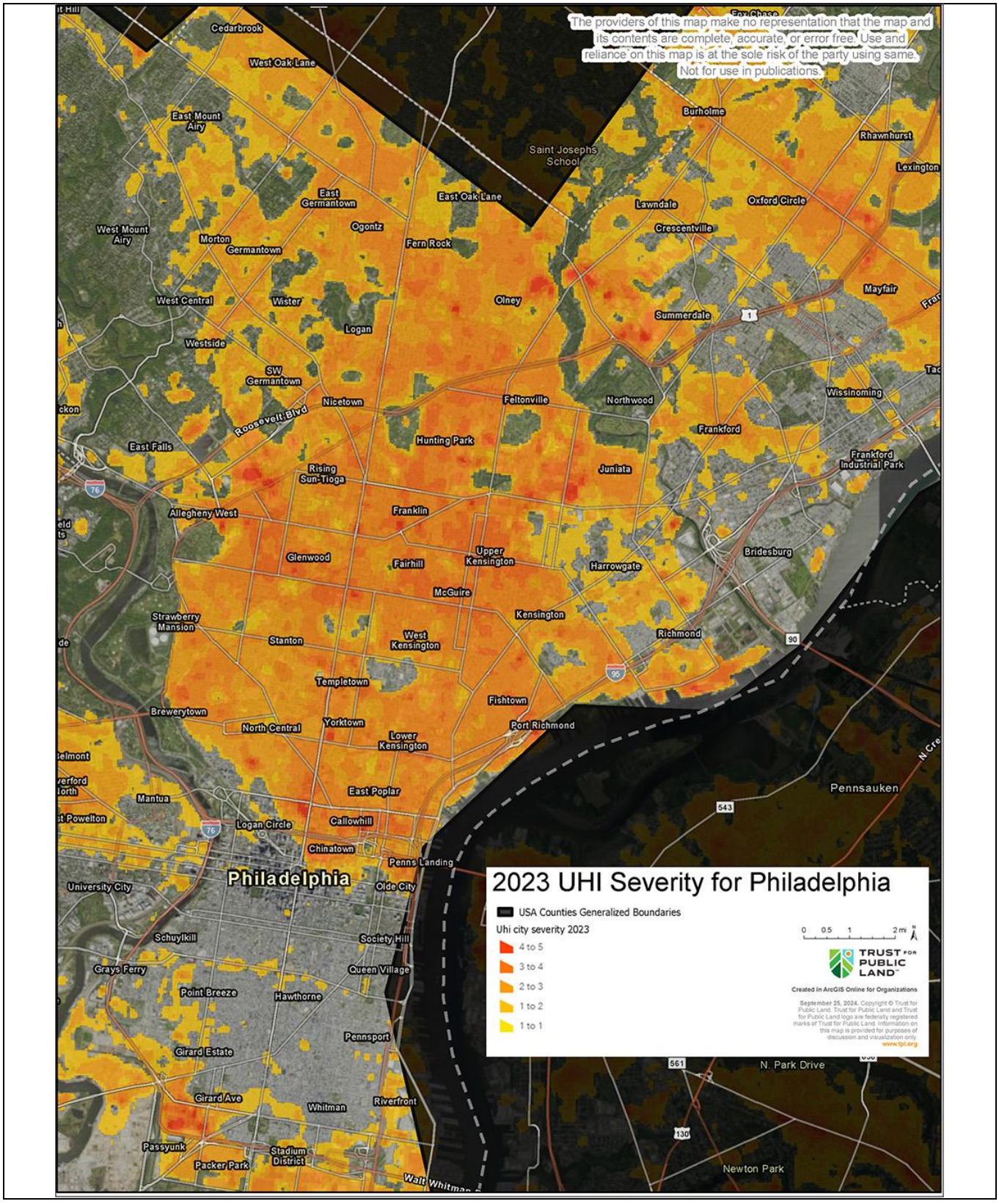
Locations most vulnerable to excessive heat in Philadelphia include Center City and surrounding neighborhoods due to the high density of buildings, heavy traffic, and limited green spaces. Other locations are North and West Philadelphia, where neighborhoods have large stretches of urbanized areas, fewer trees, and less greenery, which help retain heat. In Southwest Philadelphia, where there are large industrial complexes, higher temperatures are more likely due to heat-generating activities and the limited coverage of vegetation. Conversely, areas with more parks, trees, and open spaces, like Fairmount Park or neighborhoods with significant tree canopy coverage, tend to be cooler and less prone to extreme heat hazards. Figure 4-10 shows the differences in average surface temperature from the City average by census block group. Those blocks in deep red denote the hottest average surface temperatures (3.8—7.8 °F). Figure 4-11 indicates by census block group the areas of prioritization for action to be taken to reduce impacts from the UHI effect. (Hammer J 2020).

Figure 4-8. Urban Heat Island Effect



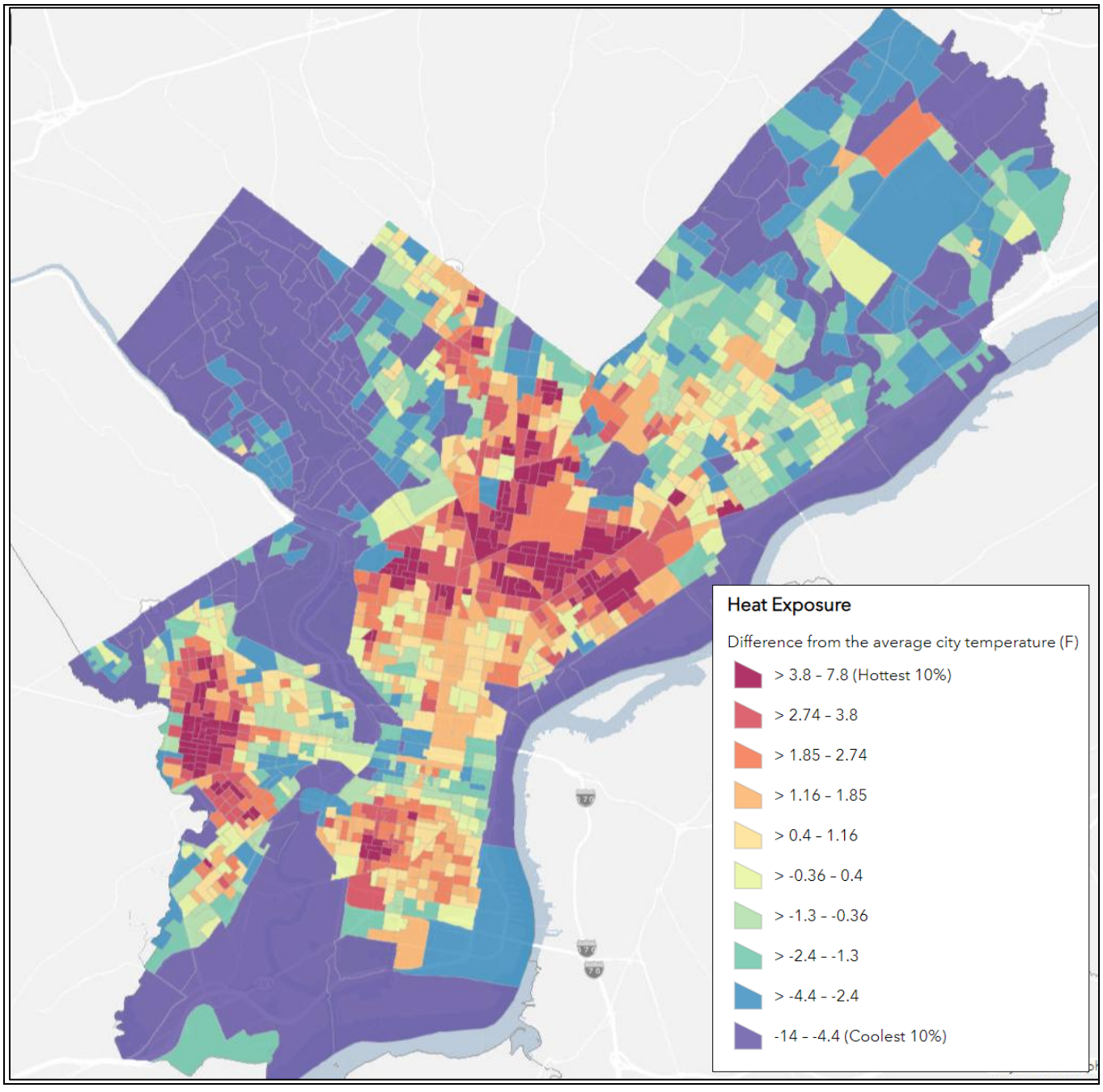
Source: (ISGlobal 2023)

Figure 4-9. Urban Heat Severity Across the City of Philadelphia



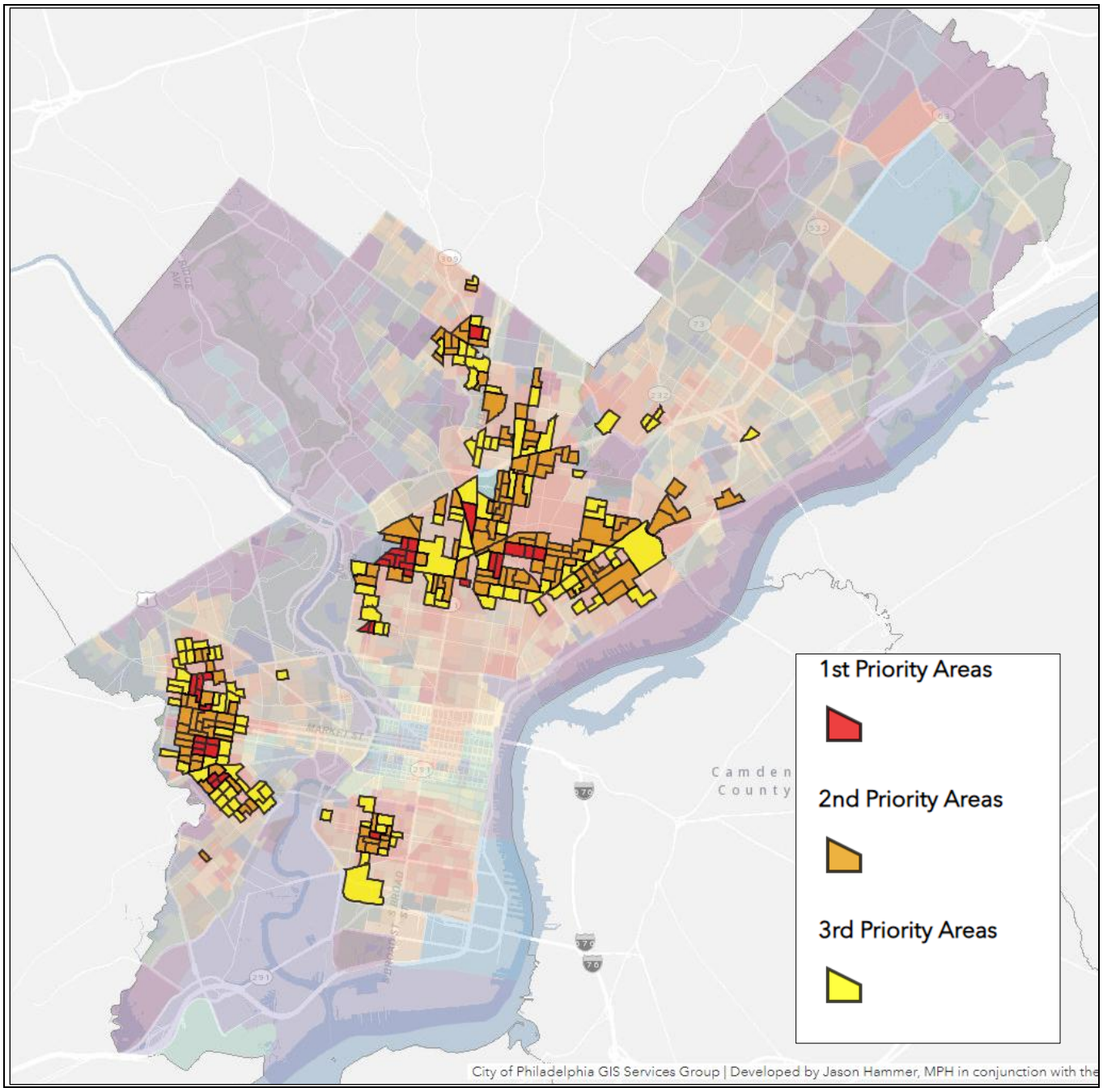
Source: Esri 2024

Figure 4-10. Heat Exposure in the City of Philadelphia (by Census tract)



Source: City of Philadelphia n.d.

Figure 4-11. Prioritized Census Block Groups in Philadelphia to Reduce UHI Impacts



Source: City of Philadelphia n.d.

Extreme Cold

Extreme cold can affect the entire City. Unlike other areas in the Commonwealth, the City doesn't have specific geographic features such as valleys or wide-open spaces that typically trap cold air and make certain spots colder than others. However, neighborhoods with aging homes that have poor insulation or outdated heating systems are more likely to be impacted by extreme cold, as these buildings are less able to keep heat in and protect individuals from low temperatures.

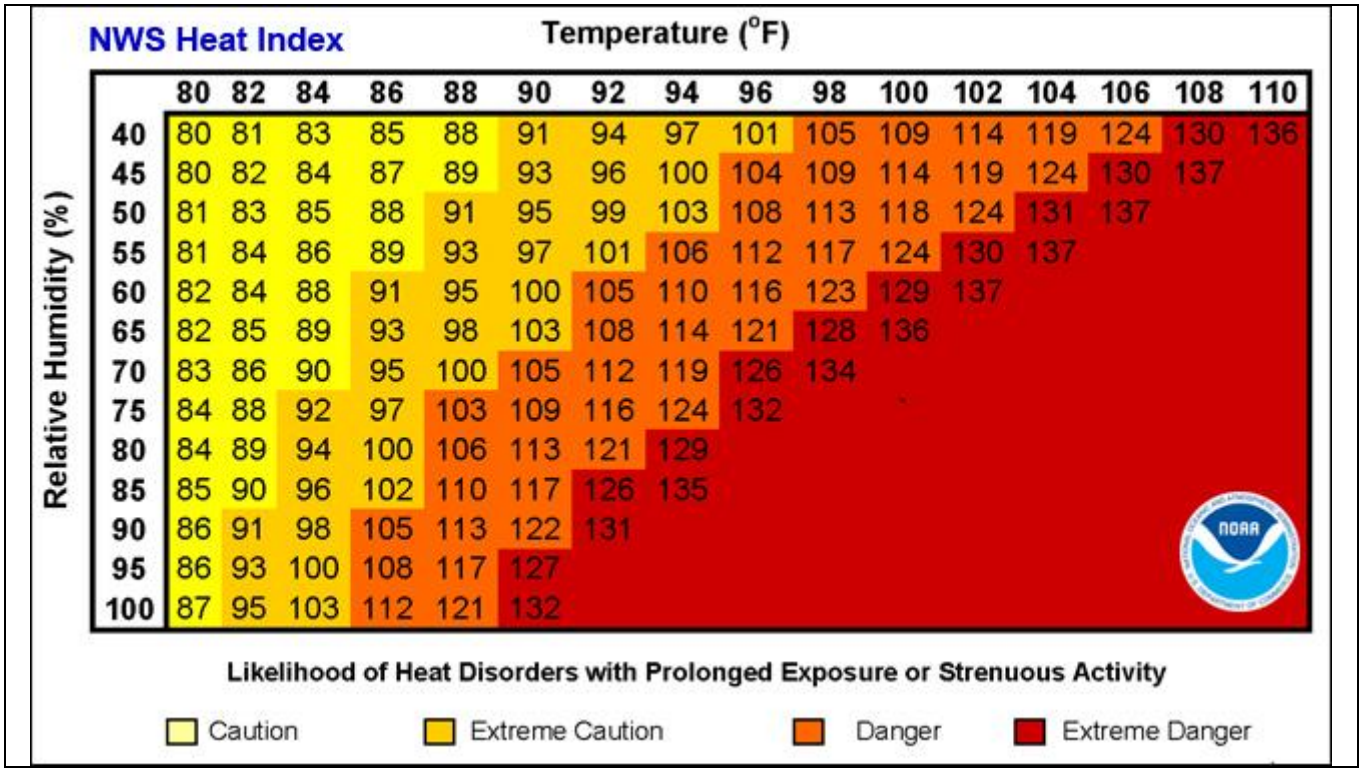
Range of Magnitude

Extreme Heat

The NWS has created a heat index chart that takes into account the temperature and relative humidity to estimate the likelihood of heat disorders with prolonged exposure. The heat index is given in degrees Fahrenheit and corresponds with the temperature that the body feels (NWS 2023). The Heat Index provides insight into the severity of extreme heat.

The index, shown in Figure 4-12, shows the heat index for shaded areas; full sun exposure can increase the index by up to 15°F. Table 4-24. describes the adverse effects of prolonged exposure to direct sunlight on an individual.

Figure 4-12. National Weather Service Heat Index Matrix



Source: NOAA/NWS 2023

Table 4-24. Adverse Effects of Prolonged Exposure to Direct Sunlight

Category	Heat Index	Effects on the Body
Caution	80°F–90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F–103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F–124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Source: NWS

The NWS will initiate alert procedures when the Heat Index is expected to exceed 105 °F (depending on local climate) for at least two consecutive days (NOAA/NWS n.d.). During these times, the City may issue heat health alerts and open cooling centers. Simultaneous efforts are also directed at advising residents to take precautions such as staying hydrated, avoiding strenuous outdoor activities, and seeking cool environments. In the event of extreme heat conditions, the NWS will issue advisories, warnings, and watches as follows:

- Excessive Heat Watch – An Excessive Heat Watch is issued when conditions are favorable for an excessive heat event in the next 12–48 hours. An Excessive Heat Watch is used when the risk of a heat wave has increased, but its occurrence and timing are still uncertain. An Excessive Heat Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans (Maryland Department of Health 2023).
- Excessive Heat Warning – An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions. An Excessive Heat Warning is used when the maximum heat index is expected to be 105°F or higher for at least two days and nighttime air temperatures will not drop below 75°F; regionally, the NWS issues an Excessive Heat Warning when the heat index is expected to exceed 110°F or conditions are such to pose a risk to life and property (Maryland Department of Health 2023).
- Heat Advisory – A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. A Heat Advisory is used when the maximum heat index is expected to be 100°F or higher for at least two days, and nighttime air temperatures will not drop below 75°F; regionally, NWS issues a Heat Advisory when the ambient temperature is expected to rise above 100°F, or the heat index is expected to reach 105 to 110°F. When determining the first Heat Advisory for the summer, these thresholds may be lower (Maryland Department of Health 2023).
- Excessive Heat Outlook – An Excessive Heat Outlook is typically issued when the potential exists for an excessive heat event within three to seven days. The Excessive Heat Outlook is designed to provide information to people who may need time to prepare for the event (NWS n.d.).

Extreme Cold

The magnitude of extreme cold temperatures is measured through the Wind Chill Temperature (WCT) index. The Index is a formula developed by the NWS to estimate how cold the air feels on human skin when factoring in wind speed. It combines air temperature and wind speed to give a “feels-like” temperature, and it is helpful when determining the risk of frostbite and hypothermia. The Wind Chill Index is only applicable when temperatures are at or below 50°F and wind speeds are above 3 mph. Wind amplifies the cooling effect by blowing away the thin layer of warm air near a person’s skin, making it feel colder than the actual air temperature.Figure 4-13 presents the WCT.

Figure 4-13. National Weather Service Wind Chill Index

WIND SPEED (mph) \ AIR TEMPERATURE (F)	50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
5	48	42	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57
10	46	40	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66
15	45	38	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71
20	44	37	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74
25	43	36	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78
30	42	35	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80
35	41	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82
40	41	34	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84
45	40	33	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86
50	40	33	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88
55	40	32	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89
60	39	32	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91
65	39	32	24	17	10	2	-5	-12	-19	-27	-34	-41	-49	-56	-63	-70	-78	-85	-92
70	38	31	24	16	9	2	-6	-13	-20	-27	-35	-42	-49	-57	-64	-71	-79	-86	-93
75	38	31	23	16	9	1	-6	-13	-21	-28	-36	-43	-50	-58	-65	-72	-80	-87	-95
80	38	30	23	16	8	1	-7	-14	-21	-29	-36	-44	-51	-59	-66	-73	-81	-88	-96
85	38	30	23	15	8	0	-7	-15	-22	-30	-37	-44	-52	-59	-67	-74	-82	-89	-97
90	37	30	22	15	7	0	-8	-15	-23	-30	-38	-45	-53	-60	-68	-75	-83	-90	-98
95	37	29	22	14	7	-1	-8	-16	-23	-31	-38	-46	-53	-61	-68	-76	-84	-91	-99
100	37	29	22	14	6	-1	-9	-16	-24	-31	-39	-47	-54	-62	-69	-77	-84	-92	-100

Approx frostbite times: 30 min | 10 min | 5 min

Source: NOAA/NWS 2018

The NWS issues a variety of freeze/cold watches, warnings, and advisories depending on the severity of the wind chill (NWS n.d.):

- Wind Chill Warning – Issued when dangerously cold wind chill values are expected or occurring.
- Wind Chill Watch – Issued when dangerously cold wind chill values are possible.
- Wind Chill Advisory – Issued when seasonably cold wind chill values but not extremely cold values are expected or occurring.
- Hard Freeze Warning – Typically issued when temperatures are expected to drop below 28°F and typically kills most commercial crops and residential plants. This warning is designed to inform people who may need time to prepare for the event.
- Freeze Warning – Typically issued when temperatures are forecasted to go below 32°F for a long period of time.
- Freeze Watch – Issued when there is potential for significant, widespread freezing temperatures within the following 24–36 hours.
- Frost Advisory – Indicates that areas of frost are expected or occurring and threaten sensitive vegetation.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City of Philadelphia was included in zero major disaster (DR) or emergency (EM) declarations for extreme temperature-related events (FEMA 2024).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2012 and 2023, the City of Philadelphia was included in eight USDA Extreme Temperature-related agricultural disaster declarations, as shown in Table 4-25 (USDA 2024).

Table 4-25. USDA Declarations for Extreme Temperature Events in the City of Philadelphia (2012 to 2023)

Event Date	USDA Declaration Number	Description
June 28 – November 8, 2012	S3487	The combined effects of Drought, High Winds (Derecho), Hail, Excessive Heat, Excessive Rain, Flash Flooding, Hurricane Sandy, Snowstorm, and Nor'easter
April 1 -- September 29, 2015	S3930	Excessive Heat and Drought
July 16 – September 29, 2015	S3932	Excessive Heat and Drought
April 1 – September 19, 2016	S4165	Combined effects of Freeze, Excessive Heat, and Drought
June 24 – July 21, 2018	S4425	Excessive Heat and Drought Conditions
April 6 – May 15, 2020	S4748	Freeze and Frost
June 18 – September 5, 2022	S5347	Drought and Excessive Heat
July 1, 2022 - Continuing	S5348	Drought and Excessive Heat

Source: USDA 2024
Note: USDA disaster declaration information was only available between 2012-2023

Previous Events

Since 1950, the City has experienced 134 excessive heat, extreme cold/wind chill, and/or heat events according to the NCEI Storm Events Database. Of these events, eight were shown to have occurred between January 1, 2021 and July 31, 2024. Recent extreme temperature events are listed Table 4-26. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-26. Extreme Temperature Events in the City of Philadelphia (2021 to 2024)

Event Date	Event Type	Description
June 29, 2021	Excessive Heat	A multi-day excessive heat event occurred across much of the mid-Atlantic near the end of June 2021. High temperatures in the mid to locally upper 90s combined with dew points in the upper 60s to near 70 caused heat index values to reach 105 to 110 over much of the region. Heat index values reached 105F on both June 29 and 30. No reported fatalities or injuries were noted.

Event Date	Event Type	Description
August 11, 2021	Excessive Heat	A multi-day excessive heat event occurred across much of the mid-Atlantic from August 11-13, 2021. Temperatures in the mid to upper 90s combined with dew point values near 70 caused widespread heat index values near to above 105°F on both August 11 and 12, and locally into the 13th before a cold front brought relief. No reported fatalities or injuries were noted.
August 9, 2022	Excessive Heat	Prolonged southwest flow and upper ridging lead to a period of temperatures in the mid to upper 90s with dewpoints in the low to mid 70s. Resulting heat index values rose to the mid to upper 100s across the region. No reported fatalities or injuries were noted.
June 22, 2024	Excessive Heat	A strong ridge of high pressure both at the surface and aloft combined with a flow of moist air northward from the Gulf of Mexico resulted in excessive heat across parts of southeastern Pennsylvania. No reported fatalities or injuries were noted.
July 5, 2024	Excessive Heat	A Bermuda high pressure resulted in high heat across parts of the state. The heat index reached 106°F at Philadelphia International Airport. No reported fatalities or injuries were noted.
July 6, 2024	Excessive Heat	Similar conditions repeated themselves the following day, with the Philadelphia International Airport recording a heat index temperature of 107°F. No reported fatalities or injuries were noted.
July 9, 2024	Excessive Heat	With the Bermuda high remaining in control, excessive heat continued through the 9th, where once again, the airport recorded heat index values upwards of 106°F. No reported fatalities or injuries were noted.
July 16, 2024	Excessive Heat	Hot conditions continued as heat indices reached 107°F again at the International Airport. No reported fatalities or injuries were noted.

Source: NOAA/NCEI 2024; FEMA 2024

Another metric helpful in determining previous occurrences is historical watches and warnings issued by the local NWS forecast office. NWS products that pertain to Extreme Temperature hazard events are defined in Table 4-27. Between January 1, 2000 and October 1, 2024, there were 135 Watches, Warnings, and Advisories issued by the NWS for the City of Philadelphia. More than 77% of these issuances were for extreme heat weather events. Table 4-27 breaks down these previous occurrences according to product type.

Table 4-27. Historical Extreme Temperature Products Issued for the City of Philadelphia (2000-2024)

	Product Name	Definition	Count
Extreme Heat	**Excessive Heat Watch**	Issued when Excessive Heat Warning Criteria may be met 12 to 48 hours out (NOAA/NWS State College 2023). A Watch is used when the risk of a heat wave has increased but its occurrence and timing are still uncertain.	**0**
	Excessive Heat Warning	An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Warning is when the maximum heat index temperature is expected to be 105° or higher for at least 2 days and nighttime air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas not used to extreme heat conditions.	**43**
	Heat Advisory	A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. Through June 30th, a Heat Advisory will be issued when Heat Index values are expected to range between 96°F and 104°F for two consecutive hours. After July 1, this threshold becomes 100°F to 104°F for two consecutive hours (FOX Weather 2022).	**61**

	Product Name	Definition	Count
Extreme Cold	**Freeze Watch**	A Freeze Watch is issued when there is a potential for significant, widespread freezing temperatures within the next 24-36 hours. A Freeze Watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.	**0**
	Freeze Warning	Low temperatures across the whole City/zone reach 32°F or below. The end of the growing season occurs when most of the City/NWS zone has had its first freeze in the autumn (at least ½ zone has reached 32°F or below), which occurs on November 13th in Philadelphia (NOAA/NWS 2024).	**19**
	Wind Chill Advisory	A Wind Chill Advisory is issued when wind chills of -10°F are expected.	**12**
	Wind Chill Warning	A Wind Chill Warning is issued when wind chills of -25°F or lower are expected.	**0**

Source: NOAA/NWS 2023; Iowa State University: IEM 2024; NOAA/NWS 2020; NOAA/NWS 2024

Probability of Future Occurrences

Information on previous Extreme Temperature occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-28. Based on historical records and input from the Steering Committee, the probability of occurrence of Extreme Temperature events in the City of Philadelphia is considered "highly likely."

Future occurrences of extreme temperatures would impact the entirety of the City. However, extreme heat impacts may be felt more greatly within the more densely populated areas of the City due to the heat island effect and fewer shade producing trees. Extreme temperatures may impact older structures within the City, as the materials used to construct these structures may be dated and not up to current building codes standards.

Table 4-28. Probability of Future Extreme Temperature Events in the City of Philadelphia

Hazard Type	Number of Occurrences Between 2000 and 2024	Percent Chance of Occurring in Any Given Year
Extreme Temperatures (Hot)	112	100%
Extreme Temperatures (Cold)	31	100%
Total	**143**	**100%**

Source: NOAA/NCEI 2024; NOAA/NWS 2023; Iowa State University: IEM 2024; NOAA/NWS 2020; NOAA/NWS 2024

Climate Change Projections

Philadelphia is at risk of increased heat, and the impacts of extreme heat are felt differently across the City. Lower-income neighborhoods and communities of color are more likely to be harmed by the changing climate. In Philadelphia, some neighborhoods can get as much as 22°F hotter than others. These neighborhoods have more low-income residents and residents of color than other neighborhoods. This pattern of unequal exposure to risk tells us that climate change is not only a public health issue. It is also a racial and social equity issue (City of Philadelphia 2022).

Climate change is expected to foster an increase in the frequency, intensity, and duration of extreme heat events. By 2050, the City could experience several additional heat waves per year, with summer temperatures becoming more similar to those currently experienced in southern U.S. cities.

While overall temperatures are expected to rise, extreme cold events may become less frequent. Climate change can cause disruptions to polar weather patterns, leading to occasional but severe cold snaps. While cold air from the Arctic can still occasionally reach further south, overall winter temperatures are anticipated to be warmer than in previous years. Ongoing research aims to better understand how Arctic warming may influence weather patterns, with scientists improving models and utilizing enhanced data to assess future atmospheric changes. Over the past five decades, the frequency of extreme cold events has decreased, and projections indicate that such cold spells are likely to become even less frequent in the future. (Carbon Brief 2025)

Philadelphia's winters are becoming milder, and its summers longer and hotter, which can shift the timing of extreme temperature events, making them harder to predict and prepare for. The City is preparing for these changes through initiatives to increase green spaces and improve infrastructure, but challenges remain, especially in economically disadvantaged areas

Cascading Impacts on Other Hazards

Extreme heat events may accelerate evaporation rates, drying out the air and soils. Extreme heat can also dry out terrestrial species, making them more susceptible to catching fire. Extreme variation in temperatures could create ideal atmospheric conditions for severe storms or worsen the outcome of winter storm during freezing and thawing periods.

Depending on severity, duration, and location; extreme heat events can lead to secondary hazards such as dust storms, droughts, wildfires, water shortages, and power outages. These secondary hazards can result in widespread impacts such as economic costs in transportation, agriculture, production, energy, and infrastructure; and losses of ecosystems, wildlife habitats, and water resources.

4.3.3.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the extreme temperature hazard, all the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the City Profile (Chapter 3) are potentially vulnerable to extreme temperatures. The following text evaluates and estimates the potential impact of the extreme temperature hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

Extreme temperature hazards pose significant risks to Philadelphia due to its urban heat island effect and socioeconomic disparities. According to the Centers for Disease Control and Prevention (CDC), populations most at risk from extreme cold and heat events include the following: (1) older adults, who are less able to withstand temperatures extremes due to their age, health conditions, and limited mobility to access shelters; (2) infants and children up to age 4; (3) individuals with chronic medical conditions (e.g., heart disease, high blood pressure); (4)

individuals experiencing economic hardships that cannot afford proper heating and cooling; and (5) the general public who may overexert themselves during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2022).

Prolonged exposure to extreme heat during the day can lead to heat-related illnesses, including heat exhaustion and heat stroke, and places significant stress on the cardiovascular and respiratory systems, increasing emergency room visits and hospitalizations. Additionally, higher temperatures exacerbate ground-level ozone formation, worsening air quality and triggering respiratory issues such as asthma and COPD. Areas with limited tree canopy coverage, including neighborhoods like Chinatown North and South Philadelphia (3 percent canopy coverage), experience more severe daytime heat, further amplifying risks for community members in these areas (L. H. Schinasi 2022).

Prolonged exposure to high temperatures is linked to increased stress, anxiety, and irritability, as well as sleep disturbances that can worsen cognitive function and emotional stability. Studies have found a correlation between heatwaves and a rise in depressive symptoms, hospitalizations for mental health conditions, and even suicide rates, with economically disadvantaged areas often experiencing the greatest impact due to lack of access to cooling resources and green spaces (Burke et al., 2018).

Philadelphia has developed programs like Heatline, a special helpline that opens for calls during heat health emergencies. Nurses provide answers to questions about health safety and heat-related illnesses (City of Philadelphia 2024). Philadelphia also has designated cooling centers to mitigate the impact of heat waves. Similarly, during extreme cold conditions, the City activates a Code Blue whenever there is precipitation and temperatures are expected to be below freezing or when Wind Chill temperatures fall below 20 °F. During a Code Blue, the City takes special measures to keep individuals who are unhoused safe. These measures include:

- 24-hour outreach to find individuals who are unhoused and transport them to safe indoor spaces.
- Additional shelter beds.
- Allowing individuals who are unhoused to stay inside emergency housing throughout the day.

Socially Vulnerable Population

Low-income and minority communities are often disproportionately affected by extreme temperatures due to factors like poor housing conditions, lack of access to healthcare, and higher exposure to urban heat. Limited access to green spaces in these areas exacerbates heat impacts. Extreme temperatures also pose severe risks to Philadelphia's population of individuals who are unhoused. Shelters can become overcrowded during cold spells, and during heat waves, lack of access to cooling centers can lead to heat exhaustion and fatalities. Table 4-29 provides a summary of some of these vulnerable sub-groups of Philadelphia's population.

Table 4-29. The City of Philadelphia Vulnerable Population Summary

Vulnerable Groups	Number	% of the City Population
Population Over 65 Years Old	223,219	14.0%
Population Under 5 Years Old	99,102	6.2%
Non-English-Speaking Population	105,761	6.6%
Populations with a Disability	267,675	16.8%
Populations Below Poverty Level	351,811	22.1%

Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals
Note: 2.34 persons per household. This number was used to calculate the Non-English-Speaking populations.

A 2022 study in the Journal of Urban Health found that historically redlined areas (grades B, C, D) have significantly lower tree canopy coverage, fewer immature street trees, and more heat-absorbing infrastructure compared to grade A areas. The research highlights the enduring impacts of historical systemic racism on urban heat vulnerability. It underscores the importance of environmental justice initiatives, such as urban greening and targeted interventions in historically disadvantaged neighborhoods, to mitigate heat-related risks in the context of climate change (L. H. Schinasi 2022).

General Building Stock

Extreme temperature events place stress on buildings, infrastructure, and public spaces, leading to potential structural damage, increased maintenance costs, and heightened risks for residents.

Many of Philadelphia's buildings, particularly aging homes, were not designed to handle extreme temperatures. Aging buildings may lack proper insulation or air conditioning, making them less able to maintain a comfortable indoor temperature during heat waves. Heat can also cause materials like asphalt, roofing, and siding to degrade more quickly, increasing maintenance costs.

Extreme cold can cause exterior materials to contract and crack. Older windows and doors may allow cold air to infiltrate, increasing heating demands and leading to discomfort or even health risks for residents. The repeated expansion and contraction of building materials due to extreme heat or cold can weaken structural components like bricks, mortar, concrete, and asphalt. This can lead to cracks in walls, foundations, and roads, necessitating frequent repairs. Table 4-30 provides a breakdown of building/structure types within the City, and it also includes the number of these structures, and the total replacement cost value of these structures.

Table 4-30. Philadelphia Building Structure Categories and Counts

	Residential	Commercial	Industrial	Other[a]	Total
Building Count	471,192	25,830	4,076	2,717	503,815
Total Replacement Cost Value	$221,637,378,903	$87,314,513,002	$15,407,211,810	$27,104,023,018	$351,463,126,733

Source: City of Philadelphia 2022, 2024; RS Means 2024

a. Other = Government, Religion, Agricultural, and Education

Community Lifelines and Other Critical Facilities

All critical facilities in the City are exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Impacts on critical facilities are the same as were described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events.

The City's aging power grid is particularly vulnerable during extreme temperatures. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as "brownouts," created by increased usage from air conditioners, appliances, and similar equipment. Heavy snowfall and ice storms, associated with extreme cold temperature events, can interrupt power as well. Backup power is recommended for critical facilities and infrastructure. During extreme temperature events, facilities serving as warming or cooling shelters may be opened. Power supply is vital at these facilities.

The City's water and sewer infrastructure is old, and extreme cold can cause pipes to freeze and burst, leading to water damage in homes and public buildings. Conversely, heat can lead to increased demand for water, straining

the supply. Heavy rainfall during heat events, often due to thunderstorms, can overload the City's combined sewer system, causing flooding and water contamination.

Heat waves can soften asphalt, causing potholes and damaging roads, while rail lines may buckle, disrupting services like SEPTA. Ventilation systems in public transit vehicles and stations also struggle under high temperatures, making travel uncomfortable or unsafe. Cold weather introduces its own hazards, such as ice accumulation on roads and tracks, which can damage electrical lines and halt transit operations. Snow and freezing rain further complicate road maintenance and pedestrian safety. Additionally, roads and bridges suffer from material expansion and contraction, leading to cracks, warping, and accelerated degradation, which increases maintenance needs and safety risks.

Table 4-31 provides a breakdown and summary of the eight lifeline categories outlined by FEMA as well as those facilities deemed as critical to the City.

Table 4-31. Critical Facility/Lifeline Category Summary for the City of Philadelphia

Category	Number of Facilities
Communication	308
Energy	23
Food, Hydration, Shelter	201
Hazardous Materials	430
Health & Medical	254
Safety & Security	728
Transportation	387
Water Systems	299
Other Critical Facilities	3,880
Total	**6,510**

Source: City of Philadelphia 2012, 2016, 2018, 2019, 2021, 2024; DEP 2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024

Economy

Extreme temperatures can indirectly impact the economy by affecting infrastructure, which may disrupt business operations. Such events can cause damage to roads, bridges, and buildings, leading to decreased productivity in industries such as construction and tourism, as well as increased utility costs and maintenance expenses. Additionally, public transportation and commuting systems are often affected, potentially impacting workforce availability and overall business continuity.

Natural, Historic and Cultural Resources

Natural

Philadelphia's parks, urban forests, and tree-lined streets are vulnerable to extreme heat, which can stress trees and vegetation, leading to tree mortality or damage. Prolonged heat waves can also dry out soil and reduce biodiversity. Trees weakened by heat may also be more susceptible to pests and diseases.

The Schuylkill and Delaware Rivers, along with smaller creeks, are essential natural resources. Extreme heat can raise water temperatures, which can negatively impact aquatic life by reducing oxygen levels and harming fish populations. On the other hand, cold spells can cause ice formation, potentially damaging ecosystems. Heat exacerbates air pollution, particularly by increasing the formation of ground-level ozone, which affects not only human health but also plant life and overall ecological balance.

Historic

Philadelphia's historic buildings and cultural institutions are highly vulnerable to extreme temperatures, which can cause significant structural and material damage. Heat and cold stress building materials like brick, wood, and stone, leading to cracking, spalling, and deterioration, especially in older structures with outdated insulation and HVAC systems. Repeated thermal cycles weaken structural integrity and threaten the preservation of historically significant architecture. Additionally, museums and archives housing delicate artifacts and documents face risks from temperature and humidity fluctuations, which can cause warping, mold, brittleness, and fading. These impacts not only endanger the City's cultural heritage but also reduce tourism during extreme weather, leading to economic losses. Ground shifting from soil drying or freeze-thaw cycles further threatens the foundations of historic sites, underscoring the need for climate-resilient preservation strategies.

Cultural

Philadelphia is known for its vibrant public art, including the famous murals of the Mural Arts Program. Extreme heat can cause the fading or degradation of these murals due to UV exposure, and cold can cause cracking or peeling of paint. Sculptures and monuments made of metal or stone are also vulnerable to thermal expansion and contraction, leading to physical damage over time.

Many of Philadelphia's cultural resources include outdoor festivals, parades, and events that celebrate the City's history and diversity. Extreme temperatures can lead to event cancellations or reduced attendance, impacting the cultural life of the City. Extreme heat may also pose health risks to participants, especially in events like parades or outdoor concerts.

4.3.3.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure the establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Planned development in Philadelphia is reshaping the City's vulnerability to extreme temperatures through increased urbanization, which intensifies the UHI effect due to more heat-retaining surfaces and reduced green space. While sustainability initiatives like green infrastructure and energy-efficient buildings aim to mitigate these impacts, challenges remain particularly for low-income communities who often lack access to climate-resilient housing and may face displacement through gentrification.

Projected Changes in Population

As Philadelphia's population grows and urbanization intensifies, the City faces increasing exposure to the UHI effect. This intensifies the impact of heat waves, especially in densely populated areas, leading to higher energy demands for cooling and added strain on the power grid. Vulnerable populations, such as older adults and low-income individuals, are at greater risk due to limited access to air conditioning, poor housing insulation, and pre-

existing health conditions. Additionally, expanding development often reduces green spaces and tree canopy, which are vital for natural cooling, further exacerbating heat stress in disadvantaged communities and increasing the need for public health and emergency services.

Climate Change

Climate change is expected to bring more frequent and intense heat waves to Philadelphia. The urban heat island effect exacerbates the issue, with impervious surfaces retaining and radiating heat. The urban heat island effect intensifies local temperature spikes, making cities hotter than surrounding rural areas. Vulnerable populations, including older adults, children, and low-income residents, are most at risk. Significant impacts include increased infant mortality, missed primary care appointments, adverse mental health impacts, increased emergency room visits for heat-related health issues include heat stress/ exhaustion and other issues, and a noted increase in heat-related mortality (L. H. Schinasi 2022).

Future climate change is expected to significantly increase both the risk and vulnerability to the extreme heat hazards in Philadelphia. As global temperatures rise, the frequency, intensity, and duration of extreme temperature events, particularly heat waves, will increase. These changes will exacerbate existing vulnerabilities and create new challenges for the City. Some of the key ways in which future climate change is likely to affect extreme temperature hazards in Philadelphia are described below.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and potential structural and economic losses associated with this hazard of concern. Collection of additional information and actual loss data specific to the plan participants will further enhance the City of Philadelphia's vulnerability assessment.

4.3.4 Flood, Flash Flood, Ice Jam

4.3.4.1 Hazard Profile

Hazard Description

Flooding is a temporary condition of partial or complete inundation on normally dry land (NWS 2019). It is a natural hazard that can occur during any season. It typically occurs during prolonged rainfalls over several days, intense rainfalls over a short period, or when an ice or debris jam causes a river or stream to overflow onto the surrounding area (NWS 2019). In Pennsylvania, flooding usually occurs in the summer; however, it has occurred during the winter months as well.

Floods are one of the most common natural hazards in the United States. In Pennsylvania, floods are the most prevalent type of natural disaster and have caused loss of lives, disruption of economic activities, millions of dollars in annual property damage to residential and commercial buildings, bridge and road closures, transit service disruptions, and damage to electrical and communication networks (PEMA 2023).

A variety of flood types can threaten a community:

- Riverine overbank flooding
- Flash floods
- Alluvial fan floods
- Local draining or high groundwater levels
- Fluctuating lake levels
- Ice jams
- Coastal flooding

The flood types discussed below have been identified as those of greatest concern for this HMP update.

Riverine Floods

Riverine floods are the most common flood type. When a river, creek, stream, or ditch receives too much water, the excess water flows over its banks and inundates low-lying areas (FEMA 2019). The normally dry land that becomes inundated with water during a flood is called a floodplain. A floodplain is made up of different sections, as shown in Figure 4-14 (FEMA 2019, U.S. DHS 2019):

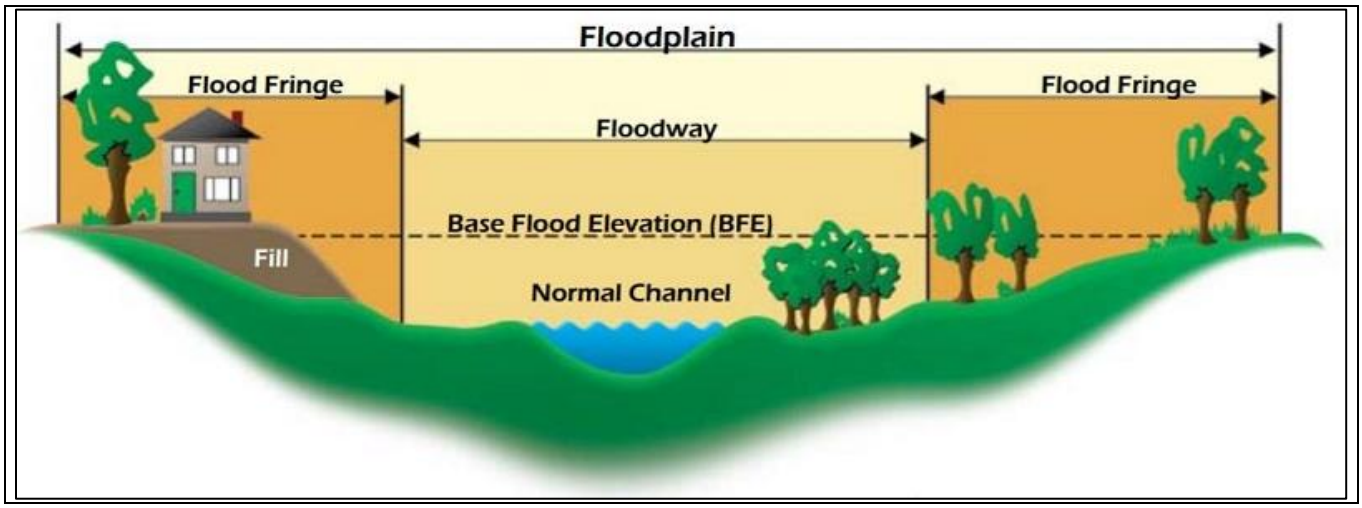
- **Floodway—**The channel of the water course and the adjacent land that is reserved to carry and discharge the overflow of water caused by flooding.
- **Flood Fringe—**The area within the floodplain but outside the floodway; this area extends from the outer banks of a floodway to the edge of the river valley, where the elevation begins to rise.

FEMA prepares maps of expected flooding, called Flood Insurance Rate Maps (FIRMs), that depict floodplain boundaries. The mapping shows the Special Flood Hazard Area (SFHA) which is the area that will be inundated by the flood event having a 1 percent chance of being equaled or exceeded in any given year (also called the base flood). A structure within a 1 percent annual chance floodplain has a 26 percent chance of undergoing flood damage during the term of a 30-year mortgage.

The SFHA on a FIRM is the area where the NFIP's floodplain management regulations must be enforced, and the area where mandatory purchase of flood insurance applies. FIRMs also identify water surface elevations within the SFHA; these are referred to as the base flood elevation (BFE). The BFE describes the elevation of the water that will result from a given discharge level, which is one of the most important factors used in estimating potential damage from flooding (FEMA 2020). The SFHA is a convenient tool for assessing risk in flood-prone communities

because many communities have maps showing the extent of the base flood and the floodwater depths that could occur (FEMA 2020). FIRMs use a variety of designations for SFHAs based on their location or available information. These include Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.

Figure 4-14. Characteristics of a Floodplain



Source: FEMA 2022

Floodplains of different sizes are defined by different flooding recurrence intervals. A 1 percent annual chance floodplain is smaller than the floodplain associated with a flood that has a 0.2 percent annual chance of occurring. These areas are determined by statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Areas subject to 2 percent and 10 percent annual chance events are not shown on maps; however, water surface elevations associated with these events are included in the flood source profiles contained in the Flood Insurance Study.

FEMA flood maps focus on existing surface water courses and do not consider future changes to flooding conditions (from factors such as sea level rise and changes in rainfall) or the effects of flooding caused when constructed storm drainage systems in urban areas are overwhelmed. As such, floodplain maps may underestimate flood risk in many areas, and the public may underestimate risk. When floodplain maps are updated, they typically account for changes in land use, the amount of impervious surface, the placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques (USGS 2016).

FEMA also prepares Flood Insurance Studies (FISs) of entire counties and individual jurisdictions. These studies aid in administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. They are narrative reports of countywide flood hazards, including descriptions of flood areas studied and engineered methods used, principal flood problems, flood protection measures, and graphic profiles of flood sources (FEMA 2020).

Flash Floods

Flash flooding is usually a result of heavy localized precipitation falling in a short period (less than six hours over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious

surfaces (PEMA 2020). It most often occurs during thunderstorm season in the summer. This type of flood can be deadly because it produces rapid rises in water levels and intense flow velocities, often leaving little time for warning and reaching peak flows within only a few minutes. The most severe conditions usually occurr when compounded with seasonal or weather patterns, such as simultaneous snowmelt or saturated/frozen soil that cannot absorb additional precipitation (FEMA n.d.).

Urban/Stormwater Floods

Stormwater/urban flooding occurs when heavy localized precipitation events produce flooding in areas other than delineated floodplains or along recognizable drainage channels (FEMA 2005). If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. During winter and spring, frozen ground and snow accumulations may contribute to inadequate drainage and localized ponding. Flooding issues of this nature generally occur in areas with flat gradients. Stormwater flooding generally increases with urbanization, which can speed the accumulation of floodwaters due to increased impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows (FEMA 1997).

Urban flooding is the flooding of streets, underpasses, low lying areas, or storm drains (NOAA n.d.). A combination of urban development and inadequate drainage capacities can increase precipitation runoff, elevating the risk for flooding. Drainage systems bypass the natural filtration process by channeling surface water away from develop areas to surrounding streams as quickly as possible to avoid localized flooding. Urban flooding can be worsened by aging and inadequate infrastructure and over development of land. The growing number of extreme rainfall events that produce intense precipitation are resulting in increased urban flooding (UMD CDR 2018).

Ice Jams

Ice-jam flooding occur when an accumulation of ice that acts as a natural dam and restricts flow of a body of water (USACE n.d.). It happens when warm temperatures and heavy rains cause rapid snow melt. The melting snow, combined with the heavy rain, causes frozen rivers to swell. The rising water breaks the ice layers into large chunks, which float downstream and often pile up near narrow passages (bridges and dams).

There are two different types of ice jams: freeze-up and breakup. Freeze-up jams occur in the early to mid-winter when floating ice may slow or stop due to a change in water slope as it reaches an obstruction to movement. Breakup jams occur during periods of thaw, generally in late winter and early spring. The ice cover breakup is usually associated with a rapid increase in runoff and corresponding river discharge caused by a heavy rainfall, snowmelt, or warmer temperatures (FEMA 2018).

Sea Level Rise

Sea level rise associated with climate change will have significant effects on coastal areas, including the City of Philadelphia, which has portions along the tidal Delaware River. Long-term sea level records show changes in global temperatures, hydrologic cycles, coverage of glaciers and ice sheets, and storm frequency and intensity. Sea levels provide a key to understanding the impact of climate change.

There are two types of sea level rise: global and relative. Global sea level rise refers to the increase currently observed in the average global sea level trend (primarily attributed to changes in ocean volume due to ice melt and thermal expansion). The melting of glaciers and continental ice masses can contribute significant amounts of freshwater input to the earth's oceans. In addition, a steady increase in global atmospheric temperature creates an expansion of saltwater molecules, increasing ocean volume.

Local sea level refers to the height of the water as measured along the coast relative to a specific point on land. Water level measurements at tide stations are referenced to stable vertical points on the land and a known relationship is established. Measurements at any given tide station include both global sea level rise and vertical land motion (subsidence, glacial rebound, or large-scale tectonic motion). The heights of both the land and water are changing; therefore, the land-water interface can vary spatially and temporally and must be defined over time. Relative sea level trends reflect changes in local sea level over time and are typically the most critical sea level trend for many coastal applications (coastal mapping, marine boundary delineation, coastal zone management, coastal engineering, and sustainable habitat restoration) (U.S. Climate Resilience Toolkit 2022).

Short-term variations in sea level typically occur on a daily basis and include waves, tides, or specific flood events. Long-term variations in sea level occur over various time scales, from monthly to several years and maybe repeatable cycles, gradual trends, or intermittent differences. Seasonal weather patterns (changes in the earth's declination), changes in coastal and ocean circulation, anthropogenic influences, vertical land motion, etc. may influence changes in sea level over time. When estimating sea level trends, a minimum of 30 years of data are used in order to account for long-term sea level variations and reduce errors in computing sea level trends based on monthly mean sea level (U.S. Climate Resilience Toolkit 2022).

Sea level rise can amplify factors that currently contribute to coastal flooding: high tides, storm surge, high waves, and high runoff from rivers and creeks. These factors change during extreme weather and climate events (U.S. Climate Resilience Toolkit 2022). An increase in sea level will cause further issues as stormwater recharge is challenged as sea-levels submerge discharge points, resulting in increases in flooding.

Location and Extent

Pennsylvania is one of the most flood-prone states in the United States. Southeastern Pennsylvania, where Philadelphia is located, is one of the most susceptible regions in the state. Philadelphia is situated between two tidal rivers: the Delaware River and the Schuylkill River. The City experiences tidal effects along its entire eastern border, as well as on the Schuylkill River, Cobbs and Darby Creeks in southwest Philadelphia, Tacony/Frankford Creek, and the Pennypack and Poquessing Creeks in northeast Philadelphia. Other creeks and streams within Philadelphia, like the Wissahickon Creek, are not influenced by tides.

Multiple types of flooding can occur in the City. Some of the most damaging floods occur in designated floodplains – the areas along rivers and major creeks – or in areas with limited drainage capacity.

Natural Floodplains

Natural floodplains and wetlands are designated areas that serve to contain floodwaters, while also playing a vital role in reducing flood risk, enhancing water quality, and supporting ecological resources. In Philadelphia, the number of natural floodplain areas is limited but includes notable sites such as the John Heinz National Wildlife Refuge, the FDR Park Wetland Restoration Project, and the Cobbs Creek Restoration Initiative.

The John Heinz National Wildlife Refuge at Tinicum features extensive tidal marshes and wetlands that naturally store and slow floodwaters. At FDR Park, ecological restoration efforts have resulted in the creation of a 33-acre urban tidal wetland designed to capture and retain water following rainfall and tidal events, thereby supporting the park's natural floodplain functions (Romo 2024). These restored wetlands help slow floodwaters, improve drainage, and increase resilience to increasingly intense weather patterns. The Cobbs Creek Restoration Initiative involves developing 40 acres of new wetlands and restoring 12,000 feet of stream channels, which will help mitigate local flooding by expanding floodplain storage capacity and enhancing the creek's ability to disperse stormwater naturally (Cobbs Creak Foundation n.d.).

Riverine Floods

Although Philadelphia is roughly 90 miles from the open ocean, the City is situated on two rivers that are influenced by the tides, so the City experiences both riverine and coastal flooding. The primary difference between riverine and coastal flooding has to do with the source of the floodwaters. The tidal Delaware River and its tributaries are susceptible to coastal flooding because they are impacted by ocean tides and storm surge. Coastal flooding can result from high tides and/or storm surge, as defined by the National Oceanic and Atmospheric Administration. High tides on the Delaware River and Schuylkill River can also contribute to basement backups. See Chapter 10 Hurricane, Tropical Storm, Nor'easter for more information on coastal flooding and storm surge.

Riverine flooding is location specific and in Philadelphia present along creeks that weave through neighborhoods and along the larger Schuylkill and Delaware Rivers, as shown in Figure 4-15. Neighborhoods throughout the City are impacted by riverine flooding. Two areas in Philadelphia repeatedly experience catastrophic flooding: Eastwick, in southwest Philadelphia, and Manayunk, in northwest Philadelphia. Both of these neighborhoods have many properties with Repetitive Losses tracked by FEMA.

Figure 4-15. FEMA Flood Hazard Area



Flash Floods

Flash floods are a rapid and extreme flow of rain or high water into a normally dry area, or rapid water level rise in a stream or creek above a predetermined flood level. Flash floods occur because of the rapid accumulation and release of runoff waters caused by heavy rainfall, cloudbursts, landslides, or the sudden break up of an ice jam. Ongoing flooding can intensify into flash flooding in cases where intense rainfall results in a rapid surge of rising floodwaters. Densely populated areas have a high risk for flash floods, as the construction of buildings, highways, driveways, and parking lots increases runoff by reducing the amount of rain absorbed by the ground. When available ground surfaces become saturated, existing groundwater levels may increase, and seep through the floors and walls of basements. Flash flooding may also lead to localized, overwhelmed sewer systems and basement backups though basement fixtures and drains.

Urban/Stormwater Floods

Philadelphia's sewer system was originally designed and built in the late 1800s and early 1900s. Since then, the amount of impervious area in the City has drastically increased. Impervious area is defined as a surface that water cannot penetrate, like traditional street paving material, roofs, sidewalks and parking lots. Today, over half of the City is considered impervious (phillywatersheds.org). Rain that used to soak into the ground now quickly runs across impervious surfaces and into the sewer system. When large amounts of precipitation fall over a small area in a short period of time, this can overwhelm the sewer system and cause localized surface flooding. Additionally, groundwater infiltration can be a factor that increases flooding risks. When the ground becomes saturated, groundwater may seep through the floors and walls of building basements.

Rising sea levels are expected to increase the frequency and severity of flooding in Philadelphia. Sea Level Rise will cause new parts of the City to be permanently inundated due to an increase in daily tide levels, and extreme storm events on top of sea level rise will cause more areas to be temporarily inundated as storm surges reach farther inland with greater depths.

Ice Jams

Ice jams in Philadelphia can occur along the Schuylkill River and the Delaware River. Ice jam flooding events often occur suddenly and are difficult to predict, allowing for little time to prepare for and warn of an event. The size of the snowpack and the rate of snowmelt controls the extent of an ice jam (Rokaya 2018).

Sea Level Rise

The global sea level trend has been recorded by satellite altimeters since 1992 and the latest calculation can be obtained from NOAA's Laboratory for Satellite Altimetry. The University of Colorado's Sea Level Research Group compares global sea level rates calculated by different research organizations and provides detailed explanations about the issues involved (NOAA 2025). A map of regional MSL in the United States can be found here: http://tidesandcurrents.noaa.gov/sltrends/slrmap.htm. The map provides an overview of variations in the rates of relative local MSL at long-term tide stations. The variations in sea level trends primarily reflect differences in rates and sources of vertical land motion. Areas that experienced little-to-no change in MSL are shown in green, including stations consistent with average global sea level rise rate of 1.7 to 1.8 mm/year. These stations do not experience significant vertical land motion. Stations that experienced positive sea level trends (yellow to red) experience both global sea level rise and lowering or sinking of the local land, causing an apparent exaggerated rate of relative sea level rise. Stations that are blue to brown have experienced global sea level rise and a greater vertical rise in local land, causing an apparent decrease in relative sea level. The rates of relative sea level rise reflect actual observations and must be accounted for in any coastal planning or engineering applications (NOAA 2025).

There are several NOAA tide gauge stations located near Philadelphia, with one being located within the City. This is where tide gauge measurements are made with respect to a local fixed reference level on land. Figure 4-16 shows these changes for Atlantic City, Sandy Hook, and Cape May. Table 4-32 presents the history and MSL trends at the Philadelphia station and additional stations along the Delaware Bay and River, which show the result of a combination of the global sea level rate and the local vertical land motion. The sea level rise hazard area for the City is shown in Figure 4-17.

Figure 4-16. Mean Sea Level Trends near Philadelphia



Source: NOAA 2020

Figure 4-17. Sea Level Rise Hazard Area



Table 4-32. Linear MSL Trends and 95% Confidence Intervals

Station Name	First Year	Year Range	For all data to 2023 MSL Trend (inches/year)
Philadelphia, PA	1900	123	0.12
Reedy Point, DE	1956	67	0.15
Cape May, NJ	1965	58	0.19
Lewes, DE	1919	104	0.14

Source: NOAA 2025

Repetitive and Severe Repetitive Loss Properties

FEMA's National Flood Insurance Program (NFIP) is a program that makes federally backed flood insurance available in those states and communities that agree to adopt and enforce flood-plain management ordinances to reduce future flood damage. The NFIP identifies properties as repetitive loss (RL) and severe repetitive loss (SRL), differing on the various criteria described below.

The NFIP defines RL properties as structures that meet one of the following qualifiers:

- Two or more claims of more than $1,000 paid by NFIP within any rolling 10-year period, since 1978.
- Two or more claims (building payments only) that, on average, equal or exceed 25 percent of the market value of the property (FEMA 2022).

The NFIP defines SRL properties as structures that meet one of the following qualifiers:

- Received four or more separate claim payments of more than $5,000 each (including building and contents payments).
- Received two or more separate claim payments (building payments only) where the total of the payments exceeds the current value of the property (FEMA 2022).

The Flood Mitigation Assistance (FMA) grant program is a competitive grant program that provides funding to states, local communities, federally recognized tribes, and territories. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program (FEMA 2023). FMA defines RL and SRL properties differently than the NFIP; see below for the FMA criteria.

FMA defines RL properties as structures covered by a contract for flood insurance made available under the NFIP that meet the following two qualifiers:

- Has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event.
- At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage (FEMA 2022).

FMA defines SRL properties as structures covered by a contract for flood insurance made available under the NFIP that has incurred flood related damage and meet one of the following qualifiers:

- Four or more separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000.

- At least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure (FEMA 2022).

Figure 4-18 displays the general areas where RL properties are located in the City; Figure 4-19 displays the general areas where severe repetitive loss properties are located. A repetitive loss area is a portion (or portions) of a community that includes buildings on FEMA's list of repetitive losses and any nearby properties that are subject to the same or similar flooding conditions (FEMA 2015).

FEMA provided a list of properties in the City with NFIP policies, past claims, and multiple claims, as listed in Table 4-33. This information is current as of March 20, 2025. FEMA also provided a list of RL and SRL statistics for the City specifying the type of structure, as listed in Table 4-34.

Table 4-33. NFIP Policies, Claims, and Repetitive Loss Statistics

NFIP Policies in Force	Total Claims	Total Payments (Building + Contents)	Number of NFIP Repetitive Loss (RL) Properties
1,095	1,455	$24,706,734.75	130

Source: FEMA Region 3

Table 4-34. Number of RL Properties by Structure Type

	Single Family	Other Residential	Commercial	Other Non-Residential
Number of RL Properties	89	15	11	15

Source: FEMA Region 3

Figure 4-18. Repetitive Loss Areas

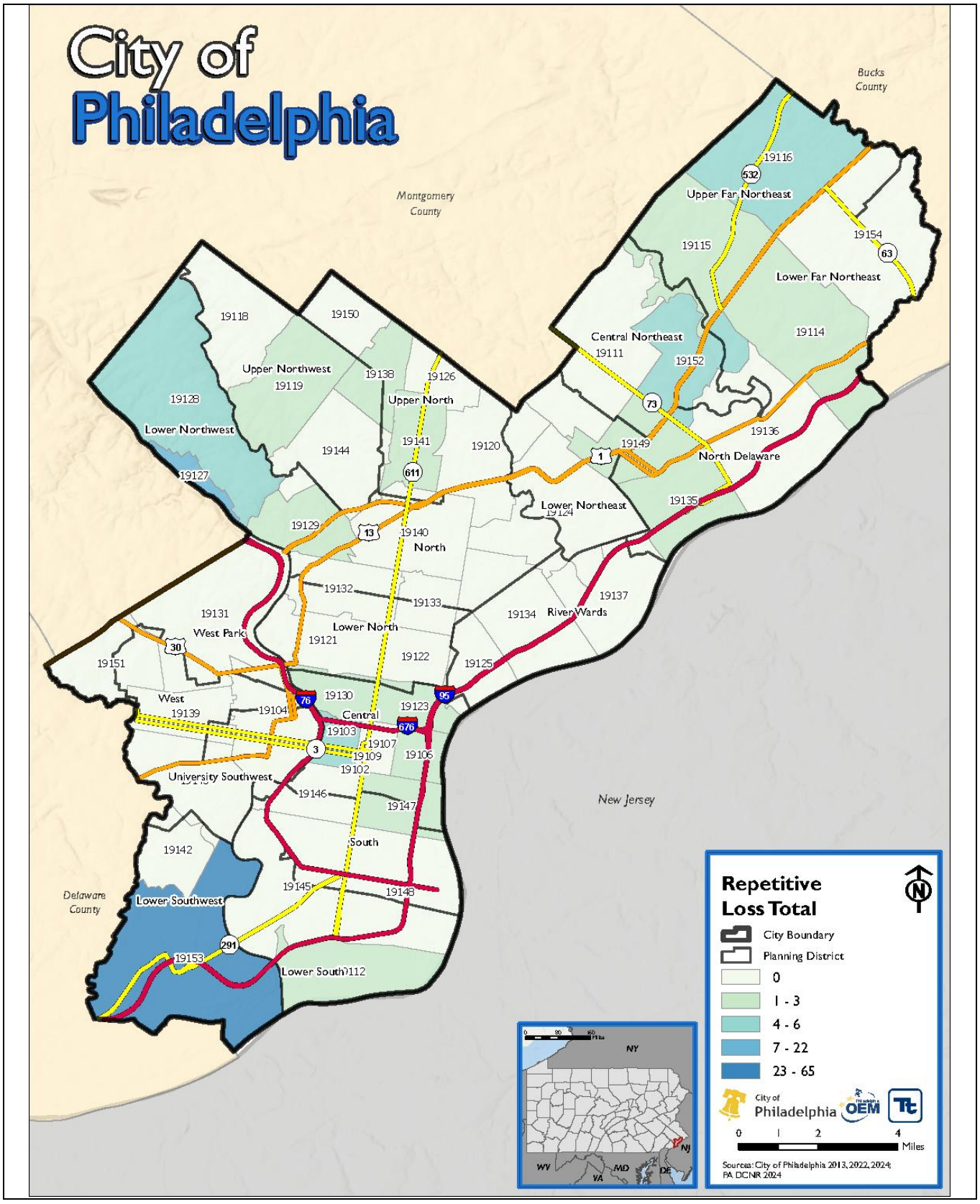
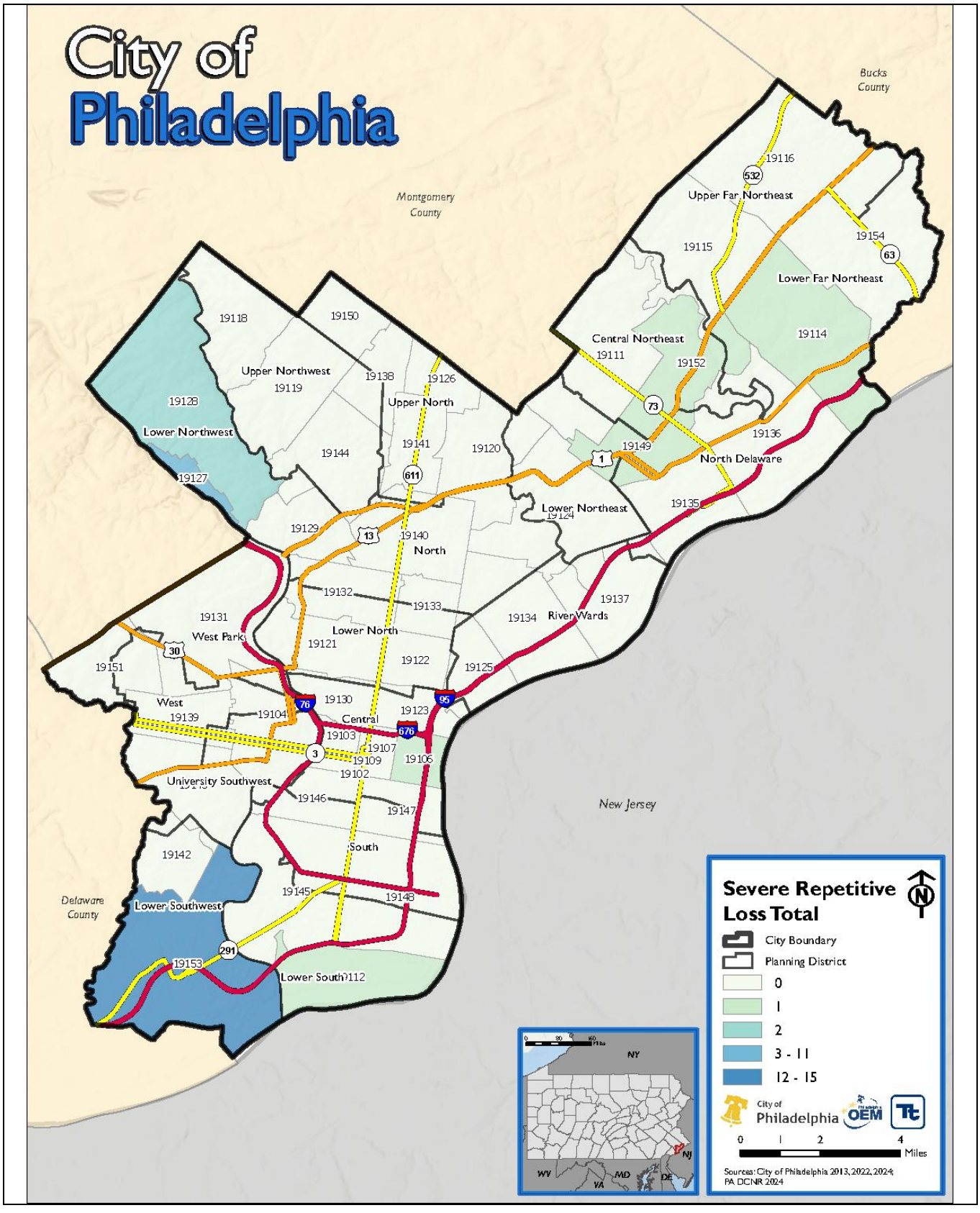


Figure 4-19. Severe Repetitive Loss Areas



Range of Magnitude

The severity of a flood depends not only on the amount of water that accumulates in a period of time, but also on the time of year, the coverage area of the storm, and the land's ability to absorb the amount of water. The National Weather Service issues several different flood products, listed in Table 4-35, depending on the degree of flooding that is expected.

Table 4-35. NWS Flood Products

National Weather Service Product	Criteria
Flood Advisory	Flood event warrants notification but is less urgent than a warning. Issued for conditions that may result in nuisance flooding and/or streams just out of their banks. Issued when rain will cause flooding of streets and low-lying areas in both urban and rural settings. May be upgraded to a Flash Flood Warning if flooding worsens and poses a threat to life and property. Forecaster confidence is at least 80 percent.
Flood Watch	Issued 6-48 hours before an event where conditions are favorable for flooding. Usually associated with non-convective events. Indicates current or developing hydrologic conditions are favorable for flooding in and close to the watch area, but the occurrence is neither certain or imminent. Forecaster confidence is approximately 50 percent.
Flood Warning	Flooding is imminent or occurring. May be issued for river and/or areal (overland) flooding. Caused from either a convective or non-convective event. There is a serious risk to life and property. Can be issued several hours before flooding occurs. Forecaster confidence is at least 80 percent.
Flash Flood Watch	Issued 6-48 hours before an event where conditions are favorable for rapidly rising water to pose an immediate hazard to life and property. Usually associated with quick-hitting convective rain events. Indicates current or developing hydrologic conditions are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain or imminent. Forecaster confidence is approximately 50 percent.
Flash Flood Warning	Rapidly rising water poses an immediate threat to life and property. This warning may also be issued for ice jams and dam breaks. If flooding is expected to persist for more than several hours, the product may be converted to a Flood Warning.
Coastal Flood Advisory	Issued for minor tidal flooding. Impacts include nuisance flooding across roads or low-lying areas with potential for isolated property damage. Generally non-lifethreatening.
Coastal Flood Watch	Coastal flooding with significant impacts (moderate or major coastal flooding) may occur within the next 12-48 hours. Inundation of people, buildings and coastal structures on land at locations that, under normal conditions, are abovethe level of high tide is p ossible.
Coastal Flood Warning	Coastal flooding with significant impacts is occurring, imminent, or highly likely within the next 24 hours. Issued for moderate or severe tidal flooding. Impacts for moderate flooding range from flooded roads to property damage. Severe flooding impacts include widespread flooding with significant property damage. Both moderate and severe tidal flooding can be life-threatening.
Storm Surge	There is possibility of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area generally within 48 hours in association with a tropical cyclone (may be issued in conjunction with a tropical storm watch/warning or hurricane watch/warning).
Storm Surge Warning	There is a danger of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within 36 hours, in association with a tropical cyclone (may be issued in conjunction with a tropical storm watch/warning or hurricane watch/warning).

Source: NWS 2024

The NWS Advanced Hydrological Prediction Service also issues river flooding guidance for rainfall events based on river flood gauge readings. Residents can subscribe for e-mails or text messages by the U.S. Geological Survey WaterAlert Services when real-time data exceeds certain thresholds. The flood stage categories are detailed in Table 4-36.

Table 4-36. Flood Stage Based on River Flood Gauge Readings

Flood Stage	Description
Low Stage	At or below the expected water level. No flooding expected.
Action Stage	The stage which, when reached by a rising stream or river, represents the level where the NWS or a partner/user needs to take some type of mitigation action in preparation for possible significant hydrologic activity.
Flood Stage	An established gage height for a given location above which a rise in water surface level begins to create a hazard to lives, property, or commerce. The issuance of flood advisories or warnings is linked to flood stage.
Moderate Stage	The stage at which there is some inundation of structures and roads near the river or stream. Some evacuations of people and/or transfer of property to higher elevations may be necessary.
Major Flood Stage	The stage at which there is extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary.

Source: NWS 2016

Flooding can have a wide range of impacts on natural and human environment, including erosion, debris flow, contaminated groundwater, and mold and fungi.

The worst-case scenario for the City would be heavy rainfall and/or rapid snowmelt in combination with high storm surge levels on the tidal Delaware River causing catastrophic flooding along all creeks and major rivers in the metropolitan area. Heavy rainfall or snow melt could occur upstream of Philadelphia. Repetitive loss properties in Eastwick and Manayunk that have experienced repeated flooding would be catastrophically impacted and homes and businesses in South Philadelphia that have experienced basement flooding would have flooding on the first floor. Flash floods would endanger individuals and vehicles, necessitating evacuations and difficult rescues in high water with fast currents. Wastewater system would be overwhelmed and cause sewage to spill into creeks, rivers, and back flow into homes without a backflow system. Flooding would close roadways for several days along I-95, the Schuylkill Expressway, Kelly and Lincoln Drives, and likely result in mudslides and roadway damage. Regional rail and other transit infrastructure would be damaged and result in delays and closures. The Philadelphia International Airport would likely experience significant delays or close for a period of time.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City of Philadelphia was included in seven major disaster (DR) or emergency (EM) declarations for Flood, Flash Flood, Ice Jam-related events (FEMA 2024). Table 4-37 lists these declarations.

Table 4-37. FEMA Declarations for Flood, Flash Flood, Ice Jam Events in City of Philadelphia (1954 to 2024)

Event Date	Declaration Date	Declaration Number	Incident Type	Declaration Title
September 18, 1971	September 18, 1971	DR-312	Flood	Floods
June 23, 1972	June 23, 1972	DR-340	Flood	Tropical Storm Agnes
January 19 – February 1, 1996	January 21, 2996	DR-1093	Flood	Severe Storms and Flooding
July 27 – August 25, 2004	August 6, 2004	DR-1538	Severe Storm	Severe Storms and Flooding
September 8 – 9, 2004	September 19, 2004	DR-1555	Severe Storm	Severe Storms and Flooding Associated with Tropical Depression Frances
September 3 – October 15, 2011	September 12, 2011	DR-4030	Flood	Tropical Storm Lee
September 3 – October 15, 2011	September 8, 2011	EM-3340	Flood	Remnants of Tropical Storm Lee

Source: FEMA 2024

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was included in four USDA Flood, Flash Flood, Ice Jam-related agricultural disaster declarations, as shown in Table 4-38 (USDA 2024).

Table 4-38. USDA Declarations for Flood, Flash Flood, Ice Jam Events in City of Philadelphia (2021 to 2024)

Event Date	USDA Declaration Number	Description
June 28 – November 8, 2012	S3487	The combined effects of drought, high winds (Derecho), hail, excessive heat, excessive rain, flash flooding, Hurricane Sandy, snowstorm, and Nor'easter
May 22, 2014	S3712	Excessive Rain and Related Flooding, High Winds, and Hail
May 28 – July 15, 2015	S3931	Excessive rain, flash flooding, high winds, and lightning
April 1 – June 21, 2019	S4519	Excessive rain, flash flooding, and flooding

Source: USDA 2024

Previous Events

Known hazard events that impacted the City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-39. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-39. Flood, Flash Flood, Ice Jam Events in City of Philadelphia (2021 to 2024)

Event Date	Description
June 14, 2021	Thunderstorms brought locally heavy rain to the City of Philadelphia and nearby communities on the evening of June 14. Rainfall totals were around 2 to 3 inches. Widespread roadway flooding occurred in South Philadelphia. There were a few water rescues.

Event Date	Description
July 12, 2021	Thunderstorms brought locally heavy rain to parts of southeastern Pennsylvania on the afternoon of July 12. Rainfall totals up to 6 to 10 inches occurred in Northeast Philadelphia and in far lower Bucks County prompting the issuance of a Flash Flood Emergency. Widespread significant street flooding occurred in Northeast Philadelphia. There were numerous road closures including Woodhaven Road near U.S. Route 1. Moderate flooding occurred along the Pennypack Creek. A total of 18 residents were evacuated from the Sherwood Crossing Apartments along Red Lion Road due to flooding from Byberry Creek.
July 17, 2021	Thunderstorms brought locally heavy rain to parts of southeastern Pennsylvania on the afternoon and evening of July 17. Rainfall totals were as high as 1 to 3 inches. Minor flooding occurred along the Frankford Creek in Philadelphia.
August 19, 2021	Heavy rain associated with Post-Tropical Cyclone Fred caused flash flooding in eastern Pennsylvania on the night of August 18-19, 2021. There were rainfall totals as high as 3 to 5 inches. Minor flooding occurred along the Pennypack Creek in Northeast Philadelphia.
August 28, 2021	Thunderstorms brought locally heavy rain to southeastern Pennsylvania during the morning and early afternoon of August 28. Rainfall totals were as high as 2.5 to 4.5 inches. Several streets were under water in North Philadelphia around Temple University.
September 1, 2021	Post Tropical Cyclone Ida brought heavy rain to eastern Pennsylvania on September 1. Rainfall totals were as high as 5 to 10 inches. The heavy rain caused significant flash flooding, mainly in the southeastern part of the state. It resulted in widespread property damage. There were several fatalities. Widespread flash flooding occurred in Philadelphia with many roadways closed. Most of the waterways in the City overflowed their banks, including the Schuylkill River, Cobbs Creek, Wissahickon Creek, Frankford Creek and Pennypack Creek. Many buildings were flooded, especially in the Manayunk section of the City. In all, $100,000,000 in property and crop damage occurred.
September 23, 2021	Thunderstorms produced locally heavy rain in southeastern Pennsylvania on the afternoon of September 23. Rainfall totals were as high as 2 to 3 inches. Minor flooding occurred along Frankford Creek in Philadelphia.
September 6, 2022	Low pressure moving eastward through the region brought heavy rain to southeastern Pennsylvania on the morning of September 6. Rainfall totals ranged from 2 to 5 inches in much of the area. Minor flooding occurred along Wissahickon Creek in Philadelphia.
June 16, 2023	Thunderstorms brought locally heavy rain to southeastern Pennsylvania during the midday hours of June 16. Rainfall totals were as high as 1.0 to 1.5 inches. Minor flooding occurred along Pennypack Creek in Northeast Philadelphia.
June 23, 2023	Thunderstorms brought locally heavy rain to southeastern Pennsylvania on the afternoon of June 23. Rainfall totals were as high as 1 to 2 inches. Minor flooding occurred along Pennypack Creek in Northeast Philadelphia.
June 27, 2023	Thunderstorms produced locally heavy rain in southeastern Pennsylvania during the late afternoon and evening of June 27. Rainfall totals were as high as 1 to 2 inches. Moderate flooding occurred along Pennypack Creek in Northeast Philadelphia.
July 5-9, 2023	Thunderstorms produced locally heavy rain in southeastern Pennsylvania on the afternoon and early evening of July 8. Rainfall totals were as high as 1 to 2 inches. Segments of Interstate 95 between East Girard Avenue and the Vine Street Expressway in Philadelphia became impassable due to flooding.
September 10, 2023	Thunderstorms produced locally heavy rain in extreme southeastern Pennsylvania on the evening of September 10. Rainfall totals were as high as 2 to 3 inches. Minor flooding occurred along the Pennypack Creek in Northeast Philadelphia.

Event Date	Description
December 18, 2023	A strengthening coastal low-pressure system brought several rounds of rain to the region Sunday night into Monday (December 17-18th). Total rainfall amounts across the forecast area varied from about 1.50 inches up to 7.00 inches. The heaviest rains fell across southern Delaware up through the coastal plain of New Jersey. This heavy rain fell on already saturated soils. As a result, river flooding was prevalent across the Passaic Basin, Raritan Basin, and southeast Pennsylvania basins including the Schuylkill and Brandywine. The Brandywine flooding extended into Delaware. Smaller streams and rivers across northern New Castle County in Delaware, such as the Christina, Red Clay, and White Clay also flooded.
December 28, 2023	A coastal surface low moved north/northeastward on Wednesday night into Thursday (December 27-28th). Total rainfall amounts across the forecast area varied from about 1.00 inches up to 3.00 inches. The heaviest rains fell west of the I-95 corridor. This heavy rain fell on already saturated soils. As a result, river flooding was prevalent across the Passaic Basin, Raritan Basin, and southeast Pennsylvania basins including the Schuylkill and Brandywine. The Brandywine flooding extended into Delaware. Smaller streams and rivers across northern New Castle County in Delaware, such as the Christina, Red Clay, and White Clay also flooded.
January 10, 2024	Strong low pressure tracked to the northwest of the forecast area on Tuesday into early Wednesday (January 9-10th). A cold front associated with the low swept through the region on Wednesday. In the system's wake, total rainfall amounts varied from about 1.50 inches up to about 4.00 inches.

Source: NOAA/NCEI 2024

Probability of Future Occurrences

Information on previous Flood, Flash Flood, Ice Jam occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-40. Based on historical records and input from the Steering Committee, the probability of occurrence for Flood, Flash Flood, Ice Jam events in the City is considered "highly likely."

Based on historical flood events, the City of Philadelphia has a high probability of flooding for the future. The fact that the elements required for flooding exist and that major flooding has occurred throughout the City in the past suggests that many people and properties are at risk from the flood hazard in the future. It is concluded that the City of Philadelphia will continue to experience direct and indirect impacts of annual flooding events.

Table 4-40. Probability of Future Flood, Flash Flood, Ice Jam Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1950 and 2024	Percent Chance of Occurring in Any Given Year
Flood	235	100%
Flash Flood	214	100%
Ice Jam	1	1.35%
Urban/Stormwater Flood*	-	-
Sea Level Rise*	-	-
Total	450	100%

Source: NOAA/NCEI 2024; IEM 2024

Note: Due to limitations in data, not all Flood, Flash Flood, Ice Jam events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2024

* *Currently, there is no system or method to record the occurrences of urban/stormwater flooding and sea level rise.*

Climate Change Projections

Climate change is expected to increase the intensity and frequency of flood events in Philadelphia due to several key factors. The first is due to heavier rainfall and more extreme weather events. In the City, this could result in more intense rainstorms, which in turn could cause flash flooding and urban flooding problems, especially where older or overwhelmed stormwater infrastructure exists. Another way in which climate change will impact this hazard is through rising sea levels and increased tidal flooding. As sea levels rise, coastal and tidal flooding is expected along the Delaware and Schuylkill Rivers. Climate change may also produce more frequent riverine flooding as upstream flood events increase in coverage and frequency.

Cascading Impacts on Other Hazards

Erosion

Riverine flooding often results in bank erosion. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much property damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail.

Public Health

After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, older adults, and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24 to 48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC n.d.).

Floodwaters also can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

The best level of mitigation for these public health impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with them in responding to flood events.

Utility Disruption

Floods of any type have the potential to impact water and power utilities, which may impact public and private use, as well as cause disruption to critical infrastructure. Flooding's harmful effects on the water supply include the following:

- **Water Supply Contamination**—Excess floodwater can contaminate private drinking water sources, such as wells and springs. Floodwater picks up debris, increasing the number of bacteria, sewage, and other industrial waste and chemicals into the water source or leaky pipes. Excess water also makes it more difficult for water treatment plants to treat the water efficiently and effectively. If there is a contamination at any step of the water flow process, this puts consumers at risk of exposure to dangerous toxins that could result in serious harm, such as wound infections, skin rashes, gastrointestinal illnesses, and tetanus; in extreme cases, death may occur.
- **Disruption to Clean Drinking and Cooking Water**—In the event of having access only to contaminated water, consumers are unable to cook or clean in their home until the water is certified as safe. Depending on the severity of the flood and the storm, this could take days, months, or, in some cases, even years. Without access to clean drinking and cooking water, consumers ultimately become reliant on bottled water. In impoverished communities, this is even more detrimental because those affected may not have the economic means to purchase sufficient bottled water. Moreover, in a flood, retail locations are often inaccessible or low on supplies of bottled water.

Floodwaters can also cause damage to power utilities. In particular, floods may disrupt utilities if a building's service panel, generator, meter, etc. are not elevated above the flood protection level. Oversaturated soils from periods of heavy rain and flooding may cause utility poles to tip over or fall completely, interrupting the power grid for a potentially large area, especially if the transformer is impacted.

Dam Failure

Severe weather, which is often a precursor to flooding events, can result in large quantities of rain upstream of a dam that will ultimately be impounded by the dam. This can raise water levels behind the dam, resulting in overtopping of the dam or flooding of properties upstream of the dam. Should the flooding result in a dam failure, the water behind the dam, including flood waters, may inundate jurisdictions downstream of the dam. More information on dam failure can be found in Chapter 14.

4.3.4.2 Vulnerability and Impact Assessment

The 1 and 0.2 percent annual chance flood events were examined to evaluate the City of Philadelphia's flood risk. Polygons representing the 1 and 0.2 percent annual chance events from the FEMA Risk Map products with an effective date of November 2015 were used to estimate exposure. Figure 4-15 presented earlier in this section illustrates the flood boundaries used for the vulnerability assessment. The 1 and 0.2 percent annual chance flood depth grids generated for the FEMA Risk Map program were imported into FEMA's Hazus model and a riverine analysis was processed to estimate potential losses. To understand risk, a community must evaluate what assets are exposed and vulnerable in the identified hazard area.

In addition, the 3-foot sea level rise event was examined using depth grid data obtained from NOAA (2019); the 3-foot sea level rise event is associated with a mid-century to end-of-century event for the City. Asset data (population, building stock, and critical facilities) presented in the City Profile were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. The sea level rise depth grid was imported into Hazus, and a riverine analysis was processed to estimate potential losses. To understand risk, a community must evaluate what assets are exposed and vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of the flood hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development

- Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time

Life, Health, and Safety

The impact of flooding on life, health, and safety is dependent upon several factors, including the severity of the event and whether adequate warning time is provided to residents. The vulnerable population consists of those living in or near floodplain areas who could be impacted should a flood event occur. It also includes people traveling in flooded areas, or whose access to emergency services is compromised during a flood.

Overall Population

Table 4-41 displays the estimated population exposure to the 1 percent and 0.2 percent annual chance flood events. There are 5,487 residents living in the 1 percent annual chance floodplain or 0.3 percent of the City's total population. There are 15,444 residents living in the 0.2 percent annual chance floodplain, or 1 percent of the City's total population. The Lower Southwest Planning District has the greatest number of residents living in the 1 percent annual chance floodplain, with 4,051 residents and the greatest number of residents living in the 0.2 percent annual chance floodplain, with 6,474 residents.

Table 4-41. Population in the 1 Percent and 0.2 Percent Annual Chance Flood Hazard Areas

Planning District	Total Population (2022 ACS 5-Year Estimates)	Estimated Population Living in the Flood Hazard Area			
		1% Annual Chance Flood Hazard Area		0.2% Annual Chance Flood Hazard Area	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total
Central	136,618	487	0.4%	2,637	1.9%
Central Northeast	85,803	0	0.0%	3	<0.1%
Lower Far Northeast	71,972	33	<0.1%	184	0.3%
Lower North	99,171	0	0.0%	0	0.0%
Lower Northeast	106,958	283	0.3%	1,670	1.6%
Lower Northwest	54,410	243	0.4%	296	0.5%
Lower South	6,465	3	<0.1%	11	0.2%
Lower Southwest	42,894	4,051	9.4%	6,474	15.1%
North	135,438	18	<0.1%	151	0.1%
North Delaware	98,608	9	<0.1%	15	<0.1%
River Wards	69,786	306	0.4%	2,290	3.3%
South	131,686	0	0.0%	1,618	1.2%
University Southwest	81,820	4	<0.1%	4	<0.1%
Upper Far Northeast	69,114	50	0.1%	88	0.1%
Upper North	151,883	0	0.0%	0	0.0%
Upper Northwest	90,934	0	0.0%	3	<0.1%

Planning District	Total Population (2022 ACS 5-Year Estimates)	Estimated Population Living in the Flood Hazard Area			
		1% Annual Chance Flood Hazard Area		0.2% Annual Chance Flood Hazard Area	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total
West	114,814	0	0.0%	0	0.0%
West Park	44,833	0	0.0%	0	0.0%
City of Philadelphia	**1,593,208**	**5,487**	**0.3%**	**15,444**	**1.0%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; FEMA 2015, 2023
Note: Population totals have been rounded down

The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades, and warnings. Therefore, injuries and deaths generally are not anticipated if proper warning and precautions are in place. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which results from persons trying to cross flooded roadways or channels during a flood.

Table 4-42 displays the estimated population exposure to the 3ft sea level rise hazard. There are 5,487 residents living in the hazard area or 4.9 percent of the City's total population. The Lower Southwest Planning District has the greatest number of residents living in the 3ft sea level rise hazard area, with 4,051 residents.

Table 4-42. Population in the 3ft Sea Level Rise Hazard Area

Planning District	Total Population (2022 ACS 5-Year Estimates)	Population in the 3ft Sea Level Rise Hazard Area	
		Number of Persons	Percent of Total
Central	136,618	487	0.4%
Central Northeast	85,803	0	0.0%
Lower Far Northeast	71,972	33	<0.1%
Lower North	99,171	0	0.0%
Lower Northeast	106,958	283	0.3%
Lower Northwest	54,410	243	0.4%
Lower South	6,465	3	<0.1%
Lower Southwest	42,894	4,051	9.4%
North	135,438	18	<0.1%
North Delaware	98,608	9	<0.1%
River Wards	69,786	306	0.4%
South	131,686	0	0.0%
University Southwest	81,820	4	<0.1%
Upper Far Northeast	69,114	50	0.1%
Upper North	151,883	0	0.0%
Upper Northwest	90,934	0	0.0%
West	114,814	0	0.0%
West Park	44,833	0	0.0%

Planning District	Total Population (2022 ACS 5-Year Estimates)	Population in the 3ft Sea Level Rise Hazard Area	
		Number of Persons	Percent of Total
City of Philadelphia	**1,593,208**	**5,487**	**0.3%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; NOAA 2019
Note: Population totals have been rounded down

The Hazus riverine model estimates the potential sheltering needs as a result of a 1 and 0.2 percent annual chance flood event. The demographic data in Hazus has not been updated and the estimated sheltering needs are based on 2020 U.S. Census data. Hazus estimates 9,562 persons may be displaced and 1,736 people may seek short-term shelter from the 1-percent annual chance flood; Hazus estimates 23,694 persons may be displaced and 3,906 people may seek short-term shelter from the 0.2-percent annual chance flood. These statistics are presented in Table 4-43.

Table 4-43. Population Displaced or Needing Short-Term Shelter from the Annual Chance Flood Events

Planning District	Total Population (U.S. Census Bureau Decennial 2020)	1 Percent Annual Chance Flood Event Hazard Area		0.2 Percent Annual Chance Flood Event Hazard Area	
		Displaced Population	Persons Seeking Short-Term Shelter	Displaced Population	Persons Seeking Short-Term Shelter
Central	136,618	3,736	190	6,387	293
Central Northeast	85,803	1	1	4	4
Lower Far Northeast	71,972	365	223	781	346
Lower North	99,171	0	0	1	0
Lower Northeast	106,958	374	193	1,565	503
Lower Northwest	54,410	418	65	582	96
Lower South	6,465	117	50	535	50
Lower Southwest	42,894	3,796	676	6,458	850
North	135,438	31	16	347	160
North Delaware	98,608	92	21	237	47
River Wards	69,786	290	50	2,248	311
South	131,686	1	0	3,807	886
University Southwest	81,820	52	24	142	59
Upper Far Northeast	69,114	285	225	583	288
Upper North	151,883	2	0	8	4
Upper Northwest	90,934	1	1	1	1
West	114,814	1	1	8	8
West Park	44,833	0	0	0	0
City of Philadelphia	**1,593,208**	**9,562**	**1,736**	**23,694**	**3,906**

Source: Hazus v6.1; U.S. Census Bureau ACS 2022; FEMA 2015, 2023

Hazus model estimates were ran to determine the potential sheltering needs as a result of a 3-foot sea level rise. The demographic data in Hazus has not been updated and the estimated sheltering needs are based on 2020 U.S. Census data. Hazus estimates 1,973 persons may be displaced and 413 people may seek short-term shelter. These

statistics are presented in Table 4-44. The estimated displaced population and number of persons seeking short-term shelter differs from the number of persons exposed, because the displaced population numbers take into consideration that not all residents will be impacted enough to be displaced or to require short-term shelter during a hazard event.

Table 4-44. Population Displaced or Needing Short-Term Shelter from the 3-foot Sea Level Rise Hazard Area

	Total Population (U.S. Census Bureau Decennial 2020)	3-foot Sea Level Rise Hazard Area	
		Displaced Population	Persons Seeking Short-Term Shelter
Central	136,618	765	25
Central Northeast	85,803	0	0
Lower Far Northeast	71,972	0	0
Lower North	99,171	0	0
Lower Northeast	106,958	1	1
Lower Northwest	54,410	0	0
Lower South	6,465	0	0
Lower Southwest	42,894	1,193	381
North	135,438	1	1
North Delaware	98,608	8	4
River Wards	69,786	5	1
South	131,686	0	0
University Southwest	81,820	0	0
Upper Far Northeast	69,114	0	0
Upper North	151,883	0	0
Upper Northwest	90,934	0	0
West	114,814	0	0
West Park	44,833	0	0
City of Philadelphia	**1,593,208**	**1,973**	**413**

Source: Hazus v6.1; U.S. Census Bureau ACS 2022; NOAA 2019

Socially Vulnerable Population

Some populations experience exacerbated impacts and prolonged recovery from flooding due to factors including their physical and financial ability to react or respond during a flood event. The most vulnerable are the economically disadvantaged, older adults, and unhoused individuals. Economically disadvantaged populations may be more vulnerable because they lack financial resources to evacuate. Older adults are more vulnerable because they are more likely to need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating. Individuals who are unhoused may face increased difficulty in washing, sanitation, and hygiene due to cascading impacts of flooding and may have increased risk of adverse health outcomes, including diarrheal disease.

Table 4-45 presents the estimated socially vulnerable populations living in the 1 percent annual chance flood hazard area. There are 623 persons over the age of 65 years, 332 persons under the age of 5 years, 427 non-English

speakers, 809 persons with a disability, and 1,318 living in poverty located in the 1 percent annual chance flood hazard area.

Table 4-46 presents the estimated socially vulnerable populations living in the 0.2 percent annual chance flood hazard area. There are 1,830 persons over the age of 65 years, 939 persons under the age of 5 years, 1,117 non-English speakers, 2,306 persons with a disability, and 3,407 living in poverty located in the 0.2 percent annual chance flood hazard area.

Table 4-47 presents the estimated socially vulnerable populations living in the 3ft sea level rise hazard area. There are 62 persons over the age of 65 years, 34 persons under the age of 5 years, 48 non-English speakers, 85 persons with a disability, and 150 living in poverty located in the 3ft sea level rise hazard area.

Table 4-45. Number of Vulnerable Persons Living in the 1 Percent Annual Chance Flood Hazard Area

Planning District	Estimated Number of Vulnerable Persons Living in the 0.2 Percent Annual Chance Flood Hazard Area									
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total
Central	73	0.4%	17	0.3%	20	0.4%	41	0.4%	51	0.4%
Central Northeast	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Far Northeast	5	<0.1%	2	<0.1%	1	<0.1%	4	<0.1%	2	<0.1%
Lower North	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Northeast	29	0.3%	23	0.3%	23	0.3%	54	0.3%	76	0.3%
Lower Northwest	35	0.4%	12	0.4%	2	0.3%	30	0.4%	21	0.4%
Lower South	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Southwest	438	9.4%	252	9.4%	351	9.4%	609	9.4%	1,080	9.4%
North	2	<0.1%	1	<0.1%	2	<0.1%	5	<0.1%	6	<0.1%
North Delaware	1	<0.1%	0	0.0%	0	0.0%	1	<0.1%	1	<0.1%
River Wards	29	0.4%	22	0.4%	19	0.4%	58	0.4%	74	0.4%
South	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
University Southwest	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	<0.1%
Upper Far Northeast	11	0.1%	3	0.1%	9	0.1%	7	0.1%	6	0.1%
Upper North	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Upper Northwest	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
West	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
West Park	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
City of Philadelphia	**623**	**0.3%**	**332**	**0.3%**	**427**	**0.4%**	**809**	**0.3%**	**1,318**	**0.4%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; FEMA 2015, 2023
Note: Population totals have been rounded down

Table 4-46. Number of Vulnerable Persons Living in the 0.2 Percent Annual Chance Flood Hazard Area

Planning District	Estimated Number of Vulnerable Persons Living in the 0.2 Percent Annual Chance Flood Hazard Area									
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total
Central	397	1.9%	97	1.9%	109	1.9%	226	1.9%	276	1.9%
Central Northeast	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Far Northeast	30	0.3%	13	0.3%	10	0.3%	24	0.2%	15	0.3%
Lower North	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Northeast	175	1.6%	138	1.6%	136	1.6%	320	1.6%	450	1.6%
Lower Northwest	42	0.5%	15	0.5%	3	0.5%	37	0.5%	26	0.5%
Lower South	2	0.2%	0	0.0%	0	0.0%	1	0.1%	0	0.0%
Lower Southwest	700	15.1%	403	15.1%	561	15.1%	973	15.1%	1,726	15.1%
North	18	0.1%	11	0.1%	21	0.1%	42	0.1%	57	0.1%
North Delaware	1	<0.1%	1	<0.1%	1	<0.1%	2	<0.1%	3	<0.1%
River Wards	223	3.3%	164	3.3%	146	3.3%	437	3.3%	557	3.3%
South	222	1.2%	92	1.2%	114	1.2%	231	1.2%	286	1.2%
University Southwest	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	<0.1%
Upper Far Northeast	20	0.1%	5	0.1%	16	0.1%	13	0.1%	10	0.1%
Upper North	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Upper Northwest	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
West	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
West Park	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
City of Philadelphia	**1,830**	**0.8%**	**939**	**0.9%**	**1,117**	**1.1%**	**2,306**	**0.9%**	**3,407**	**1.0%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; FEMA 2015, 2023
Note: Population totals have been rounded down

Table 4-47. Number of Vulnerable Persons Living in the 3ft Sea Level Rise Hazard Area

Planning District	Estimated Number of Vulnerable Persons Living in the 3ft Sea Level Rise Hazard Area									
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total
Central	2	<0.1%	0	0.0%	0	0.0%	1	<0.1%	1	<0.1%
Central Northeast	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Far Northeast	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower North	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Northeast	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Northwest	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower South	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lower Southwest	60	1.3%	34	1.3%	48	1.3%	84	1.3%	149	1.3%
North	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
North Delaware	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
River Wards	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
South	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
University Southwest	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Upper Far Northeast	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Upper North	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Upper Northwest	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
West	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
West Park	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
City of Philadelphia	**62**	**0.0%**	**34**	**0.0%**	**48**	**0.0%**	**85**	**0.0%**	**150**	**0.0%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; NOAA 2019
Note: Population totals have been rounded down

General Building Stock

Vulnerable buildings are those located in the flood and sea level rise hazard zone areas. Table 4-48 summarizes these results for the 1 percent and 0.2 percent annual chance flood hazard areas. There are 2,053 buildings located in the 1 percent annual chance flood hazard area with an estimated $9 billion of replacement cost value (i.e., building and content replacement costs). This represents 0.4 percent of the City's total general building stock inventory. There are 5,824 buildings located in the 0.2 percent annual chance flood hazard area with an estimated $17 billion of building stock and contents exposed. This represents 1.2 percent of the City's total general building stock inventory.

Table 4-49 summarizes these results for the sea level rise hazard. There are 207 buildings located in the 3ft Sea Level Rise Hazard Area with an estimated $727 million of building stock and contents exposed. This represents less than 1 percent of the City's total general building stock inventory.

Table 4-50 lists the buildings in the flood hazard areas by general occupancy. Table 4-51 lists the buildings in the sea level rise hazard area by general occupancy. The capacity to identify the use/function, service provided, number of people served, customers served, etc. of these structures does not currently exist in the City. It is likely several commercial and industrial structures are one of the major employers in the City (noted in Section 2.2.4.1 Industries). Should one of these structures be impacted by the flood hazard, those employed which work in the structures may be impacted economically.

The Hazus flood model estimated potential damage to buildings using the custom building inventory developed for this HMP and the depth grid generated for this analysis. Table 4-52 shows estimated losses for the for the 1 percent annual chance flood. The citywide total is $1.6 billion or 0.5 percent of the total building replacement cost value. The Central Planning District has the greatest estimated building loss—$594 million (0.6 percent of the total replacement cost value). Table 4-53 shows estimated losses for the for the 0.2 percent annual chance flood. The citywide total is $3.1 billion or 0.9 percent of the total building replacement cost value. The Central Planning District has the greatest estimated building loss—$1.1 billion (1.1 percent of the total replacement cost value).

Hazus estimated potential damage to buildings within the 3ft sea level rise hazard area. Table 4-54 shows estimated losses from 3ft sea level rise. The citywide total is $301 million or 0.6 percent of the total building replacement cost value. The Central Planning District has the greatest estimated building loss—$239 million (0.2 percent of the total replacement cost value).

Community Lifelines and Other Critical Facilities

Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to get to vulnerable populations or to make repairs. Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water. Loss of these utilities could create isolation issues for the inundation zones.

Flooding can cause extensive damage to public utilities and disruptions to delivery of services. Flooding can cause isolation if bridges are washed out or blocked by water or debris, health problems due to water and sewer systems that are flooded or backed up, drinking water contamination if floodwaters carry pollutants into water supplies, and urban flooding if culverts become blocked with debris. Loss of power and communications may occur, and drinking water and wastewater treatment facilities may be temporarily out of operation.

Sea level rise also causes the salt front—the mixing zone where freshwater from the rivers and saltwater from the Atlantic Ocean meet—to shift upstream, increasing the risk of salinity intrusion, which can adversely affect drinking water supplies and compromise overall water quality.

Table 4-55 and Table 4-56 summarize the number of critical facilities exposed to the 1 percent and 0.2 percent annual chance flood hazard areas; Table 4-57 summarizes the number of critical facilities exposed to the 3ft sea level rise hazard.

Mitigation planning should consider means to reduce impact on critical facilities and ensure enough emergency services remain when a significant event occurs. If short-term functionality of critical facilities in the City are impacted by flooding, facilities of neighboring municipalities may need to increase support response functions. Actions addressing shared services agreements are included in Volume II of this plan.

Table 4-48. Buildings in the 1 Percent and 0.2 Percent Annual Chance Flood Hazard Areas

Planning District	Planning District Total Buildings		1% Annual Chance Flood Hazard Area				0.2% Annual Chance Flood Hazard Area			
			Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total	Count	% of Total	Value	% of Total
Central	29,150	$104,498,861,483	167	0.6%	$2,622,470,285	2.5%	656	2.3%	$4,917,562,406	4.7%
Central Northeast	23,691	$12,324,032,453	0	0.0%	$0	0.0%	1	<0.1%	$727,929	<0.1%
Lower Far Northeast	21,899	$15,483,279,437	12	0.1%	$83,465,197	0.5%	59	0.3%	$177,351,525	1.1%
Lower North	31,876	$17,246,447,463	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Lower Northeast	31,140	$10,314,498,850	118	0.4%	$70,476,093	0.7%	580	1.9%	$178,544,967	1.7%
Lower Northwest	18,020	$13,615,067,162	120	0.7%	$378,226,383	2.8%	224	1.2%	$762,649,100	5.6%
Lower South	1,963	$8,208,372,896	52	2.6%	$1,329,219,535	16.2%	86	4.4%	$2,448,314,573	29.8%
Lower Southwest	14,503	$6,840,537,150	1,347	9.3%	$1,819,534,274	26.6%	2,171	15.0%	$3,020,857,230	44.2%
North	48,796	$13,054,275,189	14	<0.1%	$7,250,209	0.1%	77	0.2%	$31,880,150	0.2%
North Delaware	32,565	$13,552,083,648	18	0.1%	$129,686,173	1.0%	46	0.1%	$354,061,849	2.6%
River Wards	29,313	$14,267,301,089	160	0.5%	$452,992,223	3.2%	1,103	3.8%	$1,206,974,207	8.5%
South	55,342	$28,814,766,240	15	<0.1%	$279,552,912	1.0%	762	1.4%	$1,244,118,733	4.3%
University Southwest	18,972	$28,704,645,654	12	0.1%	$2,425,351,795	8.4%	17	0.1%	$2,756,916,895	9.6%
Upper Far Northeast	18,078	$14,096,177,394	15	0.1%	$46,827,772	0.3%	34	0.2%	$103,274,398	0.7%
Upper North	48,866	$15,554,930,862	1	<0.1%	$3,126,464	<0.1%	3	<0.1%	$11,023,290	0.1%
Upper Northwest	26,636	$16,619,291,505	1	<0.1%	$22,680,489	0.1%	2	<0.1%	$24,066,204	0.1%
West	40,683	$10,774,317,065	0	0.0%	$0	0.0%	2	<0.1%	$779,947	<0.1%
West Park	12,322	$7,494,241,193	1	<0.1%	$81,535,775	1.1%	1	<0.1%	$81,535,775	1.1%
City of Philadelphia	**503,815**	**$351,463,126,733**	**2,053**	**0.4%**	**$9,752,395,579**	**2.8%**	**5,824**	**1.2%**	**$17,320,639,176**	**4.9%**

Source: City of Philadelphia 2022, 2024; RS Means 2024; FEMA 2015, 2023

Table 4-49. Buildings in the 3ft Sea Level Rise Hazard Area

Planning District	Planning District Total Buildings		3ft Sea Level Rise Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total
Central	29,150	$104,498,861,483	11	<0.1%	$378,897,387	0.4%
Central Northeast	23,691	$12,324,032,453	0	0.0%	$0	0.0%
Lower Far Northeast	21,899	$15,483,279,437	0	0.0%	$0	0.0%
Lower North	31,876	$17,246,447,463	0	0.0%	$0	0.0%
Lower Northeast	31,140	$10,314,498,850	0	0.0%	$0	0.0%
Lower Northwest	18,020	$13,615,067,162	0	0.0%	$0	0.0%
Lower South	1,963	$8,208,372,896	3	0.2%	$15,480,683	0.2%
Lower Southwest	14,503	$6,840,537,150	187	1.3%	$202,462,290	3.0%
North	48,796	$13,054,275,189	0	0.0%	$0	0.0%
North Delaware	32,565	$13,552,083,648	2	<0.1%	$2,407,055	<0.1%
River Wards	29,313	$14,267,301,089	1	<0.1%	$10,645,918	0.1%
South	55,342	$28,814,766,240	3	<0.1%	$117,279,834	0.4%
University Southwest	18,972	$28,704,645,654	0	0.0%	$0	0.0%
Upper Far Northeast	18,078	$14,096,177,394	0	0.0%	$0	0.0%
Upper North	48,866	$15,554,930,862	0	0.0%	$0	0.0%
Upper Northwest	26,636	$16,619,291,505	0	0.0%	$0	0.0%
West	40,683	$10,774,317,065	0	0.0%	$0	0.0%
West Park	12,322	$7,494,241,193	0	0.0%	$0	0.0%
City of Philadelphia	**503,815**	**$351,463,126,733**	**207**	**<0.1%**	**$727,173,165**	**0.2%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; NOAA 2019; RS Means 2024

Table 4-50. Buildings in the 1 Percent and 0.2 Percent Annual Chance Flood Hazard Areas by General Occupancy Class

	Number of Buildings in Flood Hazard Area, by Occupancy Class							
	1% Annual Chance Flood Hazard Area				0.2% Annual Chance Flood Hazard Area			
Planning District	Residential	Commercial	Industrial	Other[a]	Residential	Commercial	Industrial	Other[a]
Central	100	52	14	1	539	90	24	3
Central Northeast	0	0	0	0	1	0	0	0
Lower Far Northeast	10	2	0	0	55	3	1	0
Lower North	0	0	0	0	0	0	0	0
Lower Northeast	78	22	18	0	460	71	48	1
Lower Northwest	78	38	3	1	95	117	8	4
Lower South	1	22	26	3	3	31	48	4
Lower Southwest	1,284	28	27	8	2,052	56	47	16
North	6	6	2	0	50	23	4	0
North Delaware	3	6	9	0	5	14	26	1
River Wards	118	10	32	0	881	95	125	2
South	0	5	10	0	636	89	33	4
University Southwest	1	9	2	0	1	14	2	0
Upper Far Northeast	13	0	1	1	23	3	7	1
Upper North	0	1	0	0	0	3	0	0
Upper Northwest	0	0	0	1	1	0	0	1
West	0	0	0	0	0	2	0	0
West Park	0	1	0	0	0	1	0	0
City of Philadelphia	**1,692**	**202**	**144**	**15**	**4,802**	**612**	**373**	**37**

Source: City of Philadelphia 2022, 2024; FEMA 2015, 2023
Other = government, religion, agricultural, and education

Table 4-51. Buildings in the 3ft Sea Level Rise Hazard Area by General Occupancy Class

Planning District	Residential	Commercial	Industrial	Other[a]
Central	3	3	5	0
Central Northeast	0	0	0	0
Lower Far Northeast	0	0	0	0
Lower North	0	0	0	0
Lower Northeast	0	0	0	0
Lower Northwest	0	0	0	0
Lower South	0	1	2	0
Lower Southwest	178	7	1	1
North	0	0	0	0
North Delaware	0	2	0	0
River Wards	0	1	0	0
South	0	0	3	0
University Southwest	0	0	0	0
Upper Far Northeast	0	0	0	0
Upper North	0	0	0	0
Upper Northwest	0	0	0	0
West	0	0	0	0
West Park	0	0	0	0
City of Philadelphia	**181**	**14**	**11**	**1**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; NOAA 2019

Table 4-52. Estimated General Building Stock Potential Loss to the 1 Percent Annual Chance Flood Event

Planning District	Total Replacement Cost Value	1 Percent Annual Chance Flood Event Impact on Buildings				
		Estimated Loss for All Occupancies	Percent of Total	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Central	$104,498,861,483	$594,491,375	0.6%	$228,802,165	$357,542,401	$8,146,809
Central Northeast	$12,324,032,453	$0	0.0%	$0	$0	$0
Lower Far Northeast	$15,483,279,437	$7,419,364	<0.1%	$1,473,615	$5,945,749	$0
Lower North	$17,246,447,463	$0	0.0%	$0	$0	$0
Lower Northeast	$10,314,498,850	$12,351,103	0.1%	$627,235	$8,470,515	$3,253,353
Lower Northwest	$13,615,067,162	$9,271,432	0.1%	$5,454,319	$3,413,910	$403,203
Lower South	$8,208,372,896	$225,818,992	2.8%	$0	$215,104,815	$10,714,178
Lower Southwest	$6,840,537,150	$246,557,554	3.6%	$44,446,658	$91,228,784	$110,882,111
North	$13,054,275,189	$904,680	<0.1%	$87,949	$763,681	$53,051
North Delaware	$13,552,083,648	$6,356,529	<0.1%	$174,809	$1,308,217	$4,873,503
River Wards	$14,267,301,089	$24,877,008	0.2%	$1,706,841	$5,039,360	$18,130,806
South	$28,814,766,240	$51,532,591	0.2%	$0	$1,243,384	$50,289,206
University Southwest	$28,704,645,654	$415,534,474	1.4%	$37,010,928	$378,460,466	$63,080
Upper Far Northeast	$14,096,177,394	$1,930,168	<0.1%	$1,926,580	$0	$3,589
Upper North	$15,554,930,862	$2,381,225	<0.1%	$0	$2,381,225	$0
Upper Northwest	$16,619,291,505	$0	0.0%	$0	$0	$0
West	$10,774,317,065	$0	0.0%	$0	$0	$0
West Park	$7,494,241,193	$3,391,747	<0.1%	$0	$3,391,747	$0
City of Philadelphia	**$351,463,126,733**	**$1,602,818,241**	**0.5%**	**$321,711,099**	**$1,074,294,254**	**$206,812,889**

Source: Hazus v6.1; City of Philadelphia 2022, 2024; RS Means 2024; FEMA 2015, 2023

Table 4-53. Estimated General Building Stock Potential Loss to the 0.2 Percent Annual Chance Flood Event

Planning District	Total Replacement Cost Value	0.2 Percent Annual Chance Flood Event Impact on Buildings				
		Estimated Loss for All Occupancies	Percent of Total	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Central	$104,498,861,483	$1,114,592,716	1.1%	$497,076,354	$576,997,188	$40,519,174
Central Northeast	$12,324,032,453	$74,834	<0.1%	$74,834	$0	$0
Lower Far Northeast	$15,483,279,437	$12,790,312	0.1%	$2,698,889	$10,091,423	$0
Lower North	$17,246,447,463	$0	0.0%	$0	$0	$0
Lower Northeast	$10,314,498,850	$40,742,099	0.4%	$6,904,216	$23,508,020	$10,329,862
Lower Northwest	$13,615,067,162	$64,882,055	0.5%	$10,534,472	$37,329,909	$17,017,674
Lower South	$8,208,372,896	$361,880,061	4.4%	$2,636,633	$333,621,831	$25,621,597
Lower Southwest	$6,840,537,150	$489,545,366	7.2%	$157,747,695	$122,420,168	$209,377,504
North	$13,054,275,189	$4,242,147	<0.1%	$1,237,111	$2,861,973	$143,063
North Delaware	$13,552,083,648	$28,443,276	0.2%	$462,064	$14,392,239	$13,588,973
River Wards	$14,267,301,089	$84,420,907	0.6%	$9,499,387	$44,490,984	$30,430,536
South	$28,814,766,240	$68,476,338	0.2%	$2,612,817	$18,631,749	$47,231,772
University Southwest	$28,704,645,654	$847,509,777	3.0%	$57,984,321	$788,783,264	$742,193
Upper Far Northeast	$14,096,177,394	$9,114,396	0.1%	$2,918,826	$17,174	$6,178,396
Upper North	$15,554,930,862	$5,534,477	<0.1%	$0	$5,534,477	$0
Upper Northwest	$16,619,291,505	$32,873	<0.1%	$32,873	$0	$0
West	$10,774,317,065	$0	0.0%	$0	$0	$0
West Park	$7,494,241,193	$28,723,276	0.4%	$0	$28,723,276	$0
City of Philadelphia	**$351,463,126,733**	**$3,161,004,910**	**0.9%**	**$752,420,493**	**$2,007,403,674**	**$401,180,743**

Source: Hazus v6.1; City of Philadelphia 2022, 2024; RS Means 2024; FEMA 2015, 2023

Table 4-54. Estimated General Building Stock Potential Loss to 3ft Sea Level Rise

Planning District	Total Replacement Cost Value	3ft Sea Level Rise Impact on Buildings				
		Estimated Loss for All Occupancies	Percent of Total	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Central	$104,498,861,483	$239,001,841	0.2%	$207,660,858	$22,535,863	$8,805,120
Central Northeast	$12,324,032,453	$0	0.0%	$0	$0	$0
Lower Far Northeast	$15,483,279,437	$0	0.0%	$0	$0	$0
Lower North	$17,246,447,463	$0	0.0%	$0	$0	$0
Lower Northeast	$10,314,498,850	$0	0.0%	$0	$0	$0
Lower Northwest	$13,615,067,162	$0	0.0%	$0	$0	$0
Lower South	$8,208,372,896	$2,027,014	<0.1%	$0	$36,931	$1,990,083
Lower Southwest	$6,840,537,150	$14,396,650	0.2%	$166,166	$14,223,843	$6,641
North	$13,054,275,189	$0	0.0%	$0	$0	$0
North Delaware	$13,552,083,648	$151,178	<0.1%	$0	$151,178	$0
River Wards	$14,267,301,089	$168,456	<0.1%	$0	$168,456	$0
South	$28,814,766,240	$45,892,767	0.2%	$0	$0	$45,892,767
University Southwest	$28,704,645,654	$0	0.0%	$0	$0	$0
Upper Far Northeast	$14,096,177,394	$0	0.0%	$0	$0	$0
Upper North	$15,554,930,862	$0	0.0%	$0	$0	$0
Upper Northwest	$16,619,291,505	$0	0.0%	$0	$0	$0
West	$10,774,317,065	$0	0.0%	$0	$0	$0
West Park	$7,494,241,193	$0	0.0%	$0	$0	$0
City of Philadelphia	**$351,463,126,733**	**$301,637,907**	**0.6%**	**$207,827,025**	**$37,116,271**	**$56,694,612**

Source: Hazus v6.1; City of Philadelphia 2022, 2024; RS Means 2024; NOAA 2019

Table 4-55. Critical Facilities in the 1 Percent Annual Chance Flood Hazard Area, by Lifeline Category

Planning District	Number of Critical Facilities in the 1 Percent Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Number	% of Total
Central	0	0	1	4	0	3	5	8	8	29	3.9%
Central Northeast	0	0	0	0	0	4	4	0	3	11	4.5%
Lower Far Northeast	0	0	0	0	0	1	13	1	1	16	9.2%
Lower North	1	0	0	0	0	0	0	0	2	3	0.6%
Lower Northeast	0	0	0	2	0	1	2	0	2	7	2.5%
Lower Northwest	0	0	0	1	2	6	10	1	7	27	12.0%
Lower South	0	1	0	8	0	0	5	37	2	53	20.3%
Lower Southwest	5	1	2	19	3	4	8	24	13	79	30.3%
North	0	0	0	0	0	0	2	0	1	3	0.5%
North Delaware	0	0	0	3	0	3	3	2	0	11	4.0%
River Wards	0	3	0	13	0	0	1	8	0	25	10.0%
South	0	0	1	3	0	0	1	0	0	5	1.2%
University Southwest	0	0	0	2	1	0	12	6	1	22	6.0%
Upper Far Northeast	0	0	0	0	0	0	9	0	0	9	4.4%
Upper North	0	0	0	0	0	1	2	0	0	3	0.6%
Upper Northwest	0	0	0	0	0	2	2	0	0	4	0.9%
West	0	0	0	0	0	0	0	0	0	0	0.0%
West Park	0	0	0	0	0	2	7	2	1	12	4.3%
City of Philadelphia	**6**	**5**	**4**	**55**	**6**	**27**	**86**	**89**	**41**	**319**	**4.9%**

Source: City of Philadelphia 2012, 2016, 2018, 2019, 2021, 2024; DEP 2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024; FEMA 2015, 2023

Table 4-56. Critical Facilities in the 0.2 Percent Annual Chance Flood Hazard Area, by Lifeline Category

Planning District	Number of Critical Facilities in the 0.2 Percent Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Number	% of Total
Central	1	1	1	13	1	6	7	8	20	58	7.8%
Central Northeast	0	0	0	0	0	4	5	0	3	12	5.0%
Lower Far Northeast	0	0	1	1	0	1	15	1	1	20	11.5%
Lower North	1	0	0	0	0	0	1	0	2	4	0.8%
Lower Northeast	0	0	0	2	0	1	2	0	7	12	4.2%
Lower Northwest	2	0	0	1	3	7	10	1	8	32	14.2%
Lower South	2	2	0	17	0	1	5	38	2	67	25.7%
Lower Southwest	5	2	4	23	3	6	12	26	19	100	38.3%
North	0	0	0	0	0	0	2	0	1	3	0.5%
North Delaware	0	0	0	6	0	7	3	2	0	18	6.5%
River Wards	0	5	0	20	1	2	1	14	7	50	19.9%
South	2	1	5	8	2	1	1	0	10	30	7.0%
University Southwest	0	0	0	3	1	0	13	8	1	26	7.0%
Upper Far Northeast	0	0	0	0	0	0	10	0	0	10	4.9%
Upper North	0	0	0	0	0	1	2	0	0	3	0.6%
Upper Northwest	0	0	0	0	0	2	2	0	1	5	1.2%
West	0	0	0	0	0	0	0	0	0	0	0.0%
West Park	0	0	0	0	0	2	7	2	2	13	4.7%
City of Philadelphia	**13**	**11**	**11**	**94**	**11**	**41**	**98**	**100**	**84**	**463**	**7.1%**

Source: City of Philadelphia 2012, 2016, 2018, 2019, 2021, 2024; DEP 2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024; FEMA 2015, 2023

Table 4-57. Critical Facilities within 3ft Sea Level Rise Hazard Area, by Lifeline Category

Planning District	Number of Critical Facilities within 3ft Sea Level Rise Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Number	% of Total
Central	0	0	0	0	0	0	2	2	2	6	0.8%
Central Northeast	0	0	0	0	0	0	0	0	0	0	0.0%
Lower Far Northeast	0	0	0	0	0	0	0	0	0	0	0.0%
Lower North	0	0	0	0	0	0	0	0	0	0	0.0%
Lower Northeast	0	0	0	0	0	0	1	0	0	1	0.4%
Lower Northwest	0	0	0	0	0	0	0	0	0	0	0.0%
Lower South	0	1	0	1	0	0	0	7	0	9	3.4%
Lower Southwest	0	1	0	3	2	1	2	4	3	16	6.1%
North	0	0	0	0	0	0	0	0	0	0	0.0%
North Delaware	0	0	0	1	0	0	1	2	0	4	1.4%
River Wards	0	0	0	3	0	0	0	8	0	11	4.4%
South	0	0	0	0	0	0	0	0	0	0	0.0%
University Southwest	0	0	0	0	0	0	1	0	0	1	0.3%
Upper Far Northeast	0	0	0	0	0	0	0	0	0	0	0.0%
Upper North	0	0	0	0	0	0	0	0	0	0	0.0%
Upper Northwest	0	0	0	0	0	0	0	0	0	0	0.0%
West	0	0	0	0	0	0	0	0	0	0	0.0%
West Park	0	0	0	0	0	0	1	0	0	1	0.4%
City of Philadelphia	**0**	**2**	**0**	**8**	**2**	**1**	**8**	**23**	**5**	**49**	**0.8%**

Source: City of Philadelphia 2012, 2016, 2018, 2019, 2021, 2024; DEP 2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024; NOAA 2019

Economy

Flood events can significantly impact the local and regional economy. This includes tax loss associated with general building stock damage, business interruption, and impacts on tourism. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. After the floodwaters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties.

Hazus estimates the amount of debris generated from the 1 and 0.2 percent annual chance events. The model breaks down debris into three categories based on the types of equipment needed to handle the debris: finishes (dry wall, insulation, etc.); structural (wood, brick, etc.); and foundations (concrete slab and block, rebar, etc.). This does not include non-structural debris or additional potential damage and debris possibly generated by wind that may be associated with a flood event or storm that causes flooding. Table 4-58 summarizes the debris Hazus estimates for the City. Hazus estimates 23,168 tons of debris will be generated in total for the 1-percent annual chance flood, and 36,092 tons of debris total for the 0.2-percent annual chance event.

Table 4-58. Estimated Debris Generated from the Annual Chance Flood Events in Tons

Planning District	1 Percent Annual Chance Flood Event Hazard Area				0.2 Percent Annual Chance Flood Event Hazard Area			
	Total	Finish	Structure	Foundation	Total	Finish	Structure	Foundation
Central	19,123	3,123	11,215	4,785	16,975	9,212	5,165	2,599
Central Northeast	0	0	0	0	0	0	0	0
Lower Far Northeast	113	84	20	9	165	109	39	18
Lower North	0	0	0	0	0	0	0	0
Lower Northeast	1,120	149	548	424	2,688	1,095	911	683
Lower Northwest	622	476	90	55	1,165	711	265	190
Lower South	15	15	0	0	44	44	0	0
Lower Southwest	1,854	1,849	3	2	11,158	6,545	2,718	1,896
North	24	12	7	5	85	62	13	10
North Delaware	23	12	7	5	63	32	18	13
River Wards	161	69	59	33	558	445	72	41
South	0	0	0	0	158	158	0	0
University Southwest	99	99	0	0	3,004	1,217	1,245	541
Upper Far Northeast	14	14	0	0	29	29	0	0
Upper North	0	0	0	0	0	0	0	0
Upper Northwest	0	0	0	0	0	0	0	0
West	0	0	0	0	0	0	0	0
West Park	0	0	0	0	0	0	0	0
City of Philadelphia	**23,168**	**5,902**	**11,949**	**5,318**	**36,092**	**19,659**	**10,446**	**5,991**

Source: Hazus v6.1; City of Philadelphia 2022, 2024; FEMA 2015, 2023

Natural, Historic and Cultural Resources

Natural

The environmental impacts of a flood can include significant water quality and debris-disposal issues. Floodwaters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to floodwaters. Hazardous materials may be released and distributed widely across the floodplain.

In addition, severe erosion from flooding can negatively impact local ecosystems. The erosion of riverbanks can cause additional flooding in locations that otherwise may not have experienced flooding conditions. The total land area in the floodplain, exclusive of waterbodies, is summarized in Table 4-59.

Table 4-59. Area in Philadelphia Exposed to 1 Percent and 0.2 Percent Annual Chance Flood

		Land Area (Excluding Water Bodies) in the Flood Hazard Area (acres)			
	Total Land Area	1% Annual Chance Flood		0.2% Annual Chance Flood	
Planning District	(Excluding Water Bodies) (acres)	Total Area (Acres)	% of Planning District Total	Total Area (Acres)	% of Planning District Total
Central	3,616	242	6.7%	417	11.5%
Central Northeast	5,139	347	6.8%	408	7.9%
Lower Far Northeast	6,991	279	4.0%	362	5.2%
Lower North	3,653	52	1.4%	60	1.7%
Lower Northeast	3,773	130	3.4%	203	5.4%
Lower Northwest	5,732	214	3.7%	277	4.8%
Lower South	4,347	1,594	36.7%	2,397	55.1%
Lower Southwest	5,608	2,267	40.4%	3,084	55.0%
North	5,474	41	0.7%	62	1.1%
North Delaware	5,317	305	5.7%	521	9.8%
River Wards	4,058	596	14.7%	1,180	29.1%
South	3,715	303	8.2%	703	18.9%
University Southwest	2,860	163	5.7%	230	8.0%
Upper Far Northeast	6,653	69	1.0%	119	1.8%
Upper North	5,096	33	0.6%	39	0.8%
Upper Northwest	6,498	85	1.3%	97	1.5%
West	2,984	21	0.7%	26	0.9%
West Park	4,189	161	3.9%	208	5.0%
City of Philadelphia	**85,705**	**6,902**	**8.1%**	**10,394**	**12.1%**

Source: City of Philadelphia 2024; FEMA 2015, 2023

Historic

Historic places and institutions are vulnerable to impacts from flooding. Historic buildings face structural damage during flood events. Historic structures often are not built to modern building code requirements, including design flood elevation and construction standards. Historic resources and structures were often built close to waterways, increasing their flood risk.

Cultural

Cultural institutions, parks and open spaces, community facilities, and religious institutions are all vulnerable to impacts from flooding. Venues such as museums face structural damage during flood events, with additional risk of damage to important cultural artifacts housed within them. Parks, recreation, and community space closures due to flood events can disrupt residents' lives and hinder access to community services. Parks and recreational areas are often located near waterways. Although these facilities often experience flooding, they are positioned with flooding in mind, as many parks are considered as open space to disallow development.

4.3.4.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Chapter 3 identifies areas targeted for future growth and development across the City. Any new development located in the SFHA could be impacted by riverine flooding. Development in areas outside of the SFHA can be impacted by urban flooding and by flooding events that are less frequent but more severe. Specific areas of recent and new development are indicated in tables and maps included in Volume II of this plan.

Projected Changes in Population

Any changes in the density of population can create issues for local residents during evacuation of a flood event. Historically, flooding and debris have severely impacted transportation corridors and infrastructure. As areas continue to be cleared for new development and runoff increases, the population in the City will remain exposed to this hazard.

Climate Change

Climate defines the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of events that exacerbate flooding. Warmer temperatures may lead to an increase in frequency of storms, thus leading to more weather events that can cause floods. Rising sea levels can increase the frequency of sunny-day flooding (high-tide flooding) and can exacerbate flooding impacts from storm surge.

Additional Data and Next Steps

To continue the reduction of flood risk within the City of Philadelphia, consider the following:

- Update the general building stock inventory to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
- Conduct a Hazus loss analysis for more frequent flood events (e.g., 10- and 50-year flood events).

- Conduct a repetitive loss area analysis.
- Continue to expand and update urban flood areas to further inform mitigation.
- Update the vulnerability analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version as more current FEMA floodplain data become available (i.e., DFIRMs).

4.3.5 Hurricane, Tropical Storm, Nor'easter

4.3.5.1 Hazard Profile

Hazard Description

Even though the City of Philadelphia has no coastlines, the City can still see impacts from coastal storms such as Hurricanes, Tropical Storms, Tropical Depressions, as well as Nor'easters. Tropical storm systems develop over warm ocean waters and are steered from winds aloft. As tropical storm systems weaken and deteriorate, they can (and frequently do) track across eastern Pennsylvania. Nor'easters are extra-tropical storms which typically develop from low-pressure centers off the Atlantic Coast between Georgia and New Jersey during the winter seasons, and these types of hazard events can bring impacts that range from flooding and severe weather to crippling winter precipitation (PEMA 2023). They are powerful storm systems that get their name from strong northeastern winds that blow in from the ocean as the storm develops. They are known for bringing heavy rain, snow, strong winds, and sometimes coastal flooding. They are notorious for disrupting travel and causing widespread damage, and while they can occur at any time of the year, Nor'easters are most common between late Fall and early Spring (NOAA/NWS State College, PA 2023).

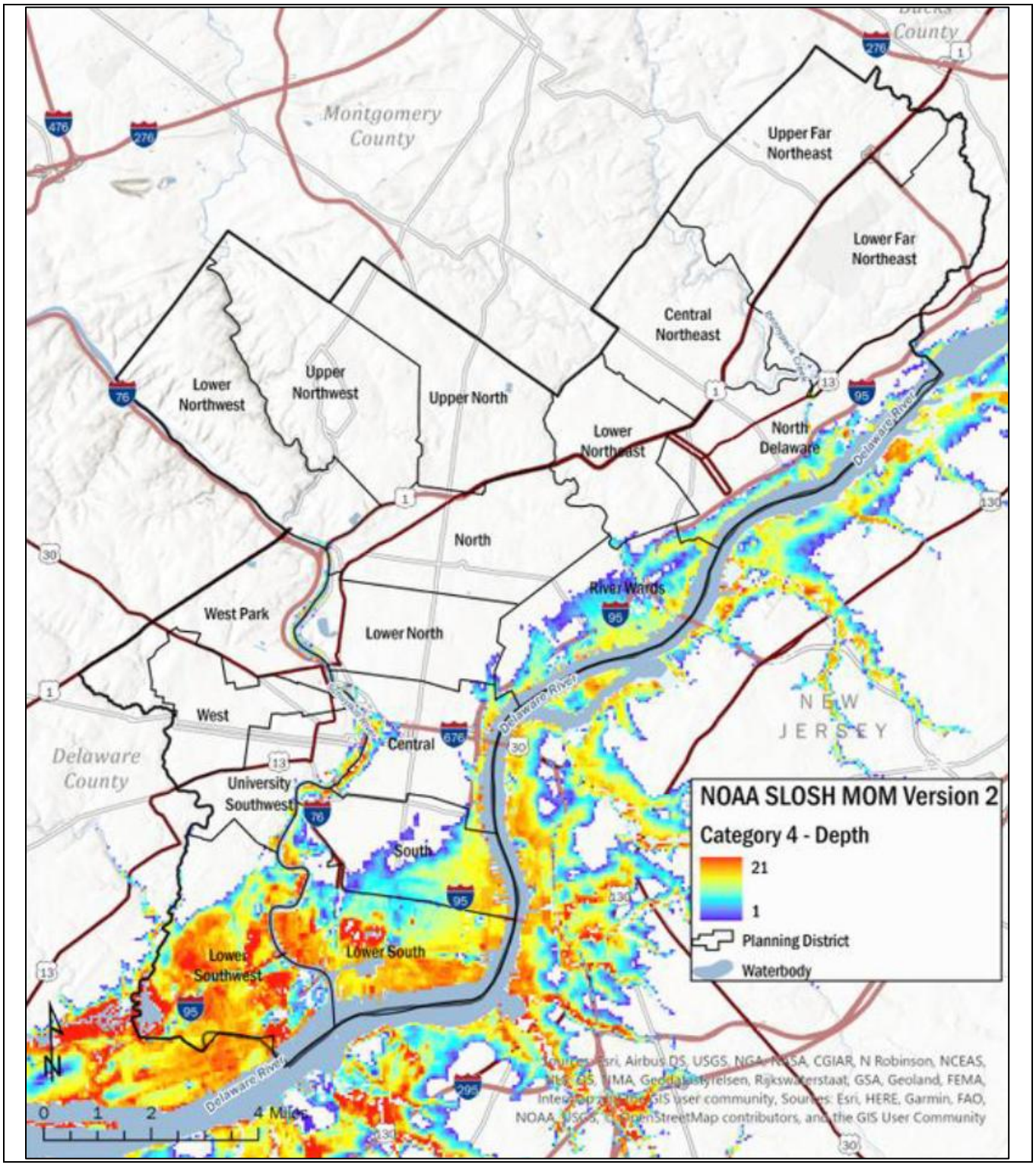
Location and Extent

While the City is located on the western bank of the Delaware River, the area is about 60 miles from the Atlantic coastline, and due to its proximity to the coast, Hurricanes, Tropical Storms, and Nor'easters can bring heavy rains, strong winds, and storm surge in some of the low-lying areas near the Delaware or Schuylkill rivers. Hurricane-force winds are generally confined closer to the Atlantic coastline, and most tropical systems that track across the planning area have winds that are Tropical Storm strength or less.

Cyclones such as Hurricanes, Tropical Storms, and Nor'easters are so expansive that they can impact an area that spans several hundred miles, and for this reason, all neighborhoods and sections of the City of Philadelphia are subject to these types of hazard events. Storm systems of this caliber frequently will generate storm surge, which is coastal flooding that results when strong winds push water onto land, exceeding the typical high tide levels (Philadelphia OEM 2022).

The threat from storm surge is unique to cyclones such as these, and the impacts they bring to the area can severely impact the built and natural environment near tidal waterways. Infrastructure systems and community lifelines can be threatened by storm surge. "Because storm surge only occurs along tidal waterways, it can be considered a localized impact. NOAA's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) Model provides guidance that can help understand the local variation in potential coastal flooding" (Philadelphia OEM 2022). Figure 4-20 shows the City's storm surge threat modeled during a Category 4 hurricane event, with flood depths ranging from one foot to 21 feet.

Figure 4-20. Storm Surge Inundation Potential near Philadelphia, PA



Source: Philadelphia OEM 2022

Mean Return Period

In evaluating the potential for hazard events of a given magnitude, a mean return period (MRP) is often used. The MRP provides an estimate of the frequency of an event that may occur within any given year based on past recorded events. Figure 4-21 and Figure 4-22 show the estimated maximum three-second gust wind speeds that can be anticipated in the study area associated with the 100- and 500-year MRP events. These peak wind speed projections were generated using FEMA's Hazus v6.1 wind model. The estimated hurricane track for the 100- and 500-year event is also shown. The maximum three-second gust wind speeds for the City for the 100-year MRP event is 74 to 95 mph (Category 1 hurricane), while the 500-year MRP event has the eastern portion of the City experiencing 74 to 95 mph winds and the astern half experiencing winds between 96 to 110 mph (Category 2 hurricane).

Range of Magnitude

Tropical Depressions are defined as a tropical cyclone with maximum sustained winds of 38 mph or less while a Tropical Storm is a tropical cyclone with maximum sustained winds ranging between 39 – 73 mph. NOAA utilizes the Saffir-Simpson Hurricane Wind Scale to differentiate between various tropical cyclones, and Table 4-60 provides the sustained wind thresholds along with types of damage common with each category.

Table 4-60. Saffir-Simpson Hurricane Wind Scale

Category	Wind Speeds	Types of Damage
1	74 – 95 mph	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days
2	96 – 110 mph	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks
3	111 – 129 mph	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes
4	130 – 156 mph	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months
5	157+ mph	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months

Source: NOAA National Hurricane Center 2012

Figure 4-21. Wind Speeds for the 100-Year Mean Return Period Event



Figure 4-22. Wind Speeds for the 500-Year Mean Return Period Event



Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City of Philadelphia was included in eight major disasters (DR) and four emergency (EM) declarations for Hurricane, Tropical Storm, Nor'easter-related events (FEMA 2024). Table 4-61 lists these declarations. It should be noted that Nor'easter events are not catalogued by the National Center for Environmental Information (NCEI) nor in FEMA disaster archives. Therefore, the list of declarations shown below omits these types of disasters. Because Nor'easter events typically involve heavy winter-season precipitation, these specific kinds of declarations are detailed in Chapter 14 of this plan.

Table 4-61. FEMA Declarations for Hurricane, Tropical Storm, Nor'easter Events in City of Philadelphia (1954 to 2024)

Event Date	Declaration Date	Declaration Number	Description
June 23, 1972	June 23, 1972	DR-340	Tropical Strom Agnes
February 5 – February 7, 1978	N/A	N/A	Blizzard of 1978
March 13 – 17, 1993	March 16, 1993	EM-3105	Storm of the Century
January 6 – 12, 1996	January 13, 1996	DR-1085	Blizzard of 1996 – over 30 inches of snow fell, making this Nor'easter one of Philadelphia's biggest snowstorms on record. Immense snowfall in the planning area caused significant disruptions citywide.
September 16 – 29, 1999	September 18, 1999	DR-1294	Hurricane Floyd Major Disaster Declaration
September 17 – October 1, 2004	September 19, 2004	DR-1557	Tropical Depression Ivan
September 8 – 9, 2004	September 19, 2004	DR-1555	Severe Storms and Flooding Associated with Tropical Depression Frances
August 29 – October 1, 2005	September 10, 2005	EM-3235	Hurricane Katrina
August 26 – September 14, 2011	August 29, 2011	EM-3339	Hurricane Irene
August 26 – 30, 2011	September 3, 2011	DR-4025	Hurricane Irene
September 3 – October 15, 2011	September 8, 2011	EM-3340	Remnants of Tropical Storm Lee
September 3 – October 15, 2011	September 12, 2011	DR-4030	Tropical Storm Lee
October 26 – November 8, 2012	October 29, 2012	EM-3356	Hurricane Sandy
October 26 – November 8, 2012	January 10, 2013	DR-4099	Hurricane Sandy
August 31 – September 5, 2021	September 10, 2021	DR-4618	Remnants of Hurricane Ida

Source: FEMA 2024

Note: While FEMA does not designate "Nor'easters" as an "Incident Type", several winter storm disasters were declared for the City of Philadelphia. Those disaster decalarations can be found in the "Winter Storm" hazard profile in Chapter 14.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2012 and 2024, City of Philadelphia was included in one USDA Hurricane, Tropical Storm, Nor'easter-related agricultural disaster declarations, as shown in Table 4-62 (USDA 2024).

Table 4-62. USDA Declarations for Hurricane, Tropical Storm, Nor'easter Events in City of Philadelphia (2012 to 2024)

Event Date	USDA Declaration Number	Description
June 28 – November 8, 2012	S3487	The combined effects of drought, high winds (Derecho), hail, excessive heat, excessive rain, flash flooding, Hurricane Sandy, snowstorm, and Nor'easter

Source: USDA 2024

Previous Events

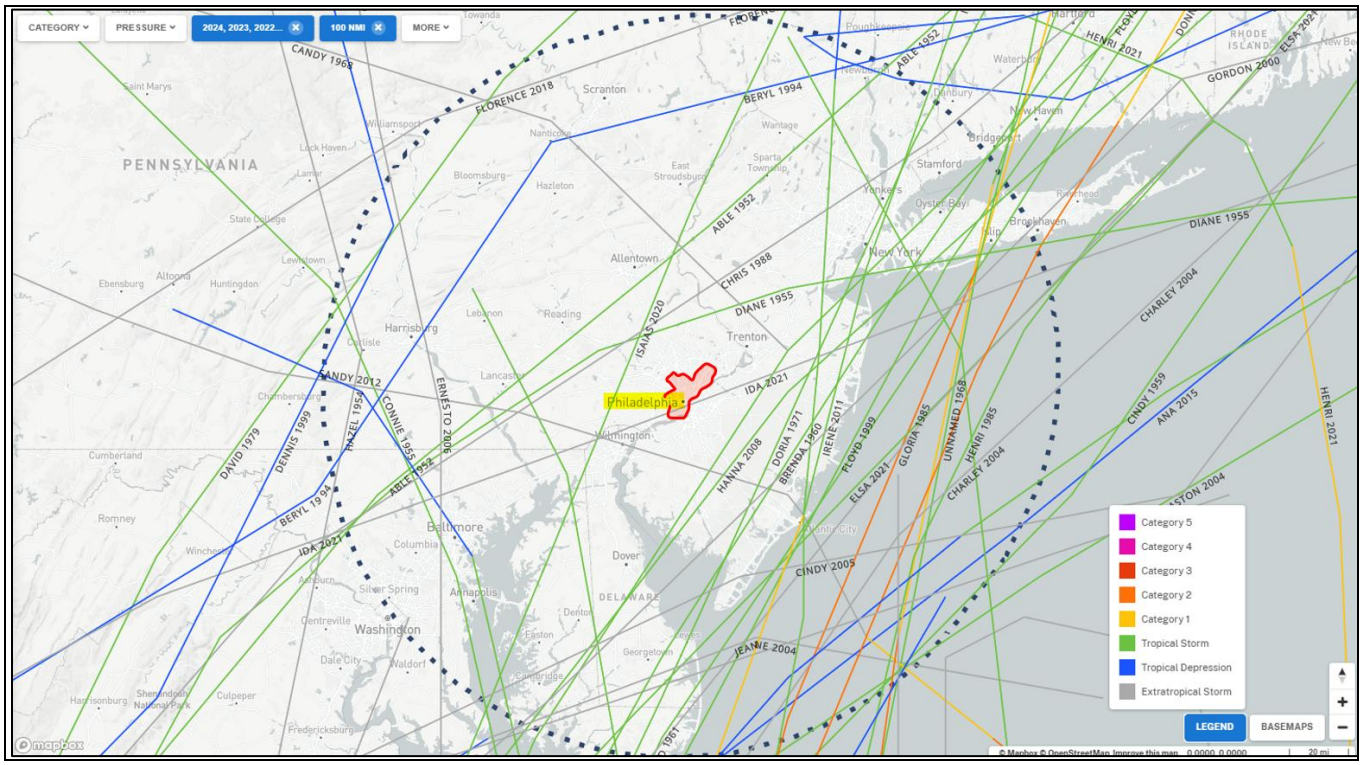
Known hurricane, tropical storm, and nor'easter events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-63. For events prior to 2021, refer to the 2022 City of Philadelphia HMP. In addition to these reports, NOAA's National Hurricane Center archives show a total of 45 storms which have tracked within 100 nautical miles of the City, and these are shown in Figure 4-23.

Table 4-63. Hurricane, Tropical Storm, and Nor'easter Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
January 31 – February 3, 2021	Citywide	The Groundhog Day Nor'easter of 2021 was a powerful Nor'easter that impacted the Northeastern U.S. and Eastern Canada. Large metropolitan areas such as New York City saw as much as 46-61 centimeters of snow accumulations from January 31 to February 2.
July 8 – 9, 2021	Citywide	Tropical Storm Elsa brought a soaking rain to portions of the area, but thanks to its offshore track and increasing speed, there were few to no issues with flooding. In addition, wind impacts were limited.
September 1 – 3, 2021	Citywide	The City saw historic flooding on the Schuylkill River along with other waterways from the Remnants of Hurricane Ida. Mud and other sediment debris impact business and homes across the City. Flood prone areas, such as Manayunk, were particularly impacted. Significant tree and utility damages occurred, resulting in reported power outages. Federal disaster declaration issued (DR-4618)
April 18 – 20, 2022	Citywide	Beginning early on April 18, a nor'easter began developing off the Southeastern United States, bringing heavy rain, wind, heavy snow, and coastal flooding to much of the Mid-Atlantic states. Philadelphia primarily experienced high winds between 20 to 30 mph with 45 to 50 mph gusts and periods of heavy rain.

Source: NOAA/NCEI 2024; IEM 2024; FEMA 2024
Note: NCEI data is valid between January 1, 1950 and August 1, 2024. NWS Storm Report data is valid between January 1, 2003 and November 30, 2024. FEMA disaster information valid between January 1, 1950 and November 30, 2024.

Figure 4-23. Historical Cyclones that Tracked with 100 miles of Philadelphia, PA (1950-2024)



Source: NOAA National Hurricane Center 2024

Probability of Future Occurrences

Information on previous Hurricane, Tropical Storm, Nor'easter occurrences in the City were used to calculate the probability of future occurrence of such events, as summarized in Table 4-64. Based on historical records and input from the Steering Committee, the probability of occurrence for Hurricane, Tropical Storm, Nor'easter events in the City are considered "likely."

Future occurrences of Hurricane, Tropical Storm, Nor'easter may impact all neighborhoods and sections of the City. The heavy rains, strong winds, and storm surge from this hazard can cause flooding in the low-lying areas near the Delaware or Schuylkill rivers, resulting in potential damages to public and private property as well as the natural environment.

Table 4-64. Probability of Future Hurricane, Tropical Storm, Nor'easter Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1950 and 2024	Percent Chance of Occurring in Any Given Year
Hurricane, Tropical Storm, Nor'easter	26	34.7%

Source: NOAA/NCEI 2024; NOAA National Hurricane Center 2024; IEM 2024; FEMA 2024

Climate Change Projections

Climate change is projected to influence the behavior of Hurricanes, Tropical Storms, and Nor'easters in several ways. As global temperatures continue to increase, the atmosphere will be capable of sustaining greater amounts

of moisture which, in turn, means increased precipitation during these types of hazard events. Warmer temperatures will also mean Nor'easters will likely occur with more rain and less snow. Coastal effects are also expected to change as a result of climate change. Rising sea levels will amplify the effects of storm surges, which can lead to more frequent and severe coastal flooding in the Philadelphia region – particularly along the Delaware River. Future conditions also are expected to bring more intense and longer storm seasons.

Cascading Impacts on Other Hazards

Hurricanes can interact with the following hazards of concern identified for this HMP:

- **Flood**—Hurricane rainfall can contribute to severe flooding
- **Geological Hazards—**Hurricane rainfall can lead to unstable ground, causing landslides. The oversaturation of the ground can also increase the likelihood of sinkhole events, depending on the soil composition.
- **Health—**Impacts of flooding associated with hurricanes may include exposure to pathogens such as mold. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials.

Secondary hazards of nor'easters may include flooding, extreme wind, erosion, infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation issues.

Nor'easters may exacerbate flooding issues in the City. Maintaining snow and ice removal could minimize the potential risk of flooding during a warming period. Nor'easters often coincide with cold temperatures and generate strong winds that result in very low wind chills. Nor'easters could also result in trees and tree branches falling due to ice, snow, and strong winds. Fallen trees and branches increase available fuel for wildfires. Ice and snow accumulation can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems.

4.3.5.2 Vulnerability and Impact Assessment

A Hazus probabilistic analysis was performed to analyze the wind hazard losses for the City of Philadelphia for the 100- and 500-year mean return period events. The probabilistic Hazus hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with the City of Philadelphia. Hazus contains data on historical hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Although damages are estimated at the census tract level, results were presented at the City planning district level. Because there are multiple census tracts that contain more than one planning district, a density analysis was used to extract the percentage of building structures that fall within each tract and planning district. The percentage was multiplied against the results calculated for each tract and summed for each planning district. The following text evaluates and estimates the potential impact of the hurricane, tropical storm, and nor'easter hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

The entire population of the City could be exposed to impacts associated with the hurricane, tropical storm, and nor'easter hazard. The impact from this hazard on life, health, and safety is dependent upon the severity of the event and whether adequate warning time is provided to residents. Some residents may be displaced or require temporary to long-term sheltering. Outdoor workers are also vulnerable to these events. Employers should prepare for the hazards associated with adverse weather conditions that may require special facilities and safety equipment being provided to employees, or in some instances, work stoppage to ensure the safety and health of workers. Rain, ice, snow, and high wind conditions can pose a greater threat to employees working in the construction and shipbuilding industries. In addition, downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. (Hazwoper 2020).

Overall Population

As shown in Table 4-65, the 100-year MRP event may result in nine displaced households and five persons seeking temporary shelter. The 500-year MRP event may result in 1,472 displaced households and 1,003 persons seeking temporary shelter.

Table 4-65. Displaced Households and Persons Seeking Shelter Caused by the 100- and 500-Year MRP Hurricane Event

Planning District	100-Year Mean Return Period Hurricane		500-Year Mean Return Period Hurricane	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Central	1	0	171	54
Central Northeast	0	0	104	85
Lower Far Northeast	0	0	157	87
Lower North	0	0	79	67
Lower Northeast	0	0	104	111
Lower Northwest	0	0	27	11
Lower South	1	0	5	2
Lower Southwest	2	1	15	11
North	0	0	89	105
North Delaware	0	0	155	122
River Wards	0	0	76	51
South	3	2	119	67
University Southwest	0	0	40	28
Upper Far Northeast	0	0	119	70
Upper North	0	0	98	64
Upper Northwest	0	0	50	27
West	2	2	46	31
West Park	0	0	18	10
City of Philadelphia	**9**	**5**	**1,472**	**1,003**

Source: Hazus v6.1; U.S. Census Bureau ACS 2022

Note: Population results are rounded down

Socially Vulnerable Population

Socially vulnerable populations are most susceptible to the hurricane, tropical storm, and nor'easter hazard, based on factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Economically disadvantaged populations are more vulnerable because they are likely to lack funds to evacuate. The population over the age of 65 is also more vulnerable and might physically have more difficulty evacuating. The older population generally requires extra time or outside assistance during evacuations and is more likely to need medical attention that might not be available due to isolation during a hurricane event. Individuals reliant on medical equipment haze a high vulnerability due to potential power outages which can result from wind, snow, or flooding.

General Building Stock

Building construction plays a major role in the extent of damage resulting from a hurricane event. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. High-rise buildings are also very vulnerable structures. Mobile homes are the most vulnerable to damage, even if tied down, and offer little protection to people inside.

The Hazus wind model was run to estimate potential losses to buildings. Damage to buildings is a direct result of wind speed, direction, and duration, which is dependent upon the storm's intensity and track. Expected building damage was evaluated across the wind damage categories described in Table 4-66. Building damage as a result of the 100-year and 500-year MRP hurricane wind events was estimated using Hazus, as summarized in Table 4-67. The analysis found that 10 buildings will be completely destroyed by the 100-year MRP event, 22 will be severely damaged, 571 will be moderately damaged, and 12,131 will have minor damage. For the 500-year MRP event, the analysis estimates that 782 buildings will be completely destroyed, 474 will experience severe damage, 10,019 will be moderately damaged, and 73,494 will have minor damage. The majority of the losses are estimated to the residential occupancy class for both MRP events.

Table 4-66. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof cover, with no or very limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
Moderate Damage **Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.**	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage **Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.**	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction **Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.**	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: FEMA 2022

Table 4-67. Expected Damages from 100 and 500-Year MRP Events

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	100-year		500-year	
			Building Count	Percent Buildings in Occupancy Class	Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	471,179	None	459,243	97.5%	390,444	82.9%
		Minor	11,486	2.4%	70,776	15.0%
		Moderate	425	0.1%	8,862	1.9%
		Severe	15	<0.1%	315	0.1%
		Complete Destruction	10	<0.1%	782	0.2%
Commercial Buildings	25,830	None	25,202	97.6%	22,748	88.1%
		Minor	519	2.0%	2,152	8.3%
		Moderate	105	0.4%	852	3.3%
		Severe	4	<0.1%	78	0.3%
		Complete Destruction	0	0.0%	0	0.0%
Industrial Buildings	4,089	None	3,953	96.7%	3,348	81.9%
		Minor	94	2.3%	388	9.5%
		Moderate	39	1.0%	274	6.7%
		Severe	3	0.1%	79	1.9%
		Complete Destruction	0	0.0%	0	0.0%
Other[a]	2,716	None	2,682	98.7%	2,506	92.2%
		Minor	32	1.2%	178	6.6%
		Moderate	2	0.1%	31	1.1%
		Severe	0	0.0%	2	0.1%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	100-year		500-year	
			Building Count	Percent Buildings in Occupancy Class	Building Count	Percent Buildings in Occupancy Class
		Complete Destruction	0	0.0%	0	0.0%

Source: Hazus v6.1; City of Philadelphia 2022, 2024

Table 4-68 summarizes the damage estimated for the 100-year MRP event. The total estimated damage to buildings for all occupancy types across the City of Philadelphia is $471 million; most of these losses are to residential buildings. The damage counts include buildings damaged at all severity levels from minor damage to destruction. Total dollar damage reflects the overall impact on buildings at an aggregate level. The Central Planning District is estimated to experience the greatest damage with $121 million in losses.

Table 4-69 summarizes the damage estimated for the 500-year MRP event. The total estimated damage to buildings for all occupancy types across the City of Philadelphia is $2.3 billion; most of these losses are to residential buildings. The damage counts include buildings damaged at all severity levels from minor damage to destruction. Total dollar damage reflects the overall impact on buildings at an aggregate level. The Central Planning District is estimated to experience the greatest damage with $495 million in losses.

Table 4-68. Estimated Building Damage by General Occupancy for the 100-Year Event

Planning District	Estimated Building Losses				
	Residential	Commercial	Industrial	Other Occupancies	All Occupancies
Central	$85,064,304	$33,117,234	$1,136,576	$1,890,267	$121,208,380
Central Northeast	$14,005,031	$881,222	$10,953	$71,348	$14,968,555
Lower Far Northeast	$12,545,095	$610,167	$319,801	$165,207	$13,640,270
Lower North	$19,055,133	$1,810,748	$337,437	$351,311	$21,554,629
Lower Northeast	$13,320,135	$666,135	$163,800	$102,761	$14,252,832
Lower Northwest	$18,556,132	$944,023	$109,716	$93,651	$19,703,522
Lower South	$3,397,682	$4,872,492	$1,035,612	$35,611	$9,341,397
Lower Southwest	$8,166,343	$2,458,808	$496,800	$398,621	$11,520,574
North	$14,285,604	$1,777,881	$480,234	$229,887	$16,773,605
North Delaware	$16,753,554	$650,000	$268,641	$95,553	$17,767,748
River Wards	$20,219,797	$982,973	$541,158	$111,360	$21,855,289
South	$57,140,268	$5,530,653	$792,857	$716,031	$64,179,809
University Southwest	$18,569,124	$11,722,138	$189,136	$1,498,843	$31,979,241
Upper Far Northeast	$12,727,889	$383,588	$148,739	$125,370	$13,385,585
Upper North	$22,361,978	$688,011	$50,363	$160,862	$23,261,214
Upper Northwest	$22,548,173	$689,903	$33,269	$170,561	$23,441,907
West	$19,809,801	$1,860,590	$55,492	$484,518	$22,210,401
West Park	$8,873,681	$1,042,354	$34,437	$240,216	$10,190,687
City of Philadelphia	**$387,399,725**	**$70,688,922**	**$6,205,020**	**$6,941,978**	**$471,235,645**

Source: Hazus v6.1; City of Philadelphia 2022, 2024; RS Means 2024

Table 4-69. Estimated Building Damage by General Occupancy for the 500-Year MRP Event

Planning District	Estimated Building Losses				
	Residential	Commercial	Industrial	Other Occupancies	All Occupancies
Central	$334,782,929	$137,743,186	$7,514,546	$15,657,187	$495,697,849
Central Northeast	$107,707,649	$12,534,756	$201,693	$2,109,504	$122,553,602
Lower Far Northeast	$171,689,416	$17,900,152	$14,478,569	$7,899,555	$211,967,693
Lower North	$80,180,502	$15,118,179	$2,816,228	$5,369,539	$103,484,449
Lower Northeast	$88,307,773	$10,189,952	$2,879,875	$3,535,954	$104,913,554
Lower Northwest	$55,081,676	$5,770,720	$643,565	$1,029,028	$62,524,989
Lower South	$10,372,254	$17,868,415	$4,872,577	$464,605	$33,577,850
Lower Southwest	$17,862,491	$6,295,244	$1,587,334	$2,275,027	$28,020,096
North	$70,097,622	$18,977,724	$6,257,255	$5,425,987	$100,758,587
North Delaware	$154,842,002	$12,498,609	$6,904,794	$4,055,211	$178,300,617
River Wards	$112,106,490	$12,923,334	$7,511,984	$2,606,142	$135,147,951
South	$199,127,097	$21,965,853	$4,296,775	$3,716,227	$229,105,951
University Southwest	$53,424,633	$39,432,553	$678,019	$10,124,351	$103,659,555
Upper Far Northeast	$143,960,919	$11,678,809	$6,762,010	$5,492,915	$167,894,653
Upper North	$103,042,403	$8,061,543	$681,661	$3,249,600	$115,035,206
Upper Northwest	$80,070,792	$6,778,268	$326,879	$2,202,851	$89,378,790
West	$47,952,723	$5,376,261	$247,570	$2,054,140	$55,630,694
West Park	$22,747,653	$4,100,274	$168,119	$1,020,713	$28,036,759
City of Philadelphia	**$1,853,357,024**	**$365,213,831**	**$68,829,453**	**$78,288,536**	**$2,365,688,844**

Source: Hazus v6.1; City of Philadelphia 2022, 2024; RS Means 2024

Community Lifelines and Other Critical Facilities

Utility infrastructure could suffer damage from hurricane high winds associated with falling tree limbs or other debris, resulting in the loss of power. Loss of service can impact residents and business operations alike. Interruptions in heating or cooling utilities can affect populations such as the young and older adults, who are particularly vulnerable to temperature-related health impacts. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water due to pump failure until power is restored. Lack of power to emergency facilities, including police, fire, EMS, and hospitals, will inhibit a community's ability to effectively respond to an event and maintain the safety of its citizens.

Table 4-70 and Table 4-71 summarize the damage state probabilities for critical facilities during the 100-year and 500-year MRP events, respectively. There are no days predicted for loss of function of any lifeline during the 100-year MRP event. During the 500-year MRP event, there are an estimated 34 loss of days for the Safety and Security lifeline.

Table 4-70. Estimated Impacts on Critical Facilities for the 100-Year MRP Hurricane Event

Lifeline Category	Loss of Days	Average Percent Probability of Sustaining Damage 100-Year Mean Return Period Hurricane			
		Minor	Moderate	Severe	Complete
Communications	0	2.1%	0.3%	<0.1%	0.0%
Energy	0	3.1%	0.9%	<0.1%	0.0%
Food, Hydration, Shelter	0	1.9%	0.4%	<0.1%	0.0%
Hazardous Materials	0	2.6%	1.0%	0.1%	<0.1%
Health and Medical	0	0.9%	<0.1%	0.0%	0.0%
Safety and Security	0	1.5%	0.1%	0.0%	0.0%
Transportation	0	0.9%	0.1%	<0.1%	0.0%
Water Systems	0	2.5%	0.7%	0.1%	0.0%

Source: Hazus v6.1; City of Philadelphia 2012, 2016, 2018, 2019, 2021, 2024; DEP 2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024

Table 4-71. Estimated Impacts on Critical Facilities for the 500-Year MRP Hurricane Event

Lifeline Category	Loss of Days	Average Percent Probability of Sustaining Damage 500-Year Mean Return Period Hurricane			
		Minor	Moderate	Severe	Complete
Communications	0	9.1%	3.0%	0.2%	0.0%
Energy	0	10.4%	5.5%	0.8%	0.0%
Food, Hydration, Shelter	0	8.4%	3.4%	0.3%	0.0%
Hazardous Materials	0	9.7%	6.7%	2.7%	<0.1%
Health and Medical	0	5.8%	1.8%	<0.1%	0.0%
Safety and Security	34	7.4%	3.7%	<0.1%	0.0%
Transportation	0	5.6%	0.7%	0.1%	0.0%
Water Systems	0	8.3%	3.4%	0.7%	0.0%

Source: Hazus v6.1; City of Philadelphia 2012, 2016, 2018, 2019, 2021, 2024; DEP 2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024

As a result of a 100-year MRP event, Hazus estimates that the Energy lifeline has the greatest chance of sustaining minor damage (3.1 percent probability), followed by the Hazardous Materials lifeline (2.6 percent probability). The Energy lifeline also has the greatest chance of moderate damage, at an approximate 0.9 percent probability. Severe and Complete damage to lifelines is negligible.

As a result of a 500-year MRP event, Hazus estimates that the Energy lifeline has the greatest chance of sustaining minor damage (10.4 percent) and the Hazardous Materials lifeline has the highest chance of sustaining moderate (6.7 percent) and severe damages (2.7 percent). Complete damage is negligible, with potential only for Hazardous Materials lifelines (<0.1 percent).

Economy

Damage to structures from hurricane flooding and wind can have long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Economic impacts include loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings.

Long-term impacts on transportation lifelines affect day-to-day commuting and goods transport. Utility infrastructure (power lines, gas lines, electrical systems) damage can result in the loss of power, which can impact business operations.

Debris management can be costly and impact the local economy. Hazus estimates the amount of debris that might be produced as result of the 100- and 500-year MRP wind events. Table 4-72 summarizes the estimated debris by Planning District. Because the estimated debris production does not include debris generated by flooding, this is likely a conservative estimate. For both MRP events, debris production from brick and wood is the greatest, with the 100-year MRP creating an estimated 42,918 tons of debris, and the 500-year MRP event creating 236,155 tons.

Table 4-72. Debris Production for 100- and 500-Year Mean Return Period Event Winds

	Brick and Wood (tons)		Concrete and Steel (tons)		Tree (tons)		Eligible Tree Volume (cubic yards)	
Planning District	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Central	8,645	35,131	0	15	0	0	0	0
Central Northeast	1,110	11,683	0	22	0	0	0	0
Lower Far Northeast	1,050	17,966	0	62	0	0	0	0
Lower North	2,998	14,667	0	0	0	0	0	0
Lower Northeast	1,527	13,514	0	84	0	0	0	0
Lower Northwest	1,508	5,791	0	0	0	0	0	0
Lower South	675	2,275	0	0	0	0	0	0
Lower Southwest	1,494	3,587	0	0	0	0	0	0
North	2,870	17,902	0	59	0	0	0	0
North Delaware	1,445	17,675	0	84	0	0	0	0
River Wards	1,785	12,830	0	92	0	0	0	0
South	4,441	18,418	0	26	0	0	0	0
University Southwest	3,662	11,197	0	0	0	0	0	0
Upper Far Northeast	1,025	15,122	0	44	0	0	0	0
Upper North	2,300	15,151	0	36	0	0	0	0
Upper Northwest	2,077	10,423	0	0	0	0	0	0
West	3,063	9,014	0	0	0	0	0	0
West Park	1,243	3,810	0	0	0	0	0	0
City of Philadelphia	**42,918**	**236,155**	**0**	**524**	**0**	**0**	**0**	**0**

Source: Hazus v6.1; City of Philadelphia 2022, 2024

Natural, Historic and Cultural Resources

Natural

The impacts of hurricane, tropical storm, and nor'easter related winds on the environment typically take place over a larger area. Widespread, severe damage to tree and plant species is likely. This includes uprooting or destruction of trees and an increased threat of wildfire in areas where dead trees are not removed. Hurricanes can also destroy terrestrial species' habitats and the aquatic species that relied on a waterbody, such as the Delaware and Schuylkill Rivers, for a habitat.

Historic

Winds associated with hurricane, tropical storm, and nor'easter events can cause damage or destruction to the City's historical infrastructure. Many historical buildings may not be built to withstand high winds. Historic buildings also face structural damage during flood events caused by the rains from a hurricane. The weight of the snow associated with winter nor'easters also could strain the structural integrity of historical infrastructure. Historic resources and structures were often built close to waterways, increasing their flood risk. Storm-induced flooding could bring devastating loss of life and property to the area in and around historical landmarks.

Cultural

Winds associated with hurricane, tropical storm, and nor'easter events can cause damage or destruction to the City's cultural resources. Cultural resources may be located inside historical buildings, which may not be built to withstand high winds. Outdoor events are likely to be postponed or cancelled as the result of storm conditions. The weight of the snow associated with winter nor'easters also could strain the structural integrity of cultural infrastructure.

4.3.5.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

As discussed in Chapter 3, areas targeted for future growth have been identified across the City. It is anticipated that any new development will be exposed to the hurricane hazard. However, due to increased standards and codes, new development might be less vulnerable to wind and flood-related hazards compared to the aging building stock.

Projected Changes in Population

The City of Philadelphia has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the City's population increased by approximately 5.06 percent between 2010 and 2020 (Census 2020). Estimated population projections provided by the Center of Rural Pennsylvania indicates that the City's population will continue to increase into 2040, increasing total population to approximately 1,772,833 persons; this is approximately a 10.53 percent increase from the City's 2020 population of 1,603,797 (Center for Rural Pennsylvania 2020). The Pennsylvania Department of Environmental Protection estimates the population of the entire City to be 1,541,630 by the year 2040; a 3.87 percent decrease from the City's 2020 population of 1,603,797 (DEP 2012). Changes in the density of population can impact the number of persons exposed to the hurricane hazard. Persons

that move into older buildings may increase their overall vulnerability. Those moving into newer construction may decrease their vulnerability.

Climate Change

Since the 1970s, there has been a global increase in tropical cyclone intensity and duration, correlated with increased sea surface temperature. This suggests that future increases of tropical sea surface temperature might lead to future increases in tropical cyclone intensity and duration. However, there is a high level of uncertainty regarding the relationship between climate change and storm events (Emanuel, Kerry 2005). Future improvements in modeling smaller scale climatic processes can be expected and will lead to improved understanding of how the changing climate will alter temperature, precipitation, and storm events. It remains to be seen if factors such as steering currents (the winds directing or pushing the storm), atmospheric shear (change in direction and speed of winds at increasing heights), and the presence of Saharan dust (the dust suppresses cloud formation by inhibiting convection) will increase or decrease the risk of hurricanes.

The effect of climate change on the risk associated with nor'easters remains in need of further study. Previous studies have found average annual snowfall in the eastern United States may decline, but also that extreme winter precipitation events may increase (National Oceanic and Atmospheric Administration 2018). While predicting changes to the intensity of nor'easter events and their effects under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment.

Additional Data and Next Steps

To enhance the assessment to the hurricane, tropical storm, and nor'easter hazard in future HMP updates, the general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates. Additionally, the integration of evacuation route data can provide insight into the risks evacuees may encounter, including potential road closures due to flooded roads or the potential for downed trees and utility lines.

4.3.6 Tornado, Windstorm

4.3.6.1 Hazard Profile

Hazard Description

Damaging winds from thunderstorms are much more common than damage from tornadoes. This section provides a profile and vulnerability assessment of the tornado and windstorm hazard. The wind hazard includes various types of wind events, including tornadoes, thunderstorm winds, as well as non-thunderstorm winds. Other types of windstorms are nor'easters, tropical storms, and hurricanes. Chapter 10 profiles each of these types, while this chapter centers around tornadoes and other types of thunderstorm and non-thunderstorm wind events.

Tornadoes

A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 250 miles per hour (mph). Damage paths can be greater than 1 mile wide and 50 miles long (NOAA/NWS 2015). Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. They can move at speeds between 30 and 125 mph and can generate combined wind speeds (forward motion and speed of the whirling winds) exceeding 300 mph. The ground time of a tornado can last up to several hours; however, the general ground time is between 5 to 10 minutes (NOAA/NWS 2015). Tornadoes can occur at any time of the year, with peak seasons at different times for different states (NSSL 2013). According to the National Weather Service, tornadoes in Pennsylvania are most frequent between May and July (NWS, Months of Peak Tornado Occurance n.d.).

Aside from thunderstorm winds and tornado events, the City of Philadelphia can see impacts from other types of weather phenomena, such as Nor'easters, Tropical Storms, and Hurricanes. Each of these hazards are profiled in Chapter 10 of this plan.

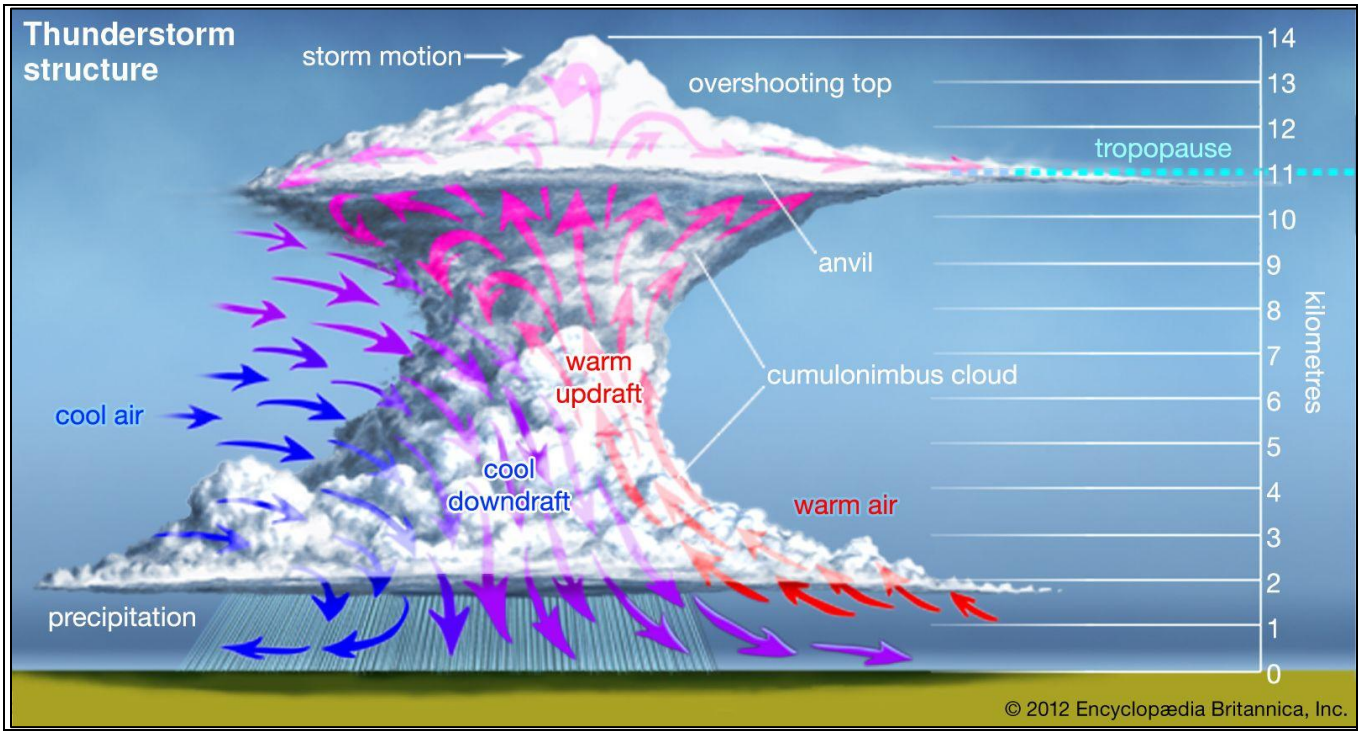
Thunderstorm Winds / Downbursts / Straight-Line Winds

Philadelphia frequently experiences thunderstorms, particularly during the warmer months. These storms can produce Straight-Line Winds and Microbursts that cause localized damage, such as downed trees and power lines. Damaging winds arise when sinking air (known as downdrafts) suddenly collapses to the ground from the center of the storm, sometimes sinking as fast as 20 miles per hour (NOAA/NWS Northern Indiana 2015). Shown in Figure 4-24, downdraft winds collide with the ground, spreading out in all directions and often under the shroud of a roll cloud. Sometimes referred to as a "microburst," these scenarios lead to widespread wind damage as downdraft winds become horizontal as they race laterally away from the storm.

Non-Thunderstorm Winds / Post-Frontal Winds

Windstorms can also refer to the broad-scale wind events that occur after the passage of a cold front or whenever pressure gradient winds are strong enough to produce damaging winds. Sustained winds can become strong enough to generate minor damage to the built and natural environments.

Figure 4-24 Thunderstorm Structure and Features

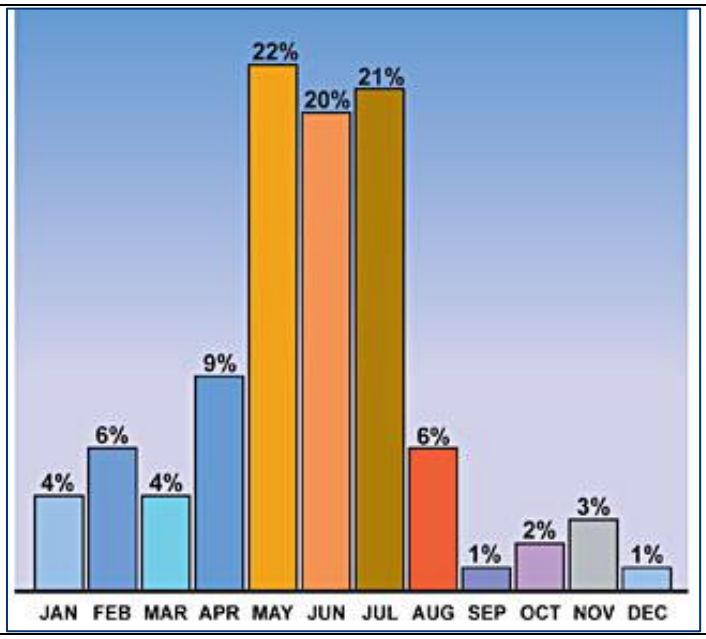


Source: Britannica 2018

Derechos

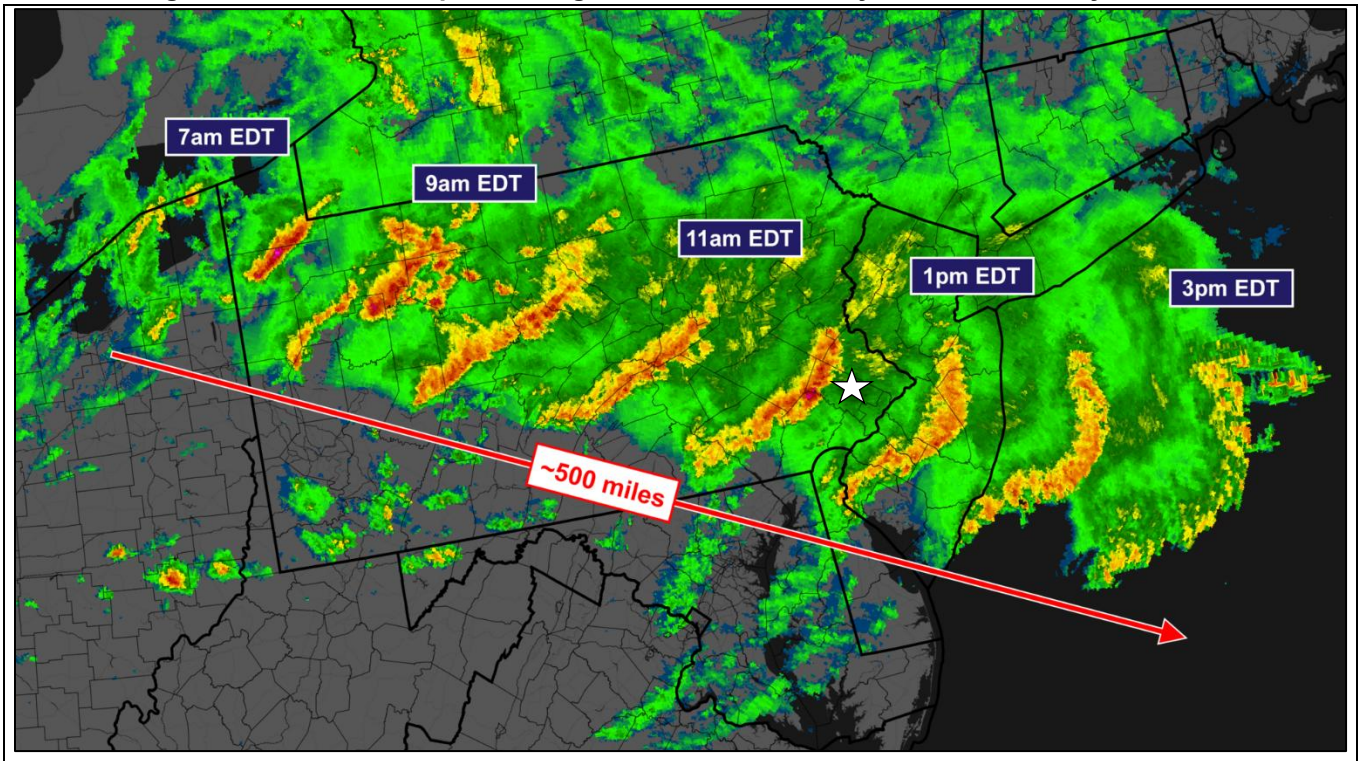
While less common, Philadelphia can be affected by derechos, which are long-lived, widespread windstorms associated with fast-moving lines of severe thunderstorms. Derechos can produce winds of 60 to 100 mph or higher, causing extensive damage over large areas, including Philadelphia and its suburbs. According to the National Weather Service, derechos are associated with a band of rapidly moving showers or thunderstorms. Although a derecho can produce destruction similar to the strength of tornadoes, the damage is typically directed in one direction along a relatively straight swath. By definition, if the wind damage swath extends more than 240 miles and includes wind gusts of 75 miles per hour (mph) or greater at several points along the damage path. along most of its length, the event may be classified as a derecho. Frequently observed in the warm season, as indicated in Figure 4-25, progressive derechos can span great distances and pose forecasting challenges to officials. The derecho shown in Figure 4-26 was the June 2020 Pennsylvania-New Jersey derecho event as seen by radar.

Figure 4-25. Annual Frequency of Derechos in the U.S.



Source: NOAA Storm Prediction Center 2024

Figure 4-26. Radar Composite Image of June 2020 Pennsylvania-New Jersey Derecho



Note: The approximate location of the City of Philadelphia is indicated by a white star.

Source: SERCC 2023

Location and Extent

The location of the tornado and windstorm hazard events is uniform across the entire City of Philadelphia. Figure 4-27 displays derecho climatology across the United States, indicating the City has a risk of experiencing one derecho every two years.

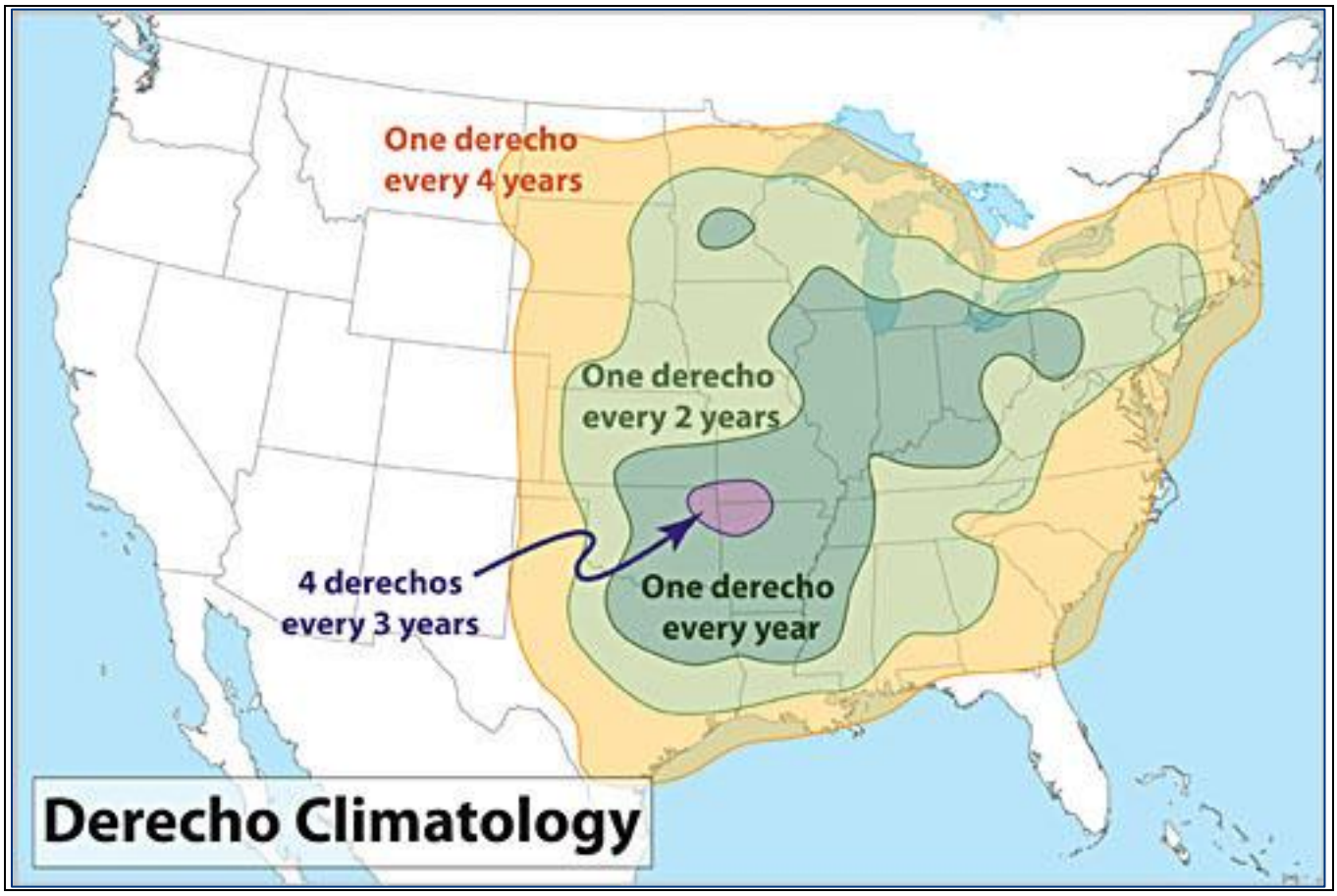
The extent (or range of magnitude) of tornado and windstorm events is best described using the NWS Enhanced Fujita (EF) Scale shown in Table 4-73. The City of Philadelphia's most extreme wind event on record was an EF-3 which occurred in 2021 and had estimated maximum wind speeds of 140 mph. As such, the extent (or range of magnitude) of tornado and windstorm hazards ranges from EF0 to EF3.

Table 4-73. Enhanced Fujita Scale for Tornadoes and Windstorm Evens in Philadelphia

Rating	Wind Speeds	Damage Description
EF0	65 – 85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow-rooted trees toppled
EF1	86 – 110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged
EF2	111 – 135 mph	"Considerable' damage: roofs torn off well-constructed homes, homes are shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed
EF3	136 – 165 mph	'Severe' damage: entire stories of well-constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark
EF4	166 – 200 mph	'Extreme' damage: Well-constructed homes are leveled, cars are thrown significant distances, top-story exterior walls of masonry buildings would likely collapse
EF5	> 200 mph	'Massive/Incredible' damage: Well-constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.

Source: NOAA/NWS 2022

Figure 4-27. Derecho Climatology in the United States



Source: NOAA Storm Prediction Center 2024

NWS Advisories/Watches/Warnings

To communicate tornado and windstorm threats to the public, the NWS provides a suite of weather advisories, watches, and warnings which are disseminated anytime conditions warrant its issuance. Table 4-74 summarizes recent NWS products of concern, including advisories, warnings, and watches that arise due to wind. Historical weather advisories, watches, and warnings can all be helpful tools to understand the frequency and distribution of high wind-related weather reports.

Table 4-74. Archived NWS Advisories, Watches, and Warnings for Philadelphia between 2010-2024

NWS Product Name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	Annual Average
Wind Advisory	10	6	13	4	1	3	6	11	5	7	10	6	7	2	8	**99**	**6 – 7**
High Wind Warning	–	2	1	–	–	1	1	2	2	1	2	1	–	–	–	**13**	**< 1**
Hurricane Warning	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**< 1**
Severe Thunderstorm Warning	16	22	18	12	18	10	16	25	12	41	42	42	15	35	21	**345**	**23**

NWS Product Name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	Annual Average
Tornado Warning	1	3	–	–	–	–	–	–	1	3	2	6	–	3	–	**19**	**1 – 2**
Tropical Storm Warning	–	1	–	–	–	–	–	–	–	–	1	–	–	–	–	**2**	**< 1**
High Wind Watch	–	3	2	–	–	1	1	1	1	1	1	1	–	–	–	**12**	**< 1**
Hurricane Watch	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**< 1**
Severe Thunderstorm Watch	13	14	11	10	10	7	9	13	3	11	11	14	10	14	13	**163**	**10 – 11**
Tornado Watch	3	2	2	3	1	1	1	–	1	4	4	2	1	2	1	**28**	**1 – 2**
Tropical Storm Watch	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	**1**	**< 1**
Total	**43**	**55**	**47**	**29**	**30**	**23**	**34**	**52**	**25**	**68**	**74**	**72**	**33**	**56**	**43**	**684**	**45 – 46**

Source: Iowa State University: IEM 2024

Previous Occurrences

In order to determine previous occurrences of tornado and windstorm events in the City of Philadelphia, multiple agencies and different databases were used such as the NCEI Storm Events Database and previous disaster declarations with FEMA and the U.S. Department of Agriculture (USDA).

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City of Philadelphia was included in 11 major disaster (DR) and four emergency (EM) declarations for tornado and windstorm-related events (FEMA 2024). Table 4-75 lists these declarations. The majority of FEMA's major declarations were associated with tropical winds as these types of systems produce an array of cascading impacts like high winds, tornadoes, flooding, and more. For this reason, these types of declarations are included in Table 4-75.

Table 4-75. FEMA Declarations for Tornado, Windstorm Events in the City of Philadelphia (1954 to 2024)

Event Date	Declaration Date	Declaration Number	Description
June 23, 1972	June 23, 1972	DR-340	Tropical Storm Agnes
January 19 – February 1, 1996	January 21, 1996	DR-1093	Severe Storms & Flooding
September 16 – 29, 1999	September 18, 1999	DR-1294	Hurricane Floyd
July 27 – August 25, 2004	August 6, 2004	DR-1538	Severe Storms & Flooding
September 17 – October 1, 2004	September 19, 2004	DR-1557	Tropical Depression Ivan
September 8 – 9, 2004	September 19, 2004	DR-1555	Severe Storms & Flooding
July 27 – August 25, 2004	August 6, 2004	DR-1538	Severe Storms & Flooding
August 29 – October 1, 2005	September 10, 2005	EM-3235	Hurricane Katrina
September 3 – October 15, 2011	September 12, 2011	DR-4030	Tropical Storm Lee
August 26 – 30, 2011	September 3, 2011	DR-4025	Hurricane Irene
September 3 – October 15, 2011	September 8, 2011	EM-3340	Remnants of Tropical Storm Lee
August 26 – September 14, 2011	August 29, 2011	EM-3339	Hurricane Irene
October 26 – November 8, 2012	January 10, 2013	DR-4099	Hurricane Sandy

Event Date	Declaration Date	Declaration Number	Description
October 26 – November 8, 2012	October 29, 2012	EM-3356	Hurricane Sandy
August 31 – September 5, 2021	September 10, 2021	DR-4618	Remnants of Hurricane Ida

Source: FEMA 2024

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, the City of Philadelphia was not included in any tornado or windstorm-related agricultural disaster declarations (USDA 2024).

Previous Events

Using NCEI and NWS local storm reports, Table 4-76 provides a summary of some of the more notable tornado and windstorm events since the City of Philadelphia's previous Hazard Mitigation Plan. For events prior to 2021, refer to the 2022 City of Philadelphia HMP. None of the events listed in Table 4-76 were associated with a FEMA disaster declaration or State Emergency Declaration.

Table 4-76. Notable Tornado and Windstorm Events in the City of Philadelphia (2021 to 2024)

Event Date	Description and Impacts to City of Philadelphia	Magnitude / Rating
March 28, 2021	***Thunderstorm Wind***: A storm system produced straight-line wind damage. Several severe wind gusts were measured, with numerous reports of tree, utility, and some structural damage.	Unavailable
April 21, 2021	***Thunderstorm Wind Gust***: A 51-mph gust measured by the Pennsylvania DOT RWIS station at I-95 and Girard Ave. Winds knocked down powerlines near Susquehanna Avenue.	51 mph
April 30, 2021	***Thunderstorm Wind:*** A Pennsylvania DOT gauge reported a 58-mph measured gust. A couple of downed trees and power outages were reported. Widespread wind gusts of 45 to 55 mph, with some gusts of 60 to 65 mph, occurred. This, combined with many trees across the region already bearing leaves, led to numerous instances of tree damage and power outages across the region. Scattered showers associated with the secondary front also helped to locally enhance wind damage.	45 to 65 mph
May 26, 2021	***Thunderstorm Wind:*** A widespread severe weather event produced damaging winds. Numerous instances of downed trees and power lines and some property damage were reported. Reports from Philadelphia included wind damage near Glenloch Street.	Unknown
June 4, 2021	***Thunderstorm Wind:*** Several storms produced damaging winds and hail.	Unknown
June 14, 2021	***Thunderstorm Wind:*** Several storms produced damaging winds and hail.	Unknown
June 30 – Jul 1, 2021	***Thunderstorm Wind:*** Several storms produced damaging winds and hail. Downed power lines and wires were reported near Miller Street and near Jackson Street in Philadelphia.	Unknown
July 6, 2021	***Thunderstorm Wind:*** Several storms produced damaging winds and hail.	53 mph
July 12, 2021	***Thunderstorm Wind:*** Severe storms produced damaging wind across the region. This event was also better known for producing prolific flash flooding near the Delaware River just northeast of Philadelphia, along the Pennsylvania and New Jersey border.	Unknown

Event Date	Description and Impacts to City of Philadelphia	Magnitude / Rating
July 17, 2021	***Thunderstorm Wind***: Several severe storms produced damaging wind. Areas of heavy rain and flash flooding also occurred due to the widespread and, at times, slow-moving storm. In Philadelphia, several instances of power outages were reported in the northeastern parts of the City.	Unknown
July 21, 2021	***Thunderstorm Wind:*** Several severe storms produced damaging winds and hail as they moved towards the coast. In Philadelphia, the public reported trees were downed near Vogt Recreation Center in Tacony and power lines down near Stanwood Street in Rhawnhurst.	Unknown
July 30, 2021	***Tornado***: An EF3 tornado better known for its impacts in Bucks County, PA began briefly in Philadelphia, PA. The tornado touched down near Southampton Road, Kelvin Avenue, and Trevose Road where it uprooted and blew down large limbs from a few softwood and hardwood trees. The tornado then moved into Bucks County, with trees uprooted at the county line.	EF3 (140 mph)
July 30, 2021	***Tornado:*** A brief tornado occurred in the Bustleton section of northeast Philadelphia. Damage was first observed near Grant Ave at the Grant Gardens Apartment complex, where some minor loss of roofing material was noted, and debris was tossed in a chaotic manner consistent with tornadic winds. The tornado moved east-southeast across Roosevelt Blvd. Continued minor structural damage was noted along a narrow path, mainly consisting of sporadic losses of siding and insulation. Minor tree damage was also noted. One building also had ceiling tiles pulled downward with insulation removed in a car park area, a strong indicator of tornadic pressure gradient forces. Near Blue Glass Rd., a couple of slightly larger trees had their trunks snapped, and winds of around 80 mph likely occurred in that area. The damage path ended near there, however, after a track length of only around half a mile.	EF0 (80 mph)
August 10, 2021	***Thunderstorm Wind Gust***: ASOS station at PHL International Airport reported winds of 56 mph.	56 mph
October 16, 2021	***Thunderstorm Wind Gust***: Pennsylvania Department of Transportation gauges measured wind gusts greater than 51 mph	51 mph
December 6, 2021	***Non-Thunderstorm Wind Gust***: Mesonet and ASOS stations reported wind gusts that ranged between 46-59 mph, with public reports showing there were tree limbs down about 1 mile north-northwest of Eddington.	46 to 59 mph
February 18, 2022	***Non-Thunderstorm Wind Gust***: The PHL ASOS station, as well as numerous others across Philadelphia, reported wind gusts that ranged between 52-59 mph.	52 to 59 mph
March 7, 2022	***Thunderstorm Wind***: Wind gusts of 50 to 65 mph occurred as a cold air mass interacted with an existing warm air mass. This resulted in scattered to numerous reports of downed trees and power outages. Sensors at Philadelphia International Airport measured wind speeds nearing 58 mph.	47 to 67 mph
April 14, 2022	***Thunderstorm Wind:*** Scattered showers and thunderstorms developed producing locally strong to damaging wind gusts.	59 mph
May 20, 2022	***Thunderstorm Wind:*** Multiple rounds of thunderstorms developed. Some storms became severe, leading to instances of damaging winds, hail, and one brief tornado in New Jersey. In Philadelphia, estimated wind speeds were 58 mph.	58 mph
June 9, 2022	***Thunderstorm Wind:*** ASOS site at PHL International Airport reported thunderstorm winds of 54 mph.	54 mph
February 17, 2023	**Non-Thunderstorm Wind Gust**: Multiple mesonet weather stations across Philadelphia recorded wind gusts ranging from 41-48 mph	41 to 48 mph

Event Date	Description and Impacts to City of Philadelphia	Magnitude / Rating
April 1, 2023	***Thunderstorm Wind:*** A strong cold front approached the region, with a line of strong showers and thunderstorms developing out ahead of the front. Storms produced damaging winds, tornadoes, and small to medium-sized hail in Pennsylvania. Winds estimated to be 62 mph.	62 mph
June 25, 2023	***Thunderstorm Wind:*** Pop-up showers and thunderstorms produced damaging wind gusts in parts of southeast Pennsylvania. Pictures submitted to NWS Philadelphia of large tree down at the intersection of Ryan Ave and Rowland Ave in NE Philadelphia	40 mph
June 27, 2023	***Thunderstorm Wind Damage***: Emergency Managers reported trees down throughout north and northeast Philadelphia	Unknown
July 5, 2023	***Thunderstorm Wind Gust***: A WeatherFlow site at south 19th St. measured 57 mph gust at 6:10 PM.	57 mph
July 16, 2023	***Thunderstorm Wind:*** An area of low pressure moved by to the west, with a cold front slowly moving through. Slow-moving showers and thunderstorms moved through, with thunderstorms producing damaging wind gusts across parts of Pennsylvania	Unknown
July 25, 2023	***Thunderstorm Wind Gust***: Measured gust of 43.7 mph earlier today.	43.7 mph
August 7, 2023	***Thunderstorm Wind:*** A strong system and associated cold front moved into eastern PA, bringing damaging winds and a tornado threat on August 7th. Trees were reported down in the Upper Roxborough section of Philadelphia as well as extensive tree damage in Chestnut Hill. Wind gust estimates were 58 mph.	58 mph
September 8, 2023	***Thunderstorm Wind:*** Public reported downed trees and limbs near Shawmont School in northwest Philadelphia. PECO reported 400 customers without power. Wind gust estimates were 58 mph.	58 mph
December 10, 2023	***Non-Thunderstorm Wind Gust:*** Multiple mesonet stations reported wind gusts from 32-35 mph	32-35 mph
January 9, 2024	***Non-Thunderstorm Wind Gust***: Damaging winds around 51 mph brought down trees and limbs which blocked the right lane of Roosevelt Blvd in northeast Philadelphia.	51 mph
February 28, 2024	***Non-Thunderstorm Wind Gust***: ASOS station KPNE Philadelphia Northeast measured wind gusts ranging between 58-63 mph	58 to 63 mph
March 10, 2024	***Non-Thunderstorm Wind Gust:*** ASOS station at KPHL Philadelphia International Airport measured a wind gust of 63 mph	63 mph
June 14, 2024	***Thunderstorm Wind Gust:*** ASOS weather station at KPNE Philadelphia Northeast reported wind gusts to 48 mph.	48 mph
June 23, 2024	***Thunderstorm Wind Gust***: 1-inch tree limbs broken; Shingles blown off homes. Downed trees blocked the right lane in Holmesburg on I-95 SB approaching Academy Rd/Exit 32. Large trees were also reported as having lost their branches down in the Pennypack Woods area.	Unknown
June 24, 2024	***Non-Thunderstorm Wind Damage***: Photos sent of medium to large tree snapped at trunk blocking outer lanes of Roosevelt Blvd northbound.	Unknown
July 14, 2024	***Thunderstorm Wind Gust:*** Storms impacting PHL International Airport brought measured wind gusts of 64 mph which resulted in damages. Trained spotters and public reports detailed how a portion of a flat roof peeled off a row of homes on Linden Ave in the Holmesburg section of Philadelphia	64 mph

Event Date	Description and Impacts to City of Philadelphia	Magnitude / Rating
July 16, 2024	***Thunderstorm Wind Damage***: Several trees were down along Woodhaven Road in Northeast Philadelphia. Winds ranging from 41-54 mph were reported at the PHL International Airport	41 to 54 mph
August 3, 2024	***Thunderstorm Wind Gust:*** ASOS station at KPHL Philadelphia International Airport measured a wind gust of 54 mph	54 mph
August 6, 2024	***Thunderstorm Wind Gust:*** ASOS station at KPHL Philadelphia International Airport measured a wind gust of 48 mph	48 mph
August 9, 2024	***Non-Thunderstorm Wind Damage***: Some power outages reported, including traffic lights that were out in Upper Roxborough/Shawmont area. Trees were reported down on Bells Mill this morning	Unknown
August 18, 2024	***Thunderstorm Wind Damage***: Tree fell on wires and also lots of branches down in the Fox Chase section.	Unknown

Source: Iowa State University 2024; NOAA/NCEI 2024
Note: mph = miles per hour

Probability of Future Occurrences

Information on previous tornado and windstorm occurrences in the City of Philadelphia was used to calculate the probability of future occurrence of such events, as summarized in Table 4-77. Based on historical records and input from the Steering Committee, the probability of the occurrence of Tornados/Windstorms in the City is considered "likely."

Future occurrences of the tornado and windstorm hazard has the potential to impact the built environment. Many of the structures in the City were built prior to 1960, and therefore are not up to current building code, making them more susceptible to damages and impacts from high winds. It is most likely the City will be impacted by high winds, including wind gusts, and not tornadic activity.

Table 4-77. Probability of Future Tornado and Windstorm Events in the City of Philadelphia

Hazard Type	Number of Occurrences Between 2010 and 2024	Percent Chance of Occurring in Any Given Year
Tornado and Windstorm	312	100%

Source: Iowa State University 2024; NOAA/NCEI 2024
Note: Tornado, Windstorm events used to determine probabilities were those that occurred between January 1, 2010 and September 23, 2024

Climate Change Projections

Climate change is expected to increase the intensity and possibly the frequency of windstorms and tornadoes in Philadelphia, despite the City not being historically tornado-prone. Warmer temperatures and higher atmospheric moisture may lead to more severe thunderstorms, shifting tornado activity eastward and extending tornado seasons beyond spring and early summer. These changes could result in more frequent and damaging wind events, especially as the City's aging infrastructure faces added stress from combined hazards like flooding and storm surges. While the direct link between climate change and tornadoes remains uncertain, the overall increase in

atmospheric instability and wind shear suggests a growing risk. As such, proactive adaptation measures such as reinforcing infrastructure and enhancing emergency preparedness will be essential to reduce vulnerability in the face of evolving storm threats.

Cascading Impacts on Other Hazards

Direct and indirect impacts of tornado and wind events may induce secondary hazards such as dust storms, wildfires, water shortages, power outages, infrastructure deterioration or failure, utility failures, water quality and supply concerns, and transportation issues.

Severe winds can breach power lines and disconnect utility systems. Fallen trees from tornado and wind events can contribute to an increase in fuel for wildfires. Fallen vegetation also reduces the soil stability of steep slopes, which can lead to an increased risk of landslides.

4.3.6.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the tornado and windstorm hazard, all the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the City Profile (Chapter 3) are potentially vulnerable to tornado and windstorm. The following text evaluates and estimates the potential impact of the tornado and windstorm hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

The entire population of the City is exposed to tornado and wind events. Risks are particularly high for people who are outdoors during these events, whether for work or recreation, at construction sites or the parks across the City. These individuals are particularly vulnerable as if there is little warning, shelter might not be available. Downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life (CDC 2022, CDC 2005).

Heavy rain, lightning, hail, high winds, and extreme temperatures all can pose a greater threat to employees in the construction industry. Employers should prepare for the hazards associated with adverse weather conditions that may require special facilities and safety equipment being provided to employees who work outdoors, or in some instances, work stoppage to ensure the safety and health of workers (Hazwoper 2020).

Socially Vulnerable Population

Populations identified as having ongoing access and functional needs, including low-income individuals, older adults, individuals with disabilities, racial and ethnic minorities, unhoused individuals, children, and immigrant populations, face heightened risks from tornadoes and windstorms due to social, economic, and structural

disadvantages. The challenges and barriers contributing to the vulnerability of these groups often include substandard housing, lack financial resources for recovery, and residing in areas with inadequate infrastructure.

Physical limitations, social isolation, and reliance on medical devices make older adults and people with disabilities particularly susceptible during storms. Racial and ethnic minorities often experience systemic barriers to emergency response and recovery, while language barriers and fear of deportation hinder immigrant populations from seeking help. Children are emotionally vulnerable and dependent on adult preparedness, and unhoused individuals face direct exposure to storm hazards. Many of these populations also live in flood-prone areas, compounding their risk during severe weather events.

According to the 2022 5-year ACS estimates, shown in Table 4-78, there are 351,811 total persons living below the poverty level, 223,219 persons over the age of 65 years, 99,102 persons under the age of 5 years, 105,761 non-English speakers, and 267,675 persons with a disability in the City (U.S. Census Bureau 2022).

General Building Stock

The City's entire building stock is exposed to the tornado and high wind hazard. Manufactured housing (i.e., mobiles homes) is particularly vulnerable to high winds and tornadoes. Because of their lightweight and often unanchored design, manufactured homes are extremely vulnerable to high winds and will generally sustain the most damage. Manufactured homes and mobile homes are not common structure types in the City, especially the inner-City areas. These structures are primarily located in the more suburban areas of the City, bordering neighboring counties.

While the chance of being hit by a tornado is small, the damage that results is devastating. An EF4 tornado can carry wind velocities of 200 mph, resulting in a force of more than 100 pounds per square foot of surface area. This is a "wind load" that exceeds the design limits of most buildings.

Community Lifelines and Other Critical Facilities

Utility infrastructure could suffer damage from high winds associated with falling tree limbs or other debris, resulting in the loss of power. Loss of service can impact residents and business operations alike. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water until power is restored, due to pump failure. Lack of power to emergency facilities, including police, fire, EMS, and hospitals, will inhibit the City's ability to effectively respond to an event and maintain the safety of its citizens.

Economy

The City's economy is vulnerable to tornadoes and windstorms. High winds can damage power grids, transportation systems, and utilities, leading to widespread business interruptions and productivity losses. Commercial and industrial operations may be halted, while tourism suffers from damage to attractions and travel disruptions. Supply chains, especially through the Port of Philadelphia and regional transport networks, are vulnerable to delays and infrastructure damage. Residential and commercial property damage can depress real estate values and increase insurance claims, raising costs for businesses and homeowners. Vulnerable populations and small businesses often lack the resources to recover quickly, exacerbating economic disparities.

Table 4-78. Socially Vulnerable Populations in the City of Philadelphia

Planning District	American Community Survey 5-Year Population Estimates (2022)									
	Population Over 65		Population Under 5		Non-English-Speaking Population		Population with Disability		Population Below Poverty Level	
	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total
Central	20,572	15.1%	5,033	3.7%	5,649	4.1%	11,714	8.6%	14,340	10.5%
Central Northeast	15,291	17.8%	6,332	7.4%	11,499	13.4%	12,956	15.1%	15,582	18.2%
Lower Far Northeast	11,898	16.5%	5,141	7.1%	3,915	5.4%	9,621	13.4%	5,889	8.2%
Lower North	10,055	10.1%	4,936	5.0%	5,361	5.4%	19,685	19.8%	32,707	33.0%
Lower Northeast	11,245	10.5%	8,865	8.3%	8,735	8.2%	20,526	19.2%	28,876	27.0%
Lower Northwest	7,850	14.4%	2,798	5.1%	624	1.1%	6,867	12.6%	4,835	8.9%
Lower South	1,230	19.0%	375	5.8%	413	6.4%	792	12.3%	378	5.9%
Lower Southwest	4,640	10.8%	2,672	6.2%	3,721	8.7%	6,452	15.0%	11,439	26.7%
North	16,712	12.3%	10,450	7.7%	19,405	14.3%	38,514	28.4%	51,673	38.2%
North Delaware	12,094	12.3%	6,769	6.9%	7,104	7.2%	15,527	15.7%	20,072	20.4%
River Wards	6,811	9.8%	5,008	7.2%	4,465	6.4%	13,317	19.1%	16,999	24.4%
South	18,100	13.7%	7,551	5.7%	9,311	7.1%	18,849	14.3%	23,271	17.7%
University Southwest	6,943	8.5%	2,825	3.5%	2,652	3.2%	11,389	13.9%	20,113	24.6%
Upper Far Northeast	15,831	22.9%	4,283	6.2%	12,900	18.7%	10,246	14.8%	8,520	12.3%
Upper North	25,546	16.8%	8,929	5.9%	6,221	4.1%	27,791	18.3%	36,558	24.1%
Upper Northwest	15,417	17.0%	6,172	6.8%	1,347	1.5%	15,619	17.2%	16,825	18.5%
West	15,573	13.6%	8,888	7.7%	1,288	1.1%	19,933	17.4%	33,513	29.2%
West Park	7,411	16.5%	2,073	4.6%	1,150	2.6%	7,876	17.6%	10,221	22.8%
City of Philadelphia (Total)	**223,219**	**14.0%**	**99,102**	**6.2%**	**105,761**	**6.6%**	**267,675**	**16.8%**	**351,811**	**22.1%**

Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals
Note: 2.34 persons per household. This number was used to calculate the Non-English-Speaking populations.

Natural, Historic and Cultural Resources

Natural

High winds can uproot trees, disrupt ecosystems, and increase soil erosion, reducing the ecological and recreational value of green spaces while heightening flood risks. Waterways like the Delaware and Schuylkill Rivers may suffer from pollution due to storm debris and runoff, while wetlands that are vital for stormwater absorption and wildlife habitat can be severely compromised.

Historic

Historic resources may suffer structural and water damage due to their age and construction materials, with irreplaceable architectural features at risk. Entire historic districts can be affected simultaneously, diminishing their aesthetic and historical value. Restoration is often costly and time-consuming, requiring specialized techniques and materials. Additionally, damage to these sites can disrupt tourism, leading to economic losses and potentially deterring future visitors, further impacting the City's cultural and financial vitality.

Cultural

Public art and monuments are at risk of physical destruction from high winds and debris, with restoration often being costly and complex. Cultural events and festivals may face cancellations or disruptions, leading to economic losses for local businesses and reduced community engagement. Additionally, many historic and cultural sites lack adequate disaster preparedness and insurance coverage, making recovery from storm damage more difficult and potentially resulting in the permanent loss of cultural assets.

4.3.6.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure the establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

As Philadelphia continues to develop and expand, more people and infrastructure will be exposed to windstorm and tornado hazards. Denser urban areas with tall buildings and complex infrastructure are particularly vulnerable to damage from high winds, flying debris, and structural failures. Taller buildings can also channel and intensify wind, exacerbating the impact of storms.

Projected Changes in Population

Projected population growth is expected to increase the City's vulnerability to tornadoes and windstorms by increasing exposure to the hazards, infrastructure strain, and emergency response challenges. As more people move into potentially hazard-prone areas the risk of property damage and personal harm rises. Densely populated neighborhoods may face greater destruction during storms.

Climate Change

An increase in storms will produce more wind events and may increase tornado activity. An increase in temperature will provide more energy to produce storms that generate tornadoes (Center for Climate and Energy Solutions n.d.).

With an increased likelihood of strong winds and tornado events, all the City's assets are at risk for losses as a result of tornado and wind events.

Additional Data and Next Steps

To enhance the assessment of the tornado and wind hazard in future HMP updates, the general building stock inventory can be updated to include attributes regarding protection against strong winds to enhance loss estimates. Additionally, the integration of evacuation route data can provide insight into the risks evacuees may encounter, including potential road closures due to the potential for downed trees and utility lines.

4.3.7 Winter Storm

4.3.7.1 Hazard Profile

Hazard Description

Winter storms consist of cold temperatures, snow, and ice. From November through April, Pennsylvania is exposed to winter storms that move up the Atlantic coast or sweep in from the west. Every county in the Commonwealth is vulnerable to severe winter storms; however, the northern tier, western counties, and mountainous regions tend to experience winter weather more frequently and with greater severity (PEMA 2023).

Winter storms can produce more damage than any other severe weather event, including tornadoes. Complications caused by winter storms can lead to road closures (especially secondary and farm roads); business losses to commercial centers in outlying areas because of supply interruption and loss of customers; property losses and roof damage from snow and ice loading and fallen trees; utility interruptions; and loss of water supplies. Flooding can result from winter storm events as well.

Types of severe winter weather events or conditions are as follows (NWS 2009):

- **Heavy Snow—**According to the National Weather Service, heavy snow is generally considered snowfall accumulating to depth of 4 inches or more within 12 hours or less or snowfall accumulating to depth of 6 inches or more within 24 hours or less. A snow squall, also known as a snowstorm, is an intense but limited-duration period of moderate to heavy snowfall accompanied by strong, gusty surface winds and possibly lightning (generally moderate to heavy snow showers).

- **Blizzard—**Blizzards are characterized by low temperatures, wind gusts of 35 miles per hour (mph) or more and falling and/or blowing snow that reduces visibility to 0.25 miles or less for an extended period (3 or more hours). A severe blizzard is defined as having a wind velocity of 45 mph, temperatures of 10 °F or lower, and a high density of blowing snow with visibility frequently measured in feet over an extended period.

- **Sleet or Freezing Rain—**Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen, partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground. Both types of precipitation, even in small accumulations, can cause significant hazards to a community.

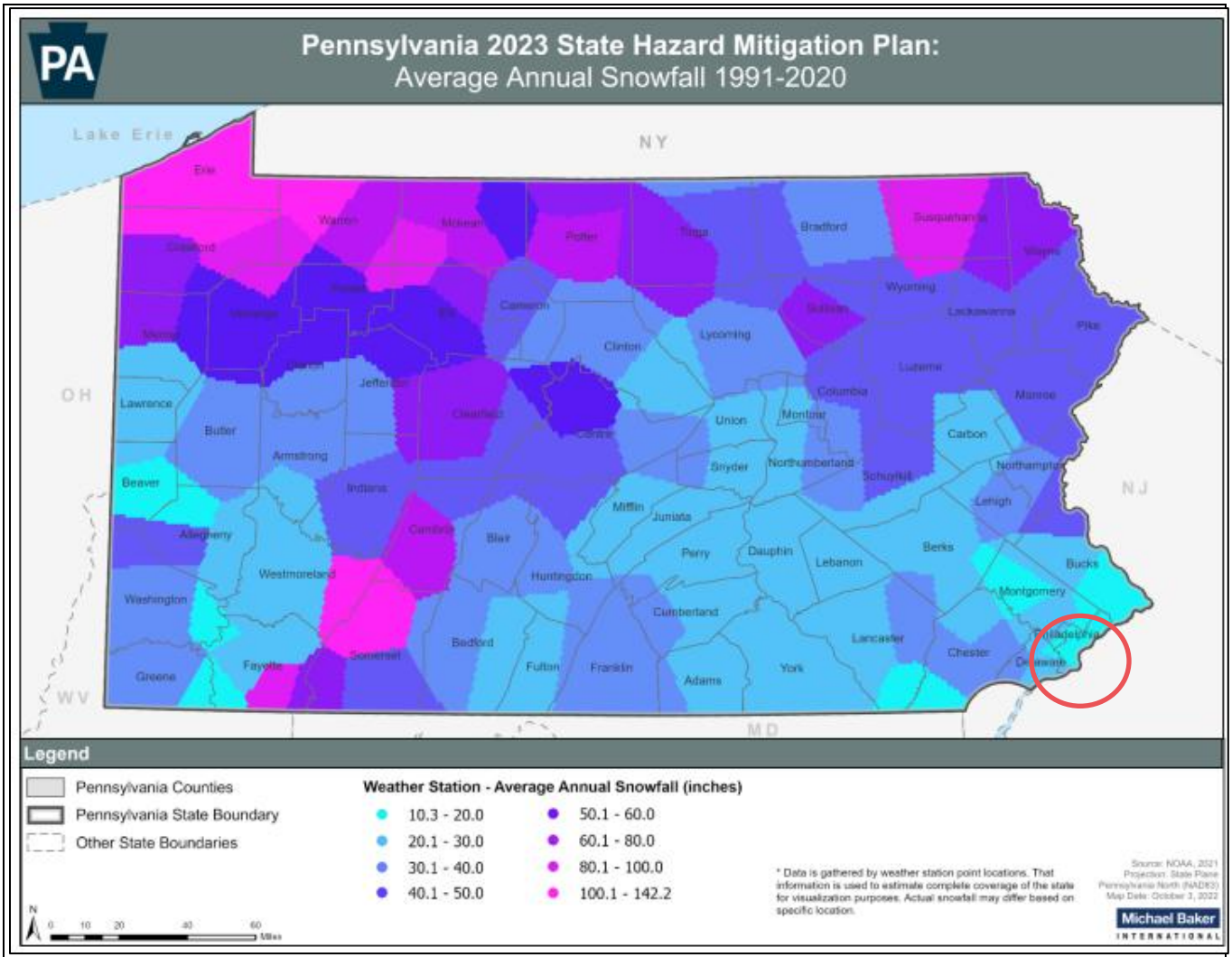
- **Ice Storm—**An ice storm is described as an occasion when damaging volumes of ice are expected to accumulate during freezing rain situations. Significant accumulations of ice pull down trees and utility lines, resulting in loss of power and means of communication. These accumulations of ice render walking and driving extremely dangerous and can create extreme hazards to motorists and pedestrians.

- **Nor'easter**—Nor'easters—low pressure fronts that move northward along the Atlantic coastline, pulling large amounts of moisture off the Atlantic Ocean—usually develop in the latitudes between Georgia and New Jersey, within 100 miles east or west of the East Coast. These storms progress generally northeastward and typically attain maximum intensity near New England and the Maritime Provinces of Canada. They nearly always bring precipitation in the form of heavy rain or snow, as well as winds of gale force, rough seas, and, occasionally, coastal flooding to the affected regions. These storms may occur at any time of year but are most frequent and most violent between September and April. While some of the most devastating effects of Nor'easters occur in coastal areas (e.g., beach erosion, coastal flooding), effects on inland areas, like the City of Philadelphia, may include heavy snow, strong winds, and blizzards (NWS, What is a Nor'Easter? 2019).

Location and Extent

Winter storms can consist of cold temperatures and heavy snow or ice. Major winter storms occur in Pennsylvania several times annually and are regional events. According to Figure 4-28 between 1991 and 2020, Philadelphia experienced between 10.3 and 30 inches of snow each year (PEMA 2023).

Figure 4-28. Average Annual Snowfall (1991-2020) for Pennsylvania



Note: Red circle indicates the City of Philadelphia.

Source: PEMA 2023

The extent of a severe winter storm can be classified by meteorological measurements and by evaluating its societal impacts. The National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) produce the Regional Snowfall Index (RSI) for significant snowstorms that affect the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale categorized from 1 to 5, where the RSI values indicate the range of snowfall received, as shown in Table 4-79 (NCEI n.d.). It is based on the interaction of the area affected by the storm, the amount of snowfall, and the population (based on the 2010 Census) (Squires, et al. 2014). The NCEI has analyzed and assigned RSI values to over 500 storms since 1900 (NCEI n.d.).

Table 4-79. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18+

Source: NCEI n.d.

Range of Magnitude

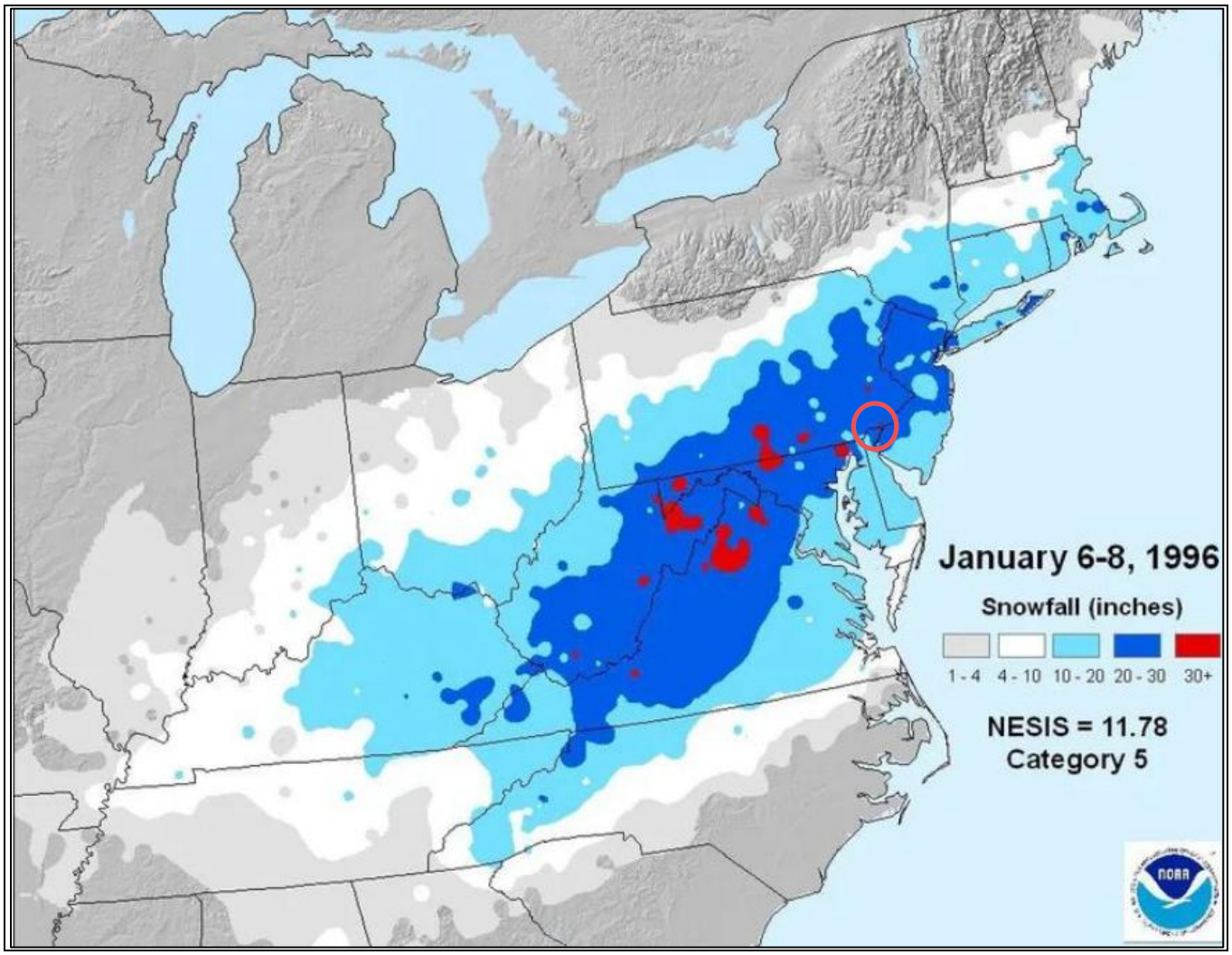
The magnitude or severity of a severe winter storm depends on several factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day (e.g., morning vs. night), and season of the year.

Due to their regular occurrence, these storms are considered hazards only when they result in damage to communications networks, impact vegetation, cause structural collapse, and/or cause very serious transportation problems and utility interruptions. Winter storms have also been known to contribute to severe flooding. A winter storm can adversely affect roadways, utilities, business activities, and can cause frostbite or loss of life.

Winter storm events can result in the closing of major or secondary roads, particularly in rural locations, stranded motorists, transportation accidents, loss of utility services, and depletion of heating supplies. Environmental impacts often include damage to shrubbery and trees due to heavy snow loading, ice build-up, and/or high winds, which can break limbs or even bring down large trees. Gradual melting of snow and ice provides excellent groundwater recharge. However, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding.

The worst winter storm in the City of Philadelphia occurred January 6 – 8, 1996. A blizzard dropped nearly 30.7 inches (over 2.5 feet) of snow on the City with significant drifting, causing many primary highway system closures and over a 30 emergency vehicles stranded on roadways. Figure 4-29 illustrates the snow accumulation of the 1996 blizzard analyzed for historical significance by the NOAA-NCEI National Climate Report in 2016. This map shows the high snowfall seen occurring throughout the eastern United States, including the City of Philadelphia (NCEI 2016).

Figure 4-29. Snow Accumulation of the 1996 Blizzard



Source: NCEI 2016
Note: Red circle indicates where the City of Philadelphia is located.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, City of Philadelphia was included in seven major disaster (DR) or emergency (EM) declarations for Winter Storm related events (FEMA 2024). Table 4-80 lists these declarations.

Table 4-80. FEMA Declarations for Winter Storm Events in City of Philadelphia (1954 to 2024)

Event Date	Declaration Date	Declaration Number	Description
March 13 –17, 1993	March 16, 1993	EM-3105	Pennsylvania Severe Snowfall and Winter Storm
January 4 – February 25, 1994	March 10, 1994	DR-1015	Pennsylvania Winter Storm, Severe Storm
January 6 –12, 1996	January 13, 1996	DR-1085	Pennsylvania Blizzard

Event Date	Declaration Date	Declaration Number	Description
February 14 – 19, 2003	March 14, 2003	EM-3180	Pennsylvania Snowstorm
February 5 –11, 2010	April 16, 2010	DR-1898	Pennsylvania Severe Winter Storms and Snowstorms
February 4 –20, 2014	February 6, 2014	EM-3367	Severe Winter Storm in Pennsylvania
January 22 –23, 2016	March 23, 2016	DR-4267	Severe Winter Storm and Snowstorm in Pennsylvania

Source: FEMA 2024

Note: FEMA Declarations are issued by County. The information above represents Philadelphia County, in which the City of Philadelphia is included.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was not included in any USDA winter storm-related agricultural disaster declarations (USDA 2024).

Previous Events

Known hazard events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-81. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-81. Winter Storm Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
January 31, 2021	Citywide	Snow fell in the City of Philadelphia, due to a winter storm.
February 1 – 7, 2021	Citywide	Snowfall accumulation from a winter storm impacted the City of Philadelphia. Philadelphia International Airport received up to 8.1 inches of snow accumulation through the duration of the storm.
February 10, 2021	Citywide	Light snowfall was recorded with up to 3.1 inches of snow accumulation at Philadelphia International Airport.
February 13, 2021	Citywide	Light freezing rain occurred and impacted the Philadelphia International Airport. Up to 0.02 inches of ice accretion was recorded.
February 18 – 19, 2021	Citywide	Snowfall accumulation from a winter storm impacted the City of Philadelphia. Freezing rain occurred with light snow. Philadelphia International Airport recorded up to 3.4 inches of snow accumulation and 0.28 inches of ice accretion from the freezing rain.
February 22, 2021	Citywide	Snowfall was seen throughout the City of Philadelphia. Philadelphia International Airport reported 0.8 inches of snow accumulations and traces of freezing rain.
January 5, 2022	Citywide	Light freezing rain was recorded in the area. Northeast Philadelphia Airport reported 0.01 inches of ice accumulation.
January 7, 2022	Citywide	Snowfall accumulation was seen widespread due to a winter storm. Snowfall ranged from 3 to 5 inches.

Event Date	Location Impacted	Description
January 16, 2022	Citywide	Freezing rain and snowfall were recorded to the area. Up to 1.5 inches of snow accumulation were recorded. The Philadelphia International Airport measured up to 0.05 inches of ice accretion.
January 28 – 29, 2022	Citywide	Snowfall accumulation from a winter storm impacted the City of Philadelphia. Snowfall totals ranged from 4 to 8 inches. The Philadelphia International Airport reported up to 7.5 inches of snow accumulation.
February 7, 2022	Citywide	Light freezing rain and traces of ice were reported for the City of Philadelphia.
February 13, 2022	Citywide	Up to 2 inches of snowfall was recorded throughout the area.
December 23 – 24, 2022	Citywide	Wind chills of -10 degrees F were recorded in the County, which included the City of Philadelphia.
January 15 – 16, 2024	Citywide	Up to 3 inches of snow accumulation was recorded across much of the City. The highest snowfall report was 3.3 inches. Ice was also recorded in some areas of the City.
January 19, 2024	Citywide	Snowfall accumulation from a winter storm impacted the City of Philadelphia. Snowfall totals ranged from 4 to 5 inches.
February 13, 2024	Citywide	Up to 3 inches of snow accumulation was recorded across much of the City. The highest snowfall report was from Shawmont with 4.5 inches.
February 17, 2024	Citywide	Up to 3 inches of snow accumulation was recorded across much of the City. The highest snowfall report was from Germantown neighborhood with 4.3 inches.

Source: NOAA-NCEI 2024

Probability of Future Occurrences

Information on previous winter storm occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-82. Based on historical records and input from the Steering Committee, the probability of occurrence for winter storms in the City is considered “likely.”

Future occurrences of winter storms may include damage to roofs and building frames rather than building content. Impacts felt by the City population includes falls, overexertion, or hypothermia while clearing snow and ice. Individuals who are unhoused and low-income individuals may not have access to housing or their housing could be less able to withstand cold temperatures. Further, infrastructure may be impacted due to freezing temperatures or cold conditions. Roads in the City often take a few hours, or sometimes days, to fully clear depending on the severity of the winter storm.

Table 4-82. Probability of Future Winter Storm Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Blizzard	2	7%
Cold/Wind Chill	28	100%
Extreme Cold/Wind Chill	4	14%
Frost/Freeze	1	4%
Heavy Snow	28	100%
Ice Storm	2	7%
Winter Storm	34	100%
Winter Weather	126	100%
Total	**225**	**100%**

Source: NOAA-NCEI 2024

Note: Due to limitations in data, not all winter storm events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2024

Climate Change Projections

Climate change will have direct impact on winter storm events. As the climate shifts to more extreme temperatures, winter storms will increase in severity and frequency. Large winter storm events which have previously been rare in occurrence may become more frequent and normal. Impacts from winter storm events such as these like power outages, extensive freezes, and extremely low temperatures will also become more common. Further research is needed to understand the projected increase in winter weather from climate change impacts.

Cascading Impacts on Other Hazards

Severe winter weather events have the potential to exacerbate flooding. The rapid thawing of snow and ice accumulated by winter weather events could create major flooding issues in the City. The mitigation of winter weather hazards by snow and ice removal could lessen the potential risk of flooding during a rapid warming period. Refer to Chapter 9 (Flood, Flash Flood, and Ice Jam) for more information about flood hazards for the City.

4.3.7.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the winter storm hazard, all the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the City Profile (Chapter 3) are potentially vulnerable to winter storms. The following text evaluates and estimates the potential impact of the winter storm hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

The entire population of the City of Philadelphia (1,603,797) is exposed to winter storm events. According to the NOAA National Severe Storms Laboratory (NSSL), every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion, and exposure (NSSL n.d.). Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow, extreme cold temperatures, and dangerous wind chills. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, by heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold (NSSL n.d.).

Socially Vulnerable Population

Individuals who are unhoused and older adults are most susceptible to the winter storm hazard. Older adults are susceptible due to their increased risk of injuries and death from falls, overexertion, or hypothermia while clearing snow and ice. Individuals who are unhoused and low-income individuals may not have access to housing or their housing could be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply).

According to the 2022 5-year ACS estimates, shown in Table 4-83, there are 351,811 total persons living below the poverty level, 223,219 persons over the age of 65 years, 99,102 persons under the age of 5 years, 105,761 non-English speakers, and 267,675 persons with a disability in the City (U.S. Census Bureau 2022).

General Building Stock

The entire general building stock inventory in the City of Philadelphia is exposed and vulnerable to the winter storm hazard. In general, structural impacts include damage to roofs and building frames rather than building content. Current modeling tools are not available to estimate specific losses from this hazard.

An area especially vulnerable to the winter storm hazard is the floodplain. At-risk building stock and infrastructure in floodplains are presented in the flood hazard profile in Chapter 9. Snow and ice melt can cause both riverine and urban flooding. Generally, losses from flooding associated with winter storms should be less than those associated with a 1-percent or 0.2-percent annual chance flood. Estimated losses caused by riverine flooding in the City are discussed in Chapter 9, Flood, Flash Flood, and Ice Jam.

Community Lifelines and Other Critical Facilities

Heavy accumulations of snow and ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NWS 2019). Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services (NOAA 2023).

Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a severe winter storm event to ensure functionality of the community lifeline. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended.

Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing

of roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required (NWS 2019).

Economy

The weight of snow can cause roofs to collapse and knock down trees and power lines disrupting business operations. Community members may be isolated for several days. The economic impact of winter weather each year is huge, with costs for snow removal, damage, and loss of business in the millions (NWS 2019).

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Another impact on the economy includes impacts on commuting into or out of the area for work or school. The loss of power and closure of roads prevents the commuter population traveling to work within and outside of the City.

Natural, Historic and Cultural Resources

Natural

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, but the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (NSIDC n.d.). Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals. Road-salt runoff can cause groundwater salinization, modify the soil structure, and result in loss or reduction in lake turnover. Additionally, road salt can cause changes in the composition of aquatic invertebrate assemblages and pose threats to birds, roadside vegetation, and mammals (Tiwari and Rachlin 2018).

Historic

Historical structures built 50 years or more, or structures deemed exceptionally significant, can be more vulnerable to winter storm impacts. These structures are likely not built with materials that are able to withstand heavy snow accumulation, hailstorms, and freezes. Oftentimes, they are not built to current standards and may require restoration in order to maintain safe accessibility. Negative impacts from winter storm events may cause the roof to collapse, pipes to freeze and burst, and more. It is important for the City to prioritize safe updates and restoration projects in order to protect these structures from future, more severe, winter storms.

Cultural

Cultural spaces and major hubs for the City include large event spaces, parks, and green spaces. These areas are mostly outside or incorporate large outdoor areas such as parking lots and garages. These spaces are vulnerable to extreme winter weather such as freeze and ice accumulation, blizzards, and more. Even during smaller or shorter winter storms safety personnel are present at events to help assist with safety precautions if necessary.

Table 4-83. Socially Vulnerable Populations in the City of Philadelphia

Planning District	American Community Survey 5-Year Population Estimates (2022)									
	Population Over 65		Population Under 5		Non-English-Speaking Population		Population with Disability		Population Below Poverty Level	
	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total
Central	20,572	15.1%	5,033	3.7%	5,649	4.1%	11,714	8.6%	14,340	10.5%
Central Northeast	15,291	17.8%	6,332	7.4%	11,499	13.4%	12,956	15.1%	15,582	18.2%
Lower Far Northeast	11,898	16.5%	5,141	7.1%	3,915	5.4%	9,621	13.4%	5,889	8.2%
Lower North	10,055	10.1%	4,936	5.0%	5,361	5.4%	19,685	19.8%	32,707	33.0%
Lower Northeast	11,245	10.5%	8,865	8.3%	8,735	8.2%	20,526	19.2%	28,876	27.0%
Lower Northwest	7,850	14.4%	2,798	5.1%	624	1.1%	6,867	12.6%	4,835	8.9%
Lower South	1,230	19.0%	375	5.8%	413	6.4%	792	12.3%	378	5.9%
Lower Southwest	4,640	10.8%	2,672	6.2%	3,721	8.7%	6,452	15.0%	11,439	26.7%
North	16,712	12.3%	10,450	7.7%	19,405	14.3%	38,514	28.4%	51,673	38.2%
North Delaware	12,094	12.3%	6,769	6.9%	7,104	7.2%	15,527	15.7%	20,072	20.4%
River Wards	6,811	9.8%	5,008	7.2%	4,465	6.4%	13,317	19.1%	16,999	24.4%
South	18,100	13.7%	7,551	5.7%	9,311	7.1%	18,849	14.3%	23,271	17.7%
University Southwest	6,943	8.5%	2,825	3.5%	2,652	3.2%	11,389	13.9%	20,113	24.6%
Upper Far Northeast	15,831	22.9%	4,283	6.2%	12,900	18.7%	10,246	14.8%	8,520	12.3%
Upper North	25,546	16.8%	8,929	5.9%	6,221	4.1%	27,791	18.3%	36,558	24.1%
Upper Northwest	15,417	17.0%	6,172	6.8%	1,347	1.5%	15,619	17.2%	16,825	18.5%
West	15,573	13.6%	8,888	7.7%	1,288	1.1%	19,933	17.4%	33,513	29.2%
West Park	7,411	16.5%	2,073	4.6%	1,150	2.6%	7,876	17.6%	10,221	22.8%
City of Philadelphia (Total)	**223,219**	**14.0%**	**99,102**	**6.2%**	**105,761**	**6.6%**	**267,675**	**16.8%**	**351,811**	**22.1%**

Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals
Note: 2.34 persons per household. This number was used to calculate the Non-English-Speaking populations.

Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Areas targeted for potential future growth and development within the next five years have been identified across the City, further discussed in Chapter 3 (City Profile). It is anticipated that any new development and new residents will be exposed to the drought hazard. Any areas of growth could be impacted by winter storms because the entire City is exposed and vulnerable. However, due to increased standards and codes, new development may be less vulnerable to the winter storm hazard than the aging building stock in the City.

Projected Changes in Population

It is probable that the City will continue to see an increase in population growth throughout the next several decades as the economy continues to flourish. Winter storms have the potential to impact a growing population by increasing their vulnerability to events such as snowfall, ice freezes, and more. Further planning mechanisms and mitigation techniques for winter storms should be implemented within the City to combat these impacts on residents.

Climate Change

The entire Commonwealth will see an increase in average annual temperatures and precipitation. Climate change can make winter weather events less frequent, but more severe when they do happen. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to freeze into heavy snowfall and icing. This increase in snow and ice could result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by severe winter events due to loss of service or access (The Climate Reality Project 2022).

Additional Data and Next Steps

As winter storms continue to increase in severity and frequency due to climate change, the City will work to increase mitigation measures that protect its ever-growing population. Planning mechanisms and mitigation efforts at decreasing impacts from snowfall, ice accumulation, freezes, hail and more, will increase overall health and safety of residents and increase economic capabilities of the City during winter seasons.

4.3.8 Building and Structure Collapse

4.3.8.1 Hazard Profile

Hazard Description

Buildings and other engineered structures, including bridges, may collapse if their structural integrity is compromised, especially due to effects from other natural or human-made hazards. Older buildings or structures, structures that are not built to standard codes, or structures that have been weakened are more susceptible to be affected by these hazards.

Adherence to modern building codes can lower a building's risk to collapse. Building codes – developed by the International Code Council in partnership with the Federal Emergency Management Agency (FEMA) and other federal, state, local, and private authorities – specify the minimum legal design and construction requirements for structural integrity, construction materials, and fire protection (FEMA 2023).

Location and Extent

Building age and ongoing maintenance affect the risk of building collapse. Older, vacant and undermaintained structures are at particular risk. Most buildings constructed after 1961 in the Commonwealth were built under modern building codes as adopted in the Pennsylvania Uniform Construction Code. However, 46.6 percent of occupied housing units were built before 1960 in Pennsylvania; the City of Philadelphia has the highest percentage (68.4 percent) of housing units built prior to 1960 (PEMA 2023). Of all Philadelphia properties, 39 percent were built before 1939 (City of Philadelphia 2022).

Vacant properties also increase the risk of a building collapse, as these properties fall into disrepair and neglect. The City has a lower percentage of vacant properties (8.2 percent) than the national and Commonwealth average (9.7 percent and 9 percent, respectively) as per the 2022 American Community Survey One-year Estimates (ACS 2022). Most areas in Philadelphia with a large percentage of vacant properties align with neighborhoods identified by the Centers for Disease Control and Prevention (CDC) as having high social vulnerability (City of Philadelphia 2022).

A bridge collapse consists of a failure of decking, superstructure, or foundation leading to a progressive or immediate collapse of the entire assembly. Bridges can span waterways, railways, or roadways and provide overpasses for surface transportation or passenger/freight rail lines. The Department of Streets designs, builds, and repairs the City's 320 bridges and 2,525 miles streets and highways (City of Philadelphia 2024). Principal causes of bridge collapse include internal and external factors (Metwally 2023):

- Internal causes, which include design error, construction mistakes, lack of maintenance, material defect, etc., usually require detailed failure investigations, such as material test, an inspection of design, construction, and maintenance documents, structural calculation, etc.
- External causes include natural disasters such as earthquake, flood, fire, and wind, as well as extreme loads such as collision and overload. This kind of cause can be determined through accident scene investigation. Natural factors are mainly natural disasters, including earthquake, flood, wind, etc., which are not easy to control and prevent. Human factors are mainly associated with human cognitive limitations, carelessness, or mismanagement, including containing design error, construction mistake, lack of maintenance, material defect, collision, and overload.

Range of Magnitude

A building collapse will typically affect adjacent structures and properties, resulting in a debris field which is dense but has a small footprint. Building collapses can cause injury to and endanger the lives of those inside or near to the structure and can result in damages to nearby property, especially if the collapse causes a large tonnage of debris near a populated area. Though occupied buildings are less likely to collapse since they would generally be maintained, more risk of death or injury would be likely with the sudden collapse of an occupied building.

Disrepair can critically affect the integrity of bridge structures as well. The level of disrepair depends on how much of the structure is damaged and how critical that portion of the structure is to the safety of drivers. The collapse of a bridge above a waterway can have additional effects on the environment through the destruction of coastal habitats. Larger pieces of debris in a waterway could disrupt flow and local currents, leading to sediment build-up and increases in turbidity.

On the morning of June 11, 2023, a vehicle fire under I-95 near the Cottman Avenue exit in Northeast Philadelphia caused a portion of the highway to collapse. Preliminary reports indicate a tanker truck was involved in the fire. The collapse of this integral portion of interstate highway caused severe traffic delays, pushing traffic throughout the City, and forcing commuters to find alternate routes. Within 12 days, three temporary lanes were opened to provide relief; however, it was not until May 23, 2024, that the permanent repairs to I-95 were completed (City of Philadelphia 2023, PennDOT 2024).

Similar to the bridge collapse in 2023, a worst-case scenario for Philadelphia would include the collapse of the Delaware Expressway (I-95) over East Palmer and East Cumberland Streets, causing damage, injuries, and severe traffic. These areas are highly trafficked, with residents and visitors enjoying eateries, outdoor activities, and a view of the Delaware River. Another worst-case scenario would include the accidental collapse of a large building outward, which would likely involve casualties, injuries, and closed roads. The City is densely populated and densely constructed making the potential for adjacent structural damages and injury or loss of life heightened.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City of Philadelphia was not included in any major disaster (DR) or emergency (EM) declarations for building and structure collapse-related events (FEMA 2024).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was not included in any USDA building and structure collapse-related agricultural disaster declarations (USDA 2024).

Previous Events

Known hazard events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-84. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-84. Building and Structure Collapse Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
June 4, 2021	200 block of Market Street	The top portion of an apartment building came down onto the sidewalk on the 200 block of Market Street. No injuries were reported.
September 2, 2021	2200 block of North Front Street	Multiple residential structures collapsed along North Front Street resulting in two injuries.
June 18, 2022	300 West Indiana Avenue	300 West Indiana Avenue collapsed shortly after a fire was placed under control. One firefighter perished during the collapse and another five individuals were injured.
September 14, 2022	1300 block of Lindley Avenue	The brick façade of a multi-story apartment building collapsed, littering the sidewalk. Residents of the apartments were displaced for some time, but no injuries were reported.
January 13, 2023	63rd and Vine Streets	A rowhouse under renovation at 63rd and Vine Streets collapsed with no injuries reported.
February 8, 2023	201 South 13th Street	Debris fell off the Walnut Square Apartment building on 201 South 13th Street striking a woman on the sidewalk below.

Event Date	Location Impacted	Description
May 8, 2023	3300 block of Germantown Avenue	Bricks and debris fell onto the sidewalk and street on the 3300 block of Germantown Avenue.
June 11, 2023	I-95 corridor between East Tioga Street in Richmond through Bleigh Avenue near Holmesburg	A vehicle fire under I-95 near the Cottman Avenue exit in Northeast Philadelphia caused a portion of the highway to collapse. Preliminary reports indicate a tanker truck was involved in the fire. The driver of the truck was fatally injured.
August 1, 2024	Graffiti Pier	A portion of the Graffiti Pier collapsed into the Delaware River.
August 7, 2024	4500 block of North Broad Street	Eleven people were displaced after a building partially collapsed on North Broad Street. Two homes were impacted by the partial collapse.
August 9, 2024	Argyle Street	A building partially collapsed on Argyle Street and buried a car under a pile of bricks.

Source: City of Philadelphia 2023; PennDOT 2024; CBS News 2024; NBC10 News 2023; NBC10 News 2023; Philadelphia Inquirer 2023; NBC10 News 2023; City of Philadelphia 2022; NBC10 News 2022; 6abc News 2024; 6abc News 2021

Probability of Future Occurrences

Philadelphia continues to have a high building vacancy rate and aging housing stock. As these factors persist, or in the case of aging housing stock increase, there is an ongoing risk of building collapses in the future. PennDOT inspects and categorizes bridges throughout the Commonwealth. According to PennDOT, there are 75 bridges listed in poor condition in the City of Philadelphia. This rating indicates that these bridges are considered structurally deficient. Structurally deficient bridges have an increased risk of collapse with an elevated risk level of one in 1,100 annually (PennDOT 2024).

Information on previous building and structure collapse occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-85. Based on historical records and input from the Steering Committee, the probability of occurrence for building and structure collapse in the City is considered “highly likely.”

Table 4-85. Probability of Future Building and Structure Collapse Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 2013 and 2024	Percent Chance of Occurring in Any Given Year
Building and Structure Collapse	18	100.00%

Source: City of Philadelphia 2023; PennDOT 2024; CBS News 2024; NBC10 News 2023; NBC10 News 2023; Philadelphia Inquirer 2023; NBC10 News 2023; City of Philadelphia 2022; NBC10 News 2022; 6abc News 2024; 6abc News 2021; City of Philadelphia 2022; PEMA 2023

Climate Change Projections

The May 2021 Pennsylvania Climate Impact Assessment indicated that Pennsylvania is very likely to undergo increased temperatures and precipitation in the 21st century. Increased average temperatures as a result of climate change make the occurrence of extreme heat more likely (Commonwealth of Pennsylvania 2021). While increased average temperatures would make the occurrence of extreme cold less likely, some climatologists have suggested that warming in the Arctic could impact the position of the jet stream, allowing for more extreme cold weather events to occur. While some research supports this concept, others do not and the impact of climate change on cold weather events is not fully understood (Kang and Krol 2024)

An increase in severe weather will place added stress onto buildings and structures. The proportion of bridge failures due to internal causes has been decreasing with the development of bridge design, manufacturing, construction, and maintenance technology. Meanwhile, external causes, such as natural factors (e.g., earthquake, flood, wind, etc.) have contributed to a larger proportion of bridge failures (Metwally 2023).

Cascading Impacts on Other Hazards

Building and structural collapse has the potential to cause cascading impacts on other hazards. For example, depending on the contents within the building or structure, and of the surrounding buildings and structures, a hazardous materials release may be caused by falling debris. Similarly, contents within a building or structure may result in an urban fire or explosion. A civil disturbance may arise if the building or structure had cultural or historical significance to groups of persons; those who cause the civil disturbance may believe the collapse of the building or structure to be linked to terrorism until proven otherwise, which could lead to criminal activity in the City.

4.3.8.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the building and structure collapse hazard, all the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the City Profile (Chapter 3) are potentially vulnerable to building and structure collapse. The following text evaluates and estimates the potential impact of the building and structure collapse hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

The building and structure collapse hazard has the potential to impact the entire population of the City of Philadelphia. Collapses may result in the displacement of persons and loss of life.

Overall Population

The entire population of the City of Philadelphia is exposed to the building and structure collapse hazard. However, those living in buildings constructed prior to 1960 are considered at a higher risk, as it was not until after 1961 when modern building codes were adopted in the Pennsylvania Uniform Construction Code.

Socially Vulnerable Population

Socially vulnerable populations are more at risk for building and structure collapse impacts as the buildings which are being occupied are typically older. Imminently dangerous buildings in the City, which are concentrated in North and West Philadelphia, coincide with the location of the most socially vulnerable populations in the City (City of Philadelphia 2022).

General Building Stock

The entire building stock of the City of Philadelphia is exposed to the building and structure collapse hazard. However, buildings constructed prior to 1960 are considered at a higher risk, as it was not until after 1961 when modern building codes were adopted in the Pennsylvania Uniform Construction Code.

The most vulnerable areas of the City are those with the highest concentration of deteriorating structures. In the case of bridges, this involves the number and location of structurally deficient bridges throughout the City of Philadelphia. PennDOT defines the overall conditions of a bridge based on the bridge's overall status in terms of structural soundness and ability to service traveling public (PennDOT 2018):

- Good - A numeric score greater than, or equal to, seven on primary component conditions rating.
- Fair - A numeric score of five or six on primary component conditions rating.
- Poor - Previously referred to as Structurally Deficient indicates that the bridge has deterioration to one or more of its major components. A numeric score of four or less on primary components conditions rating.

Overall condition is determined by the lowest rating of superstructure; superstructure is the underlying or supporting part of a bridge, for example steel members under the deck, see the list below for the overall condition categories. The condition rating is a single-digit number that describes the physical condition of the superstructure compared to its original as-built condition. Number is assigned by state-certified bridge inspectors during each inspection of the bridge, which occurs at least every two years (PennDOT 2018). Table 4-86 displays the numerical range (nine to zero) of the rating system, a rating of four or below indicates a bridge is in poor condition. Table 4-87 shows the total number of bridges in the City, as well as their conditions.

Table 4-86. PennDOT Numerical Condition Rating

Numerical Condition	Description
N	Not applicable.
9	Excellent.
8	Very good.
7	Good—some minor problems noted.
6	Satisfactory—structural elements showing minor deterioration.
5	Fair—primary structural elements are sound but showing minor cracks and signs of deterioration.
4	Poor—deterioration of primary structural elements has advanced.
3	Serious—deterioration has seriously affected the primary structural components.
2	Critical—deterioration of primary structural components has advanced, and bridge will be closely monitored, or closed, until corrective action can be taken.
1	Imminent failure—major deterioration in critical structural components. Bridge is closed but corrective action may put the bridge back into light service.
0	Failed—bridge is out of service and beyond corrective action.

Source: PennDOT 2018

Table 4-87. Condition of Bridges in the City of Philadelphia

Bridge Type	Total Number of Bridges	Condition		
		Good	Fair	Poor
Bridges on Local Route System, Length 20' or Greater	169	49	81	39
Bridges on State Route System, Length 8' or Greater	415	79	300	36

Source: PennDOT 2024; PennDOT 2024

Community Lifelines and Other Critical Facilities

The safety and security; food, hydration, shelter; and transportation lifelines would be impacted by the event of a building and structure collapse. For the safety and security lifeline, both causal and cascading impacts may threaten community safety due to structure collapse and services such as search-and-rescue may need to be deployed; government structures collapsing may cascade into service disruptions. The food, hydration, shelter lifeline in response and recovery would be impacted directly as buildings which suffered from the collapse may have been otherwise used as a shelter or hydration and feeding location. The transportation lifeline is directly impacted as bridges and roadways may suffer the collapse.

Economy

The building and structure collapse hazard may impact the economy in a number of ways including the loss of property and investment, loss of employment opportunities, loss of labor or workforce due to the loss of life, the displacement of persons, and a potential decrease in gross domestic product (GDP). Furthermore, the cost of responding to such an event, depending upon the size and extent, can be costly.

Natural, Historic and Cultural Resources

Natural

The environmental impacts of building and structure collapse can vary depending on the scale of the event and the type of collapse. As a result of the debris, a building or structure collapse may have an impact air quality. Potential impacts on air quality may also have associated health risks depending on the type of pollutants and particulate matter released in the collapse. With respect to bridge collapses over water bodies, rivers, or streams, environmental impacts can include water flow and habitat disruption and water contamination (PEMA 2023).

Historic

Most historic resources (which are typically considered eligible for listing in the National Register of Historical Places once they passed 50 years in age) were constructed prior to 1960. The hazard of building collapse poses a distinct, heightened risk as older buildings or structures are often not built to standard codes and have been weakened structurally. Based on the historical assets inventory from Pennsylvania's State Historic and Archaeological Resource Exchange (PA-SHARE), there are nearly 130,000 historical buildings in Pennsylvania; 7,894 of these buildings are located in the City of Philadelphia (PHMC 2024).

Cultural

Winds associated with severe weather can cause damage or destruction to the City's cultural resources, which can lead to a building or structure collapse. Cultural resources may be located inside of historical buildings and homes, which may not be built to withstand such high winds. Cultural resources, particularly those exposed to the elements,

are subject to weathering, degrading the integrity of the building or structure. Climate change is a potential threat to these resources as it exacerbates the expected rates of decay and contributes to the appearance of new decay. Climatic changes may aggravate the physical, chemical, and biological mechanisms causing degradation by affecting the structure or composition of building materials. Changes in temperature, precipitation, atmospheric moisture, and wind intensity, in addition to sea-level rise, desertification, and the interaction between climatic changes and air pollution, have been identified as concerns by the United Nations Educational, Scientific and Cultural Organization (Sesana, et al. 2021).

4.3.8.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

As discussed in Chapter 3 (City Profile), areas targeted for future growth and development have been identified across the City. Any areas of growth throughout the City are vulnerable to the building and structure collapse hazard; similarly, areas with no redevelopment and aging structures are susceptible to the hazard. New development sites should adhere to the proper building codes to ensure structural integrity and protect against natural elements such as high wind and heavy rains. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation, creating an increase in vulnerability for passersby.

Projected Changes in Population

A rise in population will increase the number of persons who could be impacted by the building and structure collapse hazard.

Climate Change

Projected intensification of severe weather, including high winds, heavy rains, instances of floods, and thunderstorms may contribute to the degradation of buildings and structures within the City of Philadelphia. Historic and older buildings and structures are often more at risk to face cosmetic and structural deficiencies from being exposed to natural elements, including natural sunlight. Furthermore, historic and older structures were constructed prior to the adoption of the Pennsylvania Uniform Construction Code in 1961, meaning the construction standards do not meet those of today.

Additional Data and Next Steps

The City of Philadelphia Licenses and Inspections (L&I) keeps statistics on imminently dangerous buildings that inspectors find. Furthermore, data on structurally deficient bridges throughout the City can be obtained through PennDOT. This information could be shared with the Philadelphia Fire Department (PFD) for the Department to better understand where the building and structure collapse is most likely to occur in the City and how to prepare themselves (e.g., training, personal protective equipment, vehicular equipment) to respond to an incident. The City may also benefit from keeping record of building and structural collapse events within the jurisdiction, as there is no comprehensive list of building and structural collapse events within the entirety of the Commonwealth.

4.3.9 Dam Failure- For Official Use Only, In Appendix L

4.3.10 Environmental Hazards – Hazardous Materials Release

4.3.10.1 Hazard Profile

Hazard Description

Hazardous materials can include explosives, flammable and combustible substances, radioactive materials, toxic chemicals (poisonous vapors, aerosols, liquids and solids that have toxic effects on people, animals, or plants), infectious substances, and hazardous wastes. The Environmental Protection Agency (EPA) identifies more than 800 substances as hazardous and many more as potentially hazardous depending on their characteristics and the circumstances of their release. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, defines a hazardous substance as any of the following materials (EPA 2013):

- Any element, compound, mixture, solution, or substance designated as hazardous under Section 102 of CERCLA.
- Any hazardous substance designated under Section 311(b)(2)(a) of the Clean Water Act (CWA), or any toxic pollutant listed under Section 307(a) of the CWA.
- Any hazardous waste having the characteristics identified or listed under Section 3001 of the Resource Conservation and Recovery Act.
- Any hazardous air pollutant listed under Section 112 of the Clean Air Act.
- Any imminently hazardous chemical substance or mixture for which the EPA Administrator has taken action under Section 7 of the Toxic Substances Control Act.

Such materials are present in facilities that produce, store, or use them, and they are transported along interstate highways and railways daily. A common example is a water treatment plant, which uses chlorine on-site to eliminate bacterial contaminants. Many products containing hazardous materials are used and stored in homes. Even the natural gas used in homes and businesses can be a dangerous substance when a leak occurs.

Hazardous materials can be released due to accident, human neglect, intentional acts, or cascading impacts from natural hazards. They can affect nearby populations and contaminate critical or sensitive environmental areas. When caused by natural hazards, these incidents are considered to be secondary events. The hazardous materials hazard for this HMP refers to accidental incidents related to the manufacture, transportation, storage, and use of hazardous materials. Hazardous material incidents most commonly occur as a fixed-facility or in-transit incident.

Hazardous material releases contaminate air, water, and soils, possibly resulting in death and/or injuries to humans, animals, and vegetation. Dispersion takes place rapidly when the hazardous material is transported by water and wind. The severity of a hazardous material release depends on whether it is from a fixed or mobile source, the toxicity and properties of the material, the duration of the release, and the environmental conditions (e.g., wind, precipitation, or terrain).

The City of Philadelphia Hazardous Materials Plan classifies three types of hazardous material incidents:

- A “Level I” incident is not likely to adversely impact or threaten life, health, property, or the environment; control of the incident is within capabilities of local response jurisdictions.

- A “Level II” incident may adversely impact or threaten life, health, property, or the environment within an area immediately surrounding the point of release; control of the incident is outside the capabilities of local fire departments and would require assistance of a regional hazardous materials team.
- A “Level III” incident poses a serious threat to a large area or poses a major threat to life, environment, or property. This incident would require assistance from a regional hazardous materials team and possibly state and/or federal responders.

An incident occurring at an on-site or fixed facility may be sudden and without any warning, such as an explosion, or slowly developing, such as a leaking container. Facilities that store extremely hazardous substances are required to notify local officials when an incident occurs. Local emergency responders and emergency management officials would determine the need to evacuate the public or to advise sheltering in place.

Fixed-Facility Sites

A hazardous materials incident at a fixed facility is the uncontrolled release of materials from a fixed site capable of posing a risk to health, safety, and property. It is possible to identify and prepare for a fixed-site incident because laws require facilities to notify state and local authorities about what is being used or produced at the site.

In-Transit

A hazardous materials incident in transit is an event resulting in uncontrolled release of hazardous materials during transport that can pose a risk to health, safety, and property. Hazardous materials transportation incidents can occur anywhere, although most occur on interstate highways, major federal or state highways, or major rail lines. Many incidents occur in sparsely populated areas and affect very few people. Hazardous products are shipped daily on highways, railroads, waterways, and pipelines. Transportation incidents are difficult to prepare for because there is little, if any, notice about what materials could be involved should an accident happen.

A hazardous material is any solid, liquid, or gas that, when released, can harm people, the environment, or property. The U.S. Department of Transportation (USDOT) classifies hazardous materials in transit as follows (FEMA 2019):

- **Class 1**—Explosives
- **Class 2**—Gases
- **Class 3**—Flammable liquids (and combustible liquids)
- **Class 4**—Flammable solids; substances liable to spontaneous combustion, substances that emit flammable gases on contact with water
- **Class 5**—Oxidizing substances and organic peroxides
- **Class 6**—Toxic (poisonous) substances
- **Class 7**—Radioactive materials
- **Class 8**—Corrosive substances
- **Class 9**—Miscellaneous dangerous goods/hazardous materials and articles

Hazardous materials can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. An accident involving a vehicle carrying hazardous materials becomes a HazMat incident if the hazardous material leaks or is involved in a fire, or if potential for release, fire, or another hazard exists (NFPA 2022).

Regulations

Hazardous materials at fixed sites are regulated nationally by the EPA and in Pennsylvania by the Pennsylvania Department of Environmental Protection (DEP). The USDOT's Pipeline and Hazardous Materials Safety Administration is responsible for ensuring the safe movement of hazardous materials to industry and consumers by all modes of transportation.

The EPA regulates hazardous materials under the CERCLA Congress established the Superfund program in 1980 to clean up sites where hazardous materials incidents occur. The CERCLA and the Superfund Amendments and Reauthorization Act (SARA) required that a National Priorities List (NPL) of sites throughout the United States be maintained and revised at least annually (EPA 1989). SARA, signed into law on October 17, 1986, is a federal law that applies nationwide.

The EPA administers the Superfund program in cooperation with individual states. The DEP's Hazardous Waste Program is the Commonwealth's program for regulating the generation, storage, transportation, treatment, and disposal of hazardous waste.

Location and Extent

Fixed-Facility Sites

Historically, hazardous materials were dumped on the ground or in rivers or left out in the open by public and private companies. As a result, thousands of uncontrolled or abandoned contaminated sites were created nationwide. These sites include abandoned warehouses, manufacturing facilities, processing plants, and landfills. Fixed-site facilities that use, manufacture, or store hazardous materials in the City of Philadelphia pose risk and must comply with Title III of SARA. Figure 4-30 displays 0.5-mile buffers surrounding the Tier II facilities in the City; for confidentiality, these locations are not identified. The following sources list known locations of fixed-facility hazardous waste sites in the City:

- The EPA Hazardous Waste Report provides detailed data on the generation of hazardous waste from large quantity generators and on the waste management practices of treatment, storage, and disposal facilities. The 2021 report lists 50 facilities in the City (EPA 2024). Interested parties can research this information at: https://rcrapublic.epa.gov/rcrainfoweb/action/modules/br/search/view
- The Comprehensive Environmental Response, Compensation, and Liability Information System database indicates four Superfund sites in the City (EPA 2024). Interested parties can research this information at: https://www.epa.gov/superfund/search-superfund-sites-where-you-live

In Transit

Highways

Incidents involving hazardous materials in transit can occur anywhere in the City of Philadelphia, as hazardous materials are transported via roadways every day. Roadways throughout the City are built over wetlands and across streams and rivers, creating a risk for hazardous materials release to pollute surface water and groundwater. Figure 4-31 shows the major transportation routes in the City with 0.5-mile buffers to display potentially impacted areas.

Figure 4-30. Tier II Facility Hazard Area

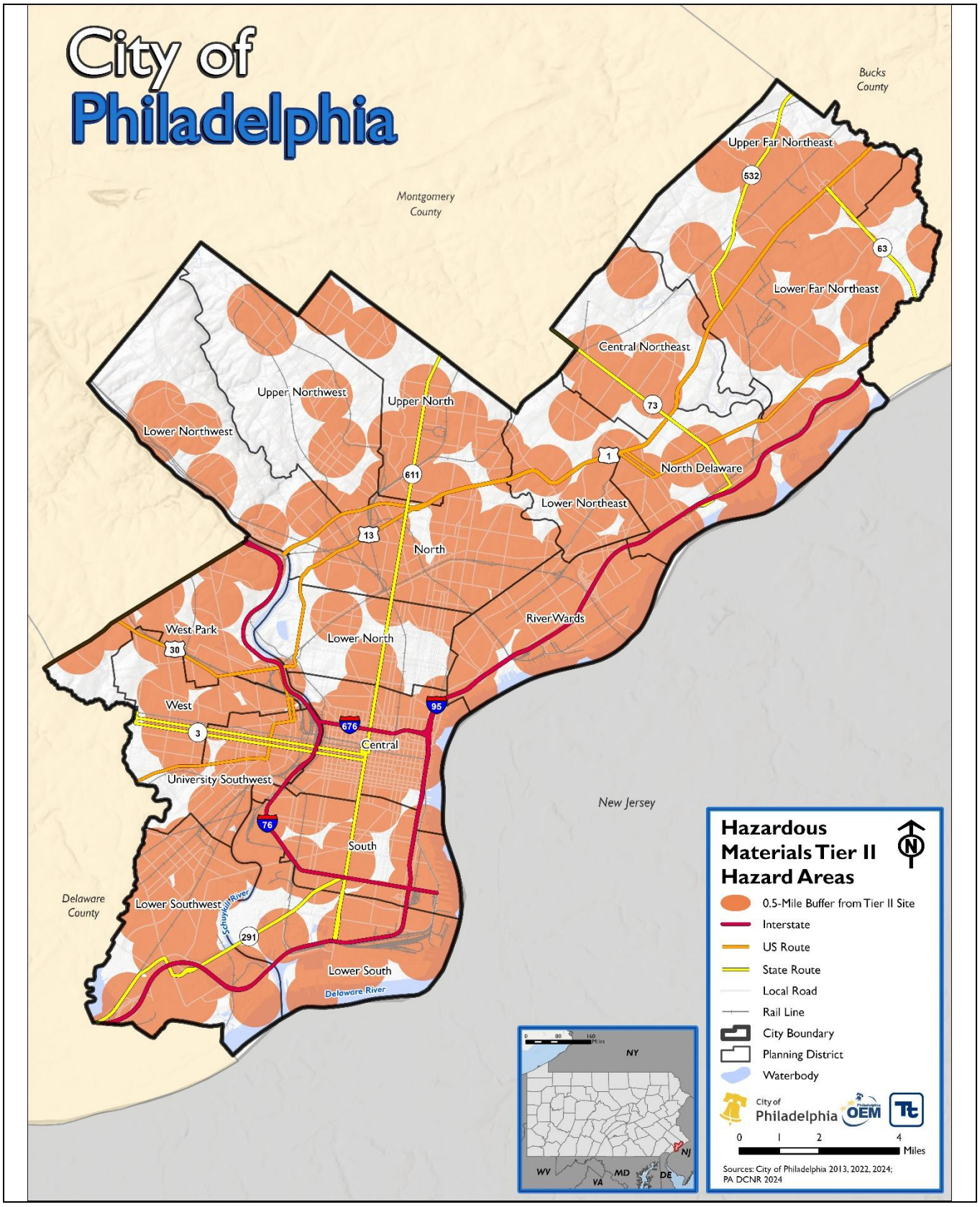


Figure 4-31. Hazardous Materials in Transit, Roadways Hazard Area



Pipelines

The City has a relatively small network of natural gas pipelines and a more moderate network of hazardous liquid pipelines. Pennsylvania is second only to Texas in estimated total proved natural gas reserves. The Commonwealth's proved reserves more than quadrupled from 2011 to 2021 because of increased natural gas development in the Marcellus Shale. Pennsylvania uses only about one-fourth of the natural gas it produces. Several pipeline projects in recent years have enabled Marcellus natural gas producers to reach additional markets, and more pipeline projects are under construction or planned (USEIA 2023). Bellwether District Holdings, Buckeye Partners, Colonial Pipeline, MIPC, Philadelphia Gas Works, Sunoco Pipeline, Texas Eastern Transmission, Transcontinental Pipeline all operate pipelines in the City of Philadelphia; there are also abandoned pipelines within the City. Table 4-88 shows how many miles of pipeline each company has within the City. Figure 4-32 shows the extent and locations of pipelines throughout the City. Hazardous materials transported by pipeline in the City of Philadelphia include natural gas, non-highly volatile liquids, highly volatile liquids (HVLs), and crude oil (PHMSA 2024). HVL pipelines are designed to transport high-vapor-pressure liquids such as crude oil, while non-HVL pipelines handle low-vapor-pressure liquids like refined products or natural gas.

Table 4-88. Miles of Pipeline in the City of Philadelphia by Company

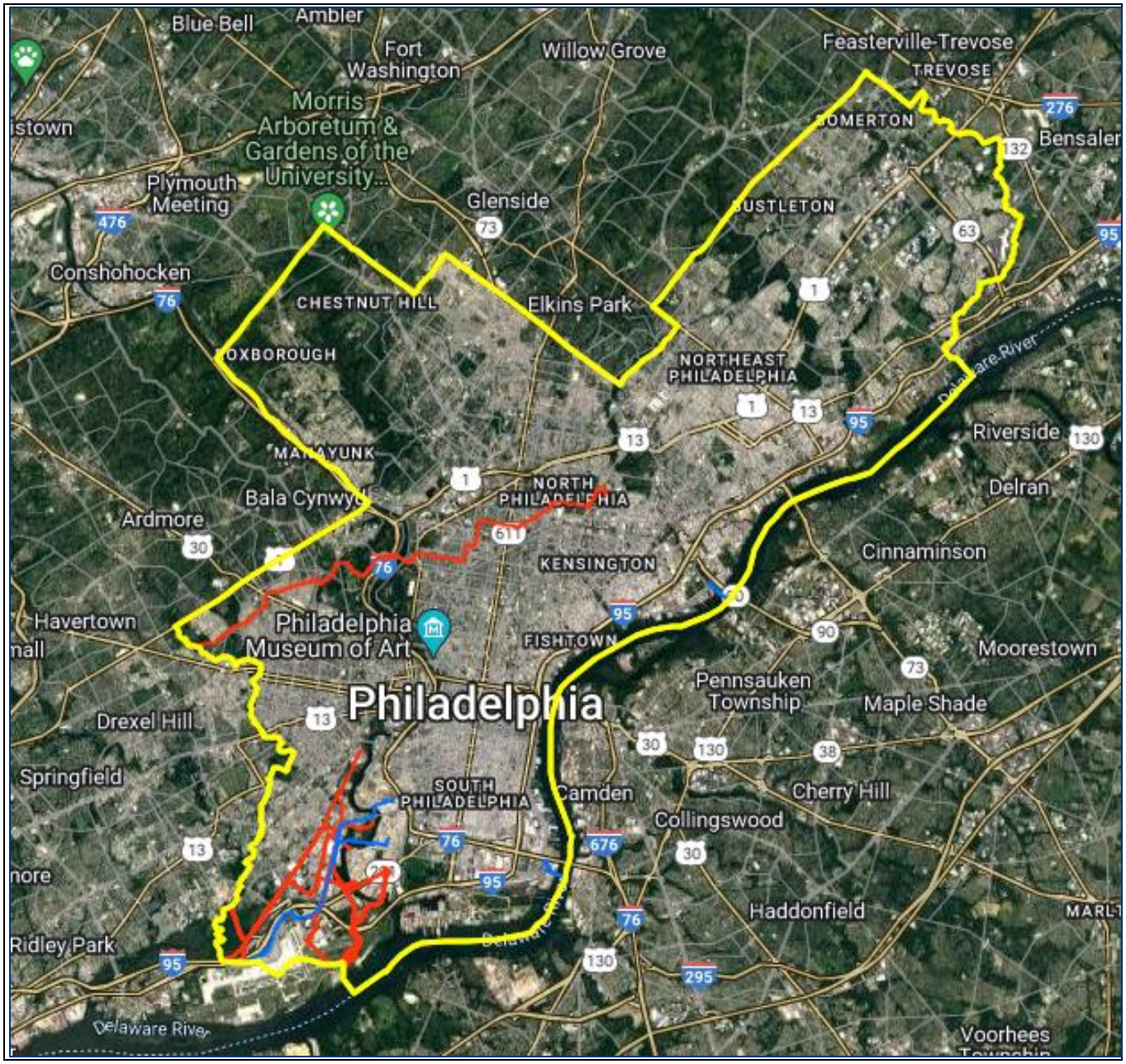
Company Name	Type of Pipeline	Miles of Pipeline in City
Abandoned	Empty Liquid	0.05
Abandoned	Empty Gas	0.03
Bellwether District Holdings	Non-HVL Product	7.74
Bellwether District Holdings	HVL Product	0.52
Bellwether District Holdings	Crude Oil	0.14
Buckeye Partners	Non-HVL Product	4.44
Colonial Pipeline	Non-HVL Product	6.78
MIPC	Non-HVL Product	11.03
Philadelphia Gas Works	Natural Gas	2.10
Sunoco Pipeline	Non-HVL Product	16.20
Sunoco Pipeline	HVL Product	5.50
Sunoco Pipeline	Crude Oil	18.16
Texas Eastern Transmission	Natural Gas	4.96
Transcontinental Gas Pipeline Company	Natural Gas	1.94

Source: PHMSA 2024

Railroads

Hazardous materials releases on and along railroads are attributed to derailments leading to a spillage of materials, or unstable conditions with cargo storage resulting in a release. Derailments can occur for several reasons including the speed of the locomotive, the placement of the cargo or load of the train, accidents at crossings, damage to the surrounding environment, and the curvature and placement of the rail lines (Bibel 2013). Figure 4-33 shows the major rail routes in the City with 0.5-mile buffers to display potentially impacted areas.

Figure 4-32. Location of Gas Transmission Pipelines in the City of Philadelphia



Source: PHMSA 2024
Note: Blue lines indicate gas transmission pipelines. Red lines indicate hazardous liquid pipelines.

Figure 4-33. Hazardous Materials in Transit, Rail Hazard Area



Range of Magnitude

Environmental hazard incidents within the City of Philadelphia could range from minor petroleum spills to large facility-based incidents that could lead to loss of life and damage to property, environment, and economy. Severity of an incident varies with type of material released and distance and related response time for emergency response teams. Areas within closest proximity to the releases are generally at the greatest risk; however, depending on the material, a release can travel great distances or persist over a long time (e.g., nuclear radiation), resulting in far-reaching effects on people and the environment.

A hazardous materials release, whether accidental or intentional, can be exacerbated or mitigated by specific circumstances surrounding the event. Exacerbating conditions are characteristics that can enhance or magnify effects of a hazard, and mitigating conditions are characteristics of the target and its physical environment that can reduce the effects of a hazard. These conditions are described as the following (PEMA 2023):

- Noncompliance with applicable codes (e.g., fire and building codes) and maintenance failures (e.g., fire protection and containment features) – can substantially increase damage to a facility and to surrounding buildings.
- Geographic location of hazmat site – if occurring within a Special Flood Hazard Area (SFHA), a materials release could cause large-scale water contamination during a flood incident, or a flood incident could compromise production and storage of hazardous chemicals. Stormwaters and floodwaters can also move toxic chemicals swiftly across great distances.
- Weather conditions – affect how the hazard develops.
- Micro-meteorological effects of buildings and terrain – alter dispersion of materials.
- Shielding in the form of sheltering-in-place – protects people and property from harmful effects.

Generally, the ways hazardous materials are harmful to humans and other animals can be broken into several categories referred to as the TRACEM (Thermal, Radiological, Asphyxiation, Chemical, Etiological, or Mechanical) model (FEMA 2019):

- Thermal Harm occurs when there is exposure to extreme temperatures either through contacting a heated surface or inhaling fumes
- Radiological Harm occurs when there is exposure to ionizing radiation removes electrons from atoms and causes damage to living cells and DNA
- Asphyxiation occurs when there is exposure to materials that reduce oxygen levels, typically in confined spaces or with very concentrated forms of hazardous material, that tissues cannot be oxygenated enough
- Chemical Harm occurs when there is exposure to chemicals that include poisons, corrosive agents, certain metals, opioids, pesticides, and more. The injuries and illnesses that result will depend entirely on the material.
- Etiological (Biological) Harm occurs when there is exposure to organic materials such as bacteria, viruses, and biological toxins which can produce delayed responses as pathogens take time to multiply
- Mechanical Harm occurs when there is either contact with fragmentation or debris created in pressure releases or explosions, injuries caused solely by pressure increases (eardrum and blood vessel rupture), or secondary blast injuries when victims are thrown by blasts.

The amount of warning time for incidents associated with hazardous substances in transit (or off-site events) varies based on the nature of the incident, the scope of the incident, and the characteristics of the substance released. If

an explosion does not occur immediately following an accident, there may be time for warning of adjacent neighborhoods and enough time to facilitate appropriate protective actions.

The Philadelphia Water Department (PWD) protects City waterways from threats and pollution sources with the Early Warning System and complementary programs. The PWD's Watershed Protection Program combines emergency preparedness systems, public and private communication networks, computer modeling systems, laboratories, regional and national partnerships, planning, and infrastructure investment.

A worst-case scenario for hazardous material release would be a large, uncontrolled release of a toxic gas within the City. This could take the form of an accident and major rupture of a tanker hauling a toxic or flammable gas in or near the City. While little physical property damage is likely from this type of event, the potential for injury and death to people up to 0.25 mile from the scene is significant. This event would likely overwhelm the medical care capacity within the City, and possibly the region. An event such as this would likely close City offices, causing a major disruption to government operations. The most likely scenario would be a transportation accident resulting in a rupture of a truck's fuel tank, spilling a small quantity of diesel fuel onto the roadway.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, City of Philadelphia was not included in any major disaster (DR) or emergency (EM) declarations for hazardous material release-related events (FEMA 2024).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was not included in any USDA hazardous material release-related agricultural disaster declarations (USDA 2024).

Previous Events

Known hazard events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-89. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-89. Hazardous Material Release Events in the City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
March 15, 2021	Intersection of Crowell Street and North 18th Street in the City.	Refined and/or petroleum product was released due to outside force damage on the MIPC, LLC owned pipeline at the intersection of Crowell Street and North 18th Street in the City.
January 1, 2023	3500 block of Miller Street	An explosion injured five people, destroyed three homes and damaged over 40 other houses in the Port Richmond neighborhood.
March 24, 2023	Entirety of the City due to the water supply	8,000 gallons of a water-based latex finishing solution from the Trinseo Altuglas chemical facility in Bristol, Bucks County, leaked into the Otter Creek near the Delaware River

Source: PHMSA 2024; PEMA 2023; City of Philadelphia 2022

In addition to the occurrences noted in Table 4-89, the EPA documented 348,653 pounds of on- and off-site disposals and other releases from facilities contained in its 2022 Toxic Release Inventory and 356,446 pounds of on- and off-site disposals and other releases from facilities contained in its 2021 Toxic Release Inventory (EPA 2023).

In March 2023, an estimated 8,000 gallons of a water-based latex finishing solution from the Trinseo Altuglas chemical facility in Bristol, Bucks County, leaked into the Otter Creek near the Delaware River. The incident, which occurred upstream of the City's Baxter Drinking Water Treatment Plant, did not impact drinking water; however, the City of Philadelphia was criticized for unclear public messaging. After the City issued numerous bottled water advisories, panic buying ensued, leaving some supermarket shelves empty. Trinseo and its subsidiary Altuglas, blame the cause of the spill on equipment failure (WHYY 2024). There was no study or report found on environmental impacts from this incident.

Probability of Future Occurrences

Information on previous hazardous material release occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-90. Based on historical records and input from the Steering Committee, the probability of occurrence for hazardous material release in the City is considered "highly likely."

Future occurrences of hazardous material releases have the potential to impact the entirety of the City. Populations in the immediate vicinity of a release would be the impacted the most. Releases may occur in a variety of locations due to the vast highway, pipelines, and rail systems in the City; further, the 50 Tier II facilities and four superfund sites are fixed-location sites which could be the focus of a hazardous material release. These releases can impact populations by the spread of air particles – even populations downwind have the potential for impacts due to the spread of the contaminant. Releases in waterways which supply potable water to the City have occurred in the past. Impacts to potable water sources can cause detriment to the public, as drinkable water becomes unavailable and first responders may not have a viable source to assist in fire suppression activities.

Table 4-90. Probability of Future Hazardous Material Release Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Hazardous Material Release	3	10.71%

Source: PHMSA 2024; PEMA 2023; City of Philadelphia 2022

Climate Change Projections

It can be assumed that the projected increase in temperatures may impact the storage and ultimately transportation of hazardous materials. If stored improperly or if storage methods are not adapted to withstand extreme temperatures, hazardous materials may have an adverse reaction, leading to a potential hazardous materials incident (OSHA 2016).

Similarly, the increase in frequency and magnitude of flood and severe weather events may impact hazardous materials at fixed sites and during transit. The City experiences significant flooding events already, and based on future climate projections, these events may become more frequent and intense. If not properly stored, hazardous materials could mix with flood waters and cause adverse impacts (EPA 2021). Hazardous materials in-transit would be at risk, varying by mode of transport. Transport by rail and highway would need to be aware of flooding conditions and visibility during severe storms; transport by water would need to be aware of wave action and water elevation

levels; transport by pipeline would need to be aware of potential excess soil saturation, which could influence the integrity of pipelines during extreme conditions.

Cascading Impacts on Other Hazards

Hazardous materials releases have the potential to cause major disruptions to local businesses that house hazardous materials and to other major businesses in the vicinity. Depending on the severity of the release event, this could result in additional economic impacts to the region, such as prolonged business closures or supply chain disruptions.

Urban fires may occur as a result of a hazardous materials incident. Hazardous materials releases can result in fires, leading to urban fires in the densely populated City of Philadelphia. Flammable gases, combustible materials, and electrical hazards are just a number of hazardous materials which can result in a fire. Mixed-use areas within the City may be more at risk to an urban fire caused by a hazardous materials release.

Instability to a building or structure following a hazardous materials incidents may cause a collapse of the impacted site. Hazardous materials can be stored in a variety of locations, including at industrial facilities, hospitals, gas stations, and even residential properties. The improper storage of these materials can result in an incident that can cause substantial structural damage. Structural damage to any building has the potential to lead to a collapse of the site which can cause additional harm to surrounding structures, infrastructure, and nearby persons.

4.3.10.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate what assets are vulnerable within the identified hazard area. The transportation data obtained through the City of Philadelphia was used to define the hazard area around major roadways and railways. The hazard area was defined as a 0.5-mile buffer around the Interstate, State, and U.S. roadways and railways where hazardous materials may be in transit to estimate areas that may be directly or indirectly impacted by a release.

The City of Philadelphia also provided a spatial layer for Tier II sites. Like with the major roadways & railways, the hazard area was defined as a 0.5-mile buffer around these features.

The defined hazard areas were overlaid upon the asset data (population, building stock, critical facilities) to estimate the exposure to each hazard. Centroids that intersected the hazardous materials buffer boundary were totaled to estimate the building replacement cost value and population vulnerable to hazardous material release. The following text evaluates and estimates the potential impact of the hazardous material release hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Hazardous materials incidents can cause acute and chronic health issues and have an impact on long-term public health. People near facilities producing, storing, or transporting hazardous substances are at higher risk of exposure, with populations downstream, downwind, and downhill of a released substance at particular risk.

Depending on the substance released, people in a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation. People outside the immediate affected area may be evacuated for precautionary reasons or told to shelter-in-place, depending on the release type and wind conditions.

Overall Population

The vulnerability analysis evaluated populations within 0.5 miles of major transportation infrastructure where a hazardous materials event could occur. Table 4-91 summarizes population vulnerability to hazardous material incidents. According to this analysis:

- There are 743,037 persons, 1.117 million persons, and 1.162 million persons living within 0.5 miles of all roadways, railways, and Tier II facilities, respectively.
- The North Delaware Planning District has the greatest number of people living within 0.5 miles of all roadways (91,111).
- The Central Planning District has the greatest number of people living within 0.5 miles of all railways (113,908).
- The North Planning District has the largest population living within 0.5 miles of a Tier II facility (119,806).

If a facility is in a densely populated neighborhood with high rates of overcrowded units or low-income households, then these populations may face elevated vulnerability. People employed at facilities producing elevated levels of hazardous materials also face an increased risk of exposure due to their direct contact with the hazardous materials.

Hazardous materials pose a significant risk to emergency response personnel. All first responders and emergency personnel in the City currently are and will be properly trained to the level of emergency response actions required of their individual position at the response scene.

Mitigating conditions are measures taken in advance to reduce the impact of a release on the surrounding environment. Primary and secondary containment or shielding by sheltering-in-place can protect people and property from the harmful effects of a hazardous material release.

Exacerbating conditions, characteristics that can enhance or magnify the effects of a hazardous material release, include the following factors:

- Weather conditions, which affect how the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain, which affect dispersion of hazardous materials
- Non-compliance with applicable codes (such as building or fire codes)
- Maintenance failures (such as fire protection and containment features), which can substantially increase the damage to the facility itself and to surrounding buildings.

Socially Vulnerable Population

Socially vulnerable populations may be impacted by hazardous material events differently than others. For example, in the event of an evacuation, younger and older populations and those with disabilities may have mobility issues or rely on others (i.e., parents, aides) to get around. Low-income households have less disposable capital to pay for temporary shelter (i.e., hotels) should their place of occupancy become unlivable. Individuals who do not speak English very well, or speak another language, may receive warning or evacuation notices but not understand them.

As shown in Table 4-92, within 0.5 miles of all roadways:

- The South Planning District has the highest population over 65 (1,311).
- The West Planning District has largest population under the age of 5 (164) and the greatest population living in poverty (744).
- The North Planning District has the greatest population of non-English speaking persons (7,105).
- The North Delaware Planning District has the highest disabled population (14,346).

As shown in Table 4-93, within 0.5 miles of all railways:

- The Central Planning District has the highest population over 65 (17,152).
- The Upper Northwest Planning District has the largest population under the age of 5 (5,677).
- The North Planning District Town of Torrey has the greatest population of non-English speaking persons (15,576), disabled population (30,914), population living in poverty (41,477).

As shown in Table 4-94, within 0.5 miles of all Tier II facilities:

- The Upper North Planning District has the highest population over 65 (18,982).
- The North Planning District has the largest population under the age of 5 (9,243), non-English speaking persons (17,165), disabled population (34,068), population living in poverty (45,709).

Table 4-91. Population in the Hazardous Materials Buffer Hazard Areas

Planning District	Total Population	Population Vulnerable to Hazardous Material Incidents					
		Within 0.5 Miles of Hazardous Materials Roadways		Within 0.5 Miles of Hazardous Materials Railways		Within 0.5 Miles of Tier II Facilities	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Central	136,618	73,777	54.0%	113,908	83.4%	104,472	76.5%
Central Northeast	85,803	41,045	47.8%	33,183	38.7%	50,255	58.6%
Lower Far Northeast	71,972	24,522	34.1%	16,732	23.2%	50,733	70.5%
Lower North	99,171	44,311	44.7%	88,090	88.8%	50,471	50.9%
Lower Northeast	106,958	44,775	41.9%	55,802	52.2%	74,121	69.3%
Lower Northwest	54,410	5,992	11.0%	31,796	58.4%	32,784	60.3%
Lower South	6,465	6,450	99.8%	6,450	99.8%	4,184	64.7%
Lower Southwest	42,894	422	1.0%	39,378	91.8%	41,209	96.1%
North	135,438	49,590	36.6%	108,714	80.3%	119,806	88.5%
North Delaware	98,608	91,111	92.4%	44,874	45.5%	75,308	76.4%
River Wards	69,786	31,110	44.6%	63,534	91.0%	66,500	95.3%
South	131,686	86,837	65.9%	110,442	83.9%	112,041	85.1%
University Southwest	81,820	45,668	55.8%	78,707	96.2%	57,002	69.7%
Upper Far Northeast	69,114	35,079	50.8%	44,698	64.7%	40,448	58.5%
Upper North	151,883	50,492	33.2%	76,686	50.5%	112,859	74.3%
Upper Northwest	90,934	5,184	5.7%	83,647	92.0%	44,593	49.0%
West	114,814	76,249	66.4%	90,468	78.8%	87,417	76.1%
West Park	44,833	30,423	67.9%	30,511	68.1%	37,817	84.4%
City of Philadelphia (Total)	**1,593,208**	**743,037**	**46.6%**	**1,117,620**	**70.1%**	**1,162,020**	**72.9%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024
Note: Population totals have been rounded down

Table 4-92. Estimated Vulnerable Population in the 0.5-Mile Hazardous Materials Roadway Buffer Hazard Area

Planning District	Estimated Number of Vulnerable Persons Located in the Roadway Buffer Hazard Area									
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total
Central	11,109	54.0%	2,717	54.0%	3,050	54.0%	6,325	54.0%	7,743	54.0%
Central Northeast	7,314	47.8%	3,029	47.8%	5,500	47.8%	6,197	47.8%	7,453	47.8%
Lower Far Northeast	4,053	34.1%	1,751	34.1%	1,333	34.0%	3,278	34.1%	2,006	34.1%
Lower North	4,492	44.7%	2,205	44.7%	2,395	44.7%	8,795	44.7%	14,614	44.7%
Lower Northeast	4,707	41.9%	3,711	41.9%	3,656	41.9%	8,592	41.9%	12,088	41.9%
Lower Northwest	864	11.0%	308	11.0%	68	10.9%	756	11.0%	532	11.0%
Lower South	1,227	99.8%	374	99.7%	412	99.8%	790	99.7%	377	99.7%
Lower Southwest	45	1.0%	26	1.0%	36	1.0%	63	1.0%	112	1.0%
North	6,119	36.6%	3,826	36.6%	7,105	36.6%	14,101	36.6%	18,919	36.6%
North Delaware	11,174	92.4%	6,254	92.4%	6,563	92.4%	14,346	92.4%	18,546	92.4%
River Wards	3,036	44.6%	2,232	44.6%	1,990	44.6%	5,936	44.6%	7,578	44.6%
South	11,935	65.9%	4,979	65.9%	6,139	65.9%	12,429	65.9%	15,345	65.9%
University Southwest	3,875	55.8%	1,576	55.8%	1,480	55.8%	6,356	55.8%	11,226	55.8%
Upper Far Northeast	8,035	50.8%	2,173	50.7%	6,547	50.8%	5,200	50.8%	4,324	50.7%
Upper North	8,492	33.2%	2,968	33.2%	2,068	33.2%	9,239	33.2%	12,153	33.2%
Upper Northwest	878	5.7%	351	5.7%	76	5.6%	890	5.7%	959	5.7%
West	10,342	66.4%	5,902	66.4%	855	66.4%	13,237	66.4%	22,256	66.4%
West Park	5,029	67.9%	1,406	67.8%	780	67.8%	5,344	67.9%	6,936	67.9%
City of Philadelphia (Total)	**102,726**	**46.0%**	**45,788**	**46.2%**	**50,053**	**47.3%**	**121,874**	**45.5%**	**163,167**	**46.4%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024
Note: Population totals have been rounded down

Table 4-93. Estimated Vulnerable Population in the 0.5-Mile Hazardous Materials Railway Buffer Hazard Area

Planning District	Estimated Number of Vulnerable Persons Located in the Railway Buffer Hazard Area									
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total
Central	17,152	83.4%	4,196	83.37%	4,709	83.4%	9,766	83.4%	11,956	83.4%
Central Northeast	5,913	38.7%	2,448	38.7%	4,447	38.7%	5,010	38.7%	6,026	38.7%
Lower Far Northeast	2,766	23.2%	1,195	23.2%	910	23.2%	2,236	23.2%	1,369	23.2%
Lower North	8,931	88.8%	4,384	88.8%	4,762	88.8%	17,485	88.8%	29,052	88.8%
Lower Northeast	5,866	52.2%	4,625	52.2%	4,557	52.2%	10,708	52.2%	15,065	52.2%
Lower Northwest	4,587	58.4%	1,635	58.4%	364	58.4%	4,012	58.4%	2,825	58.4%
Lower South	1,227	99.8%	374	99.7%	412	99.8%	790	99.7%	377	99.7%
Lower Southwest	4,259	91.8%	2,453	91.8%	3,416	91.8%	5,923	91.8%	10,501	91.8%
North	13,414	80.3%	8,388	80.3%	15,576	80.3%	30,914	80.3%	41,477	80.3%
North Delaware	5,503	45.5%	3,080	45.5%	3,232	45.5%	7,066	45.5%	9,134	45.5%
River Wards	6,200	91.0%	4,559	91.0%	4,065	91.0%	12,123	91.0%	15,476	91.0%
South	15,180	83.9%	6,332	83.9%	7,808	83.9%	15,808	83.9%	19,516	83.9%
University Southwest	6,678	96.2%	2,717	96.2%	2,551	96.2%	10,955	96.2%	19,347	96.2%
Upper Far Northeast	10,238	64.7%	2,769	64.7%	8,342	64.7%	6,626	64.7%	5,510	64.7%
Upper North	12,898	50.5%	4,508	50.5%	3,141	50.5%	14,031	50.5%	18,458	50.5%
Upper Northwest	14,181	92.0%	5,677	92.0%	1,239	92.0%	14,367	92.0%	15,476	92.0%
West	12,270	78.8%	7,003	78.8%	1,014	78.7%	15,706	78.8%	26,406	78.8%
West Park	5,043	68.0%	1,410	68.0%	782	68.0%	5,360	68.1%	6,956	68.1%
City of Philadelphia (Total)	**152,306**	**68.2%**	**67,753**	**68.4%**	**71,327**	**67.4%**	**188,886**	**70.6%**	**254,927**	**72.5%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024
Note: Population totals have been rounded down

Table 4-94. Estimated Vulnerable Population in the 0.5-Mile Hazardous Materials Tier II Facility Buffer Hazard Area

Planning District	Estimated Number of Vulnerable Persons Located in the Tier II Facility Buffer Hazard Area									
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total
Central	15,731	76.5%	3,848	76.5%	4,319	76.5%	8,957	76.5%	10,965	76.5%
Central Northeast	8,955	58.6%	3,708	58.6%	6,734	58.6%	7,588	58.6%	9,126	58.6%
Lower Far Northeast	8,386	70.5%	3,623	70.5%	2,759	70.5%	6,781	70.5%	4,151	70.5%
Lower North	5,117	50.9%	2,512	50.9%	2,728	50.9%	10,018	50.9%	16,645	50.9%
Lower Northeast	7,792	69.3%	6,143	69.3%	6,053	69.3%	14,224	69.3%	20,011	69.3%
Lower Northwest	4,729	60.2%	1,685	60.2%	375	60.1%	4,137	60.2%	2,913	60.2%
Lower South	796	64.7%	242	64.5%	267	64.7%	512	64.6%	244	64.5%
Lower Southwest	4,457	96.0%	2,567	96.1%	3,574	96.0%	6,198	96.1%	10,989	96.1%
North	14,783	88.5%	9,243	88.5%	17,165	88.5%	34,068	88.5%	45,709	88.5%
North Delaware	9,236	76.4%	5,169	76.4%	5,425	76.4%	11,858	76.4%	15,329	76.4%
River Wards	6,490	95.3%	4,772	95.3%	4,254	95.3%	12,689	95.3%	16,198	95.3%
South	15,399	85.1%	6,424	85.1%	7,921	85.1%	16,037	85.1%	19,799	85.1%
University Southwest	4,837	69.7%	1,968	69.7%	1,847	69.7%	7,934	69.7%	14,012	69.7%
Upper Far Northeast	9,265	58.5%	2,506	58.5%	7,549	58.5%	5,996	58.5%	4,986	58.5%
Upper North	18,982	74.3%	6,634	74.3%	4,622	74.3%	20,650	74.3%	27,165	74.3%
Upper Northwest	7,560	49.0%	3,026	49.0%	660	49.0%	7,659	49.0%	8,250	49.0%
West	11,857	76.1%	6,767	76.1%	980	76.1%	15,176	76.1%	25,516	76.1%
West Park	6,251	84.3%	1,748	84.3%	970	84.3%	6,643	84.3%	8,621	84.3%
City of Philadelphia (Total)	**160,623**	**72.0%**	**72,585**	**73.2%**	**78,202**	**73.9%**	**197,125**	**73.6%**	**260,629**	**74.1%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024
Note: Population totals have been rounded down

General Building Stock

Potential losses to property caused by a hazardous materials release, whether in transit or at fixed sites, are difficult to quantify. The degree of damage depends on the scale of the incident. Potential impacts may include inaccessibility, loss of service, contamination, and/or potential damage to the structure or contents. Hazardous materials can pose a serious long-term threat to property, particularly to the fixed-site facilities where hazardous materials are stored.

The impact of a fixed-facility incident will often be localized to the property where it occurs. It is difficult to determine potential losses to surrounding development because of the variable nature of a hazardous material spill. For example, a very small chemical spill in a less populated area would be much less costly and possibly limited to remediation of soil. Local building stock characteristics and the type of substance released during a spill will greatly affect the extent of property damage.

The vulnerability analysis indicates 239,878 buildings with an estimated value of $221 billion within 0.5 miles of all roadways, 361,404 buildings with an estimated value of $285 billion within 0.5 miles of all railways, and 378,644 buildings with an estimated value of $288 billion within 0.5 miles of all Tier II facilities. The South Planning District has the greatest number of buildings within 0.5 miles of all roadways (36,490), railways (46,499), and Tier II facilities (47,264). Refer to Table 4-95 through Table 4-97 for building vulnerability to hazardous material incidents.

Table 4-98 through Table 4-100 list the buildings within the hazardous material hazard areas by general occupancy. The vulnerability analysis estimates that across all hazardous materials hazard areas, residential buildings face the most vulnerability to the hazardous material hazard, accounting for 44.27 percent, 66.36 percent, and 69.79 percent of the buildings within 0.5 miles of railways, 0.5 miles of roadways, and 0.5 miles of Tier II facilities, respectively.

Table 4-95. Estimated Number and Total Replacement Cost Value of Structures in the 0.5-Mile Hazardous Materials Roadway Buffer Hazard Area

Planning District	Planning District Total Buildings		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total
Central	29,150	$104,498,861,483	18,308	62.8%	$87,633,352,009	83.9%
Central Northeast	23,691	$12,324,032,453	11,447	48.3%	$6,134,853,535	49.8%
Lower Far Northeast	21,899	$15,483,279,437	7,508	34.3%	$5,663,647,123	36.6%
Lower North	31,876	$17,246,447,463	14,192	44.5%	$9,101,286,948	52.8%
Lower Northeast	31,140	$10,314,498,850	12,775	41.0%	$3,993,120,777	38.7%
Lower Northwest	18,020	$13,615,067,162	2,023	11.2%	$1,669,530,918	12.3%
Lower South	1,963	$8,208,372,896	1,901	96.8%	$6,128,569,377	74.7%
Lower Southwest	14,503	$6,840,537,150	169	1.2%	$1,227,456,342	17.9%
North	48,796	$13,054,275,189	18,011	36.9%	$6,186,211,912	47.4%
North Delaware	32,565	$13,552,083,648	30,258	92.9%	$12,755,774,748	94.1%
River Wards	29,313	$14,267,301,089	13,126	44.8%	$7,142,295,341	50.1%
South	55,342	$28,814,766,240	36,490	65.9%	$20,081,064,263	69.7%
University Southwest	18,972	$28,704,645,654	10,725	56.5%	$26,991,135,797	94.0%
Upper Far Northeast	18,078	$14,096,177,394	9,465	52.4%	$8,176,587,014	58.0%
Upper North	48,866	$15,554,930,862	16,512	33.8%	$5,110,346,391	32.9%
Upper Northwest	26,636	$16,619,291,505	1,471	5.5%	$498,456,152	3.0%
West	40,683	$10,774,317,065	27,002	66.4%	$7,384,057,665	68.5%
West Park	12,322	$7,494,241,193	8,495	68.9%	$5,590,603,336	74.6%
City of Philadelphia (Total)	**503,815**	**$351,463,126,733**	**239,878**	**47.6%**	**$221,468,349,647**	**63.0%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; RS Means 2024

Table 4-96. Estimated Number and Total Replacement Cost Value of Structures in the 0.5-Mile Hazardous Materials Railway Buffer Hazard Area

Planning District	Planning District Total Buildings		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total
Central	29,150	$104,498,861,483	27,120	93.0%	$102,370,628,134	98.0%
Central Northeast	23,691	$12,324,032,453	9,117	38.5%	$4,929,624,908	40.0%
Lower Far Northeast	21,899	$15,483,279,437	5,206	23.8%	$4,959,547,525	32.0%
Lower North	31,876	$17,246,447,463	28,822	90.4%	$16,252,316,555	94.2%
Lower Northeast	31,140	$10,314,498,850	16,590	53.3%	$4,922,193,403	47.7%
Lower Northwest	18,020	$13,615,067,162	10,745	59.6%	$7,737,221,217	56.8%
Lower South	1,963	$8,208,372,896	1,936	98.6%	$7,723,000,826	94.1%
Lower Southwest	14,503	$6,840,537,150	13,348	92.0%	$5,829,170,965	85.2%
North	48,796	$13,054,275,189	39,216	80.4%	$10,434,630,080	79.9%
North Delaware	32,565	$13,552,083,648	15,211	46.7%	$7,016,236,943	51.8%
River Wards	29,313	$14,267,301,089	26,987	92.1%	$12,933,232,143	90.6%
South	55,342	$28,814,766,240	46,499	84.0%	$24,748,252,350	85.9%
University Southwest	18,972	$28,704,645,654	18,301	96.5%	$28,447,258,448	99.1%
Upper Far Northeast	18,078	$14,096,177,394	11,954	66.1%	$9,568,259,886	67.9%
Upper North	48,866	$15,554,930,862	25,119	51.4%	$8,096,782,442	52.1%
Upper Northwest	26,636	$16,619,291,505	24,576	92.3%	$15,178,368,456	91.3%
West	40,683	$10,774,317,065	32,162	79.1%	$8,787,452,574	81.6%
West Park	12,322	$7,494,241,193	8,495	68.9%	$5,227,707,560	69.8%
City of Philadelphia (Total)	**503,815**	**$351,463,126,733**	**361,404**	**71.7%**	**$285,161,884,415**	**81.1%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; RS Means 2024

Table 4-97. Estimated Number and Total Replacement Cost Value of Structures in the 0.5-Mile Hazardous Materials Tier II Buffer Hazard Area

Planning District	Planning District Total Buildings		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total
Central	29,150	$104,498,861,483	25,191	86.4%	$100,037,652,245	95.7%
Central Northeast	23,691	$12,324,032,453	13,924	58.8%	$6,927,975,021	56.2%
Lower Far Northeast	21,899	$15,483,279,437	15,428	70.5%	$12,091,422,401	78.1%
Lower North	31,876	$17,246,447,463	16,708	52.4%	$9,189,796,287	53.3%
Lower Northeast	31,140	$10,314,498,850	21,676	69.6%	$7,248,875,222	70.3%
Lower Northwest	18,020	$13,615,067,162	11,081	61.5%	$8,175,075,911	60.0%
Lower South	1,963	$8,208,372,896	1,326	67.5%	$7,487,518,506	91.2%
Lower Southwest	14,503	$6,840,537,150	13,959	96.2%	$6,575,137,703	96.1%
North	48,796	$13,054,275,189	43,281	88.7%	$11,367,546,184	87.1%
North Delaware	32,565	$13,552,083,648	24,985	76.7%	$10,170,777,107	75.0%
River Wards	29,313	$14,267,301,089	28,232	96.3%	$13,818,542,449	96.9%
South	55,342	$28,814,766,240	47,264	85.4%	$25,629,439,799	88.9%
University Southwest	18,972	$28,704,645,654	13,427	70.8%	$27,106,607,681	94.4%
Upper Far Northeast	18,078	$14,096,177,394	10,904	60.3%	$9,197,806,596	65.3%
Upper North	48,866	$15,554,930,862	36,368	74.4%	$11,520,829,523	74.1%
Upper Northwest	26,636	$16,619,291,505	13,304	49.9%	$7,584,655,903	45.6%
West	40,683	$10,774,317,065	31,120	76.5%	$8,030,674,918	74.5%
West Park	12,322	$7,494,241,193	10,466	84.9%	$6,392,029,416	85.3%
City of Philadelphia (Total)	**503,815**	**$351,463,126,733**	**378,644**	**75.2%**	**$288,552,362,873**	**82.1%**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024; RS Means 2024

Table 4-98. Buildings in the 0.5-Mile Hazardous Materials Roadway Buffer Hazard Area by General Occupancy Class

Planning District	Buildings in the 0.5-Mile Hazardous Materials Roadway Buffer Hazard Area			
	Residential	Commercial	Industrial	Other[a]
Central	15,021	2,884	208	195
Central Northeast	10,901	502	9	35
Lower Far Northeast	7,319	145	21	23
Lower North	13,229	731	82	150
Lower Northeast	12,331	387	32	25
Lower Northwest	1,922	86	9	6
Lower South	1,731	90	77	3
Lower Southwest	134	16	16	3
North	16,430	1,193	242	146
North Delaware	28,707	1,191	277	83
River Wards	11,969	804	320	33
South	34,116	2,038	225	111
University Southwest	9,904	613	54	154
Upper Far Northeast	9,089	298	45	33
Upper North	15,487	854	64	107
Upper Northwest	1,430	32	6	3
West	25,369	1,431	61	141
West Park	7,958	414	41	82
City of Philadelphia (Total)	**223,047**	**13,709**	**1,789**	**1,333**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024

a. Other = Government, Religion, Agricultural, and Education

Table 4-99. Buildings in the 0.5-Mile Hazardous Materials Railway Buffer Hazard Area by General Occupancy Class

Planning District	Buildings in the 0.5-Mile Hazardous Materials Roadway Buffer Hazard Area			
	Residential	Commercial	Industrial	Other[a]
Central	23,183	3,399	294	244
Central Northeast	8,813	254	18	32
Lower Far Northeast	4,994	158	40	14
Lower North	26,299	1,823	376	324
Lower Northeast	15,368	939	215	68
Lower Northwest	10,198	443	68	36
Lower South	1,731	106	94	5
Lower Southwest	12,480	694	113	61
North	36,003	2,420	532	261
North Delaware	14,139	729	279	64
River Wards	24,442	1,741	719	85
South	43,390	2,601	334	174
University Southwest	17,069	943	94	195
Upper Far Northeast	11,581	288	51	34
Upper North	23,521	1,342	109	147
Upper Northwest	23,074	1,184	117	201
West	30,100	1,792	68	202
West Park	7,981	393	42	79
City of Philadelphia (Total)	**334,366**	**21,249**	**3,563**	**2,226**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024

a. Other = Government, Religion, Agricultural, and Education

Table 4-100. Buildings in the 0.5-Mile Hazardous Materials Tier II Buffer Hazard Area by General Occupancy Class

Planning District	Buildings in the 0.5-Mile Hazardous Materials Roadway Buffer Hazard Area			
	Residential	Commercial	Industrial	Other[a]
Central	21,266	3,387	296	242
Central Northeast	13,347	517	11	49
Lower Far Northeast	15,142	165	89	32
Lower North	15,068	1,202	214	224
Lower Northeast	20,413	977	211	75
Lower Northwest	10,515	462	60	44
Lower South	1,123	94	103	6
Lower Southwest	13,060	702	135	62
North	39,662	2,708	635	276
North Delaware	23,728	948	243	66
River Wards	25,583	1,799	743	107
South	44,018	2,724	348	174
University Southwest	12,362	803	87	175
Upper Far Northeast	10,480	285	105	34
Upper North	34,616	1,499	88	165
Upper Northwest	12,301	786	84	133
West	29,085	1,764	68	203
West Park	9,892	444	40	90
City of Philadelphia (Total)	**351,661**	**21,266**	**3,560**	**2,157**

Source: U.S. Census Bureau ACS 2022; City of Philadelphia 2022, 2024
a. Other = Government, Religion, Agricultural, and Education

Community Lifelines and Other Critical Facilities

Most community lifelines house and store hazardous materials and thus are vulnerable to possible incidents. Potential impacts to community lifelines may include inaccessibility, loss of service, contamination, and/or potential damage to the structure or contents if an explosion related to a hazardous materials release occurs. Hospitals often store large quantities of hazardous materials and may face elevated risk in the event of a spill. If an incident were to occur in a hospital setting, patients would be jeopardized, and accessibility issues could prevent them from being moved and first responders from gaining access to the building. Patients who are moved may influx surrounding hospitals in addition to any new patients from the incident.

Hazardous material incidents have the potential to lead to major transportation route closures in the City. The closure of railroads, airports, and highways as a result of hazard material release incidents has the potential to impact the ability to deliver goods and services. The City has 320 bridges and 2,525 miles streets and highways that are vulnerable to hazardous materials incidents (City of Philadelphia 2024).

Water pollution is an immediate concern for direct human consumption, recreation, and crop irrigation. Waterways are at risk during a hazardous materials incident. Hazardous materials can leach into soil and impact groundwater or as shown during the March 2023 hazardous materials spill, be released into water resources, including potable

water sources. Impacts on water systems from a hazardous materials incident may cause interruption to water utilities in the City.

Table 4-101 summarizes critical facilities and lifelines located within the hazardous materials hazard areas. A total of 6,510 critical facilities are located in the City of Philadelphia. Across all hazard areas, the Safety and Security lifeline has the greatest number of facilities exposed, while the Energy lifeline has the fewest facilities exposed.

Table 4-101. Number of Facilities in Hazardous Materials Hazard Areas, by Lifeline Category

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines 0.5 Miles of Hazardous Materials Roadways	Number of Lifelines 0.5 Miles of Hazardous Materials Railways	Number of Lifelines 0.5 Miles of Tier II Facilities
Communications	308	204	257	276
Energy	23	12	17	21
Food, Hydration, Shelter	201	116	162	168
Hazardous Materials	430	263	370	426
Health and Medical	254	146	203	203
Safety and Security	728	393	572	550
Transportation	387	218	329	298
Water Systems	299	144	234	270
Other Critical Facilities	3,880	1,994	3,115	2,970
City of Philadelphia (Total)	**6,510**	**3,490**	**5,259**	**5,182**

Source: City of Philadelphia 2012, 2016, 2018, 2019, 2021, 2022, 2024; DEP 2024; SEPTA 2023; ESRI 2023; HIFLD 2019, 2023, 2024

Economy

If a significant hazardous materials release occurred, not only would life, safety, and building stock be at risk, but the economy of the City may be impacted as well. A significant incident in a developed area may force businesses to close for an extended period of time because of contamination or direct damage. The potential losses to existing development vary because of the variable nature of hazardous material spills, but costs from product loss, property damage and decontamination, and other costs can add up to millions of dollars.

Hazardous material incidents can cause major economic disruptions. Not only do these events impact the companies transporting the materials, but the incidents may also impact facilities surrounding the location of the incident. A hazardous materials event can become costly quickly due to the cost of responders, response equipment, and clean-up.

Hazardous material incidents can lead to extended business closures that greatly affect the local economy. As businesses close and tourists are prohibited from entering the affected area, tourism may decline, and public perception of the area may be permanently affected. It may also prevent workers from commuting or consumers from traveling to businesses.

The closure of railroads, airports, and highways as a result of a hazardous materials incident has the potential to impact the ability to deliver goods and services efficiently. Potential impacts may be local, regional, or statewide, depending on the magnitude of the event and level of service disruptions.

Natural, Historic and Cultural Resources

Natural

Hazardous materials incidents can have obvious, direct environmental impact as well as long-term, hidden environmental damage. Spilled hazardous substances can kill wildlife and harm ecosystems. Water pollution is an immediate concern for fish and wildlife consumption. Waterways are at risk during a hazardous materials incident. Hazardous materials can leach into soil and impact groundwater or as shown during the March 2023 hazardous materials spill, be released into water resources.

Depending on the material, pollutants can bio-accumulate to differing degrees, affecting animals high on the food chain long after a spill. Hazardous wastes can also leach into soils and travel with wind, which not only impacts the localized habitat but also can create issues for surrounding communities. Strict disposal regulations have been defined by the EPA to ensure that the environment and community are protected from these types of events (EPA 2023). Hazardous material incidents would not likely affect geology but could significantly impact soils and farmlands, requiring expensive remediation.

Historic

Unless a spill is directly adjacent to a site or if the site stores hazard materials, a hazardous materials incident is unlikely to affect historic resources. However, hazardous materials can pose a serious long-term threat to historic resources, particularly if the incident is on or near a historic site. Historic sites are typically not built to modern building codes, making them susceptible to damage. These sites often cannot be easily moved or upgraded without getting special permits.

Cultural

Unless a spill is directly adjacent to a site or if the site stores hazard materials, a hazardous materials incident is unlikely to affect cultural resources. However, hazardous materials can pose a serious long-term threat to cultural resources, particularly if the incident is on or near a cultural site. Cultural events and/or festivals often take place in outdoor areas. A hazardous materials incident could impact the participants or visitors at these events and festivals or result in the event or festival becoming postponed or cancelled.

4.3.10.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

As discussed in Chapter 3 (City Profile), areas targeted for future growth and development have been identified across the City of Philadelphia. Any areas of growth near a fixed facility site or transportation corridor would become exposed to hazardous material incidents. The number and types of hazardous chemicals stored in and transported through the City may increase as the City continues to develop available land.

Development near the transit routes for hazardous materials and facilities will increase the City's overall risk. Therefore, the City should take precautions with the location of new development and the development's proximity to hazardous material facilities and transit routes. The City may want to consider implementing designs into new development that enable improved evacuation or protection from residual impacts of hazardous materials.

Projected Changes in Population

An increase in population density and future development can increase the exposure to a hazardous substance incident.

Climate Change

Hazardous materials moved by transportation systems could be impacted by climate change, depending on the method for storing materials. If storage systems do not adapt to changing temperatures, hazardous materials could react to any increase in extreme temperatures caused by climate change. Furthermore, if climate change leads to a significant increase in temperature, roads and potential rail lines may buckle and warp. Climate change may increase the frequency and magnitude of flood and severe weather events, which may lead to an increased release of hazardous substances at both fixed sites and in-transit.

Additional Data and Next Steps

Facilities that produce, use, or store hazardous chemicals must notify the public via the City's emergency dispatch center and PEMA if an accidental release of a hazardous substance meets or exceeds a designated reportable quantity and has the potential to affect persons and/or the environment outside the facility. The City should continue to maintain contact directories for facilities which store or transport hazardous materials. The City should seek to collect data on the locations of pipelines across the jurisdiction.

4.3.11 Terrorism

4.3.11.1 Hazard Profile

Hazard Description

Terrorism is a human-caused hazard that can occur anywhere. The Federal Bureau of Investigation (FBI) defines terrorism as an unlawful use of force and violence against persons and property to intimate or coerce a government, civilian population, or in the furtherance of political and social objectives (PEMA 2023). When assessing terrorism risks, several key factors must be considered, including the presence of facilities, landmarks, or buildings of international, national, or regional significance. According to FEMA, high-risk targets include military and civilian government installations, international airports, major cities, and cultural landmarks. Additional potential targets are large public events, water and food supplies, utilities, and corporate centers. Terrorists may also employ cyber-attacks or send explosive, chemical, or biological agents through the mail (PEMA 2023).

Location and Extent

Terrorism can stem from a wide range of political, personal, and cultural agendas, making any location a potential target for terrorist activity. In the City of Philadelphia, there are numerous critical facilities and infrastructure that could be targeted. These include police stations, hospitals, fire stations, schools, bridges, utility facilities, government buildings, and more. Each of these sites plays a vital role in the daily functioning and safety of the community.

Philadelphia is home to 331 schools, enrolling over 190,000 students (The School District of Philadelphia 2023). These educational institutions are essential for the development and future of the City's youth. Any attack on these schools could have devastating effects, not only on the students and staff but also on the broader community, disrupting education and causing widespread fear.

Hospitals and medical facilities are another critical target. These institutions provide essential healthcare services to the population. An attack on a hospital could result in significant loss of life and hinder the ability to provide medical care to those in need. It would also strain the healthcare system, making it difficult to respond to other emergencies.

Police and fire stations are crucial for maintaining public safety and responding to emergencies. An attack on these facilities could impair the City's ability to protect its residents and respond to crises, leading to increased vulnerability and chaos.

Bridges and transportation infrastructure are vital for the movement of people and goods. Damage to these structures could disrupt commerce, hinder emergency response efforts, and isolate parts of the City, causing significant economic and logistical challenges.

Utility facilities, including water, electricity, and gas services, are essential for the daily functioning of homes and businesses. An attack on these facilities could lead to widespread outages, affecting the quality of life and economic stability of the City.

Government buildings house essential services and administrative functions. An attack on these buildings could disrupt governance and public services, leading to confusion and instability.

The potential damage to these systems and structures could have far-reaching negative impacts on the community, commerce, and transportation sectors (PEMA 2023). It is crucial for the City of Philadelphia to implement robust

security measures and emergency response plans to protect these critical facilities and ensure the safety and resilience of the community.

Range of Magnitude

The FBI characterizes terrorism into two categories (PEMA 2023):

- International Terrorism: Violent acts committed by individuals or groups inspired/associated with foreign terrorist organizations.
- Domestic Terrorism: Violent, criminal acts that are carried out by individuals or groups to further their ideological goals which stem from domestic influences, such as political, religious, social, and racial nature (PEMA 2023).

FEMA has defined three main goals of terrorism which are (1) to cause public fear; (2) convince the community that the government cannot protect them from terrorist attacks; (3) make the terrorist cause and motivation know to the community (PEMA 2023). Some common strategies of terrorism include:

- Agriterrorism: Food contamination or pest/disease agents to destroy crops.
- Arson: malicious damage/destruction of property by fire/explosion (Bernard 2024).
- Armed Attack: Armed groups who are incentivized to attack those who do not support their cause (Goodwin 2019).
- Assassination: The murder of a public figure, typically a political figure (Encyclopaedia Britannica 2024).
- Biological Agent: In association with bioterrorism, it is the deliberate release of bioweapons to cause death or disease in humans, plants, or animals. Often can include bacteria, viruses, toxins, or fungi (Rathish, et al. 2023)
- Chemical Agent: In association with chemical terrorism, it is the spread of toxic chemicals with the intent to do harm. Often can include chemical weapons developed for military use (U.S. Department of Homeland Security 2022).
- Cyberterrorism: The act of using the internet and other forms of information/communication technologies to threaten or cause bodily harm, with the goal to gain political/ideological power (Akleylek 2024).
- Conventional Bomb: A streamlined cylinder consisting of an outer casing with inner explosive materials and an arming mechanism (Encyclopaedia Britannica 2024). These bombs use chemical energy as opposed to nuclear.
- Hijackings: The illegal seizure of a vehicle, aircraft, or other conveyance while it is in transit (Jenkins 2024).
- Intentional Hazardous Material Release: The intentional release of hazardous material substances which pose a threat to human health and safety. Often includes substances which are explosive, toxic, and radioactive (U.S. Department of Homeland Security 2023).
- Kidnapping: The unlawful taking and carrying away of a person by force or fraud against their free will (Encyclopaedia Britannica 2024).
- Nuclear Bomb: Also known as a nuclear weapon, atomic bombs, or hydrogen bombs, it is a device that is designed to release energy in an explosion as a result of nuclear fission and/or nuclear fusion (Cochran and Norris 2024).
- Radiological Agent: Any radioactive material that is released to cause adverse health impacts. Often exposing the community to radiological materials (EPA 2024).

Terrorism severity depends upon the method, proximity to people/assets, and the duration of exposure to terrorist attacks. An example would be if an explosive goes off in a public park. The severity of injuries depends on the amount of people and critical assets which are exposed to the explosive at the park and the duration and size of the explosive itself. Explosive attacks are difficult to track and prevent as sometimes they can be random acts of terrorism. Usually following the event is when reasoning behind the attack can be pieced together, so that the community can come together to heal and prevent further attacks.

With technology continuing to grow and influencing our daily lives and economy, cyberterrorism is an ever-growing threat. Cyberterrorism can range from smaller attack such as taking control of a website, to larger attacks such as using networked resources to cause direct destruction and harm to a community (PEMA 2023). Cyberterrorists are difficult to track down due to the internet providing connections between people on a global scale. Those who plan to carry out cyber-attacks are not organized like other terrorist groups; they can be geographically separated but can still plan and communicate virtually.

On September 11, 2001, a hijacking attack impacted the entire Commonwealth, in parallel efforts of the 9/11 terrorist attacks on the United States. On 9/11, United Flight 93 crashed in Pennsylvania. Terrorist who hijacked the plane planned to target a critical governmental asset in Washington D.C. They failed their efforts due to the 40 brave passengers onboard Flight 93, who were able to gain control of the plane and crash it before it reached its destination. All 40 passengers and crew members perished in these heroic efforts.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, City of Philadelphia was not included in any major disaster (DR) or emergency (EM) declarations for terrorist-related events (FEMA 2024).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was not included in any USDA terrorist-related agricultural disaster declarations (USDA 2024).

Previous Events

Known hazard events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-102. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-102. Terrorist Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
June 11, 2024	Regional	Eight people who had ties to ISIS, an extremist terrorist group, were arrested in Philadelphia, New York City, and Los Angeles by the FBI Join Terrorism Task Force and U.S. Immigration and Customs Enforcement (ICE).
April 26, 2024	Philadelphia International Airport	An American Airline plane that landed in Philadelphia International Airport from the Turks and Caicos Islands was inspected by the FBI and Philadelphia police due to a bomb threat. It was determined by officials that no credible threat was identified.

Event Date	Location Impacted	Description
August 14, 2023	Commonwealth	The FBI and Philadelphia police investigated a 17-year-old supporter of an Islamic extremist group, who was allegedly radicalized online and had purchased materials to make bombs. The FBI Joint Terrorism Task Force halted a potential catastrophic terrorist attack through monitoring and evaluation.
May 15, 2023	Commonwealth	A possible cyberattack was identified in Philadelphia which disrupted a major communication hub, the Philadelphia Inquirer, which is where much of the community receives its news and information. This cyberattack attempt resulted in closing of the newsroom for several days.

Source: NBC Philadelphia 2024; New York Times 2023

Probability of Future Occurrences

Information on previous terrorism occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-103. Based on historical records and input from the Steering Committee, the probability of occurrence for terrorism in the City is considered “possible.”

The 2025 Homeland Security Threat Assessment from the Department of Homeland Security indicates that looking forward, the threat of violence from United States-based violent extremists will remain high. The threat will continue to be characterized primarily by lone offenders or small cells motivated to violence by a combination of racial, religious, gender, or anti-government grievances; conspiracy theories; and personalized factors. Concern primarily surrounds the likelihood of violence motivated by developing domestic and global events, including the ongoing Israel-HAMAS conflict. Foreign Terrorist Organizations (FTO), like ISIS and al-Qaida, are thought to continue maintaining the intent to conduct or inspire attacks in the United States and have leveraged the conflict in the Middle East to reaffirm this intent. FTO media outlets promote rhetoric intended to inspire persons in the United States to mobilize to violence, while foreign terrorists continue engaging online supporters to solicit funds; create and share media; and encourage followers to attack the United States, its interests, and what the FTOs perceive as the West (Department of Homeland Security 2024).

Future occurrences of terrorism in the City may be more likely to be focused on historic or cultural locations, critical infrastructure, and critical facilities. Persons which work or live near potential targets may be at higher risk of being impacted.

Table 4-103. Probability of Future Terrorist Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Terrorism	7	25%

Source: Global Terrorism Database, 2024

Note: Due to limitations in data, not all terrorist events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2024

Climate Change Projections

Climate change is not expected to impact terrorist activity as a whole. However, it may exacerbate the impacts felt by agroterrorism which can impact entire regions and economies which rely on agriculture for food, goods, and services.

Cascading Impacts on Other Hazards

Terrorism and potential terrorist activity have the potential to impact and/or exacerbate other hazard events identified in this plan. For example, chemical terrorism is the release of toxins and radiological agents to cause harm. This form of terrorism is meant to cause physical harm and/or spread illness and disease. Other hazards that can impact the health of the community is hazardous material releases and pandemics. If chemical terrorism were to occur during a large hazardous material release or a pandemic, the community impacts would be severely worse than if the incidents happened on separate occasions. Terrorist activity can leave the community more vulnerable to other hazards, by separating people and causing terror during a time of stress.

4.3.11.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. Regarding terrorism events, the whole of the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines), as described in Chapter 3, City Profile, are potentially vulnerable. The following text evaluates and estimates the potential impact of the terrorism hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

The entire population of the City of Philadelphia (1,603,797) is exposed to terrorism events (Census 2020). The number of people in the United States who are harmed or die because of terrorism fluctuates each year depending on the specific incidents that occur. From 1995 to 2019, there was a total of 3,282 deaths due to terrorist attacks in the United States (National Consortium for the Study of Terrorism and Responses to Terrorism 2020). In the City of Philadelphia, common terrorist activity includes explosives such as bombs. To combat this and protect residents from such events, the City has implemented highly trained explosives specialists which can deploy and respond to any explosive threat (City of Philadelphia - Office of Emergency Management 2024). It is important for the community to stay vigilant and aware of bomb threats and to report them to public safety personnel so that they may be safely contained.

Socially Vulnerable Population

A 2018 study indicates that some societal subgroups are more vulnerable to health impacts of terror attacks—in particular mental health—than others and need specific public health attention. This study focused on vulnerable subgroups including first responders, survivors, relatives of victims, bereaved persons who lost a loved one, and young children (Bilsen and Lindert 2018).

Individuals who frequent historical or culturally sensitive locations may be more vulnerable to experiencing an act of terrorism. Historic and cultural resources and locations often symbolize the heritage and identity of a community,

making the resources, and those within or around them, potential targets for terrorist activities aiming to disrupt and demoralize the community.

A National Institute of Justice study reported that the most prominent terrorism risk profiles are locations characterized by the following (NIJ 2023):

- High population density
- Less-than-high-school education
- Moderate unemployment
- Low percentage of families below the poverty line
- Moderate percentage of families living in the same residence as one year prior (stability measure)
- Low percentage of vacant houses
- High percentage of foreign born

Large-scale incidents have the potential to kill or injure many residents in the immediate vicinity of the attack, and they may also affect people located a distance from the initial event.

General Building Stock

The entire general building stock inventory in the City of Philadelphia is exposed and vulnerable to the threat of terrorism. This includes a wide range of structures, from residential buildings to commercial properties, all of which can suffer significant damage in the event of a terrorist attack. Structural impacts typically include damage to roofs, building frames, windows, and the contents within these buildings. Unfortunately, current modeling tools are not sophisticated enough to estimate specific losses from such hazards accurately.

Particularly vulnerable to terrorism are critical facilities and culturally significant locations. These include schools, community centers, libraries, and other public spaces that are essential to the fabric of the community. These areas are not only important for their functional roles but also as places where people gather, socialize, and spend time. As previously discussed, the core aim of terrorism is to instill fear and terror among large groups of people by targeting community events and public spaces.

Schools, for instance, are vital as they educate and nurture the City's youth. An attack on a school could have devastating psychological and emotional impacts on students, staff, and families, disrupting education and creating a climate of fear. Community centers and libraries serve as hubs for social interaction, learning, and cultural activities. An attack on these facilities could disrupt community cohesion and access to essential services.

Given these vulnerabilities, it is imperative that the City of Philadelphia continues to implement and enhance mitigation and protection measures to safeguard these public locations. This includes physical security measures such as surveillance systems, security personnel, and controlled access points. Additionally, emergency preparedness plans should be regularly updated and tested to ensure a swift and effective response in the event of an attack.

Public awareness and community engagement are also crucial. Educating residents about the importance of vigilance and encouraging them to report suspicious activities can help prevent potential threats. Collaboration with federal and state agencies can provide additional resources and expertise to bolster local efforts.

By taking a comprehensive approach to security and preparedness, Philadelphia can better protect its critical facilities and culturally significant locations, ensuring that these spaces remain safe and welcoming for all members of the community. This proactive stance not only helps to mitigate the immediate risks of terrorism but also strengthens the overall resilience and unity of the City.

Community Lifelines and Other Critical Facilities

The full functionality of critical facilities, such as police stations, fire departments, and medical facilities, is absolutely essential for both the immediate response to and the aftermath of a terrorist event. These facilities are the backbone of the community's safety and security, providing the necessary services to protect and assist residents during emergencies. Ensuring their protection from terrorist attacks is paramount, as they are the first responders who spring into action to safeguard the community when such incidents occur.

Police stations are crucial for maintaining law and order, coordinating emergency responses, and providing security during a terrorist attack. Fire departments are vital for managing fires, hazardous materials, and rescue operations, which are often necessary in the chaotic aftermath of an attack. Medical facilities, including hospitals and emergency medical services, are indispensable for treating the injured, managing casualties, and providing ongoing care to those affected by the incident.

Recognizing the importance of these critical facilities, the City of Philadelphia has implemented specialized first response units to address specific types of terrorist threats. For instance, explosive specialists are trained to handle situations involving bombs and other explosive devices. These experts are equipped with the skills and tools needed to safely defuse and remove explosive threats, thereby preventing further harm and ensuring the safety of both responders and the public.

In addition to explosive specialists, the City has also invested in other specialized response teams, such as hazardous materials (HAZMAT) units, which are trained to deal with chemical, biological, radiological, and nuclear threats. These teams are essential for containing and mitigating the effects of hazardous substances that may be used in a terrorist attack.

To further enhance the preparedness and resilience of these critical facilities, the City conducts regular training exercises and drills. These simulations help first responders practice their skills, improve coordination, and identify areas for improvement. By staying well-prepared, these teams can respond more effectively and efficiently when a real emergency occurs.

Moreover, the City has established robust communication networks to ensure that information flows quickly and accurately between different agencies and departments. This enables a coordinated and unified response, which is crucial for managing the complex and dynamic nature of terrorist incidents.

Public awareness and community engagement are also key components of the City's strategy to protect critical facilities. By educating residents about the importance of vigilance and encouraging them to report suspicious activities, the City can help prevent potential threats and enhance overall security.

Economy

Terrorism can immobilize a region and paralyze a city, shutting down all transportation and disrupting medical and emergency services as they respond and control the impacted location. It can take several weeks, months, and even years for the economy in the affected areas to fully bounce back from a terrorist attack.

The economy is vital to the health and wellbeing of a community and is often a target for terrorist attacks. By disrupting the economy, terrorist groups can instill fear and create additional vulnerabilities within the community. This can have long-lasting effects on residents and neighboring areas. In response, new measures are often implemented after a terrorist attempt to prevent future incidents and to build a more resilient economy and community.

Natural, Historic and Cultural Resources

Natural

Terrorist events, particularly those involving biological or chemical agents, can have severe and long-lasting impacts on the natural environment. Chemical agents can seep into groundwater, contaminating water sources like rivers and lakes, making drinking water unsafe and harming aquatic wildlife. Toxic agents can also degrade soil, affecting plant life and leading to long-term agricultural issues. The release of chemical gases can cause air pollution, leading to respiratory problems and other health issues for humans and wildlife. It is important to prioritize preparedness and response strategies to mitigate the effects of such attacks on the environment.

Historic

Historical structures, especially those built 50 years ago or more, as well as landmarks deemed exceptionally significant, hold immense cultural, historical, and emotional value for the community. These sites often symbolize the heritage and identity of a city, making them potential targets for terrorist activities aiming to disrupt and demoralize the community.

In Philadelphia, a city rich with historical significance, there are numerous such structures and landmarks. These include iconic sites like Independence Hall, where the Declaration of Independence and the Constitution were debated and adopted, and the Liberty Bell, a symbol of American independence. Other notable historical sites include the Betsy Ross House, where the first American flag was sewn, and the Philadelphia Museum of Art, famous for its “Rocky Steps.”

Given their importance, it is crucial for the City of Philadelphia to incorporate these historical structures and exceptionally significant landmarks into its strategies for mitigating the impacts of terrorist attacks. This involves not only physical security measures but also comprehensive emergency preparedness plans.

Physical security measures might include enhanced surveillance, increased police presence, and the installation of barriers to prevent unauthorized access. Additionally, the City could employ advanced technologies such as drones and AI-powered monitoring systems to detect and respond to potential threats swiftly.

Emergency preparedness plans should involve detailed protocols for evacuation, medical response, and communication with the public. Regular drills and training exercises for emergency personnel can ensure that they are well-prepared to protect these sites and respond effectively in the event of an attack.

Furthermore, public awareness campaigns can play a vital role in safeguarding these landmarks. Educating the community about the importance of vigilance and encouraging the reporting of suspicious activities can help prevent potential threats.

By prioritizing the protection of its historical structures and significant landmarks, Philadelphia can preserve its rich heritage and ensure that these symbols of its past continue to inspire future generations. This proactive approach not only safeguards the physical integrity of these sites but also strengthens the resilience and unity of the community in the face of potential threats.

Cultural

Cultural spaces and major hubs in the City, such as large event venues, parks, and green spaces, are particularly vulnerable to terrorist activities because they serve as gathering spots for the community. Terrorists often target events with large crowds. In Philadelphia, examples include major, publicly televised events at the Wells Fargo

Center, which hosts numerous NHL and NBA games. To protect attendees from potential terrorist threats, the City of Philadelphia ensures that emergency personnel are present at these events.

In Philadelphia, notable examples include major, publicly televised events at the Wells Fargo Center, which hosts numerous NHL and NBA games, as well as concerts and other large-scale events. These events attract thousands of attendees, making them potential targets for terrorist activities.

To mitigate these risks, the City of Philadelphia has implemented several security measures. Emergency personnel, including police, fire, and medical teams, are present at these events to ensure the safety of attendees. Security screenings, such as bag checks and metal detectors, are also in place to prevent dangerous items from being brought into the venues. Additionally, surveillance systems and coordination with federal agencies help monitor and respond to any potential threats.

The City also conducts regular training and drills for emergency responders to prepare for various scenarios, including terrorist attacks. Public awareness campaigns encourage residents and visitors to report any suspicious activity, further enhancing the community's overall safety.

By taking these comprehensive measures, Philadelphia aims to protect its cultural spaces and major hubs, ensuring that they remain safe places for the community to gather and enjoy events.

4.3.11.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Areas targeted for potential future growth and development within the next five years have been identified across the City, further discussed in Chapter 3 (City Profile). Any areas of growth could be impacted by terrorism because the entire City is exposed and vulnerable.

Projected Changes in Population

It is probable that the City will continue to see an increase in population growth throughout the next several decades as the economy continues to flourish. Terrorism has the potential to impact a growing population by increasing their vulnerability through large public events such as sporting events, public spaces, concerts, schooling, and more. Further mitigation and planning mechanisms for safety and emergency personnel on how to prevent and respond to terrorist attacks should be implemented within the City to combat these impacts on residents.

Climate Change

The entire Commonwealth will see an increase in average annual temperatures and precipitation. Although it is unknown the amount of impact climate change will have on the severity and frequency of terrorist activity. It can be assumed that climate change can have a negative impact, as it increases civil unrest and can cause panic through natural disasters which may leave a community more vulnerable to terrorism.

Additional Data and Next Steps

As terrorism continues to be a concern within the community, the City will work to increase mitigation and planning mechanisms for safety and emergency personnel to protect its ever-growing population.

4.3.12 Urban Fire and Explosion

4.3.12.1 Hazard Profile

Hazard Description

Urban fire and explosion hazards include vehicle and building/structure fires as well as overpressure rupture, overheat, or other explosions that do not ignite. This hazard occurs in denser, more urbanized areas and most often affects residential structures. Urban fires can more easily spread from building to building in denser areas. Furthermore, urban fires are a more significant threat in the many areas of the Commonwealth with a significant proportion of buildings built before 1970 (PEMA 2023). Electrical equipment is often a major cause of fire in areas with older buildings, yet cooking has been found be the most common cause of structural fires nationally in 2022. In 2022, there were an estimated 503,800 fires in both residential (374,300) and nonresidential buildings (129,500), resulting in 2,860 deaths and over $14.5 billion in damage (USFA 2024, USFA 2024).

Urban fires and explosions often occur because of another natural or human caused event including severe and winter storms (Chapters 10, 11, and 12), drought (chapter 6), earthquakes (Chapter 7), hazardous materials releases (Chapter 15), criminal activity (Chapter 23), and terrorism (Chapter 16). The City of Philadelphia has varying risks for each of these events. For more information on the level of risk for each of these events, see their respective hazard profile.

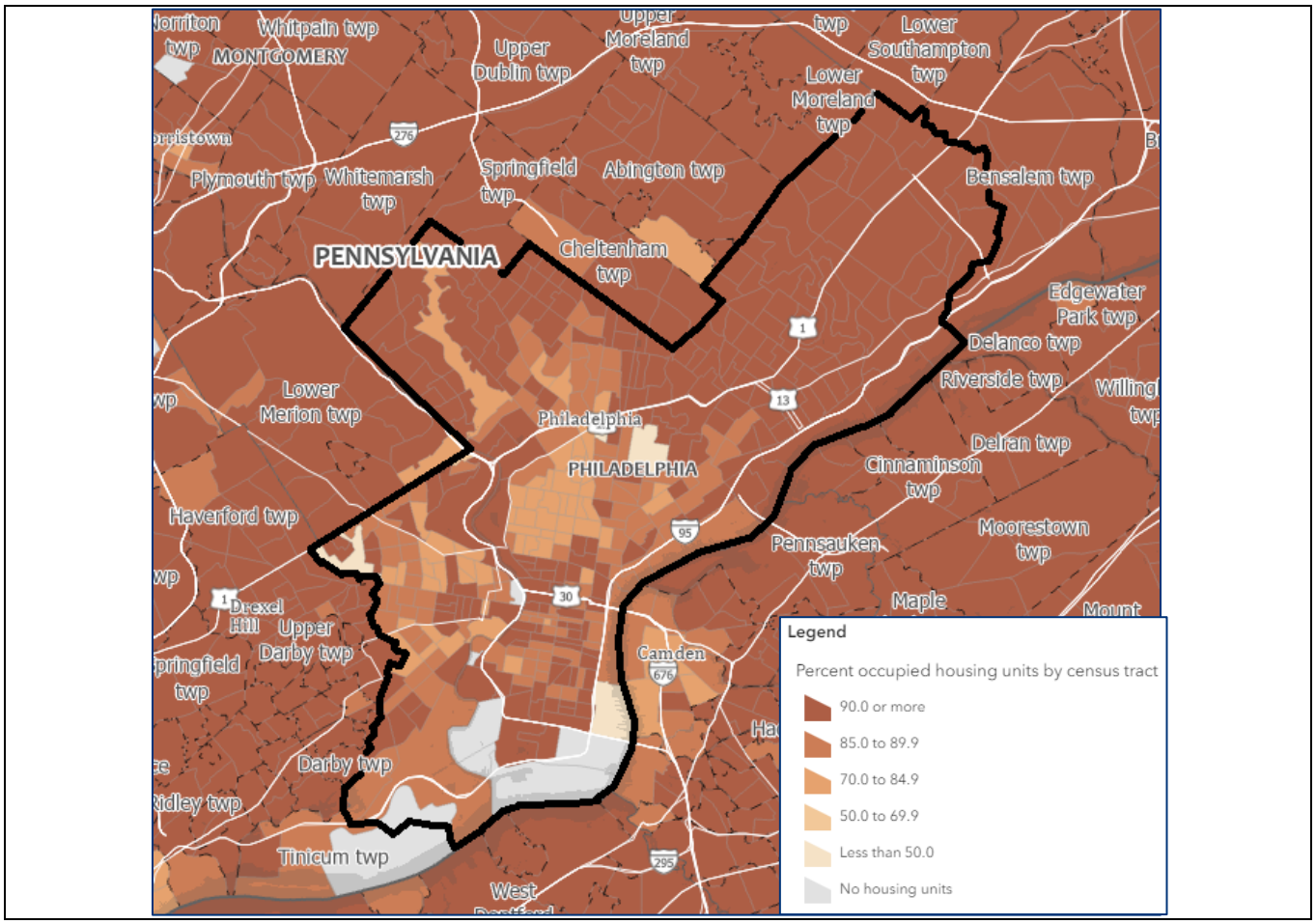
Location and Extent

Urban fires are a more significant threat in areas of the City with a significant number of buildings built before 1970. Older buildings often were not built up to modern codes, do not follow National Fire Protection Association (NFPA) regulations, and have less safety measures for fire prevention, detection, and extinguishment than newer housing units. Furthermore, urban fires and explosions tend to occur in denser, more urbanized areas (PEMA 2023).

Densely built urban environments can assist in the spread of fire through shared roofs and narrow separations between homes. Philadelphia has numerous alleys and narrow streets with many concentrated in the Old City neighborhood and a significant number of attached rowhomes. Density mapping assists in the identification of areas prone to urban fire. Figure 4-34 uses the most recent occupied housing unit information from the United States Census to demonstrate where the greatest concentration of buildings exists. The map shows that the majority of the City is densely populated and therefore at risk for widespread fire, and in turn, urban conflagration.

In recent years, junkyard and tire fires have become more common in the City. While improperly stored materials can contribute to unsafe conditions, fires can also be sparked by flammable materials hidden inside junk dropped off by a customer. Code enforcement inspectors in the City will visit junkyards to make sure tires and other combustibles are not stacked too high or too close to property lines, that there is enough space between scrap piles for fire truck access, and that other rules are being met. Junkyard and tire fires emit dark plumes of smoke and often smell of burning rubber or plastic, impacting those within the City of Philadelphia and also neighboring communities.

Figure 4-34. Occupied Housing Units in Philadelphia by Census Tract



Source: U.S. Census 2020

Range of Magnitude

Urban fires have the potential to cause extensive damage to residential, commercial, or public property. Damage ranges from minor smoke and/or water damage to the destruction of buildings. People are often displaced for several months to years depending on the magnitude of the event. Urban fires and explosions can also cause injuries and death.

The duration of an urban fire is dependent on weather conditions, the magnitude of the fire, and fire suppression resources. Structural fires could burn for several hours before being fully contained, and the presence of fire fuel can cause fires to spread away from their source.

Generally, all urban structural fire events take place with very little to no advanced warning before the building is engulfed in flames. From a wider perspective, prolonged drought and severe winds can greatly increase the likelihood of a fire event (Goss, et al. 2020). Severe weather can be predicted, so special attention can be paid during natural hazard events that may contribute to urban fires. There is no way to predict a human-caused urban fire in advance. If an urban fire starts and spreads rapidly, residents, employees, and others may need to evacuate within minutes.

The fire and life safety systems installed in urban structures are designed to provide an early warning in the event of a fire. The challenge is to know if it is best to stay in place or descend the stairs to evacuate. Automatic fire sprinkler protection in modern buildings within the City of Philadelphia are designed to control a fire and therefore lessen the need to evacuate all occupants.

Information received at a dispatch center determines the initial type of response a fire agency will provide. Response could be a single resource, usually an engine, or an alarm level. Apparatuses that typically respond to urban fires include fire engines, fire trucks (ladder, aerial, tiller, platform), and ambulances, rescue units, and/or battalion chiefs. Additional resources may include support units (breathing, supply, relief), hazardous materials responders, Urban Search and Rescue, Heavy Equipment, mobile command unit, or mobile communication unit.

In serious urban fire events, the extreme heat of a fire event can damage the underlying infrastructure. For example, in 1996, an eight-alarm tire fire ignited in Philadelphia under I-95. The extreme heat of the fire caused the bridge to buckle, which required two months of repairs to the bridge. The governor declared this event a disaster shortly after it occurred. Additionally, the City's deadliest fire in the past 100 years occurred in January 2022 in a Philadelphia Housing Authority (PHA) rowhome in the Fairmount neighborhood; 12 people died, including eight children (City of Philadelphia 2022). These would be considered worst-case scenarios for the City.

Previous Occurrences

Previous Events

Known hazard events that impacted City of Philadelphia between Fiscal Year 2021 to Fiscal Year 2023 are discussed in Table 4-104. For events prior to Fiscal Year 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-104. Urban Fire and Explosion Events in City of Philadelphia (FY 2021 to FY 2023)

Fiscal Year	Fire Incidents	Structure Fires	EMS Incidents	Calls Received
FY 2021	49,321	3,353	271,494	373,628
FY 2022	48,440	3,128	251,501	370,629
FY 2023	52,890	3,055	268,332	372,860

Source: PFD 2022; PFD 2023; PFD 2024
Note: At the time of writing (August 2024), the FY 2024 Philadelphia Fire Department Fact Sheet was unavailable. A fiscal year runs from July 1 through June 30. FY = Fiscal Year

A major urban fire and explosion occurred on January 5, 2022, when a PHA rowhome in the Fairmount neighborhood caught fire, causing twelve deaths, including eight children. The Bureau of Alcohol, Tobacco, Firearms, and Explosives, Philadelphia Police Department and other agencies indicated the incredibly intense and quick-moving fire began after a lighter was applied to a Christmas tree. The Fire Department found six inoperable and/or disabled smoke alarms in the unit where the fire occurred. According to the PHA, when the units were last inspected in April 2021 and May 2021, all smoke detectors were operating properly (Mayor's Office of Communications 2022).

Probability of Future Occurrences

The City of Philadelphia's dense, urban areas, aging building stock, vacant properties, and stored hazardous materials leads to an increased risk for urban fire and explosion occurrences. However, the probability of future occurrences may decrease with the construction of new buildings to building codes that address fire prevention,

detection, and extinguishment. Also, the City's extensive network of fire hydrants, the ongoing and extensive training of the Philadelphia Fire Department, temperate climate, and efforts to increase public awareness of the dangers of urban fires all reduce this risk of injury, death, and property loss. Generally, the probability of future occurrence may increase in portions of the City where populations are growing, and new areas are developed (City of Philadelphia 2022).

Information on previous urban fire and explosion occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-105. Based on historical records and input from the Steering Committee, the probability of occurrence for urban fire and explosions in the City is considered "highly likely."

Table 4-105. Probability of Future Urban Fire and Explosion Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 2021 and 2023	Percent Chance of Occurring in Any Given Year
Fire Incidents	150,651	100.00%
Structure Fires	9,536	100.00%
EMS Incidents	791,327	100.00%
Total	**951,514**	**100.00%**

Source: PEMA 2023; City of Philadelphia 2022; PFD 2022; PFD 2023; PFD 2024

Climate Change Projections

Climate change could potentially impact the future of urban fire risk by impacting the availability of water resources for fire departments and by creating more favorable conditions for fires to both start and burn. While research typically focuses on wildfires, air becoming hotter and drier can lead to higher amounts of moisture drawn from the surrounding environment, increasing the flammability of certain materials. Prolonged periods of low precipitation combined with hotter temperatures can create more favorable conditions for fires to start and may increase the likelihood that a fire will spread (U.S. EPA 2024).

Cascading Impacts on Other Hazards

The following are notable cascading impacts associated with urban structural fires (Alarie 2008):

- Air pollution associated with fire smoke is a cascading hazard associated with urban structural fires
- Fires, in general, present the potential for causing hazardous material releases
- Explosions from natural gas lines or propane tanks are a concern
- Those who are uninsured or under insured could face displacement from their homes
- Critical infrastructure disruptions may occur as a result of an urban structural fire event
- Extreme fire conditions may cause structural failure and building collapse

Due to the unpredictable nature of the urban structural fire hazard, it is challenging to identify all cascading and compounding impacts of this hazard.

Human service agencies (community support programs, health and medical services, public assistance programs and social services) can be affected by urban fire and explosion events as well. Effects may consist of physical damage to facilities and equipment, disruption of emergency communications, loss of health and medical facilities

and supplies, or an overwhelming load of victims who are suffering from the effects of the urban fire, including loss of their home or place of business.

4.3.12.2 Vulnerability and Impact Assessment

To understand risk, a qualitative assessment was performed to evaluate what assets are exposed or vulnerable to the urban fire and explosion hazard. The entire City has been identified as exposed to the human-caused hazard. Therefore, all assets in the City of Philadelphia (population, structures, critical facilities, and lifelines), as described in the Chapter 3 (City Profile), are exposed and potentially vulnerable. The following text evaluates and estimates the potential impact of the urban fire and explosion hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

The entire population of the City of Philadelphia is potentially exposed to the effects of the urban structural fire hazard. Residents living in higher density areas containing high-rise buildings and multi-family residences face a greater overall risk of being trapped and unable to evacuate in the event of a large-scale urban structural fire.

Overall Population

There is the potential for loss of life and injuries in any structural fire for both first responders and property owners. All persons living in the City are vulnerable to the urban fire and explosion hazard, but persons living in certain types of housing (i.e., degraded or old buildings) are more vulnerable to being affected.

Socially Vulnerable Population

Populations identified as having ongoing access and functional needs and/or emerging needs facing urban structural fires, include older adults, low-income residents, and individuals who are unhoused. Individuals with ongoing and acute mobility needs may need additional support in existing structures with elevator service disruption.

When an urban structural fire impacts a community with high rents where multiple families live in one structure, it may be difficult for those not listed on the lease to prove that they were affected by the fire. This could result in lack of access to services or higher insurance rates. Fires in residential areas can increase the price of housing and rent due to an increased demand, which further displaces people already affected by the fire. The number of unhoused individuals can increase (National Academies Press 2020).

One consideration regarding socially vulnerable communities within the City would be the potential for those individuals who are unhoused to be temporarily living in abandoned buildings that may not be up to code. In the event of an urban structural fire, these individuals would be especially vulnerable to severe injury or death.

General Building Stock

In most cases, damage, injuries, and loss of life from an urban structural fire are limited to the building itself and the immediate surroundings. Due to the City's dense, urban areas, aging building stock, vacant properties, and storage

of flammable and hazardous materials in businesses and homes, all structures in the City are considered at risk for situations that would lead to a fire or explosion. Table 4-106 displays the total number of buildings and replacement cost values of the structure and its contents by Planning District in the City. Overall, there are 503,815 buildings within the City with a total replacement cost value of $351.4 billion.

Table 4-106. Buildings in the City of Philadelphia

Planning District	Number of Buildings	Replacement Cost Value		
		Structure	Contents	Total
Central	29,150	$61,934,167,904	$42,564,693,579	$104,498,861,483
Central Northeast	23,691	$7,728,030,815	$4,596,001,638	$12,324,032,453
Lower Far Northeast	21,899	$9,063,476,224	$6,419,803,213	$15,483,279,437
Lower North	31,876	$10,508,579,002	$6,737,868,461	$17,246,447,463
Lower Northeast	31,140	$6,362,193,245	$3,952,305,605	$10,314,498,850
Lower Northwest	18,020	$8,474,590,636	$5,140,476,526	$13,615,067,162
Lower South	1,963	$4,191,753,538	$4,016,619,358	$8,208,372,896
Lower Southwest	14,503	$3,874,062,915	$2,966,474,235	$6,840,537,150
North	48,796	$7,532,654,609	$5,521,620,580	$13,054,275,189
North Delaware	32,565	$8,338,867,552	$5,213,216,096	$13,552,083,648
River Wards	29,313	$8,607,226,016	$5,660,075,073	$14,267,301,089
South	55,342	$17,942,166,375	$10,872,599,865	$28,814,766,240
University Southwest	18,972	$16,057,670,041	$12,646,975,613	$28,704,645,654
Upper Far Northeast	18,078	$8,628,215,713	$5,467,961,681	$14,096,177,394
Upper North	48,866	$9,855,035,861	$5,699,895,001	$15,554,930,862
Upper Northwest	26,636	$10,549,209,223	$6,070,082,282	$16,619,291,505
West	40,683	$6,778,263,055	$3,996,054,010	$10,774,317,065
West Park	12,322	$4,633,387,286	$2,860,853,907	$7,494,241,193
City of Philadelphia (Total)	**503,815**	**$211,059,550,010**	**$140,403,576,723**	**$351,463,126,733**

Source: City of Philadelphia 2022, 2024; RS Means 2024

Community Lifelines and Other Critical Facilities

Urban structural fires impacting community lifelines pose a significant threat to the local population. As previously mentioned, urban structural fires carry the potential to significantly disrupt the complex communications systems within the City, greatly impacting the dispatch and coordination of first responders in an emergency. Local alert and warning systems would also be impacted in this disruption. Urban structural fires present a risk to all community lifeline categories and may lead to cascading or compounding impacts such as hazardous material concerns, transportation disruptions, and disruptions to the City power grid.

Economy

Urban fire events can pose a significant threat to the local economy depending on the severity and location of the fire. Urban structural fires affecting multiple businesses within the City may cause widespread shutdown of business activities while the recovery process takes place, stunting economic growth. Urban structural fires also have an

impact on the local real estate market, impacting the availability of local properties and affecting the perception of buyers considering the purchase of property within the City of Philadelphia.

Nationally, residential fires in 2022 have resulted in over $10.8 billion in losses from a reported 374,300 fires averaging to roughly $ 28,910.76 in losses per fire. Non-residential fires in 2022 have resulted in over $3.7 billion in losses from a reported 129,500 fires averaging to roughly $ 28,889.57 in losses per fire. Between 2013 and 2022, there has been a 21 percent increase in dollar loss for residential fires and a 23 percent increase in dollar loss for non-residential fires. This overall dollar loss trends takes inflation into account by adjusting each year's dollar loss to its equivalent in 2022 value (USFA 2022, USFA 2022).

Natural, Historic and Cultural Resources

Natural

Most fires occurring in the built environment contribute to air contamination from the fire plume (which is likely to cause land and water contamination), contamination from water runoff containing toxic products, and other environmental discharges or releases from burned materials (Fire Protection Research Foundation 2022).

Historic

Urban fire events affecting historic resources have the potential to partially damage these landmarks or entirely destroy them depending on the severity of the fire. A large number of historic resources within the City are located in particularly dense population zones, increasing the risk for a devastating urban structural fire where residents and visitors may have a difficult time escaping the blaze. Historic structures are not built to modern building codes and were generally constructed with less flame-resistant materials, making them more susceptible to urban fire events.

Cultural

Urban fire events can cause extensive damage, and in some cases, complete destruction to cultural resources. The potential impacts on cultural resources from urban fires depend heavily on the materials used to construct the facility in which cultural resources are located. In many instances, historic structures house cultural resources and artifacts; many historic structures are made of wood, which is a highly flammable material. Outdoor events may be postponed or cancelled as the result of urban fire conditions, as smoke can have harmful impacts to the human body.

4.3.12.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Due to Philadelphia's dense, urban areas, aging building stock, vacant properties, and storage of flammable and hazardous materials in businesses and homes, the City is considered at risk for situations that would lead to a fire or explosion. However, the probability of future occurrences may decrease with the construction of new buildings to building codes that address fire prevention, detection, and extinguishment.

Projected Changes in Population

A rise in population will increase the number of persons who could be impacted by the urban fire and explosion hazard.

Climate Change

Climate change has the potential to exacerbate the effects of urban structural fires by increasing their size and severity through the creation of drier conditions and increase in severe wind events that may spread an event from one structure to multiple structures.

Additional Data and Next Steps

There are hundreds of urban structures in the City of Philadelphia and more will continue to be built in the future. Despite vigorous code enforcement, building inspection, and training for owners and occupants, the potential for a future disastrous event still exists. There is no way to predict when or where such an event will occur. Another consideration regarding urban structural fire can be found among the City's unhoused population. While not always inside structures, the effects of urban fire could extend to the local unhoused population if fires start within tent cities.

4.3.13 Civil Disturbance

4.3.13.1 Hazard Profile

Hazard Description

Civil disturbance is defined by PEMA as one or more forms of disturbance by a group of people (PEMA 2023). Generally, this is a broad term used by law enforcement to describe this hazard event. FEMA further provides examples of civil disturbance events such as riots, strikes, or demonstrations that require intervention to provide public safety (PEMA 2023). When civil disturbances become more serious, they have the potential to lead to large acts of violence against property or individuals, resulting in damages, injuries, and/or fatalities.

Civil disturbances can include other hazards such as (PEMA 2023):

- Famine: the widespread scarcity of food which leads to malnutrition and increased mortality.
- Recession: Negative economic growth.
- Misinformation: False information spread unintentionally.
- Strikes: Issues related to terms and conditions of employment.

Location and Extent

Anywhere there is a large group of people or a gathering of people, there is potential for civil disturbance to occur. Therefore, the location of civil disturbances tends to vary depending on the issue and messaging. However, it is more common to see civil disturbances occur at government facilities, landmarks, prisons, and universities where crowds can easily gather in reference to a common issue or message. Within the City of Philadelphia, there are four prison facilities, 67 national historic landmarks, and 32 schools including the University of Pennsylvania, Temple University, and Drexel College (Philadelphia Department of Prisons n.d.). These locations within the City are at high risk to civil disturbance hazard events due to public accessibility and cultural importance.

Range of Magnitude

Civil disturbances can range from small gatherings on the peaceful protesting of a common issue, to a large group riot who are disrupting normal community activities through noise and intimidation. Severe civil disturbance events such as mobs and riots can result in the burning of property and the terrorization of residents in the community. Even peaceful protests, which may be small in scale, have the potential to cause public worry and can escalate into community chaos. According to PEMA, the two types of large gatherings which are associated with civil disturbances are mobs and crowds (PEMA 2023). PEMA defines crowd as the casual and temporary gathering of people without a strong or cohesive relationship. Crowds can be further categorized into four subcategories (PEMA 2023):

- Casual Crowd: a group of people who happen to be gathered in the same place at the same time without violence.
- Cohesive Crowd: members involved in a unified behavior or activity. For example, religious practices, dancing, sporting events, etc. A cohesive crow would require provocation to initiate actions.
- Expressive Crowd: a group which is held together for a common purpose or commitment. These are normally not formally organized but are assembled through a common sentiment. Example would be a group which has assembled to protest. A cohesive crown sometimes may become an expressive crowd through emotional expression.

- Aggressive Crowd: this group goes a step beyond expressive crowd by acting in a violent or destructive manner, such as looting or property damage. Panic can be an intense emotional reaction of a group due to emergencies, which can result in trampling and fatalities. Events such as these would also be categorized as an aggressive crowd.

PEMA defines mobs as a large disorderly group of people. Mobs can be characterized as loud, violent, and emotional in reaction or actions. Mobs are similar to crowds in that they can be categorized into four subcategories (PEMA 2023):

- Aggressive Mob: a group that attacks, riots, and/or terrorizes a community. Violence may be acted upon a person, property, community, or all of the above. An aggressive mob is distinguished from an aggressive crown through lawless activity. An example would be inmates in a jail to develop a mob and carry out destructive actions.
- Escape Mob: a group that is attempting to flee from hazards, such as fires, bombs, flooding, and more. These groups are difficult to control and are characterized as having intense terror.
- Acquisitive Mob: a group motivated by the desire to acquire something. An example would be if a riot turns to looting activities. This group would exploit lack of control in safeguarding private properties.
- Expressive Mob: a group that expresses intense emotional reaction and debauchery following an event. Often times this group is centered around a sporting event, religious event, or a large celebration. People of this group experience a large release of pent-up emotional reactions into an already emotionally charged situation.

The severity of civil disturbance coincides with the level of public unrest and outrage. Civil disturbances often arise from protests on political issues, unions, institutional uprisings, or even from large celebrations that become out of control (PEMA 2023).

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 2021 and 2024, City of Philadelphia was not included in any major disaster (DR) or emergency (EM) declarations for civil disturbance-related events (FEMA 2024).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was not included in any USDA civil disturbance-related agricultural disaster declarations (USDA 2024).

Previous Events

Philadelphia has had several civil disturbances take place which were notable enough to be recorded in the Commonwealth's history or that garnered widespread media attention. The following list includes notable civil disturbances:

- 1742 – Philadelphia Election Riot
- 1775 – Philadelphia Anti-Loyalist Riot
- 1844 – Philadelphia Nativist Riots
- 1967 – Long Hot Summer of 1967
- 2008 – Phillies Parade
- 2011 – Occupy Philadelphia protests

- 1877 – Philadelphia Railroad Strike
- 1910 – Philadelphia General Strike
- 1919 – Red Summer (July 7, July 31)
- 1964 – Philadelphia Race Riot
- 2018 – Philadelphia Eagles Winning the Superbowl
- 2020 – George Floyd Protests
- 2020 – Death of Walter Wallace
- 2020 – Anti-Trump Protest (November 5)

Known hazard events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-107. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-107. Civil Disturbance Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
May 15, 2021	Center City	Protesters rallied in the City, days after Israel and Hamas agreed to a ceasefire ending the latest round of violence and bloodshed in a decades-long conflict.
May 22, 2021	Center City	Protesters rallied in the City, days after Israel and Hamas agreed to a ceasefire ending the latest round of violence and bloodshed in a decades-long conflict. This event was similar to the May 15, 2021 Civil Disturbance.
June 25, 2022	Philadelphia City Hall	A huge crowd formed at Philadelphia City Hall to protest the overturn of Roe V. Wade by the Supreme Court.
September 27, 2023	Philadelphia City Center	A Flash-style mob of teenagers ransacked stores in the Philadelphia Center City and stuffed plastic bags with goods before fleeing. The mob formed after a peaceful protest over a judge division to dismiss murder against a police officer who shot and killed a driver. Those involved in the mob were not affiliated with the peaceful protest. Police were able to make 52 arrests, but not all involved were caught. Burglary, theft, and other counts were filed against 30 people involved.
October 12, 2023	6th and Race Streets	More than 160 people gathered outside of WHYY's studio at Independence Hall to protest the news coverage of Palestinian people in the escalated conflict between Israel and Hamas.
April 15, 2024	Philadelphia roads and intersections; Philadelphia City Center	Philadelphia police arrested 68 people during a pro-Palestinian protest which occurred on busy Philadelphia roads and intersections. Protestors said they are a part of A15, a worldwide economic blockage for solidarity with Palestine in calling for an arms embargo. The Philadelphia Palestine Coalition took part in the protest and led the march through the Philadelphia City Center.

Source: AP News 2023; CBS 2022; NBC 10 Philadelphia 2024

Note: The City of Philadelphia respects the right for people to use their protected first amendment rights, the examples above catalogue some of the larger demonstrations that have occurred and is not meant as an endorsement or complete overview of all events that could be categorized as "Civil Disturbances".

Probability of Future Occurrences

Information on previous civil disturbance occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-108. Based on historical records and input from the Steering Committee, the probability of occurrence for civil disturbance in the City is considered "likely."

Future occurrences of civil disturbance in the City may be located at government facilities, landmarks, prisons, and universities where crowds can easily gather in reference to a common issue or message. These locations within the City are at high risk to civil disturbance hazard events due to public accessibility and cultural importance.

Generally, structures will not have many impacts from civil disturbances unless the incident becomes volatile; similarly, populations may be impacted due to closed transportation routes or facilities/buildings, but unless an incident becomes volatile risks are low.

Table 4-108. Probability of Future Civil Disturbance Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 2008 and 2024	Percent Chance of Occurring in Any Given Year
Civil Disturbance	12	75%

Source: AP News 2023; CBS 2022; NBC10 Philadelphia 2024; Gupta 2020; City of Philadelphia 2022
Note: Due to limitations in data, not all civil disturbance events are accounted for in the tally of occurrences.

Climate Change Projections

Climate change can have a direct impact on civil disturbance by impacting a large quantity of people in the community and even a region. The increase of severity and frequency of natural hazard events due to climate change has the potential to result in civil unrest, protests, and even cause panic during natural disaster events. Since climate change factors will continue to increase with global warming and emissions, civil disturbance may likely increase due to the climate stressors and impacts felt by the entire group. Socially vulnerable populations and underserved communities are more vulnerable to climate change due to medical needs and lack of resources to respond to natural hazards. These groups may be at high risk for civil disturbance as a response to climate stressors on their daily lives.

Cascading Impacts on Other Hazards

Civil disturbances have the potential to impact and exacerbate other hazard events identified in this plan. For example, civil disturbances can lead to various criminal activities such as looting, burglary, arson, car theft, and more. These activities not only pose immediate threats to public safety but can also strain emergency services and disrupt community lifelines. For more detailed information on these hazards, refer to Chapter 23 – Gun Violence and Criminal Activity.

4.3.13.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. Regarding civil disturbance events, all of the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines), as described in Chapter 3 (City Profile) are potentially vulnerable. The following text evaluates and estimates the potential impact of the civil disturbance hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

The entire population of the City of Philadelphia (1,603,797) is exposed to civil disturbance events (Census 2020). Civil disturbances can significantly impact the life and safety of residents in the City of Philadelphia. Such events often lead to violence, property damage, and disruptions to daily life. Residents may face physical harm from clashes between protestors and law enforcement, as well as from criminal activities like looting and arson that often accompany civil unrest (Philadelphia Police Department 2020). The psychological toll can also be substantial, with increased anxiety and fear among the community. Emergency services can become overwhelmed, delaying response times and reducing the availability of essential services (Concordia 2021). Overall, civil disturbances can create an environment of instability and insecurity, affecting the well-being of all residents (Philadelphia Police Department 2022).

Socially Vulnerable Population

Individuals who frequent historical or culturally sensitive locations may be more vulnerable to experiencing civil disturbance events. Historic and cultural resources and locations often symbolize the heritage and identity of a community, making the resources, and those within or around them, potential sites for civil disturbances.

General Building Stock

The entire general building stock inventory in the City of Philadelphia is exposed and vulnerable to the threat of civil disturbance. This includes a wide range of structures, from residential buildings to commercial properties, all of which can suffer significant damage in the event of a civil disturbance event. Structural impacts typically include damage to building frames, windows, and the contents within these buildings. Unfortunately, current modeling tools are not sophisticated enough to estimate specific losses from such hazards accurately.

Community Lifelines and Other Critical Facilities

The full functionality of critical facilities, such as police stations, fire departments, and medical facilities, is essential for both the immediate response to and the aftermath of a civil disturbance event. These facilities are the pillar of the community's safety and security, providing the necessary services to protect and assist residents during emergencies. Ensuring their protection from civil disturbance is paramount, as they are the first responders who spring into action to safeguard the community when such incidents occur.

Police stations are crucial for maintaining law and order, coordinating emergency responses, and providing security during a terrorist attack. Police stations face greater vulnerability to being the site of civil disturbance events and can be impacted while they are operating at full capacity. Fire departments are vital for managing fires, hazardous materials, and rescue operations, which are often necessary in the chaotic onset of a civil disturbance event. Medical facilities, including hospitals and emergency medical services, are indispensable for treating the injured, managing casualties, and providing ongoing care to those affected by the civil disturbance impacts.

Economy

Civil disturbances can have a significant impact on the economy of the City of Philadelphia. These events often lead to property damage, looting, and vandalism, which can result in substantial financial losses for businesses and property owners (Concordia 2021). The cost of repairing damaged infrastructure and increased security measures can strain public resources and divert funds from other essential services (Concordia 2021). Additionally, civil unrest can deter investment and tourism, as potential investors and visitors may perceive the City as unsafe. The disruption

of daily activities and business operations can also lead to lost revenue and decreased productivity, further affecting the local economy (Concordia 2021). Overall, the economic repercussions of civil disturbances can be long-lasting, hindering the City's growth and development.

Natural, Historic and Cultural Resources

Natural

Civil disturbances and unrest generally do not have a significant impact on the natural environment. However, large groups engaging in criminal activities such as arson and looting can indirectly affect the surrounding environment through pollution and uncontrolled fires. These actions can lead to air and water contamination, as well as damage to local flora and fauna.

Historic

Historical structures can be affected by civil disturbances and unrest due to their significance to the community. These places of historical importance often serve as starting points for protests. If a protest is not managed and conducted peacefully, it can escalate into a civil disturbance, potentially leading to criminal activities such as arson and looting.

Cultural

Cultural spaces and structures, due to their significance to the community, often serve as starting points for protests. These public spaces are easily accessible to all individuals within the community, making them common gathering spots for demonstrations.

4.3.13.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

As discussed and illustrated in Chapter 3 (City Profile), areas targeted for future growth and development have been identified across the City. Any areas of growth could be impacted by civil disturbance because the entire City is exposed and vulnerable.

Projected Changes in Population

It is probable that the City will continue to see an increase in population growth throughout the next several decades as the economy continues to flourish. Civil disturbance and unrest has the potential to impact a growing population by increasing their vulnerability through large public events such as sporting events, public spaces, concerts, schooling, and more. Further mitigation and planning mechanisms for safety and emergency personnel on how to prevent and respond to civil unrest should be implemented within the City to combat these impacts on residents.

Climate Change

The entire Commonwealth will see an increase in average annual temperatures and precipitation. Although it is unknown the amount of impact climate change will have on the severity and frequency of civil disturbance events.

It can be assumed that climate change can have a negative impact, as it increases civil unrest and can cause panic through natural disasters which may leave a community more vulnerable to incidents.

Additional Data and Next Steps

As civil disturbance and unrest continues to be a concern within the community, the City will work to increase mitigation and planning mechanisms for safety and emergency personnel to protect its ever-growing population.

4.3.14 Cyber Terrorism

4.3.14.1 Hazard Profile

Hazard Description

Cyberterrorism is a broad term that refers to acts associated with the convergence of terrorism and cyberspace. Generally, cyberterrorism involves unlawful attacks or threats against computers, networks, and the information stored therein to intimidate or coerce a government or its people to achieve political or social objectives (Denning 2000). These acts can range from taking control of a host website to using networked resources to directly cause destruction and harm (PEMA 2023). Table 4-109 identified how the Pennsylvania Governor's Office of Homeland Security defines the types and methods of cyberattacks in the 2023 State HMP.

Table 4-109. Methods of Cyberattacks

Threat	Description
Botnet (zombies)	A collection of computers subject to control by an outside party, usually without the knowledge of the owners, using secretly installed software robots. The robots are spread by Trojan horses and viruses. The botnets can be used to launch denial - of - service attacks and transmit spam.
Card Skimming	The act of using a skimmer to illegally collect data from the magnetic stripe of a credit, debit or ATM card. This information, copied onto another blank card's magnetic stripe, is then used by an identity thief to make purchases or withdraw cash in the name of the actual account holder. Skimming can take place at an ATM and can occur at restaurants, taxis, or other places where a user surrenders his or her card to an employee
Denial-of-service attack	Flooding the networks or servers of individuals or organizations with false data requests so they are unable to respond to requests from legitimate users.
Malicious code (malware)	Any code that can be used to attack a computer by spreading viruses, crashing networks, gathering intelligence, corrupting data, distributing misinformation, and interfering with normal operations.
Pharming	The act of sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft. The email directs the user to visit a website where they are asked to update personal information, such as passwords and credit card, social security, and bank account numbers that the legitimate organization already has. The website, however, is bogus and set up only to steal the user's information.
Phishing	Using fake email to trick individuals into revealing personal information, such as Social Security numbers, debit and credit card account numbers and passwords, for nefarious uses.
Spam	Unsolicited bulk email that may contain malicious software. Spam is now said to account for around 81 percent of all email traffic.

Threat	Description
Spear Phishing	A type of phishing attack that focuses on a single user or department within an organization, addressed from someone within the company in a position of trust and requesting information such as login IDs and passwords. Spear phishing scams will often appear to be from a company's own human resources or technical support divisions and may ask employees to update their username and passwords. Once hackers get this data, they can gain entry into secured networks. Another type of spear phishing attack will ask users to click on a link, which deploys spyware that can thieve data.
Spoofing	Making a message or transaction appear to come from a source other than the originator.
Spyware	Software that collects information without a user's knowledge and transfers it to a third party.
Trojan horse	A destructive program that masquerades as a benign application. Unlike viruses, Trojan horses do not replicate themselves, but they can be just as destructive. One of the most insidious types of Trojan horse is a program that claims to rid a computer of viruses but instead introduces viruses onto a computer.
Virus	A program designed to degrade service, cause inexplicable symptoms or damage networks.
Worm	Program or algorithm that replicates itself over a computer network and usually performs malicious actions, such as using up the computer's resources and possibly shutting the system down. A worm, unlike a virus, has the capability to travel without human action and does not need to be attached to another file or program.

Source: PEMA 2023

Cyberterrorism can cause severe disruptions to transportation, public safety, and utility services, all of which are critical infrastructure that are highly dependent on information technology. The healthcare industry may also be targeted. Cyberterrorism can take many forms, including attacks through physical means, electronic means, and use of malicious code. Cyberterrorists can also have a wide range of personal, political, or cultural agendas. There are three main categories for attacker motivations (IBM 2022):

- **Criminally motivated** attackers seek financial gain through monetary theft, data theft, or business disruption. Criminals may hack into a bank account to steal money or use scams to trick people into sending money. Hackers may steal data and use it to commit identity theft, sell it on the dark web, or hold it for ransom.
- **Politically motivated** attackers are associated with cyberwarfare or cyberterrorism. In cyberwarfare, nation-state actors often target their enemies' government agencies or critical infrastructure. Activist hackers, called "hacktivists," may not cause extensive damage. Instead, attention is typically sought for causes by making the attacks known to the public.
- **Personally motivated** attackers primarily seek retribution for perceived slight. Money or sensitive data may be stolen, or disruption to an organization's systems could occur.

Less common motivations include corporate espionage, in which hackers steal intellectual property to gain an advantage over competitors, and vigilante hackers, who exploit a system's vulnerabilities to warn others about them. Some hackers enjoy the challenge of breaking into an organization's data and will perform the action to show intellectual superiority (IBM 2022).

Location and Extent

Cyberattacks can occur from anywhere. Cyberterrorists can be difficult to identify because the internet provides a meeting place for individuals from various parts of the world. Individuals or groups planning a cyber-attack are not organized in a traditional manner, as they are able to effectively communicate over long distances without delay. Attackers may be local, wishing harm on local governments, officials, or individuals. City residents can also be

affected by mass breaches elsewhere in the United States or the world, such as a breach at a bank or credit card institution. It is frequent that the source and location of the cyberattack is unknown. Cyberattacks are unpredictable and typically occur without warning.

Range of Magnitude

The magnitude of a cyberattack can vary greatly. An attack against an individual can cost a few hundred dollars immediately or an attack can cost much more in cases of identity fraud, which can affect livelihoods years or decades later. Attacks against governments or government officials can create a lack of trust and a loss of reputation. Small businesses can go out of business and cyberattacks on larger businesses can cost shareholders and consumers. Hacked transportation systems can cause delays and impact service. Every person and sector can be affected by cybersecurity threats.

The magnitude of the effect of a cyberattack varies based upon which system is attacked, the ability to preempt an attack, and an attack's effect on continuity of operations. The largest threat to institutions from cyberterrorism comes from any processes that are networked and controlled via computer.

Cyberattacks have been more frequent in recent years, impacting individuals, businesses, institutions, local governments, and state agencies. The Federal Bureau of Investigations (FBI) reported that in 2023, approximately 880,418 complaints regarding internet scams were received from across the globe with an estimated $12.5 billion in total losses. Phishing was the top cybercrime reported in 2023, with nearly 300,000 reported instances (FBI 2024).

A 2020 joint study performed by the Center for Strategic and International Studies and McAfee concludes that cybercrime costs the world economy more than $1 trillion, or just more than one percent of global gross domestic product (GDP), which is up more than 50 percent from a 2018 study that put global losses at close to $600 billion (NASDAQ 2020). Sophos *"The State of Ransomware"* 2022 study revealed the average ransom payment was $812,360, a 4.8-percent increase from the 2020 average of $170,000 (Sophos 2022). The worst-case scenario for the City of Philadelphia would be a ransomware attack that cost the City millions of dollars to restore online functionality. This type of cyberattack would stall or halt government functions and programs, including those which support socially vulnerable populations.

Previous Occurrences

Previous Events

Known hazard events that impacted City of Philadelphia between January 2021 and October 2024 are discussed in Table 4-110. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-110. Cyberterrorism Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
March 2020 – January 2021	Department of Behavioral Health and Intellectual disAbility Services, Community Behavioral Health	A data breach left some employee email accounts accessible to unauthorized individuals. The breach impacted people receiving services from the Department of Behavioral Health and Intellectual disAbility Services, as well as Community Behavioral Health, a nonprofit contracted by the City to administer the behavioral health Medicaid program, HealthChoices.

Event Date	Location Impacted	Description
May 14, 2023	Philadelphia Inquirer	A weekend cyberattack caused disruption to operations, preventing the publishing of the Sunday print edition. The cyberattack has caused the largest disruption to publication of Pennsylvania's largest news organization since a massive blizzard in January 1996.
May – July, 2023	Citywide	The City of Philadelphia's email system suffered a data breach that impacted 35,881 people. The breach exposed personal information, including names, addresses, dates of birth, and other data.
January 21, 2024	Pennsylvania Courts	Portions of the Pennsylvania Courts' website were unavailable due to a denial of service cyberattack. The cyberattack affected court web services.

Source: NBC Philadelphia 2024; WHYY 2021; 6abc 2024; 6abc 2023

Probability of Future Occurrences

Information on previous cyberterrorism occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-111. Based on historical records and input from the Steering Committee, the probability of occurrence for cyberterrorism in the City is considered "likely."

Future occurrences in the City may impact the City government by shutting down technology and halting public programs; this can impact City residents which may rely on those programs for their livelihood. City residents can also be affected by mass breaches, such as a breach at a bank or credit card institution. Buildings and structures in general are usually not impacted by cyber threats, but systems operated by electronics and computers are vulnerable. All community lifelines that are operated by electricity and/or a computer system are vulnerable to cyber threats.

Table 4-111. Probability of Future Cyberterrorism Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 2018 and 2024	Percent Chance of Occurring in Any Given Year
Cyberterrorism	12	100.00%

Source: NBC Philadelphia 2024; WHYY 2021; 6abc 2024; 6abc 2023; PEMA 2023; City of Philadelphia 2022

The 2025 Homeland Security Threat Assessment from the Department of Homeland Security indicates that looking forward, adverse cyber actors will continue to seek access to, or to pre-position themselves on, United States critical infrastructure networks. In particular, actors could exploit such access or pre-positioning for cyber-attacks in the event of an imminent conflict or periods of heightened tensions, and potentially disrupt critical functions that support the economy, critical services, and way of life, possibly including continuity of government. Ongoing conflicts in Ukraine and Gaza have given rise to a range of ideologically motivated criminal hacktivists and adversarial state-affiliated actors conducting cyber-attacks against U.S. critical infrastructure (Department of Homeland Security 2024).

Financially motivated cyber criminals will continue to employ ransomware and other schemes that will disrupt targeted United States critical infrastructure entities and impose significant financial costs on victims. Similar to other malicious cyber threat actors, those with financial motivations consistently evolve and adapt to take advantage of software vulnerabilities, poor network security configurations, and social engineering tactics to gain systems access. Ransomware actors likely will continue to opportunistically target victims which provide the largest payouts (Department of Homeland Security 2024).

Climate Change Projections

A long-running research by the U.S. Department of Defense ties climate change to increasing instability that has the potential to increase the potential for certain human-caused hazards, which can include cyberterrorism (Department of Defense 2021).

Cascading Impacts on Other Hazards

Critical infrastructure such as power grids, transportation networks, and water supply systems are vital to the City's economy and prosperity. The cascading effect of a cyberattack can be devastating, creating chaos to major economic, food, and health systems and lasting for long periods of time. Interdependencies among critical infrastructure are often necessary to meet design specifications but also lead to undesirable situations when a fault or attack occurs in one and escalates to other connected locations. Escalations may disrupt the operation of the involved critical infrastructure and create feedback loops that can initiate and propagate disturbances in unforeseen ways due to the complexity of the connected systems (Reddy Palleti, et al. 2021).

In the event of a major cyberattack targeting critical infrastructure, such as the power grid, catastrophic, widespread, and lengthy blackouts should be expected. Other loss of electrical services may impact wastewater systems, causing contamination and additional widespread service outages. Consumption of contaminated water and widespread loss of electrical power may result in devastating consequences to public health and safety, including illness, death, and instances of civil disorder (Ben-Meir 2021).

4.3.14.2 Vulnerability and Impact Assessment

To understand risk, a qualitative assessment was performed to evaluate what assets are exposed or vulnerable to the cyberterrorism hazard. The entire City has been identified as exposed to the human-caused hazard. Therefore, all assets in the City of Philadelphia (population, structures, critical facilities, and lifelines), as described in the Chapter 3 (City Profile), are exposed and potentially vulnerable. The following text evaluates and estimates the potential impact of the cyberterrorism hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

The entire City's population is vulnerable to cyberattacks personally or at places of employment. The impact of a cyberattack can begin at the government-level and trickle down to affecting those in the City. Even if a cybersecurity threat does not take place within the City of Philadelphia, its citizens can be affected by cyberterrorism.

Entities or individuals that can be affected by cyberterrorism in Philadelphia, such as local governments, businesses, medical facilities, and schools, have taken steps to prevent and defend against cyberattacks. Employing multiple layers of security limits vulnerability, minimizes damage, and reduces recovery time.

Overall Population

All populations who directly use a computer or receive services from automated systems are vulnerable to cyberterrorism. If a cyberattack targeted a facility storing or manufacturing hazardous materials, individuals living adjacent to these facilities would be susceptible to the secondary effects, should the attack successfully cause a critical failure at that facility.

Socially Vulnerable Population

In general, socially vulnerable populations may not be impacted by cyberterrorism events to the extent of other social groups and populations. Socially vulnerable populations are often reliant on government or community programs for access to technology, such as laptops and desktops. Access to those items would be indirectly impacted if the agency or organization providing those services were directly impacted. However, certain types of cyberthreats, such as phishing, often target older adults (AARP 2021).

Socially vulnerable populations with existing medical conditions, limited access to cell phone service due to economic hardship, and limited transportation access may be especially vulnerable during acts of cyberterrorism or other cyberthreats. As transportation systems are affected and may go offline, those with limited transportation access may be unable to travel to obtain essential items such as food and water. Individuals in need of immediate and consistent medical attention may also be unable to contact emergency services in their time of need, potentially leading to prolonged suffering and/or death. Certain types of attacks would be most likely to affect specific segments of the population:

- If the cyberattack targeted the City's power or utility grid, individuals with medical needs would be impacted the most. These populations are most at risk because many of the life-saving systems they rely on require power.
- If an attack occurred during months of extreme hot weather, those 65 years of age and older would be susceptible to the effects of the lack of climate control. These individuals might require an air-conditioned shelter operating on a back-up generator.

General Building Stock

Buildings and structures in general are usually not impacted by cyber threats, but systems operated by electronics and computers are vulnerable. Examples of City assets using these systems include critical facilities such as water treatment plants, power grid stations, and other government facilities.

A catastrophic cyberattack can have far-ranging effects on public and private infrastructure systems. Cyberattacks can cause physical damage if real assets or end consumers are affected by service disruption. This might occur if cyberattacks target industries related to utilities, life support, transportation, human services, or telecommunications. In many cases, attacks on these systems initially will not be detected, and any malfunction will be thought to be system failure.

Community Lifelines and Other Critical Facilities

All community lifelines that are operated by electricity and/or a computer system are vulnerable to cyber threats. Cyberattacks may affect structures if any critical electronic systems suffer service disruption. For instance, a cyberattack may cripple the electronic system that controls a cooling system or pressure system within critical infrastructure. This may result in physical damage to the structure from components overheating, or an explosion if pressure relief systems are rendered inoperable.

Economy

A cyberattack can have significant impacts on the economy. Investigations into the stock price impact of cyberattacks show that identified target firms suffer losses of 1 to 5 percent in the days after an attack (Congressional Research Service 2004). A 2020 joint study performed by the Center for Strategic and International Studies and McAfee concluded that cybercrime costs the world economy more than $1 trillion, or just more than one percent of global GDP, which is up more than 50 percent from a 2018 study that put global losses at close to $600 billion (NASDAQ 2020).

Natural, Historic and Cultural Resources

Natural

The natural environment is not vulnerable to cyber threats and thus would not risk damage. It would only be through a secondary effect that the environment could be affected by a cyberattack, such as the disruption or failure of wastewater treatment facilities.

Historic

Cyberthreats and their associated attacks may pose significant risk to the electrical systems located near or within historic resources. Attacks that target these systems carry the potential to cause large electrical fires which may severely damage or destroy these City resources.

Cultural

Perpetrators motivated by political and personal views may seek retribution for a perceived wrongdoing by invoking an attack on a cultural resource, including a facility.

4.3.14.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Generally, cyberattacks will not be affected by change in land use and development.

Projected Changes in Population

An increase in the population will ultimately increase the number of persons who could be impacted by a cyber-attack within the City. However, as populations continue to rely on technology and increase their virtual footprint, the likelihood of a cyberattack will increase.

Climate Change

Climate change has many direct and indirect impacts on the human population, including influences on human behavior. A 2023 study by John Hopkins University, University of California at Berkeley, and New York University evaluated cyberthreats targeting critical infrastructure during a hazard event, such as a hurricane or heat wave. The study found that the resulting impact from compound threats increased by more than three times compared to a

standalone cyberattack. The compound threats also exacerbate economy-wide losses across sectors, which for different attack strategies lead to daily GDP reductions of up to 3.1 percent (Avraam, Ceferino and Dvorkin 2023).

Additional Data and Next Steps

The City of Philadelphia will continue to be impacted and compelled to respond to cyber threats in the future. The nature of these threats is projected to evolve in sophistication over time. The City has taken a proactive position in its cybersecurity efforts with the establishment of the Office of Innovation and Technology's Information Security Team and is expected to remain vigilant in its efforts to prevent attacks from occurring or disrupting business operations. The reality remains that many computers and networks in organizations of all sizes and industries around the United States will continue to suffer intrusion attempts daily from viruses and malware that are passed through websites and emails. As cyberthreats continue to evolve and become increasingly sophisticated, these threats become more challenging to identify, prevent, and recover from their consequences.

4.3.15 Substance Abuse Disorder

4.3.15.1 Hazard Profile

Hazard Description

Substance use disorder is defined by PEMA as when a person is physically dependent upon a drug, either legally or illegally. Such disorders are treatable, however more chronic cases are more difficult to treat and may lead to further physical and behavioral impairments, or even death. Pennsylvania is experiencing an unprecedented epidemic of drug abuse and drug-related deaths, affecting residents throughout the state. In 2022, 5,044 drug overdose deaths were identified statewide (PDH 2022). Of those deaths, 84.3 percent have been confirmed to be opioid-related (PDH 2023). Since 2012, the number of fatal drug overdoses have increased within the Commonwealth (PDH 2023). In 2021 alone, over 1,200 recorded drug overdose related deaths occurred in Philadelphia. Which is the most recorded over a year timespan for Philadelphia (City of Philadelphia 2022).

For the purpose of this Hazard Mitigation Plan (HMP) update and as identified by the Steering Committee, the drugs which will be discussed in further detail in this section are the most common types of opioids: prescription opioids, fentanyl, and heroin, as well as xylazine (Table 4-112). This section also describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the substance use disorder hazard for the City of Philadelphia HMP.

Table 4-112. Center for Disease Control and Prevention (CDC) Most Common Types of Opioids

Category	Definition
Prescription Opioids	These are medications prescribed by doctors to treat pain symptoms. They can be synthetic (methadone, Oxycodone, hydrocodone), or natural (morphine).
Fentanyl	These are powerful synthetic opioids that are up to 100 times more powerful than morphine (prescription opioids) and are used to treat severe pain symptoms.
Heroin	Is an illegal and highly addictive natural opioid that is processed from morphine. Heroin is becoming more common in the U.S. and is the most commonly abused with other substances such as cocaine or prescription opioids.

Source: CDC 2017; PEMA 2023

Opioid is a broad term for drugs that include opiates, a naturally extracted drug from types of poppy plants and narcotics. Opioids can also be made synthetically to resemble opium (PEMA 2023). Opioids can be in many different forms, such as tablets, capsules, patches, liquid, and more. The powder form can range in color from white to shades of brown or black. Opioids work by blocking the body's pain receptors, and can create a feeling of euphoria, which can result in extremely addictive properties (PEMA 2023). When someone suffers from substance use disorder, especially to opioids, they can build up a tolerance to the drug resulting in higher levels of substance and overdose susceptibility.

Xylazine is a non-opioid veterinary tranquilizer used as an additive in illicit drug supplies, notably in combination with heroin and fentanyl. In veterinary medicine, xylazine is used as a sedative, analgesic (pain reliever), and muscle relaxant for animals. In humans, xylazine has a sedating effect which can last for hours and often outlasts the effects of the substances it is mixed with (HHRC 2023). Additional symptoms and health risks of xylazine include (CDC 2024):

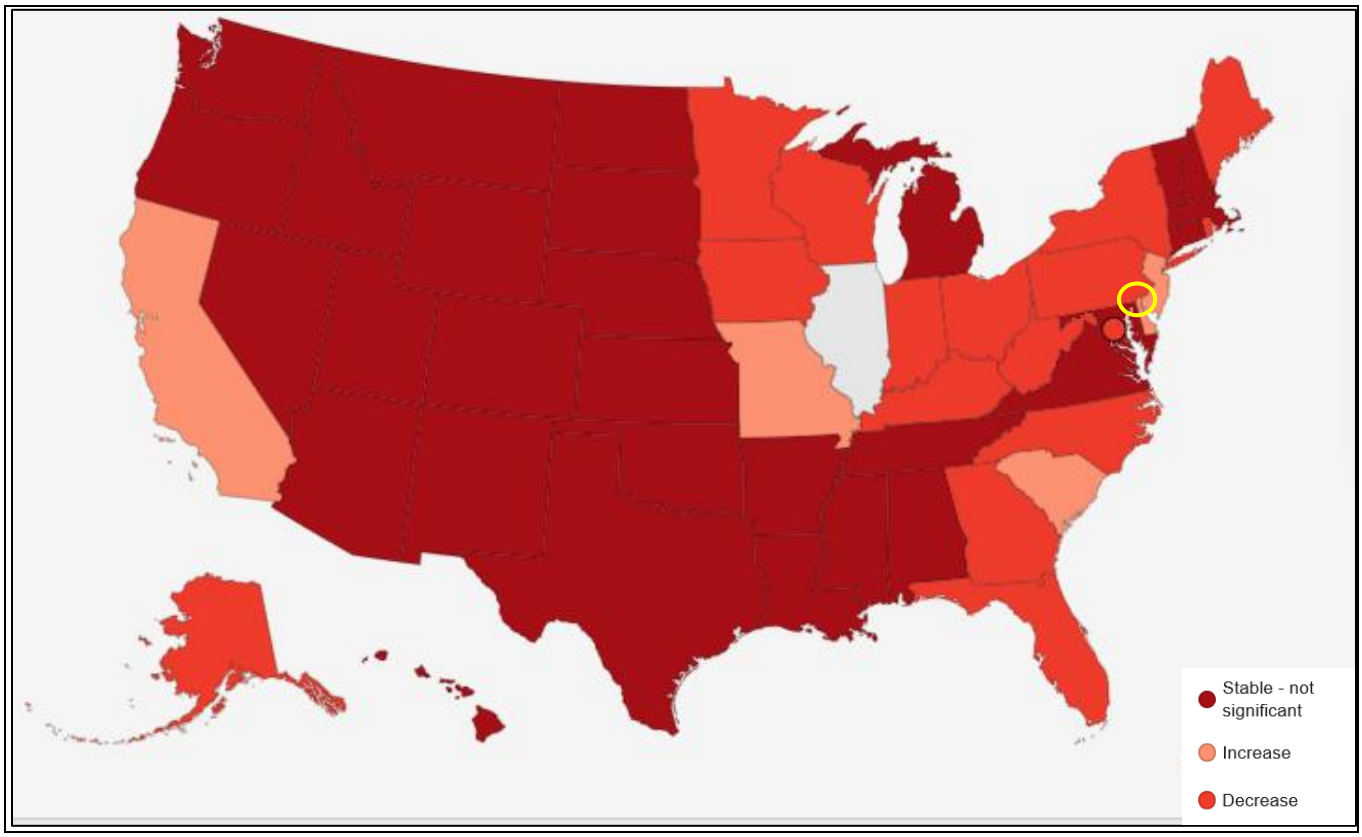
- Sedation
- Difficulty breathing

- Dangerously low blood pressure
- Slowed heart rate
- Wounds that can become infected
- Severe withdrawal symptoms
- Death

Location and Extent

Death rates have been stabling in the majority of the United States, with some states reporting a decrease, including Pennsylvania (highlighted on Figure 4-35). It is estimated that there has been a 4% decrease since 2022 for the entire Commonwealth (PDH 2023).

Figure 4-35. Changes in Drug Overdose Death Rate, 2017 to 2018



Source: Centers for Disease Control and Prevention (CDC) 2019
Note: Yellow circle overapproximate location of the City of Philadelphia

In 2017, the U.S. Drug Enforcement Administration (DEA) Philadelphia Division and the University of Pittsburgh prepared a document to help law enforcement's efforts to identify and combat drug suppliers and ultimately drug abuse and related overdoses (DEA Philadelphia Division and University of Pittsburgh 2017). The drugs included in the analysis (listed in Table 4-113) were selected based on (1) law enforcement intelligence regarding frequency of abuse and diversion, and (2) the most common drugs present in drug-related overdose deaths according to national public safety and public health sources. Based on this analysis, it was found that Philadelphia had a drug overdose mortality rate of almost 60 per 100,000 people. This was ranked as 'Highest 25 percent' compared to other Pennsylvania counties by the DEA (DEA Philadelphia Division and University of Pittsburgh 2017).

Table 4-113. Drugs included in analysis of Drug-Related Overdose Deaths, Pennsylvania, 2016

Category	Substances Included in Analysis		
Benzodiazepines	Alprazolam Chlordiazepoxide Clonazepam Delorazepam	Diazepam Estazolam Flurazepam Lorazepam	Midazolam Oxazepam Temazepam
Cocaine	-	-	-
Fentanyl, Fentanyl-Related Substances, Non-Prescription Synthetic Opioids	3-Methylfentanyl 4-Methoxy-Butyryl Fentanyl Acetyl Fentanyl Acryl Fentanyl	Carfentanil Fentanyl Fluorobutyrfentanyl Fluorofentanyl	Furanyl Fentanyl Para-Fluoro-Isobutyryl Fentanyl/FIBF Sufentanil U-47700
Heroin	-	-	-
Other Illicit Drugs	Lysergic Acid Diethylamide (LSD) Methylenedioxy-amphetamine (MDA) 3,4-Methylenedioxymethamphetamine (MDMA)	Methamphetamine Phencyclidine (PCP)	-
Prescription Opioids	Hydrocodone Hydromorphone Meperidine	Morphine Oxycodone Oxymorphone	Tapentadol Tramadol

Source: DEA Philadelphia Division and University of Pittsburgh 2017

The overdose crisis is citywide. In 2021, most fatal overdoses occurred outside of the Kensington area, with 69 percent of fatal overdoses taking place in the victim's home. Sharp increases in unintentional fatal overdoses were seen in North Philadelphia ZIP Codes 19124, 19132, 19133, and 19144 (City of Philadelphia 2023).

Range of Magnitude

Substance use disorders often result in misuse and overdose, which can be fatal. Another dangerous impact of an opioid overdose is depressed breathing and lack of oxygen to the brain. This can cause permanent brain damage and lead to organ failure, or even death. Signs of someone who is experiencing an opioid overdose is depressed breathing, disorientation, small pupils, and clammy skin. Additionally, a child still in the mother's womb can be severely impacted if the mother uses opioids. This is called neonatal abstinence syndrome, a disorder which has increased along with the opioid rise (PEMA 2023).

Other impacts from substance use disorder are the cascading impacts to family members and communities. Substance use disorders can span generations and reach all family members. Substance use disorder can even reach children if they are exposed and have access to opioid drugs. Community hubs such as schools and businesses are also impacted by substance use disorder as individuals who suffer from opioid drug abuse are unable to properly function. The high risk of drug overdose puts a strain on the family sphere and causes heartache for the entire community.

Naloxone, more commonly referred to as Narcan, is a lifesaving medicine that can reverse an opioid overdose. Naloxone quickly reverses an overdose by blocking the effects of opioids. It can restore normal breathing within 2 to 3 minutes in a person whose breath has slowed, or even stopped, as a result of opioid overdose (CDC 2024). Narcan should still be given in response to any suspected drug overdose to reverse any possible opioid effects; however, it will not reverse the effects of xylazine, and symptoms may continue (CDC 2024).

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, City of Philadelphia was not included in any major disaster (DR) or emergency (EM) declarations for opioid-related events (FEMA 2024). FEMA does not include opioid-related events as categories for major disaster (DR) or emergency (EM) declarations.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, City of Philadelphia was not included in any USDA opioid-related agricultural disaster declarations (USDA 2024). USDA does not include opioid-related events as categories for disaster declarations.

Previous Events

The Pennsylvania Department of Health (DOH) keeps record of all reported drug-related deaths throughout the Commonwealth. Table 4-114 identifies the total deaths in the City of Philadelphia between 1990 and 2023.

Table 4-114. Reported Drug-Induced Deaths in City of Philadelphia (1990 to 2023)

Year	Total Deaths	Year	Total Deaths	Year	Total Deaths
1990	202	**2002**	309	**2014**	523
1991	297	**2003**	292	**2015**	579
1992	319	**2004**	332	**2016**	739
1993	391	**2005**	390	**2017**	1,045
1994	393	**2006**	451	**2018**	971
1995	406	**2007**	364	**2019**	1,010
1996	353	**2008**	385	**2020**	1,119
1997	432	**2009**	355	**2021**	1,183
1998	336	**2010**	339	**2022**	1,252
1999	305	**2011**	427	**2023**	1,166
2000	376	**2012**	470		
2001	316	**2013**	415		

Source: DOH 2024
Note: Total drug induced death data was not available for 2024.

Probability of Future Occurrences

Information on previous substance use disorder occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-115. Based on historical records and input from the Steering Committee, the probability of occurrence for substance use disorder in the City is considered “highly likely.”

Future occurrences of substance abuse disorder can impact the entire population of the City. However, most fatal overdoses occurred outside of the Kensington area, with 69 percent of fatal overdoses taking place in the victim’s

home. Sharp increases in unintentional fatal overdoses were seen in North Philadelphia ZIP Codes 19124, 19132, 19133, and 19144 (City of Philadelphia 2023). Buildings, structures, and infrastructure are not directly impacted by this hazard.

Table 4-115. Probability of Future Substance Use Disorder Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1990 and 2023	Percent Chance of Occurring in Any Given Year
Drug-Induced Deaths	18,242	100%

Source: DOH 2024

The 2025 Homeland Security Threat Assessment from the Department of Homeland Security indicates that looking forward, illegal drugs smuggled into and sold in the United States will continue to kill more Americans than any other harmful security threat. While fentanyl seizure volumes are significantly below those of methamphetamine and cocaine, fentanyl remains a top concern due to its potency, lethality, and availability. Criminal actors and criminal drug manufacturers are responding to increased United States and partner nation efforts targeting the precursor chemicals needed for fentanyl production by modifying existing chemicals and substituting different chemicals in their drug compositions. Criminals also are adapting their smuggling methods to circumvent United States customs regulations aimed at blocking the import of these chemicals and drug manufacturing equipment into the United States (Department of Homeland Security 2024).

Future occurrences of substance use disorder will be affected by implementation of overdose prevention initiatives. In January 2018, Pennsylvania's governor declared opioid addictions a disaster emergency. This declaration enhanced coordination and data collection between state and local responders, improved tools for families and first responders, and expanded treatment access. Naloxone, a lifesaving drug that reverses the effects of a drug-overdose, has become more available as a result (PEMA 2023). However, the opioid emergency declaration ended on August 25, 2021 after the General Assembly declined to extend it. In fall 2018, Major Jim Kenney signed an executive order to combat the opioid crisis in Philadelphia. This led to the formation of the Philadelphia Resilience Project, a joint emergency response by 35 City agencies. Today, the City's Opioid Response Unit (ORU) coordinates the multi-departmental response to this public health epidemic (City of Philadelphia 2022).

Climate Change Projections

Climate change is not anticipated to have a direct impact on substance use disorder. However, it may have a small indirect impact on the number of prescribed opioids. Climate has a large influence on people and human health. If large climatic events result in injury or pain, then physicians may prescribe more opioids which could increase the reliance of painkillers in the community.

Cascading Impacts on Other Hazards

Reliance or dependence on substances may cause incidents of civil disturbance. If an individual, or group of individuals, are denied access to substances, the person or persons may become agitated and unruly, leading to a public disturbance.

4.3.15.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. The following text evaluates and estimates the potential impact of the substance abuse disorder hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

Substance use disorder can affect people of any race, gender, income level, and social class (PEMA 2023). However, it was found in a DEA Philadelphia Division study that people under the age of 35 have a higher vulnerability to substance use disorder. In fact, from 2015 to 2016 fentanyl use increased up to 380 percent among ages 15- to 24-year-old, while Heroin increased 970 percent for ages 25 to 34 years old. It is still unclear why these ages are more vulnerable to substance use disorder.

Some occupation-specific risks may make employees more vulnerable to this hazard. City employees working in direct patient care are vulnerable to fentanyl exposure. Since fentanyl can be ingested orally, inhaled through the nose or mouth, or absorbed through the skin or eyes, any substance suspected to contain fentanyl should be handled with extreme caution. Exposure to a small amount of fentanyl can lead to respiratory depression or death.

Socially Vulnerable Population

A new study published in JAMA Psychiatry uncovers significant associations between social vulnerability and the prevalence and treatment of mental health disorders in the United States. The analysis revealed that socially vulnerable populations are at greater risk of specific mental health disorders, including bipolar I disorder, post-traumatic stress disorder, schizophrenia spectrum disorder, stimulant use disorder, and opioid use disorder (Gibbons, Robert D.; Olfson, Mark; Saulsberry, Loren 2024).

General Building Stock

Buildings and facilities are not at risk from the substance use disorder hazard.

Community Lifelines and Other Critical Facilities

The Health and Medical lifeline in response and recovery as substance use has negative impacts on public health and may require medical treatment and mental health services. There may be cascading impacts to family and friends, who may require mental health services as well. Substance use disorders can span generations and reach all family members. Community hubs such as schools and businesses are impacted as individuals who suffer from opioid drug abuse are unable to properly function (PEMA 2023).

Economy

Losses associated with substance use stem from lost wages, productivity, and resources. The City of Philadelphia has seen an increase of time and resources devoted to the situation as overdose and response increases, with tracking mechanisms being used as a fairly new capability; however, there is no comprehensive database currently tracking monetary costs (PEMA 2023).

The American Enterprise Institute (AEI), using national data from the CDC and White House Council of Economic Advisors, calculated a total cost per capita ($1,799), of the opioid crisis for Pennsylvania. AEI's estimates were calculated using national estimates based on variations in local wages, health care costs, and criminal justice costs along with variation in opioid-related death and addiction rates, and average age-adjusted value of statistical lives lost, divided by the state's population in the 2012-2016 American Community Survey. In the City of Philadelphia, this amounts to a total estimated cost of more than $2.8 billion (PEMA 2023).

Natural, Historic and Cultural Resources

Natural

Opioid drug traces can be found in streams, rivers, and lakes. These traces are sources from human urine and feces, or through medication being improperly disposed of. It is still unclear the environmental impacts due to these opioid drug traces. The U.S. EPA is working on further research to identify known impacts from this hazard on the natural environment (PEMA 2023).

Historic

Ther are no known impacts to historic resources from the substance use disorder hazard.

Cultural

Individuals impacted by the substance use disorder hazard may seek comfort from cultural resources, such as churches, community groups, and by being located near structures of symbolic or cultural importance.

4.3.15.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Changes in land use can impact the availability of safe housing, in particular to socially vulnerable populations who may be more at risk to the substance use disorder hazard. Providing safe, available housing may improve the mental health of populations by the reduction of stress, which may be a precursor to begin drug use.

Projected Changes in Population

In general, jurisdictions that are more densely populated are more vulnerable to substance use threats as access to the drugs increases. However, rural communities often experience larger per-capita opioid-related death rates (PEMA 2023).

Climate Change

Climate change is not anticipated to have a direct impact on substance use disorder.

Additional Data and Next Steps

The City's Opioid Response Unit continues to coordinate multi-departmental response to the substance use disorder hazard. Despite how far the City has come in combatting the challenge of reducing drug-induced deaths,

there is not a quick fix to this complex problem, and the probability of future drug overdoses and deaths within the next five years is likely. This indicates a continued need for investment in this response.

4.3.16 Pandemic and Infectious Disease

4.3.16.1 Hazard Profile

Hazard Description

A pandemic is defined as a disease outbreak affecting a large number of people across an extensive region, including several countries, and/or continent(s). It is further described as extensively epidemic. Generally, pandemic diseases cause sudden, pervasive illness in all age groups on a global scale (PEMA 2023). An epidemic describes a smaller scale infectious outbreak, within a region or population, that emerges at a disproportional rate. Infectious disease outbreaks may be widely dispersed geographically, impact large numbers of the population, and could arrive in waves lasting several months at a time (Columbia University 2021).

For the purpose of this hazard mitigation plan update, the following infectious diseases will be discussed in further detail: Novel Influenza, Vector-Borne Diseases (Mosquito related), Hepatitis A, Novel Coronavirus, and measles.

Novel Influenza

Novel influenza viruses are distinct from the seasonal human influenza A viruses that commonly circulate among people. These novel viruses can originate from animals, including ducks, chickens (poultry), pigs (swine), cattle, whales, horses, seals, and cats. Although it is uncommon for humans to contract influenza directly from animals, there have been instances of human infections and outbreaks following contact with infected animals. Some novel influenza A viruses are considered to pose a greater pandemic threat than others (VDH 2024).

Novel influenza viruses can emerge in two primary ways: they can originate in animals where they gain the ability to infect and spread among humans, or they can result from significant changes in human flu viruses, differentiating them from the current seasonal flu A viruses. Avian influenza, or bird flu, typically circulates in wild aquatic birds and can infect domestic poultry and other bird and animal species. When avian influenza viruses infect humans, they are classified as novel influenza A viruses. Variant influenza viruses occur when humans are infected with swine flu viruses, such as H1N2v and H1N3v. Swine flu is a respiratory disease in pigs that frequently causes flu outbreaks in pig populations. Variant influenza viruses, such as H5N1, H7N9, and H3N2v, usually circulate in swine but can occasionally infect humans (DSHS 2024). Certain animal populations, particularly avian and swine, are considered higher risk for transmitting novel or variant influenza strains to humans. Monitoring and managing these risks are crucial for preventing potential outbreaks.

Mosquito-Borne Disease

Vector-borne diseases, particularly those transmitted by mosquitoes, pose significant health risks globally. Annually, over 700,000 deaths are attributed to diseases such as malaria, dengue, yellow fever, and Zika. These illnesses predominantly affect tropical and subtropical regions, disproportionately impacting the poorest populations. Since 2014, major outbreaks of dengue, malaria, chikungunya, yellow fever, and Zika have caused widespread morbidity and mortality, overwhelming health systems in numerous countries. The distribution of these diseases is influenced by demographic, environmental, and social factors, including global travel and trade, unplanned urbanization, climate change, and the silent spread and adaptation of mosquito vectors (WHO 2024). Figure 4-36 presents a non-exhaustive list of mosquito-borne diseases and the type of pathogen that causes the disease in humans.

Figure 4-36 List of Mosquito-Borne Diseases

Vector		Disease caused	Type of pathogen
Mosquito	*Aedes*	Chikungunya	Virus
		Dengue	Virus
		Lymphatic filariasis	Parasite
		Rift Valley fever	Virus
		Yellow Fever	Virus
		Zika	Virus
	Anopheles	Lymphatic filariasis	Parasite
		Malaria	Parasite
		O'nyong'nyong virus	Virus
	Culex	Japanese encephalitis	Virus
		Lymphatic filariasis	Parasite
		West Nile fever	Virus

Source: WHO 2024

Additional mosquito-borne diseases not listed include Eastern equine encephalitis virus, St. Louis encephalitis virus, Jamestown Canyon virus, and La Crosse encephalitis virus. Eastern equine encephalitis virus is a rare but severe disease that can cause inflammation of the brain. St. Louis encephalitis virus primarily affects the central nervous system, leading to encephalitis. Jamestown Canyon virus is widely distributed in North America and can cause mild to severe illness. La Crosse encephalitis virus is most common in the eastern United States and can result in severe neurological disease, especially in children (DOH 2024).

Hepatitis A

Hepatitis A is a liver inflammation caused by the hepatitis A virus (HAV). Transmission primarily occurs when an unvaccinated individual consumes food or water contaminated with the feces of an infected person. The disease is closely linked to contaminated water or food, inadequate sanitation, poor personal hygiene, and sexual contact with an infected person (WHO 2023).

Novel Coronavirus

Coronaviruses are a family of viruses that includes Middle Easter Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS), and COVID-19. There are many different kinds, and some cause disease. Coronaviruses are spread through droplets and virus particles released into the air when an infected person breathes, talks, laughs, sings, coughs, or sneezes. Larger droplets may fall to the ground in a few seconds, but tiny infectious particles can linger in the air and accumulate in indoor places, especially where many people are gathered and there is poor ventilation (John Hopkins University 2022).

COVID-19 is an infectious disease first identified in 2019 caused by a novel coronavirus, SARS-CoV-2. The virus rapidly spread into a global pandemic by the spring of 2020 and was officially declared a pandemic by the WHO. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory

disease, and cancer are more likely to develop serious illnesses (WHO 2022). SARS-CoV-2 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes.

Reported illnesses have ranged from mild symptoms to severe illness and death. Reported symptoms include difficulty breathing and shortness of breath, fever or chills, cough, fatigue, muscle or body aches, loss of smell or taste, sore throat, congestion, and nausea or vomiting. Symptoms that require immediate medical attention include trouble breathing, persistent pain or pressure in the chest, confusion, or inability to wake or stay awake, and bluish lips or face. Symptoms may appear two to 14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC 2021).

Measles

Measles is a highly contagious infectious disease that can cause serious health complications, especially in children under 5 years of age. Serious health complications can include encephalitis and pneumonia. Measles can spread from contact with an infected person or contact with air droplets if a person breathes in contaminated air or touches an infected surface and then touches their face. Symptoms typically start 7 to 14 days after infection and can include a high fever, cough, runny nose, and conjunctivitis. Additional symptoms that can appear after the initial symptoms include tiny white spots inside the mouth and a rash of red spots that spread across the body. An infected person can spread measles 4 days before through 4 days after a rash or other symptoms appear.

Location and Extent

Pandemic and infectious disease events cover a wide geographical area and can affect large populations, potentially including the entire population of the Commonwealth. The exact size and extent of an infected population is dependent upon how easily the illness is spread, the mode of transmission and the amount of contact between infected and uninfected individuals (PEMA 2023). The transmission rates of pandemic illnesses are often higher in denser areas where there are large concentrations of people. The transmission rate of infectious disease will depend on the mode of transmission of a given pathogen. Pandemic events can also occur after other natural disasters, particularly floods, when there is the potential for bacteria to grow and contaminate water (Van Seventer and Hochberg 2017). Historically, the Commonwealth has been primarily concerned with three diseases with pandemic and infectious potential: Zika virus, West Nile Virus, and Influenza (PEMA 2023).

Novel Influenza

Influenza viruses with the potential to reach seasonal epidemic levels include the influenza A (H1N1 and H3N2) and influenza B (Yamagata and Victoria) viruses (WHO 2023). Several years ago, the swine influenza (H1N1) was of particular concern for the City. H1N1 was first detected in people in the United States in April 2009. On June 11, 2009, WHO signaled that a pandemic of 2009 H1N1 flu was underway (CDC 2009).

Since early 2024, highly pathogenic avian influenza (HPAI) A (H5N1) has been circulating worldwide among wild birds and other animal species. Within the United States, outbreaks in poultry and U.S. dairy cows have been identified, and 70 human cases have been confirmed, with multiple exposure sources including dairy cattle and poultry; 1 human death within the United States has also occurred as of April 22, 2025. The CDC is currently monitoring the situation, and the current public health risk remains low, but remaining vigilant to monitor for H5N1 activity in people, especially in people with known animal exposures. No known human-to-human transmission has been documented at this time, but the CDC will continue to assess the risk and continually analyze the virus to identify any genetic changes that could suggest easier transmissibility of the virus.

Mosquito-Borne Disease

Travel-Related Arboviral Infections: Malaria, Chikungunya, Dengue, and Zika

Philadelphia hosts a diverse population, with many residents maintaining connections to tropical and subtropical regions. These individuals frequently travel to visit friends and family in areas where travel-associated vector-borne diseases, such as malaria, dengue, chikungunya, and Zika, are endemic. Chikungunya, dengue, and Zika viruses are transmitted by Aedes spp. mosquitoes, which bite during daylight hours and commonly found around homes due to their limited flight range. While Aedes aegypti, a primary vector for these viruses, is not present in Philadelphia, Aedes albopictus (Asian tiger mosquito), a less efficient vector, is active during the warmer months. The Philadelphia Department of Public Health (PDPH) will continue to monitor the presence of A. albopictus and closely track human surveillance data to promptly identify any local transmission (PDPH 2021). Table 4-116 shows travel-related arboviral infections between the years of 2016 and 2020.

Table 4-116. Travel-Related Arboviral Infections, 2016 to 2020 Season

Year	Malaria	Chikungunya	Dengue	Zika
2016	22	0	3	48
2017	30	0	0	11
2018	41	0	1	0
2019	45	0	13	0
2020	7	0	1	0
Total	**145**	**0**	**19**	**59**

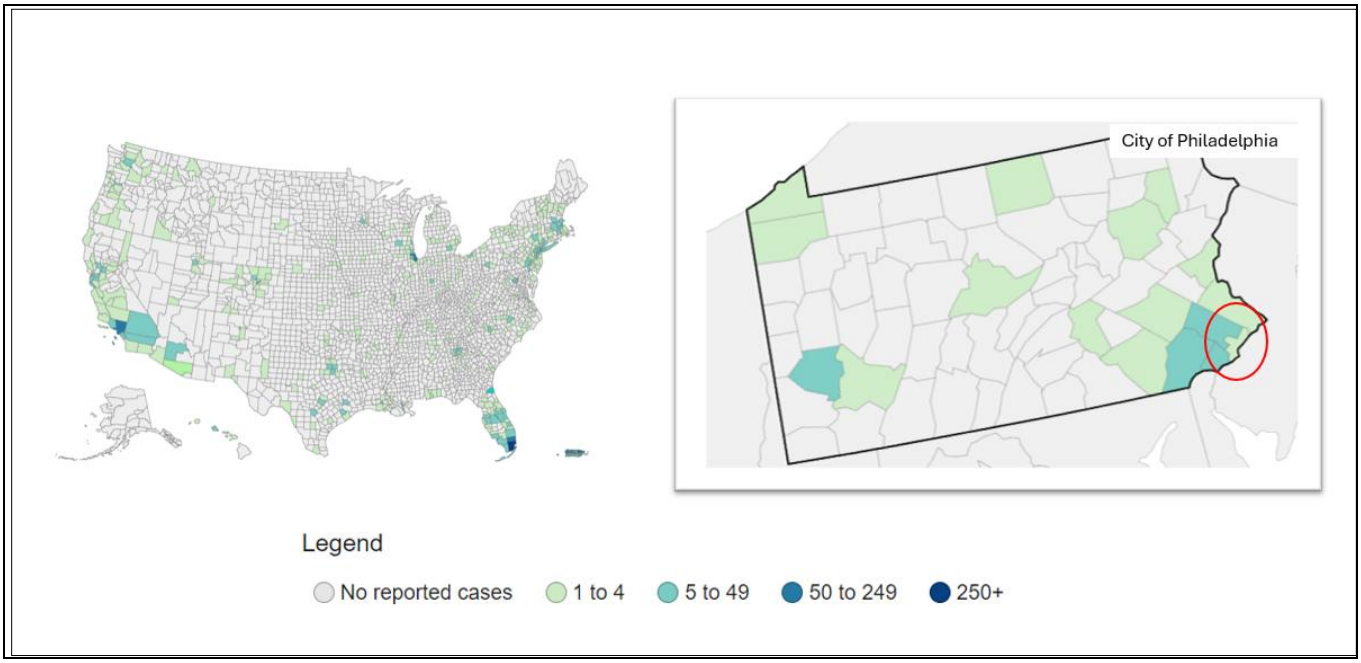
Source: PDPH 2021
Note: No data was displayed after year 2020 by source.

There have been cases in travelers who have returned from areas where Zika virus is common. Local transmission of Zika virus (virus acquired from local mosquitoes) has not been identified in Pennsylvania (DOH 2024). The Pennsylvania DOH and DEP created a Zika Response Plan to prepare for Zika virus testing, to enhance surveillance and control of mosquito populations that can spread Zika virus, and to enhance surveillance for Zika cases in Pennsylvania (DOH 2024).

Before 2006, chikungunya was rarely identified in U.S. travelers. Between 2006 and 2013, an average of 28 people per year in the United States tested positive for recent chikungunya virus infection, all of whom were travelers returning from affected areas in Asia, Africa, or the Indian Ocean. In late 2013, the first local transmission of chikungunya virus in the Americas was identified in Caribbean countries and territories, indicating that mosquitoes in these areas had become infected and were spreading the virus to people. Starting in 2014, chikungunya was reported among U.S. travelers returning from affected areas in the Americas, with local transmission identified in Florida, Texas, Puerto Rico, and the U.S. Virgin Islands. Chikungunya became a nationally notifiable condition in 2015, with cases reported to the CDC by state and local health departments using standard case definitions. Since 2019, no locally acquired chikungunya cases have been reported from U.S. states or territories (CDC 2024).

According to the CDC, as of October 2024, there have been 45 cases of dengue reported in Pennsylvania. Of those 45 cases, one to four cases have been reported in the City, as shown in Figure 4-37 (CDC 2024).

Figure 4-37. Dengue Cases in the United States by County, 2024



Source: CDC 2024
Note: Data reported as of October 2024; Per the CDC, surveillance data have several limitations that should be considered when using and interpreting the data. Under-reporting is a limitation common to all surveillance systems that rely on healthcare providers to consider the disease as a possible diagnosis in a patient, obtain the appropriate laboratory test, and report confirmed to public health authorities. There is a lag in case reporting to CDC and states and territories may publish surveillance data on different schedules than CDC. Surveillance data are reported by county of residence, not the location (county or state) of exposure. Cases of mild illness are more likely to be underreported compared to more severe disease cases. The degree of underreporting varies by disease awareness and healthcare-seeking behavior in any area. Surveillance data for non-neuroinvasive disease should not be used to make comparisons of disease activity between different locations or over time.

West Nile Virus

West Nile virus has been detected in all 67 counties in Pennsylvania at least once in the past 10 years (PEMA 2023). For the 2024 season (May 1 to August 31, 2024), PDPH has identified eight neuroinvasive WNV infections for the City. The WNV pool positivity in 2024 is higher than the year-to-date historic median rate from 2001-2023 (45% vs 9%) and similar to rates observed in 2018 and 2022 (41%-46%), peak WNV activity seasons in Philadelphia (PDPH 2024).

From May through October, PDPH, in collaboration with the PA Department of Environmental Protection, conducts mosquito management activities throughout Philadelphia, which entails surveillance and identification of mosquito pools, testing pools for WNV, and control activities (eliminating breeding sites, larviciding catch basins, ground spraying, etc.). Since May 2024, 112 locations in Philadelphia were treated to control larval mosquito populations and 37 locations to control adult mosquito populations (PDPH 2024). Table 4-117 explains the WNV mosquito and human case surveillance for the City for the 2024 season.

Table 4-117. West Nile Virus Mosquito and Human Case Surveillance, Cumulative 2024 Season Update

Mosquito Pools Tested	892
WNV Positive Pools	404
Human WNV Cases	8
Neuroinvasive WNV	8
WNV Fever	0
Human WNV Deaths	0
Presumptive Viremic Donors	2

Source: PDPH 2024
Note: ^892 mosquito pools at 121 different mosquito trapping sites; State and National WNV Activity Reports, DOH and CDC.

Hepatitis A

Hepatitis A outbreaks are an ongoing concern in Philadelphia and several other U.S. states. The majority of cases are among individuals who use drugs and individuals who are unhoused, although cases are also occurring among individuals with no known risk factors. Typically, Philadelphia has seen between two and six cases of Hepatitis A per year (City of Philadelphia 2019). Between January and August 2019, the Health Department was notified of 154 cases. In response to the growing number of Hepatitis A cases, the Health Department collaborated with nonprofit organizations, healthcare providers, and City agencies to vaccinate at-risk populations. Between July 2018 and August 2019, the Health Department coordinated the vaccination of 1,775 at-risk individuals and reported that over 12,439 Hepatitis A vaccinations had been administered in the City (City of Philadelphia 2019).

Following large outbreaks of Hepatitis A in 2019 and 2020, and a smaller but significant outbreak in early 2023, infections are once again on the rise in Philadelphia. A preliminary count indicates 10 confirmed, locally acquired cases since late December 2023 (DOH 2024a). The current risk factors are consistent with those observed over the past year. Since December 2023, 70% of cases reported current injection and/or non-injection drug use, with 50% of these individuals being unhoused. The median age of recent cases is 35 years, ranging from 25 to 62 years, and 60% of the cases are male. Hepatitis A was a contributing cause of death for one individual with a recent infection. Adult vaccination rates have declined since Fall 2023 compared to earlier in the year when vaccination activity was higher (DOH 2024a).

The CDC maintains statistics and surveillance on number and rates of reported hepatitis A cases as shown in Table 4-118 for Pennsylvania.

Table 4-118. Number and Rates of Reported Cases of Hepatitis A, Pennsylvania, 2018-2022

	2018		2019		2020		2021		2022	
State	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Pennsylvania	99	0.8	696	5.4	124	1.0	254	2.0	94	0.7

Source: CDC 2024
Note: Rates per 100,000 population. Beginning in 2021, single-race population estimates are used for rate calculations. For prior years, bridged-race population estimates are used. Reported confirmed cases. This is the most recent data surveille list on the CDC Viral Hepatitis Surveillance – United States site.

Novel Coronavirus

The first human cases of COVID-19 were first reported by officials in Wuhan City, China, in December 2019. In the United States, community transmission of COVID-19 was first detected in February 2020. By mid-March, all 50 states and four U.S. territories had reported cases of COVID-19. As of August 4, 2024, a total of 103 million cases and 3,025,344 deaths related to COVID-19 have been reported in the United States (WHO 2024). According to the State HMP, the City has experienced 390,528 cases and 5,501 deaths between March 1, 2020, to February 8, 2023 (PEMA 2023).

Measles

Measles outbreaks are currently occurring across the United States and a total of 884 confirmed cases have been documented as of April 24, 2025. There were 16 outbreaks identified in 2024, and out of 285 confirmed measles cases documented that year, 198 cases were outbreak-associated. As of January 2024, at least 93 percent of children in Philadelphia had been fully vaccinated by age 6. The Philadelphia Department of Public Health is working closely with local and state public health agencies and local health care systems to respond to any confirmed measles cases in the region.

Range of Magnitude

Severity of a pandemic disease depends on several factors, including the aggressiveness of the disease, ease of transmission, available medical countermeasures, and factors associated with the impacted community (e.g., access to medical care, demographic data, and population density). High-risk populations considered more vulnerable to various pandemic diseases are described in the vulnerability assessment presented in Chapter 21.2.1, Life, Health, and Safety.

Novel Influenza

Pandemic flu should not be confused with seasonal flu. Seasonal flu is a less severe concern because of its regularity of occurrence and predictability. Table 4-119 lists key differences between pandemic and seasonal flu. The 1918 Spanish flu pandemic remains the worst-case pandemic event on record both in Pennsylvania and worldwide. While mortality figures were probably under-reported, in the first month of the pandemic alone, 8,000 Pennsylvanians died from the flu or its complications. As the densest city in the Commonwealth, Philadelphia experienced particularly high losses from this event (PEMA 2023).

Table 4-119 Seasonal Flu vs. Pandemic Flu

Pandemic Flu	Seasonal Flu
Rarely happens (three times in 20th century).	Happens annually and usually peaks in January or February.
People have little or no immunity because they have no previous exposure to the virus.	Sufferers usually have some immunity built up from previous exposure.
Healthy people may be at increased risk for serious complications.	Usually only people in vulnerable populations, not healthy adults, are at risk of serious complications.
Healthcare providers and hospitals may be overwhelmed.	Healthcare providers and hospitals can usually meet public and patient needs.
Vaccine probably would not be available in the early stages of a pandemic.	Vaccine is available for annual flu season.
Effective antivirals may be in limited supply	Adequate supplies of antivirals are usually available.

Pandemic Flu	Seasonal Flu
Number of deaths could be high (U.S. death toll during the 1918 pandemic was approximately 675,000).	Seasonal flu-associated deaths in the United States over 30 years ending in 2007 have ranged from about 3,000 per season to about 49,000 per season.
Symptoms may be more severe.	Symptoms include fever, cough, runny nose, and muscle pain.
May cause major impact on the general public, such as widespread travel restrictions and school or business closings.	Usually causes minor impact on the general public; some schools may close, and sick people are encouraged to stay home.
Potential for severe impact on domestic and world economy.	Manageable impact on domestic and world economy.

Source: CDC 2024

In 2014, CDC updated the Pandemic Intervals Framework (PIF), which describes the progression of an influenza pandemic using six intervals. The framework is used to guide planning for an influenza pandemic and provides recommendations for risk assessment, decision-making, and action in the United States. Descriptions of the CDC pandemic intervals are presented in Table 4-120.

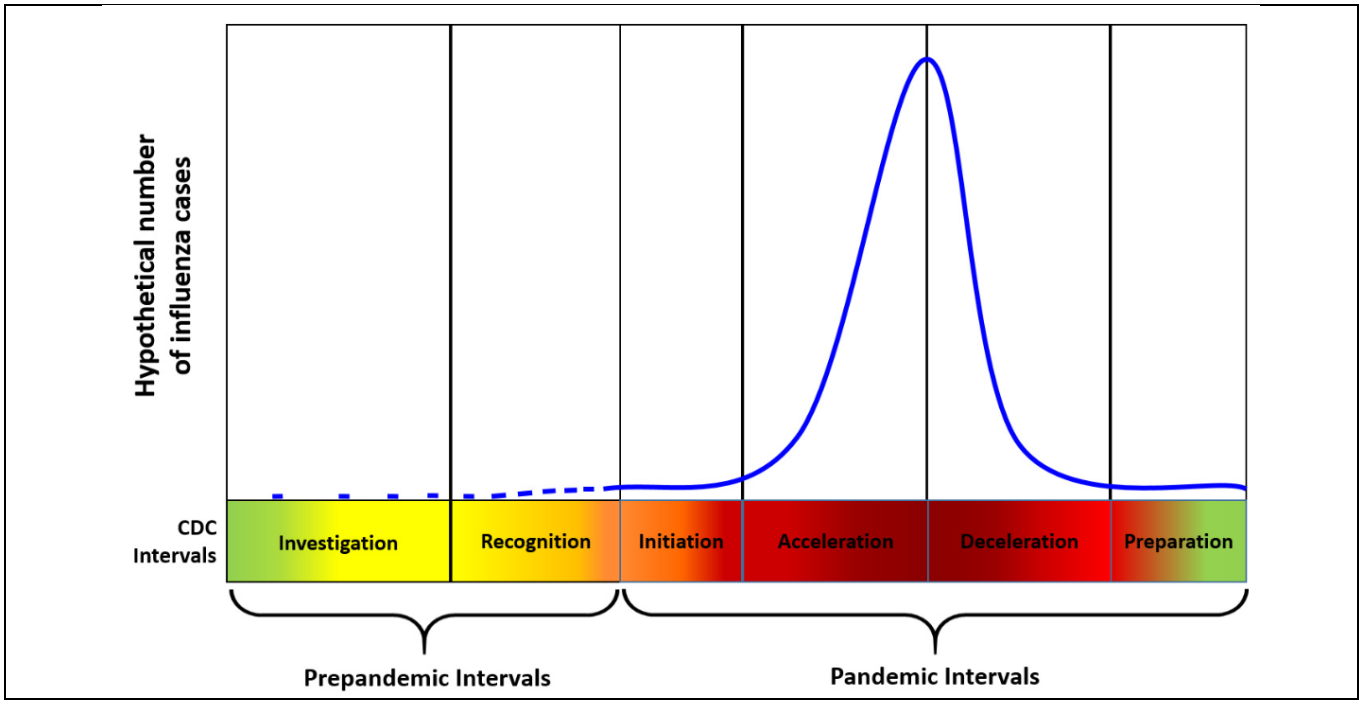
Table 4-120. CDC Pandemic Intervals Framework

Interval	Description
Interval 1: Investigation of cases of novel influenza A virus infection in humans	When novel influenza A viruses are identified in people, public health actions focus on targeted monitoring and investigation. This can trigger a risk assessment of that virus with the Influenza Risk Assessment Tool, which is used to evaluate whether the virus has the potential to cause a pandemic.
Interval 2: Recognition of increased potential for ongoing transmission of a novel influenza A virus	When increasing numbers of human cases of novel influenza A illness are identified and the virus has the potential to spread from person to person, public health actions focus on control of the outbreak, including treatment of sick persons.
Interval 3: Initiation of a pandemic wave	A pandemic occurs when people are easily infected with a novel influenza A virus that has the ability to spread in a sustained manner from person to person.
Interval 4: Acceleration of a pandemic wave	The acceleration (or “speeding up”) is the upward epidemiological curve as the new virus infects susceptible people. Public health actions at this time may focus on the use of appropriate non-pharmaceutical interventions in the community (e.g., school and child-care facility closures, social distancing), as well the use of medications (e.g., antivirals) and vaccines, if available. These actions combined can reduce the spread of the disease and prevent illness or death.
Interval 5: Deceleration of a pandemic wave	The deceleration (or “slowing down”) happens when the number of reported pandemic influenza cases consistently decreases in the United States. Public health actions include continued vaccination, monitoring of pandemic influenza A virus circulation and illness, and reducing the use of non-pharmaceutical interventions in the community (e.g., school closures).
Interval 6: Preparation for future pandemic waves	When pandemic influenza has subsided, public health actions include continued monitoring of pandemic influenza A virus activity and preparing for potential additional waves of infection. It is possible that a second pandemic wave could have higher severity than the initial wave. An influenza pandemic is declared “ended” when enough data show that the reported cases of influenza virus worldwide are similar to cases of seasonal influenza virus in the way they spread and the severity of the illness they can cause.

Source: CDC 2024

Conclusion of Interval 6 leads to the post-peak period, where the pandemic is declared "ended" when enough data show that the influenza virus, worldwide, presents similar to a seasonal influenza virus. Despite a decrease in activity, countries still must be prepared for additional waves of the pandemic. Pandemic waves can be separated by a period of months leading to a long recovery time, to guarantee entry of the pandemic into the post-pandemic interval (CDC 2024). Figure 4-38 illustrates the six intervals of pandemic influenza described by CDC.

Figure 4-38. Preparedness and Response Framework for Novel Influenza A Virus Pandemics



Source: CDC 2024

Mosquito-Borne Disease

The clinical spectrum of human arboviral infections varies widely, encompassing subclinical cases with no noticeable symptoms, mild flu-like illnesses, and severe neuroinvasive diseases that can occasionally be fatal (Commonwealth of Pennsylvania 2023). For example, slightly less than 80 percent of WNV cases are clinically asymptomatic. Approximately 20 percent of cases result in mild infection, called West Nile fever, lasting two to seven days. However, one in 150 cases result in severe neurological disease or death. Since the appearance of West Nile virus in Pennsylvania in 2000, the worst year was 2003 when 237 Pennsylvanians were infected with the virus and 9 people died. The virus is typically more serious in older adults (PEMA 2023).

Many arboviruses can lead to neuroinvasive diseases such as aseptic meningitis, encephalitis, or acute flaccid paralysis (AFP). These conditions typically present with an acute onset of fever, headache, myalgia, stiff neck, altered mental status, seizures, limb weakness, or cerebrospinal fluid (CSF) pleocytosis. AFP may result from anterior ("polio") myelitis, peripheral neuritis, or post-infectious peripheral demyelinating neuropathy, such as Guillain-Barré syndrome (Commonwealth of Pennsylvania 2023). Less common neurological manifestations, including cranial nerve palsies, can also occur. Additionally, most arboviruses can cause an acute systemic febrile illness, such as West Nile fever, characterized by symptoms such as headache, myalgias, arthralgia, rash, or gastrointestinal issues. Some viruses, like Chikungunya), can cause more specific clinical manifestations, such as severe polyarthralgia or arthritis (Commonwealth of Pennsylvania 2023).

Hepatitis A

Individuals infected with Hepatitis A may not exhibit any symptoms, with adults more likely to exhibit symptoms than children. When symptoms do occur, they can include fever, loss of appetite, nausea, vomiting, stomach pain, dark urine, light-colored stools, and jaundice (yellowing of the skin and eyes). The average incubation period from exposure to the onset of symptoms is 28 days, but it can range from 15 to 50 days. Symptoms usually last less than two months, though some individuals may remain ill for up to six months (DOH 2024b).

Hepatitis A is highly contagious and can be spread from two weeks before symptoms appear to a few weeks after infection. The virus can survive outside the body for months, depending on environmental conditions. It is primarily spread through ingestion of food or water contaminated with feces from an infected person, making it more prevalent in areas with poor sanitary conditions or inadequate handwashing practices. Close contact with an infected household member, particularly young children who may not show symptoms, is a common mode of transmission. Hepatitis A can also be spread through sexual contact with an infected person, but not through casual contact such as sitting next to or hugging someone (DOH 2024b).

Diagnosis of Hepatitis A requires a blood test. Unlike other hepatitis infections, Hepatitis A does not lead to chronic illness, but in rare cases, it can cause acute liver failure, particularly in older adults or those with pre-existing liver conditions. Post-exposure prophylaxis (PEP) with the Hepatitis A vaccine and/or immune globulin can prevent the disease if administered within two weeks of exposure (DOH 2024b).

Novel Coronavirus

COVID-19 is currently the biggest pandemic threat to the City because (1) it is easily spreadable, (2) infected people can be asymptomatic, and (3) the virus is not yet fully understood. Viruses like COVID-19 constantly change through mutation, which sometimes result in a new variant of the virus. Some changes and mutations may allow the virus to spread more easily or make it resistant to treatments and vaccines. It is essential to track and monitor the incidence of variants during a pandemic to effectively respond to changing trends in transmission and patient care (CDC 2023, PEMA 2023). Variants can have multiple lineages or groups of lineages in which there are further mutations in the genetic code. As of February 2022, the CDC was tracking 11 variants being monitored (VBM) and one variant of concern (VOC) related to COVID-19. Several changes have been made to SARS-CoV-2 variant classifications as their transmission rates increase or decrease. On November 30, 2021, the Omicron variant of SARSCov-2 was classified as a VOC. On April 14, 2022, the Delta variant was downgraded from a VOC to a VBM (CDC 2023).

COVID-19 symptoms may appear 2-14 days after exposure to the virus. Symptoms of COVID-19 include fever, chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea (WHO 2023). Anyone can have mild to severe symptoms but older adults and people who have severe underlying medical conditions appear to be at higher risk for developing more serious complications. Ways to prevent the spread of COVID-19 include social distancing, staying home whenever possible and avoiding crowds, taking care of personal health (by resting and staying hydrated), staying in touch with a healthcare professional, and avoiding public transportation. COVID-19 has caused a major impact on the public, such as widespread travel restrictions and closures of schools and businesses. COVID-19 has the potential for severe impact on domestic and world economy (Hacker, et al. 2021). Three COVID-19 Vaccines are Authorized for Emergency Use or FDA-Approved. Pfizer-BioNTech and Moderna are a two-shot series (COVID-19 mRNA vaccines) and have been FDA approved in 2021.The Johnson & Johnson's Janssen vaccine, a single viral vector shot, was also once available as another option which has expired and is no longer available for use in the U.S. as of May 6, 2023 (CDC 2023). The Novavax vaccine is a single dose adjuvanted vaccine that is authorized under an EUA for people ages 12 years and older to received as a booster dose or two-

dose series if receiving a COVID-19 vaccine for the first time (CDC 2024). The Pfizer and Moderna COVID-19 vaccines are available for people ages 6 months and older. Additional booster doses have been available to people 6 months and older and those specifically at risk for severe disease due to underlying medical conditions or at higher occupational risk for exposure (CDC 2025).

Measles

Measles has been common in many parts of the world and global activity has been increasing in recent months. In 2000, measles was declared eliminated from the United States, indicating that measles cases are not circulating in the country and new cases are only imported from travel abroad. Historically, measles cases in the U.S. have been acquired through international travel in unvaccinated individuals. Imported measles cases cause important concern for local transmission of the virus amongst unvaccinated individuals. The measles virus can live up to 2 hours in the air, and if one person has the virus, 9 out of 10 people nearby that the infected individual can become infected if they are not protected. Prompt recognition, investigation, and reporting of possible cases and contact tracing are critical to stop the spread of disease. The measles, mumps, and rubella (MMR) vaccine is the best protection against all strains of measles and is given as a two-dose series to children starting at 12 months of age. Another available vaccine is the measles, mumps, rubella, and varicella (MMRV) vaccine which is also given in a two-dose series, but limited children up to 12 years of age. If an unprotected individual is exposed to measles, the MMR vaccine given within 72 hours of exposure may offer some protection or milder illness. Immunoglobulin (IG) can also be given within 6 days and offer some protection or milder illness.

Previous Occurrences

Several pandemic influenza outbreaks have occurred worldwide over the past 100 years, as listed in Table 4-121. Deaths occurred in the U.S. because of Spanish Flu, Asian flu, and Hong Kong Flu outbreaks. In the U.S., approximately 675,000 people died while 22 million caught the Spanish Flu (1918-1920). Pennsylvania, one of the states that was hit the hardest, faced over 60,000 deaths (Shetty 2018). Most deaths resulting from Asian flu occurred between September 1957 and March 1958; within the United States, approximately 70,000 people died, and approximately 15 percent of the population of Pennsylvania was affected. The first cases of Hong Kong Flu in the United States were detected in September 1968, with deaths peaking between December 1968 and January 1969 (Rogers 2020). As of August 2010, H1N1 was identified as being in a post-pandemic period. The COVID-19 virus has no “past occurrence” data, as it was first reported in 2019.

Table 4-121. Previous Pandemic Outbreaks

Date	Pandemic/Subtype	Worldwide Deaths (Approx.)
1918-1920	Spanish Flu/H1N1	17-50 Million
1957-1958	Asian Flu/H2N2	1.1 Million
1968-1969	Hong Kong Flu/H3N2	15-50 Million
2009-2010	Swine Flu/H1N1	> 18,000
2019- ongoing	COVID-19	7.1 Million of 6/12/2024

Source: CDC 2013; WHO 2024

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City was included in two major disaster (DR) or emergency (EM) declarations for pandemic and infectious disease -related events (FEMA 2024). Table 4-122 lists these declarations.

Table 4-122. FEMA Declarations for Pandemic and Infectious Disease Events in City of Philadelphia (1954 to 2024)

Event Date	Declaration Date	Declaration Number	Description
January 20, 2020 to May 11, 2023	March 13, 2020	EM-3441	COVID-19
January 20, 2020 to May 11, 2023	March 30, 2020	DR-4506	COVID-19 Pandemic

Source: FEMA 2024

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, the City was not included in any USDA pandemic and infectious disease-related agricultural disaster declarations (USDA 2024).

Previous Events

Known pandemic and infectious disease events that impacted the City between January 2021 and October 2024 are discussed in Table 4-123. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-123. Pandemic and Infectious Disease Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
January 20, 2020 to May 11, 2023	Global/City of Philadelphia	Global COVID-19 Pandemic Federal disaster declarations issued (EM-3441 and DR-4506)
August 2021, March 2023, February 2-24	City of Philadelphia	Alert: Hepatitis A Increases among At-Risk Persons in Philadelphia:
May to October 2022	City of Philadelphia	2022 West Nile Virus Season: 11 human infections occurred in Philadelphia. Seven adults developed neuroinvasive disease, four developed febrile illness. All required hospitalization and one neuroinvasive case was fatal.
July 2022 to May 2023	Nationwide/City of Philadelphia	Global clade II mpox outbreak
March 28, 2023	City of Philadelphia	Alert: Hepatitis A Increases among At-Risk Persons in Philadelphia
June 26, 2023	City of Philadelphia	Alert: Hepatitis A in Philadelphia: Updates on Recent Increases and the National Frozen Strawberry Recall
May to October 2023	City of Philadelphia	2023 West Nile Virus Season: Four neuroinvasive West Nile Virus infections were identified. All four cases were adults who were hospitalized. One case had a significant underlying medical history and was fatal.
October 2023	City of Philadelphia	Increase in Shigella cases
December 2023 to January 2024	City of Philadelphia	Measles outbreak
February 20, 2024	City of Philadelphia	Alert: Hepatitis A Increases among At-Risk Persons in Philadelphia: Recommendations for Prevention and Control Through Vaccination
May to October 2024	City of Philadelphia	2024 West Nile Virus Season: Nine neuroinvasive WNV infections were identified in Philadelphia.

Source: DOH 2024; FEMA 2024; PDPH 2024

Probability of Future Occurrences

Information on previous pandemic and infectious disease occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized Table 4-124. Based on historical records and input from the Steering Committee, the probability of occurrence for Pandemic and Infectious Disease in the City is considered "possible."

Future occurrences of pandemic and infectious disease can impact the entire population of the City; buildings, structures, and infrastructure are not directly impacted by this hazard. The transmission rates of pandemic illnesses are often higher in denser areas where there are large concentrations of people, making the City especially vulnerable to the spread of pandemic and infectious disease. Impacts to the population would include becoming ill, contributing to the spread of the pandemic or disease, and death.

Table 4-124. Probability of Future Pandemic and Infectious Disease Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 1996 and 2024	Percent Chance of Occurring in Any Given Year
Novel Influenza[a]	-	-
Mosquito-Borne Disease	350	100%
Hepatitis A	1,157	100%
Novel Coronavirus	397,762	100%
Total	**399,269**	**100%**

Source: DEP 2024; USA Facts 2024; Philadelphia DPH 2025

Note: Due to limitations in data, not all Pandemic and Infectious Disease events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2024.

a. Total number of occurrences of Novel Influenza were unable to be located. However, based on weekly reports and visual trendlines, it can be inferred that a minimum of 100 cases of Influenza A and/or Influenza B likely occur within the City each year.

Climate Change Projections

The relationship between climate change and an increase in infectious diseases is difficult to predict with certainty, but there are scientific linkages between the two. Increased rainfall and heavy rainfalls increase the chances of standing water where mosquitos breed. As flooding events increase in the City owing to climate change, water-borne and vector-borne diseases (particularly those associated with mosquitos) may similarly increase owing to the prevalence of standing water over long periods (National Geographic 2022).

The notion that rising temperatures will increase the number of ticks and mosquitoes that can transmit diseases such as Lyme disease and WNV among humans (rather than just shift their range) has been the subject of debate over the past decade. Many researchers have pointed out that climate is not the only force at work in increasing the spread of infectious diseases into the future (Jordan 2019). However, a warming climate is likely to increase the length of the insect season, increasing the potential rates of transmission of insect-borne disease.

Cascading Impacts on Other Hazards

There are no known cascading impacts that pandemic and infectious disease events can cause to other hazards of concern for the City. However, disease outbreak events can result in necessary changes to emergency response and sheltering procedures to prevent the spread of disease.

4.3.16.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard. The following text evaluates and estimates the potential impact of the pandemic and infectious disease hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

The entire population of the City (1,593,208) is vulnerable to pandemics and infectious disease outbreaks. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard.

Overall Population

Maintaining certain key functions is important to preserve life and decrease societal disruption during disease outbreaks. Heat, clean water, waste disposal, and decedent management all contribute to public health. Ensuring functional transportation systems also protects health by making it possible for people to access medical care and by transporting food and other essential goods. Critical infrastructure groups have a responsibility to maintain public health, provide public safety, transport medical supplies and food, implement a pandemic response, and sustain societal functions. If critical infrastructure workers are absent due to a pandemic outbreak, these systems will be gravely impacted or cease to function (Cybersecurity and Infrastructure Security Agency n.d.).

In addition, individuals affected by contagious disease may face stigma and people who are associated with the country of origin may also face this stigma.

Socially Vulnerable Population

Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. According to the U.S. Bureau of Labor Statistics, there were 335,800 individuals employed in the education and healthcare sector in September 2024 (refer to Table), over 3,000 members of the Philadelphia Fire Department, and over 6,000 employees of the Philadelphia Police Department (PFD 2022, PEW 2025). Areas with a higher population density also have an increased risk of exposure or transmission of disease due to their proximity to potentially infected people. Young children, older adults, pregnant people, and people with chronic health conditions (like asthma, diabetes, or heart disease) are most at risk of severe illness. According to the 2022 5-year ACS estimates, shown in Table 4-125, there are 351,811 total persons living below the poverty level, 223,219 persons over the age of 65 years, 99,102 persons under the age of 5 years, 105,761 non-English speakers, and 267,675 persons with a disability in the City (U.S. Census Bureau 2022).

General Building Stock

No structures are anticipated to be directly impacted by a pandemic or infectious disease. However, structures, especially critical facilities, could be greatly impacted due to the lack of maintenance personnel onsite because of

illness or necessary isolation or quarantine measures. This is especially true of critical facilities and businesses with processes (e.g., chemical reactions) that occur continuously.

Community Lifelines and Other Critical Facilities

Pandemics and infectious diseases can have profound impacts on community lifelines and critical facilities. The COVID-19 pandemic, for instance, strained healthcare systems, disrupted supply chains, and affected essential services such as water, electricity, and transportation. Workforce shortages due to illness or quarantine measures further exacerbated these disruptions, leading to reduced capacity and efficiency in critical infrastructure (CISA 2021). Essential services may be disrupted by insufficient staffing, insecure supply chains, and fragile critical infrastructure. These vulnerabilities can lead to significant disruptions in vital services during pandemics.

Economy

The impact disease outbreaks have on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address pandemics have not been quantified in available documentation. Instead, activities and programs implemented by the City to address this hazard are described below, all of which could impact the local economy.

Pandemics and infectious diseases can have profound economic impacts, and the COVID-19 pandemic is a prime example of this in the City. The pandemic led to widespread business closures, particularly affecting non-essential businesses, which resulted in significant job losses and economic disruption.

Philadelphia saw a sharp increase in unemployment claims, with more than 208,000 initial claims filed between March and August 2020 (City of Philadelphia 2020). This surge in unemployment disproportionately affected minority communities, intensifying existing economic inequalities. Additionally, the rise of remote work significantly impacted Philadelphia's economy, particularly its wage tax, which had generated nearly half of the City's local tax revenue. This tax applied to people who live in the suburbs working in Philadelphia and all City residents, regardless of their job location. With more people working remotely, fewer people who live in the suburbs commuted into the City, leading to a substantial decline in wage tax revenue. Increased remote work also reduced demand for public transportation, restaurants, retail shops, and office space, further straining the local economy (Pew Trusts 2022).

Moreover, the pandemic severely disrupted global supply chains, leading to significant economic impacts. Shutdowns and restrictions shifted consumer demand from in-person services to goods, creating supply shocks and inflationary pressures. These disruptions affected various sectors, causing delays, shortages, and increased costs, which in turn strained businesses and consumers alike (The White House 2021).

Smaller-scale disease outbreaks can also cause negative economic impacts, though the extent of impact can be variable.

Table 4-125. Socially Vulnerable Populations in the City of Philadelphia

Planning District	American Community Survey 5-Year Population Estimates (2022)									
	Population Over 65		Population Under 5		Non-English-Speaking Population		Population with Disability		Population Below Poverty Level	
	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total
Central	20,572	15.1%	5,033	3.7%	5,649	4.1%	11,714	8.6%	14,340	10.5%
Central Northeast	15,291	17.8%	6,332	7.4%	11,499	13.4%	12,956	15.1%	15,582	18.2%
Lower Far Northeast	11,898	16.5%	5,141	7.1%	3,915	5.4%	9,621	13.4%	5,889	8.2%
Lower North	10,055	10.1%	4,936	5.0%	5,361	5.4%	19,685	19.8%	32,707	33.0%
Lower Northeast	11,245	10.5%	8,865	8.3%	8,735	8.2%	20,526	19.2%	28,876	27.0%
Lower Northwest	7,850	14.4%	2,798	5.1%	624	1.1%	6,867	12.6%	4,835	8.9%
Lower South	1,230	19.0%	375	5.8%	413	6.4%	792	12.3%	378	5.9%
Lower Southwest	4,640	10.8%	2,672	6.2%	3,721	8.7%	6,452	15.0%	11,439	26.7%
North	16,712	12.3%	10,450	7.7%	19,405	14.3%	38,514	28.4%	51,673	38.2%
North Delaware	12,094	12.3%	6,769	6.9%	7,104	7.2%	15,527	15.7%	20,072	20.4%
River Wards	6,811	9.8%	5,008	7.2%	4,465	6.4%	13,317	19.1%	16,999	24.4%
South	18,100	13.7%	7,551	5.7%	9,311	7.1%	18,849	14.3%	23,271	17.7%
University Southwest	6,943	8.5%	2,825	3.5%	2,652	3.2%	11,389	13.9%	20,113	24.6%
Upper Far Northeast	15,831	22.9%	4,283	6.2%	12,900	18.7%	10,246	14.8%	8,520	12.3%
Upper North	25,546	16.8%	8,929	5.9%	6,221	4.1%	27,791	18.3%	36,558	24.1%
Upper Northwest	15,417	17.0%	6,172	6.8%	1,347	1.5%	15,619	17.2%	16,825	18.5%
West	15,573	13.6%	8,888	7.7%	1,288	1.1%	19,933	17.4%	33,513	29.2%
West Park	7,411	16.5%	2,073	4.6%	1,150	2.6%	7,876	17.6%	10,221	22.8%
City of Philadelphia (Total)	**223,219**	**14.0%**	**99,102**	**6.2%**	**105,761**	**6.6%**	**267,675**	**16.8%**	**351,811**	**22.1%**

Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals
Note: 2.34 persons per household. This number was used to calculate the Non-English-Speaking populations.

Natural, Historic and Cultural Resources

Natural

There are no anticipated direct impacts on the City's natural resources. However, pandemics and infectious diseases may result in increased utilization of single-use plastics, which could place additional stress on waste management systems and potentially contribute to land and water pollution.

Historic

Pandemics and infectious diseases may limit access to historic resources. As seen during the COVID-19 pandemic, historic monuments, facilities, and sites had imposed restricted access to minimize the spread of the disease. The limitation of access during a disease outbreak can assist in lowering the rate of transmission.

Cultural

Pandemics and infectious diseases can significantly impact cultural resources in Philadelphia. The closure of small businesses, including shops and restaurants, threatened the unique identities and cultures of neighborhoods. The loss of these businesses could lead to dramatic and potentially irreversible changes in the cultural landscape of the City (Rhynhart 2020).

4.3.16.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed. As population counts change in the City, there may be an increased risk to certain diseases. Higher concentrations of persons traveling via public transportation may become more vulnerable to the exchange of disease through airborne transmission. Increase development in rural areas may expose a higher percentage of the population to vector-borne diseases.

Projected Changes in Population

Changes in population density could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are at risk of greater exposure to disease outbreak. Density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities. Further, as the population ages there may be increased risk to this demographic. Older adults and people who have severe underlying medical conditions like heart or lung disease or diabetes can be at higher risk for developing more serious complications from certain diseases, such as COVID-19.

Climate Change

The May 2021 Pennsylvania Climate Impact Assessment indicated that increased temperatures and precipitation due to climate change could lead to more extreme weather events. This includes higher chances of standing water from heavy rainfall, which can breed mosquitoes and increase water-borne and vector-borne diseases. Rising temperatures may also extend the insect season, potentially increasing the transmission rates of diseases like Lyme

disease and West Nile Virus. The relationship between climate change and infectious diseases is complex, but the potential for increased disease spread is a significant concern.

Additional Data and Next Steps

The qualitative assessment above identifies the potential human health and economic impacts associated with opioid response. Additional next steps to further enhance the evaluation of this hazard include continual collaboration and integration of health service providers with emergency management in order to improve documentation of pandemic and infectious disease events.

4.3.17 Subsidence, Sinkhole

4.3.17.1 Hazard Profile

Hazard Description

Land subsidence is a gradual settling or sudden sinking of the Earth's surface due to removal or displacement of subsurface earth materials. Sinkholes are subsidence features resulting from the downward movement of surficial material into a pre-existing subsurface void (PEMA 2023). Subsidence can also be caused by earthquakes, soil compaction, erosion, and sinkholes (NOAA 2022). Mine subsidence is also of concern due to the number of underground coal and clay mines. Mine subsidence is the movement of the ground surface as a result of the collapse of the roof, floor, or pillars of underground mines (DCNR 2022).

A sinkhole is a subsidence feature that results from the downward movement of surface material resulting in a hole or cavity (DCNR 2022). Sinkholes are generally found in areas underlain by carbonate bedrock (such as limestone and dolomite), found in large areas of central and eastern Pennsylvania. They occur naturally due to the physical and chemical weathering of the bedrock. Water passing through naturally occurring fractures and bedding planes dissolve the bedrock leaving voids below the surface. Eventually, overburden on top of the voids collapse, leaving surface depressions resulting in karst topography. Characteristics structures associated with karst topography include sinkholes, linear depressions, and caves. Often, sub-surface solution of limestone will not result in the immediate formation of karst features (USGS 2021).

As stated in the 2023 Pennsylvania State Hazard Mitigation Plan, there are two common causes of subsidence in the State: 1) dissolution of carbonate rock such as limestone or dolomite and 2) mining activity. In the first case, water passing through naturally occurring fractures and bedding planes dissolves bedrock leaving voids below the surface. Eventually, overburden on top of the voids collapses, leaving surface depressions resulting in karst topography. Characteristic structures associated with karst topography include sinkholes, linear depressions, and caves. Often, sub-surface solution of limestone will not result in the immediate formation of karst features. Collapse sometimes occurs only after a large amount of activity, or when a heavy burden is placed on the overlying material (PEMA 2023).

In addition to these types, the City is also vulnerable to sinkholes and subsidence resulting from subsurface infrastructure failures and sites that have been backfilled to create developable land. Many neighborhoods in the City are situated on filled-in stream and former industrial sites where landfills contained organic waste, construction debris, and ash. Over time, the decomposition of organic materials can result in subsidence and the release of gases, causing uneven ground settlement. Additionally, water infiltration into these areas may accelerate the dissolution of underlying limestone and dolostone, leading to the formation of underground cavities that could collapse and create sinkholes. Poor drainage and legacy infrastructure can further increase these risks, making certain areas of the City more susceptible to ground instability.

The following sections discuss the location and extent, range of magnitude, previous occurrence, future occurrence, and vulnerability assessment associated with the subsidence/sinkhole hazard for the City.

Location and Extent

According to USGS, one of the most affected states of sinkhole damage is Pennsylvania (USGS). There are two common causes of subsidence in Pennsylvania: 1) dissolution of carbonate rock such as limestone or dolomite, also known as karst topography, and 2) mining activity. However, most sinkholes in cities are caused by human activity rather than geology. Human decisions to impede the flow of water and to force water to flow along unnatural

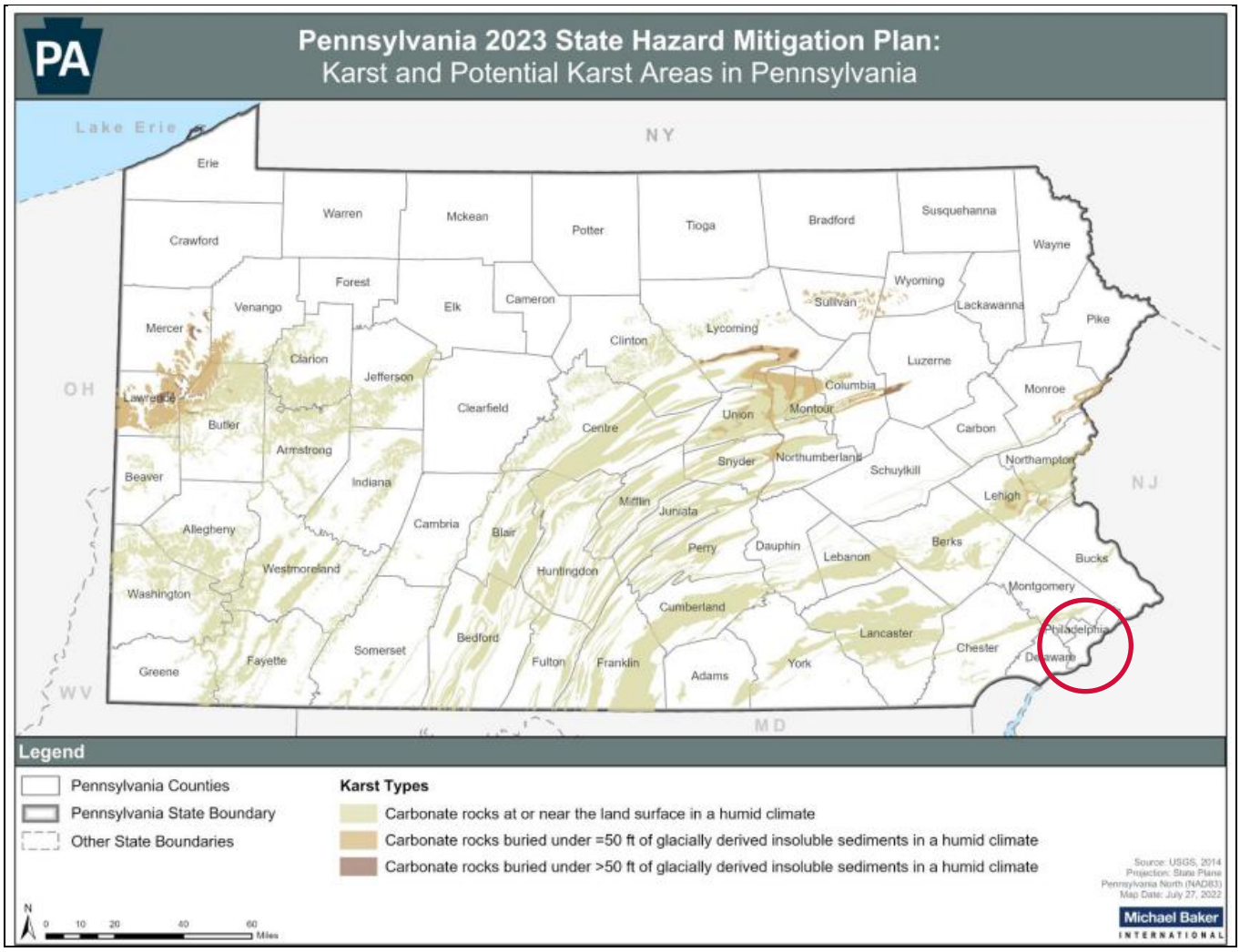
pathways can contribute to the formation of sinkholes. Sinkholes develop in urban areas like Philadelphia because of the underground network of piping and conduits. Urban areas also have a high percentage of impervious surfaces (such as pavement) which impedes natural stormwater flow (DCNR 2015).

Aging infrastructure also plays an important role in the creation of sinkholes in urban areas. Most sinkholes that form in cities like Philadelphia occur because water slowly eroded the soil that supports buildings and roads. Pipes that carry drinking water, runoff, or sewage are susceptible to leaking as they age. Leaking pipes erode the soil surrounding pipes and create large voids below the surface. Due to the nature of aging infrastructure, the entire City is at risk at any time for an infrastructure caused sinkhole or subsidence problem.

Figure 4-39 illustrates the distribution of areas in Pennsylvania that have karst or the potential for karst development. This map highlights regions underlain by soluble rocks, primarily based on state geologic maps of rock units. These regions are further categorized by general climate setting and degree of exposure. In Pennsylvania, extensive sequences of structurally deformed carbonates form the surface bedrock in significant portions of central, south-central, and southeastern Pennsylvania (PEMA 2023). It is important to note that Figure 4-39 offers only an initial approximation for delineating the degree of karst hazard across Pennsylvania. Although areas underlain by carbonate rock are known to possess karst landforms or karst potential, the risk of ground collapse within these areas varies significantly.

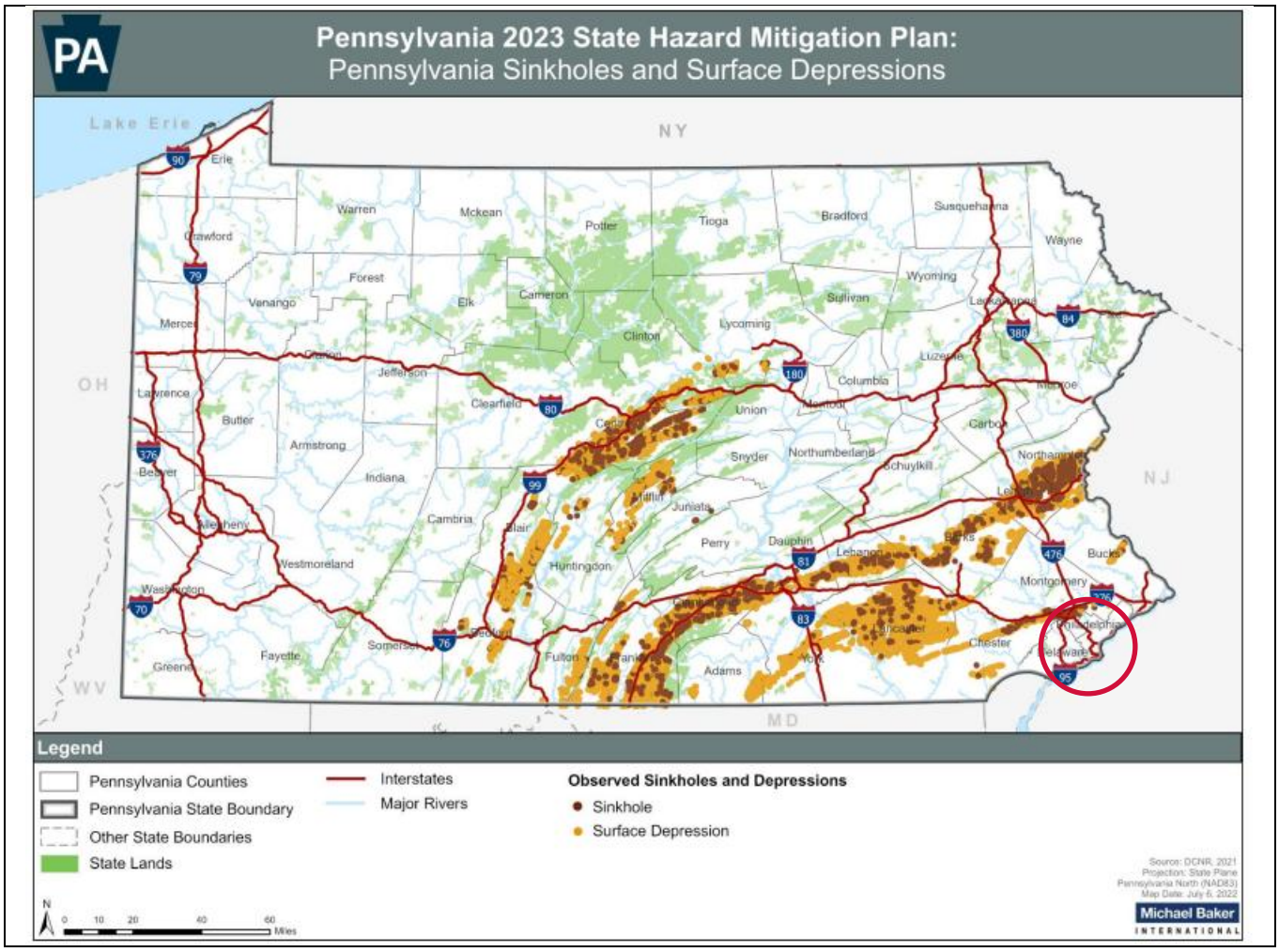
To more accurately assess the degrees of karst hazard in regions underlain by soluble rocks, Figure 4-40 also indicates the locations of observed sinkholes and surface depressions in Pennsylvania (PEMA 2023).

Figure 4-39. Karst and Potential Karst Areas in Pennsylvania



Source: PEMA 2023
Note: City of Philadelphia is indicated by the red circle.

Figure 4-40. Pennsylvania Sinkholes and Surface Depressions



Source: PEMA 2023
Note: City of Philadelphia is indicated by the red circle.

Range of Magnitude

Subsidence and sinkhole events may occur gradually or abruptly. Events could result in minor elevation changes or deep, gaping holes in the ground surface. Subsidence and sinkhole events can cause severe damage in urban environments, although gradual events can be addressed before significant damage occurs (PEMA 2023). If long-term subsidence or sinkhole formation is not recognized and mitigation measures are not implemented, fractures or complete collapse of building foundations and roadways may result.

The worst-case scenario in Philadelphia is a historic event that impacted the Logan Triangle neighborhood. In the 1920s, houses were built on poor quality ash fill on top of the Wingohocking Creek Bed. The houses began sinking due to soil conditions and weakened foundations due to water exposure. The homes began to subside because of the unstable soil mix which led to a gas main break and fire in 1986. Inspections that same year by the Department of Licenses and Inspections found several homes “imminently dangerous” or “structurally dangerous.” In August 1986, Philadelphia public officials recommended that residents of more than 950 houses permanently leave their homes. The Logan Assistance Corporation was established in 1987 to help relocate residents over 15 years (PHDC 2024). In 2002, there was a last call to relocate with assistance from the Logan Assistance Corporation and the

American Red Cross. The cost of this hazard was $38 million for relocations and $12 million to demolish houses covering 17 blocks. The area remains undeveloped in 2022 (Philadelphia OEM 2022).

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City was not included in any major disaster (DR) or emergency (EM) declarations for subsidence, sinkhole-related events (FEMA 2024).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, the City was not included in any USDA subsidence, sinkhole-related agricultural disaster declarations (USDA 2024).

Previous Events

Known hazard events that impacted the City between January 2021 and October 2024 are discussed in Table 4-126. For events prior to 2021, refer to the 2022 City of Philadelphia HMP.

Table 4-126. Subsidence, Sinkhole Events in City of Philadelphia (2021 to 2024)

Event Date	Location Impacted	Description
July 25, 2021	Queen Village	A 130-year-old water main broke causing a sinkhole in the street near Sixth and Bainbridge. This event is known as “The Great Philly Sinkhole.”
July 26, 2023	West Philadelphia	A massive sinkhole opened at 57th and Media Streets.
January 2024	Port Richmond	Large sinkhole on the 3200-block of Almond Street.
August 2024	South Philadelphia	Street caving in from a sinkhole near Pierce Street.

Source: FEMA 2024; NOAA NCEI 2024; WHYY 2023; Philly Voice 2021; FOX29 2024

Probability of Future Occurrences

Information on previous subsidence, sinkhole occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-127. Based on historical records and input from the Steering Committee, the probability of occurrence for subsidence, sinkhole in the City is considered “possible.”

Future occurrences of subsidence and sinkhole in the City can have some impacts on the population. These impacts are normally indirect, instead causing direct impacts to water infrastructure, transportation routes, and property. Generally, a landslide or subsidence event is an isolated incidence. The events can cause damages to residential buildings and displace residents. The hazard events can block or damage major roadways and inhibit travel, potentially causing delays for emergency responders. Impacts to structures include damages to building foundations, which can lead to cracks in walls, floors, and foundations, compromising structural integrity.

Table 4-127. Probability of Future Subsidence, Sinkhole Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 2015 and 2024	Percent Chance of Occurring in Any Given Year
Subsidence, Sinkhole	17,686	100%

Source: PhillyMag 2019; FEMA 2024; NOAA NCEI 2024; WHYY 2023; Philly Voice 2021; FOX29 2024
Note: The total occurrences is reported from the Philadelphia Streets Department. This total may include a combination of naturally occurring and infrastructure-induced occurrences of subsidence and/or sinkholes.

Climate Change Projections

Limited research exists on how climate change affects sinkhole development in the U.S. Sinkholes are caused by changes in the groundwater table, soil disturbance, concentrated water flow, erosion, and heavy surface loads. Factors driving these mechanisms include thawing ground, groundwater pumping, land use practices, construction, drought, declining water levels, mining, pipe leakage, water impoundments, runoff, and drilling. Climate change-related drought and groundwater decline are significant drivers of sinkhole formation. With projected increases in drought and low summer groundwater levels, sinkholes may become more frequent. More research is needed to understand climate change's impact on sinkhole development in the Commonwealth (Commonwealth of Pennsylvania 2021).

Cascading Impacts on Other Hazards

Subsidence and sinkholes can trigger a range of cascading impacts on other hazards. They can cause structural damage to buildings, roads, and infrastructure, leading to secondary hazards like gas leaks, fires, and utility disruptions (NACHI 2024). These geological events can also alter drainage patterns, increasing the risk of flooding in previously unaffected areas. Furthermore, subsidence can destabilize slopes, heightening the risk of landslides, especially in regions with steep terrain or heavy rainfall. The disruption of land stability and water flow can also impact local ecosystems, affecting plant and animal life and causing long-term environmental changes. These cascading effects underscore the need for comprehensive risk assessments and mitigation strategies to manage the broader impacts of subsidence and sinkholes.

4.3.17.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the subsidence and sinkhole hazard, all the City of Philadelphia has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the City Profile (Chapter 3) are potentially vulnerable to subsidence and sinkholes. The following text evaluates and estimates the potential impact of the subsidence and sinkholes hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

Generally, a landslide or subsidence event is an isolated incidence, impacting the populations within the immediate area. Specifically, the population located downslope of the landslide hazard areas are vulnerable. In addition to causing damages to residential buildings and displacing residents, landslides and subsidence events can block or damage major roadways and inhibit travel for emergency responders or populations trying to evacuate the area.

Socially Vulnerable Population

Populations most vulnerable to geological hazards such as earthquakes, landslides, and subsidence are those living in or near built environments, especially near unreinforced masonry construction. Among these, socially vulnerable groups, including older adults (over age 65) and individuals living below the poverty threshold, are particularly susceptible. This increased vulnerability is due to factors like decreased mobility, limited financial resources to respond to hazards, and the quality and location of their housing. Research indicates that while some populations may not face higher hazard exposure, they can experience more severe impacts and longer recovery times if affected. For instance, older adults and those living in poverty are at greater risk during geological events due to potential limited access to mobilization or medical resources.

The entire City is vulnerable to the subsidence and sinkhole hazard, as the City's underground pipes are among the oldest in the country, making them more prone to failure.

According to the 2022 5-year ACS estimates, shown in Table 4-128, there are 351,811 total persons living below the poverty level, 223,219 persons over the age of 65 years, 99,102 persons under the age of 5 years, 105,761 non-English speakers, and 267,675 persons with a disability in the City (U.S. Census Bureau 2022).

General Building Stock

Subsidence and sinkholes can significantly impact general building stock, leading to structural and economic challenges. Subsidence causes gradual ground sinking, resulting in uneven settling of building foundations, which can lead to cracks in walls, floors, and foundations, compromising structural integrity. Sinkholes, which are sudden depressions or holes in the ground, pose an immediate threat, causing rapid and severe structural damage to buildings located above or near them. The economic implications include costly repairs, potential demolition and rebuilding, decreased property values, and higher insurance premiums. Safety is a major concern, as structural damage can make buildings unsafe to inhabit, necessitating temporary or permanent relocation of residents.

Table 4-128. Socially Vulnerable Populations in the City of Philadelphia

Planning District	American Community Survey 5-Year Population Estimates (2022)									
	Population Over 65		Population Under 5		Non-English-Speaking Population		Population with Disability		Population Below Poverty Level	
	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total	Number	% of Planning District Total
Central	20,572	15.1%	5,033	3.7%	5,649	4.1%	11,714	8.6%	14,340	10.5%
Central Northeast	15,291	17.8%	6,332	7.4%	11,499	13.4%	12,956	15.1%	15,582	18.2%
Lower Far Northeast	11,898	16.5%	5,141	7.1%	3,915	5.4%	9,621	13.4%	5,889	8.2%
Lower North	10,055	10.1%	4,936	5.0%	5,361	5.4%	19,685	19.8%	32,707	33.0%
Lower Northeast	11,245	10.5%	8,865	8.3%	8,735	8.2%	20,526	19.2%	28,876	27.0%
Lower Northwest	7,850	14.4%	2,798	5.1%	624	1.1%	6,867	12.6%	4,835	8.9%
Lower South	1,230	19.0%	375	5.8%	413	6.4%	792	12.3%	378	5.9%
Lower Southwest	4,640	10.8%	2,672	6.2%	3,721	8.7%	6,452	15.0%	11,439	26.7%
North	16,712	12.3%	10,450	7.7%	19,405	14.3%	38,514	28.4%	51,673	38.2%
North Delaware	12,094	12.3%	6,769	6.9%	7,104	7.2%	15,527	15.7%	20,072	20.4%
River Wards	6,811	9.8%	5,008	7.2%	4,465	6.4%	13,317	19.1%	16,999	24.4%
South	18,100	13.7%	7,551	5.7%	9,311	7.1%	18,849	14.3%	23,271	17.7%
University Southwest	6,943	8.5%	2,825	3.5%	2,652	3.2%	11,389	13.9%	20,113	24.6%
Upper Far Northeast	15,831	22.9%	4,283	6.2%	12,900	18.7%	10,246	14.8%	8,520	12.3%
Upper North	25,546	16.8%	8,929	5.9%	6,221	4.1%	27,791	18.3%	36,558	24.1%
Upper Northwest	15,417	17.0%	6,172	6.8%	1,347	1.5%	15,619	17.2%	16,825	18.5%
West	15,573	13.6%	8,888	7.7%	1,288	1.1%	19,933	17.4%	33,513	29.2%
West Park	7,411	16.5%	2,073	4.6%	1,150	2.6%	7,876	17.6%	10,221	22.8%
City of Philadelphia (Total)	**223,219**	**14.0%**	**99,102**	**6.2%**	**105,761**	**6.6%**	**267,675**	**16.8%**	**351,811**	**22.1%**

Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals
Note: 2.34 persons per household. This number was used to calculate the Non-English-Speaking populations.

Community Lifelines and Other Critical Facilities

Subsidence and sinkholes pose significant risks to the infrastructure and community lifelines of Philadelphia. These geological hazards can disrupt transportation networks, damage utilities, and compromise critical facilities, affecting the daily lives and safety of residents (for a list of critical facilities which can be impacted by the subsidence and sinkhole hazard, refer to Appendix I). Understanding and mitigating these impacts is essential for ensuring the resilience and sustainability of the City's infrastructure and services.

In addition to critical facilities, a significant amount of infrastructure in the City can be exposed to subsidence and sinkholes. Sinkholes in the City are primarily caused by leaks and breaks in the aging water main infrastructure. Recent incidents on West Oak Lane and the Schuylkill River Trail were directly linked to water main breaks.

- **Roads:** Access to major roads is crucial for life-safety after a disaster event and for response and recovery operations. Sinkholes can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems, and delays for public and private transportation. This can result in economic losses for businesses.
- **Bridges:** Sinkholes can significantly impact road bridges. They can undermine bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- **Power Lines:** Power lines are generally elevated, but the towers supporting them can be affected by subsidence. A sinkhole could cause failure of the soil underneath a tower, leading to its collapse and ripping down the lines. Sinkholes can also swallow utility lines and cause impacts to underground pipes. Power and communication failures due to subsidence and sinkholes can create problems for vulnerable populations and businesses.
- **Rail Lines:** Similar to roads, rail lines are important for response and recovery operations after a disaster. Sinkholes can block travel along the rail lines, which would be especially troublesome, as it is not as easy to detour a rail line as it is on a local road or highway. Many residents rely on public transport to get to work around the City, and a sinkhole event could prevent travel to and from work.

Economy

The impact of subsidence and sinkholes on the economy and estimated dollar losses are difficult to measure. As stated earlier, these hazards can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property, and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, subsidence and sinkholes threaten transportation corridors, fuel and energy conduits, and communication lines (USGS 2000).

Direct building losses are the estimated costs to repair or replace the damage caused to the building. Subsidence and sinkholes can cause several types of secondary effects, such as blocking access to roads, which can isolate residents and businesses and delay commercial, public, and private transportation.

Natural, Historic and Cultural Resources

Natural

Subsidence and sinkholes pose significant threats to the City's natural resources. These geological phenomena can disrupt local ecosystems by altering groundwater flow and surface water patterns. Such changes can lead to the degradation of wetlands, which are crucial for maintaining biodiversity and water quality. Additionally, the sudden

collapse of land can destroy vegetation and disrupt wildlife habitats, leading to a loss of biodiversity and ecological balance (USGS 2019).

Historic

Subsidence can cause gradual but severe structural damage to historical buildings and landmarks, compromising their integrity and historical value. Sinkholes, which can appear suddenly, pose an immediate threat to the stability of these structures. The cost of repairing such damage can be substantial, and in some cases, the historical authenticity of the buildings may be irreparably harmed.

Cultural

Cultural resources, including museums, monuments, and public art installations, are also at risk from subsidence and sinkholes. Damage to these sites can result in the loss of cultural heritage and diminish the City's historical and cultural landscape. For instance, a sinkhole near a museum could lead to the loss of invaluable artifacts and exhibits, while subsidence could undermine the foundations of monuments, leading to their collapse or significant damage.

4.3.17.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

As discussed in Chapter 3 (City Profile), areas targeted for future growth and development have been identified across the City. New development occurring within the identified hazard areas may be exposed to risks associated with the subsidence and sinkhole hazard.

Projected Changes in Population

Any changes in population density throughout the City may impact the ability of persons in the City to mobilize or receive essential services. Population growth in areas of the City with the oldest infrastructure or areas situated on fill will increase the chance that sinkholes and subsidence will cause damage or impact more people.

Climate Change

The May 2021 Pennsylvania Climate Impact Assessment indicated that Pennsylvania is very likely to undergo increased temperatures and precipitation in the 21st century (Commonwealth of Pennsylvania 2021). Climate change factors such as an extended growing season, higher temperatures, and the possibility of more intense and less frequent summer rainfall may lead to changes in water resource availability. Any over-withdrawal of groundwater, diversion of surface water from a large area to a single point, artificial creation of surface water ponds, or drilling of new water wells can cause sinkholes. These actions can also accelerate the natural processes of bedrock degradation, which can have a direct impact on sinkhole creation. The potential effects of climate change on the City's vulnerability to subsidence/sinkhole events will need to be considered as more information develops regarding regional climate change impacts.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and potential structural and economic losses associated with this hazard of concern. Collection of additional information and actual loss data specific to the plan participants will further enhance the City of Philadelphia's vulnerability assessment.

4.3.18 Gun Violence and Criminal Activity

4.3.18.1 Hazard Profile

Hazard Description

War and criminal activity is defined by PEMA as the intentional act of violence, property damage, and/or other criminal activities. This category specifically includes the following hazards (PEMA 2023):

- **War, Enemy Attack** – foreign attack on territory of the United States.
- **Disinformation, Sabotage** – intentionally spread inaccurate information, for example, interfering or impairing an operator's management or control of an organization.
- **Criminal Activity** – lawlessness, acts committed for which punishment is imposed upon conviction after due process.
- **Physical or Information Security Breach** – contravening security and confidentiality laws and procedures; burglary, unreasonable search and seizure, for example.
- **Workplace, School Violence** – some environments are more likely than others to experience violence including occupations involving contact with the public.
- **Harassment** – a pattern of conduct that causes substantial emotional distress with no legal purpose.
- **Discrimination** – widespread treatment based on class, category, or prejudice rather than merit, applies extensively to civil and labor law.

The City of Philadelphia profiled 'War and Criminal Activities' to address the active assailant and gun violence human-caused hazards. With permission from PEMA, this hazard profile has been renamed "Gun Violence and Criminal Activity."

The Department of Homeland Security defines an active assailant as an individual actively engaged in killing or attempting to kill people in a confined and populated area; there is no pattern or method to their selection of victims (Department of Homeland Security 2008). The FBI defines an active shooter assailant as one or more individuals "actively engaged in killing or attempting to kill people in a populated area. In most cases, active assailants use firearm(s); however, active assailant incidents involving other types of weaponry are increasing. Other types of weaponry include but are not limited to knives, bombs or IEDs, and even the use of cars to drive through crowds of people.

Gun violence is violence committed with the use of firearms. Gun-related violence may be considered criminal or non-criminal. Criminal violence includes homicide, assault with a deadly weapon, and suicide or attempted suicide. Non-criminal violence includes accidental or unintentional injury and death. The City considers gun violence a public health problem that disproportionately affects specific areas, races, and economic classes of the City (City of Philadelphia 2019). There are underlying causes at the root of gun violence within communities, which will be discussed in more detail below.

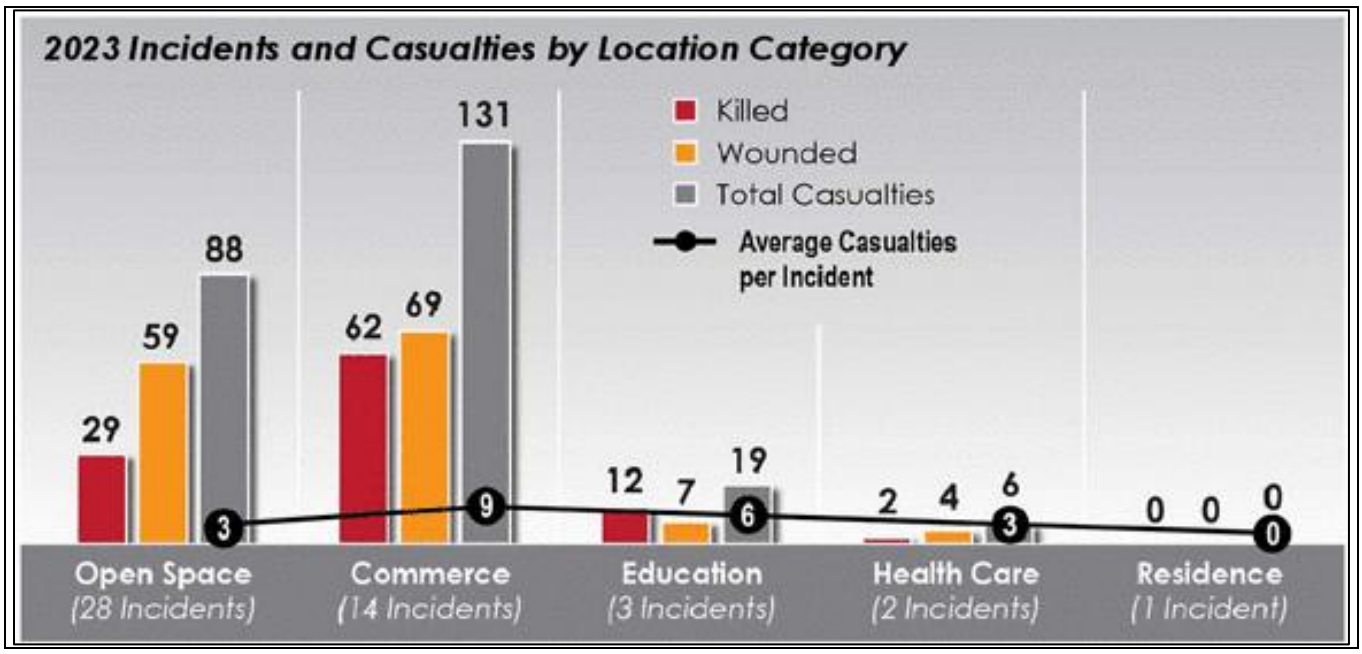
Location and Extent

Active Assailant

According to the FBI, active shooter assailant incidents occur primarily in commercial or educational environments; other locations may include private residences, places of worship, open spaces, hospitals, or military bases. In some cases, an active assailant may target more than one place or use more than one method of attack. These

are called Complex Coordinated Attacks or complex coordinated terror attacks. Figure 4-41 below shows the number of incidents by location as identified by the FBI where in 2023 these attacks occurred. The public may be most at-risk for active assailant attacks in the United States at these locations (FBI 2024).

Figure 4-41. 2023 Incidents and Casualties by Location Category, as Reported by the FBI



Source: FBI 2024

Gun Violence

Gun violence can occur almost anywhere; however, most gun violence occurs in cities. Over half of all firearm homicides in 2015 occurred in just 127 cities (Aufrichtig, et al. 2017). Homicides, the vast majority of which are committed with a gun, have increased every year since 2016, while non-fatal shootings have increased every year since 2017. The City experienced 562 homicides in 2021, making it the deadliest year in Philadelphia's recorded history. In recent years these numbers have decreased with 516 homicides in 2022, 410 in 2023, and 269 in 2025 (PPD 2025). Gun violence occurs in public places such as streets, parks, front porches, or in private residences.

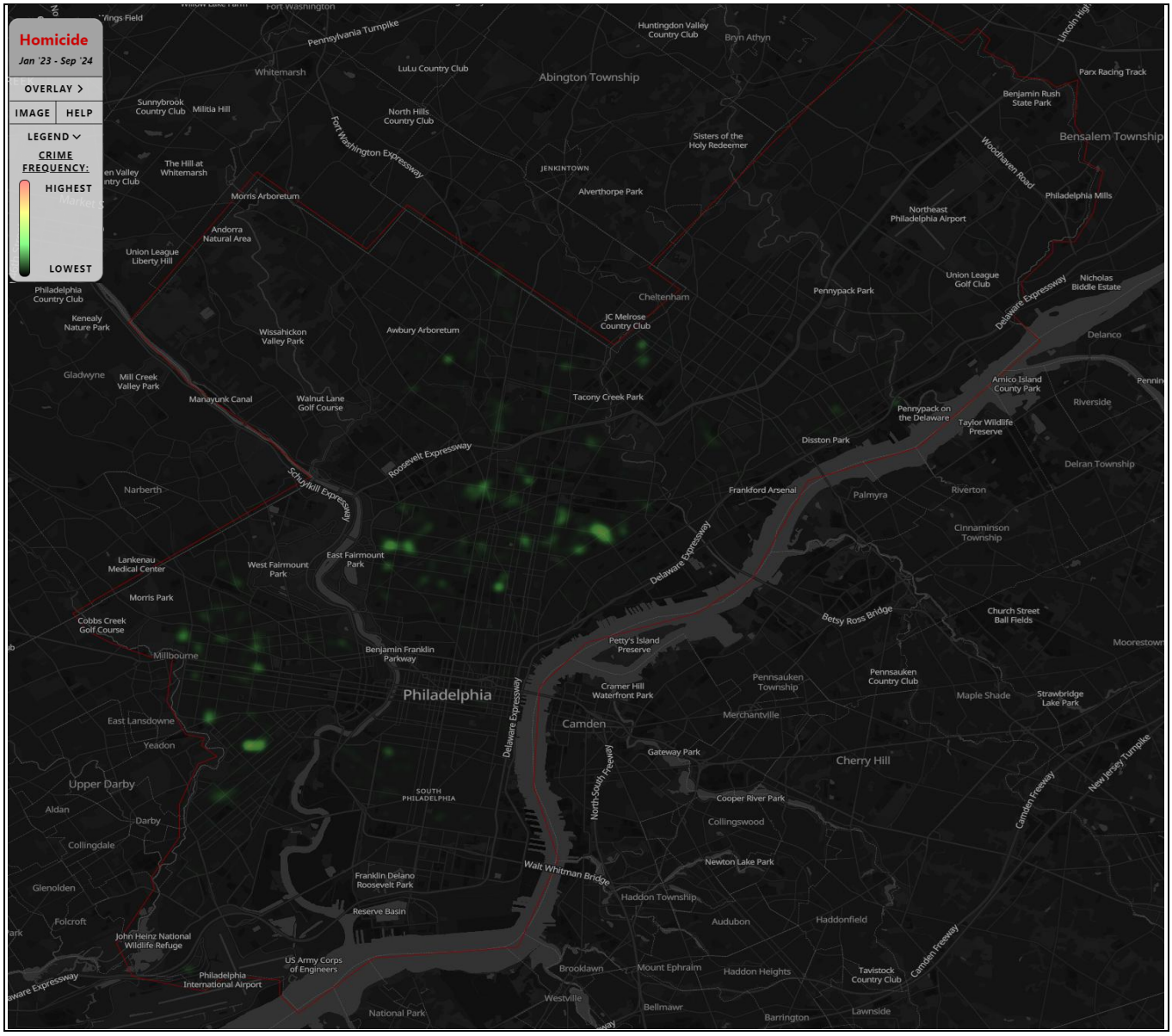
While gun violence occurs throughout Philadelphia, it is concentrated in under-resourced neighborhoods. Neighborhoods disproportionately affected by community gun violence are the often the same neighborhoods impacted by social and economic inequities that can be traced to racism, segregation, and current discriminatory policies, like redlining, exclusionary zoning, and mass incarceration (Parsons, et al. 2023). These inequities often are at the root of gun violence within communities.

Criminal activity such as theft, arson, burglary, hate crimes, homicide, and more, are prevalent throughout any major city in the United States. The entire City of Philadelphia is vulnerable to criminal activities. Figure 4-42 and Figure 4-43 illustrate heat maps that indicate homicides and weapons offenses from highest to lowest areas of occurrence for the City, respectively.

Figure 4-42 depicts the frequency of homicides within the City. The map indicates a low to medium homicide frequency in the City. Figure 4-43 depicts the frequency weapon offenses within the City. Weapon offenses show

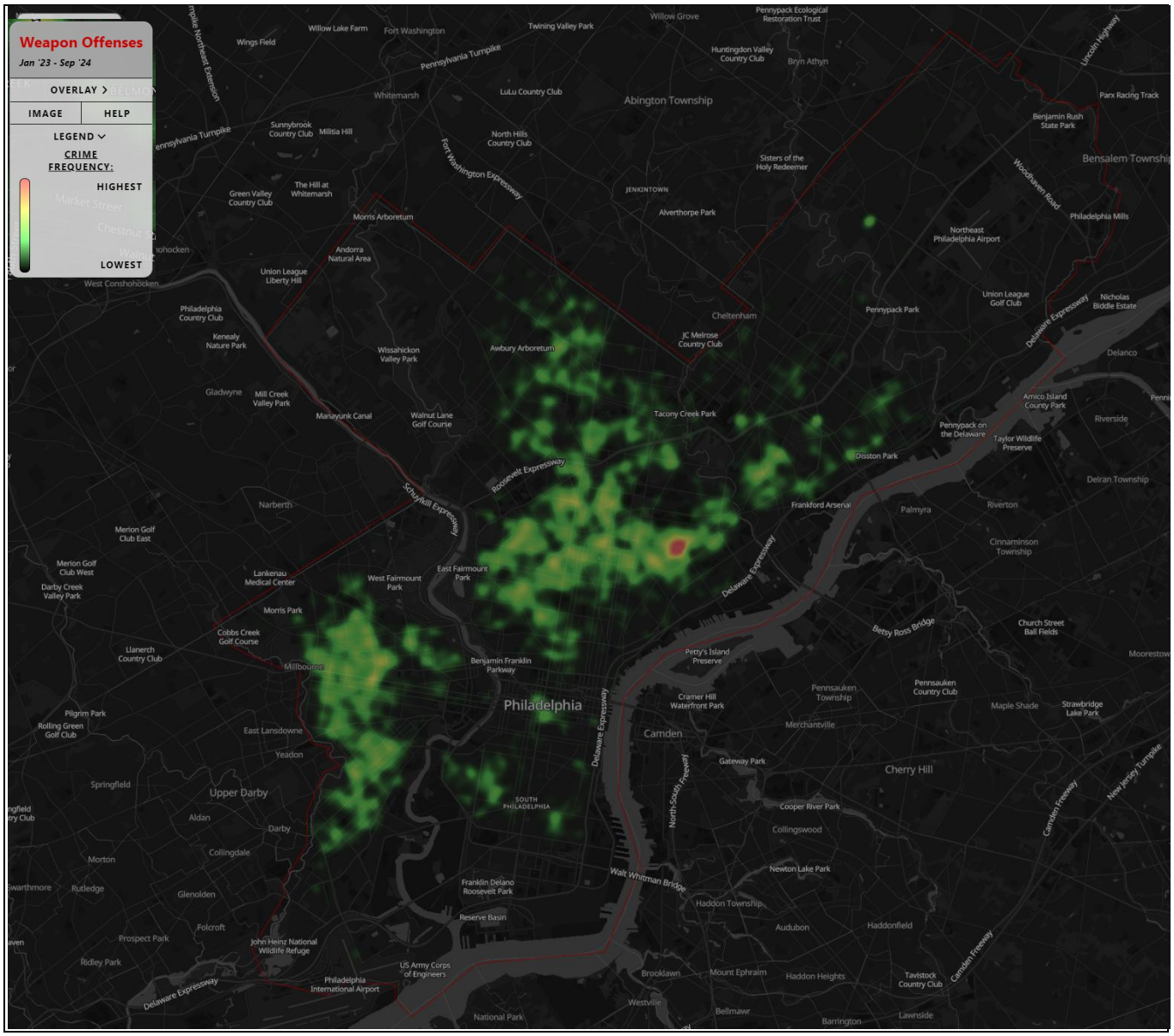
a scattered medium frequency hotspots in the City with the highest frequency located in the Kensington neighborhood.

Figure 4-42. Homicide Heat Map for the City of Philadelphia, January 2023 to September 2024



Source: SafeMap 2024
Note: Red border indicates City of Philadelphia.

Figure 4-43. Weapon Offense Heat Map for the City of Philadelphia, January 2023 to September 2024



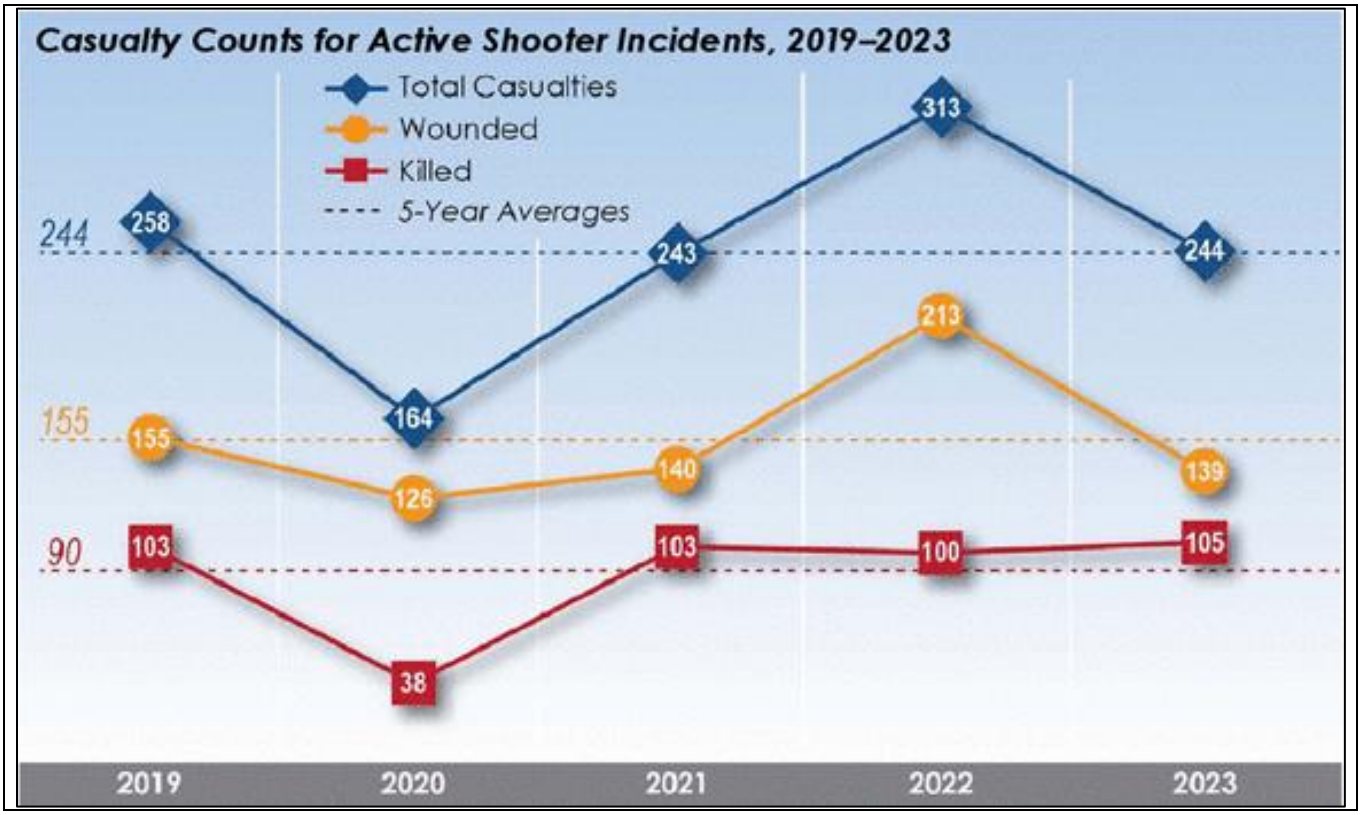
Source: SafeMap 2024
Note: Red border indicates City of Philadelphia.

Range of Magnitude

Active Assailant

The immediate consequences of an active shooter attack include death or injury to people. The extent of those affected depends on the level of training, motivation, ammunition, and targeted area of the attacker. Figure 4-44 below illustrates incidents by casualty type between the years 2019 and 2023 (FBI 2024).

Figure 4-44. Casualty Counts for Active Shooter Incidents, 2019-2023 as Reported by the FBI



Source: FBI 2024

A worst-case scenario for Philadelphia would be comparable to other high-profile active shooter incidences like the 2016 Pulse nightclub shooting in Orlando, Florida, the 2017 Las Vegas shooting where a gunman opened fire in a concert setting, or the 2012 Sandy Hook Elementary School shootings.

Gun Violence

The most obvious consequence of gun violence is death or injury to people. The extent of damage depends on the type of firearm and proximity of incident to other people. The less obvious consequences of gun violence stem from exposure to it. Exposure to gun violence is associated with PTSD, antisocial behavior, depression, stunted cognitive and emotional development, increased risk for substance use, and increased likelihood of engaging in violence (Smith, et al. 2020). The worst-case scenario in Philadelphia for gun violence would be a continued increase in death and injury to people, accompanied by indirect consequences to the community of exposure to gun violence.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2024, the City was not included in any major disaster (DR) or emergency (EM) declarations for gun violence and criminal activity-related events (FEMA 2024).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2021 and 2024, the City was not included in any USDA gun violence and criminal activity-related agricultural disaster declarations (USDA 2024). USDA does not include gun violence and criminal activity-related events as categories for agricultural disaster declarations.

Previous Events

Active Assailant

Most of the gun violence in the City is largely criminal in nature rather than active assailant or active shooter. Active assailant is newer terminology based on more recent events of assailants using vehicles and weapons other than guns to attack; since it is a newer grouping or term, the analysis focuses on active shooter events. Table 4-129 shows active shooter incidents in Philadelphia between 2021 to 2023; deaths and injuries do not include the shooter. Additionally, twenty-four school shootings occurred in Philadelphia from 1974 to 2021, seven of which occurred in 2021. Two incidents were considered active shooters by the FBI and are also included in the table below.

Table 4-129. Active Assailant Incidents in City of Philadelphia (2021 to 2023)

Event Date	Description
October 4, 2021	An active shooter fled a workplace shooting scene, shootout with police behind the School of the Future.
November 17, 2021	On November 17, 2021, four Asian American high school students were attacked on SEPTA's Broad Street line. This was a racially motivated assault.
2021	In 2021 there were several school shootings resulting in nearly 100 students who were shot and 18 killed. This alarming statistic raises major concern for school violence within the City.
June 21, 2022	On June 21, 2022, between approximately 4:52 a.m. and 5:06 a.m., an identified male shooter, 24, armed with a handgun, began shooting at people at various locations, Philadelphia, Pennsylvania. One person was killed. The shooter was apprehended by law enforcement at another location.
September 27, 2022	On September 27, 2022, a shooting occurred nearby Roxborough High School following a football event. Four High School students were injured, and one 14-year-old student was killed. The gunmen had ambushed members of the High School's football team following the game.
July 3, 2023	On July 3, 2023, at approximately 8:28 p.m., an identified male shooter, 40, armed with a rifle, began shooting people at various locations in Philadelphia, Pennsylvania. Four people were killed; four people were wounded (two sustained incidental injuries). The shooter was apprehended by law enforcement at the scene.

Source: CBS News 2021; City of Philadelphia 2022; WHYY 2022; PhillyVoice 2023; FBI 2024; FBI 2023; FBI 2022

Gun Violence

Between 2015 and 2024, Philadelphia had an average of 270 firearm homicides annually, which is 3.6 times higher than the national firearm homicide rate. Table 4-130 shows the fatal and nonfatal totals for gun violence victims in Philadelphia from 2015 through 2021.

Table 4-130. Fatal and Nonfatal Victims of Gun Violence in Philadelphia, 2015-2024

Year	Victims of Gun Violence			
	Total	Nonfatal	Fatal	Unknown
2015	1,294	1,038	233	23
2016	1,342	1,057	262	23
2017	1,263	991	259	13
2018	1,450	1,136	302	12
2019	1,473	1,153	311	9
2020	2,260	1,796	449	15
2021	2,338	1,824	507	7
2022	2,270	1,780	475	15
2023	1,666	1,285	375	6
2024	1,082	857	225	0

Source: Philadelphia Center for Gun Violence Reporting 2025

Probability of Future Occurrences

There is no discernible pattern to the location chosen by the shooters. Past active shooter incidents in Philadelphia do not provide enough data to determine a local trend. Many instances of gun violence are a symptom of other issues, including income inequality, poverty, underfunded public housing, under-resourced public services, and access to firearms. In turn, the presence of gun violence can exacerbate social and economic inequalities, such as significantly reducing the growth of new retail and service businesses and jobs, and lowering home values, credit scores, and homeownership rates, which then further perpetuates gun violence. Until systematic social and economic inequities are addressed, it is highly unlikely gun violence will decrease, indicating a need for continued investment in gun violence prevention and mitigation (Smith, et al. 2020, Parsons, et al. 2023).

Information on previous gun violence and crime occurrences in the City was used to calculate the probability of future occurrence of such events, as summarized in Table 4-131. Based on historical records and input from the Steering Committee, the probability of occurrence for war and crime in the City is considered “highly likely.”

Table 4-131. Probability of Future Gun Violence and Criminal Activity Events in City of Philadelphia

Hazard Type	Number of Occurrences Between 2015 and 2024	Percent Chance of Occurring in Any Given Year
Active Assailant	7	77%
Gun Violence	16,438	100%
Total	**16,445**	**100%**

Source: CBS News 2021; City of Philadelphia 2022; Whyy 2022; PhillyVoice 2023; FBI 2024; FBI 2023; FBI 2022

Climate Change Projections

It is unknown the exact impacts climate change will have on gun violence and criminal activity. As extreme natural hazard events continue to increase in severity and frequency, communities will be under social, physical, and economical strain. As a result, this strain may increase gun violence and criminal activity. Further research is needed to understand fully the quantitative impacts associated with climate change for this hazard event.

Cascading Impacts on Other Hazards

Gun violence and criminal activity have the potential to impact and exacerbate other hazard events identified in this plan. For instance, criminal activity can spark civil unrest, leading to disturbances that may cause damage to people and property. For more information on this hazard, refer to Chapter 18 - Civil Disturbance. In more severe cases, acts of terrorism could result in foreign attacks, leading to war, injuries, and loss of life. For further details on these hazards as they relate to the City of Philadelphia, refer to Chapter 19 - Cyberterrorism and Chapter 16 - Terrorism.

4.3.18.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. The following text evaluates and estimates the potential impact of the gun violence and criminal activity hazard on the City, including:

- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
  - Specific impacts from previous event occurrences are detailed in the previous events tables (refer to *Previous Occurrences*).
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Life, Health, and Safety

Overall Population

The entire population of the City (1,603,797) is exposed to gun violence and criminal activity. The City combats criminal activity through a comprehensive approach that includes prevention, enforcement, and community engagement. The City has developed and implemented several programs and initiatives as a result of the impacts felt from the gun violence and criminal activity hazard. The Philadelphia Police Department employs data-driven strategies like “Operation Pinpoint,” which focuses on high-crime areas and repeat offenders (Reyes 2021). Collaborative efforts with local, state, and federal partners enhance these strategies, ensuring a coordinated response to crime (Outlaw 2023). Programs such as Group Violence Intervention target individuals most at risk of engaging in violence, offering them support services while making it clear that continued violence will result in swift legal consequences (Reyes 2021). Additionally, community policing initiatives and public awareness campaigns aim to build trust between law enforcement and residents, fostering a safer environment for all (Philadelphia Police Department 2008).

Socially Vulnerable Population

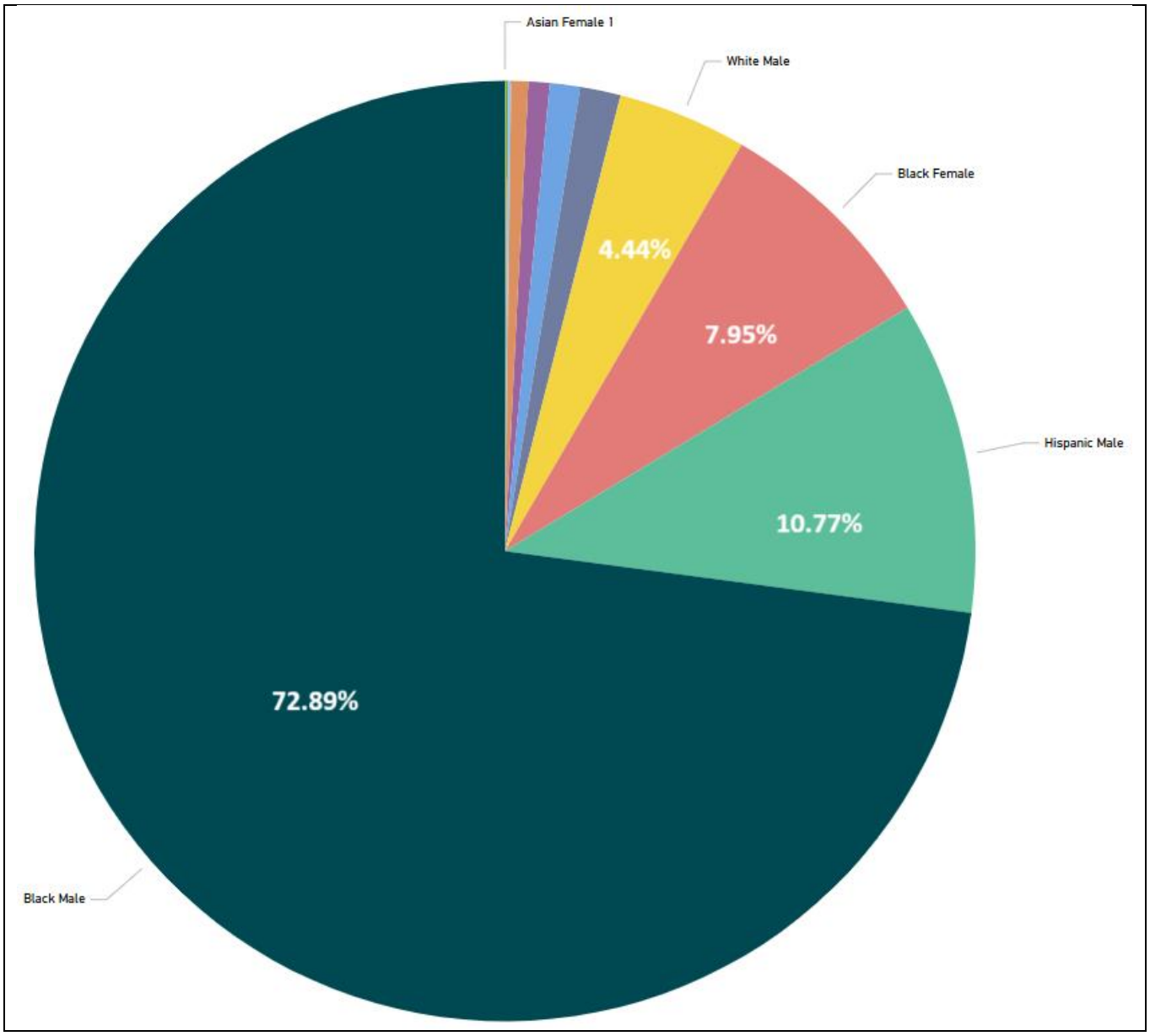
Active assailant incidents put people at an increased risk of psychological trauma and future mental health issues. Consequences of mass violence such as an active assailant can result in anxiety, depression, reduced sense of safety, stress or posttraumatic stress disorder (PTSD), sleep problems, feelings of guilt and shame, an increased risk of smoking and misuse of alcohol and other substances (Smith, et al. 2020). Trauma from an active assailant event can affect not only the individual involved in the incident, but family, friends, and the community of the individual.

Gun violence disproportionately effects disadvantaged and socially vulnerable communities. As Figure 4-42 and Figure 4-43 show, gun violence is concentrated in the most socially vulnerable communities. Figure 4-45 shows the

distribution of gun violence victims between 2015-present by race/ethnicity. Black males make up an overwhelming majority of gun violence victims in Philadelphia (Philadelphia Center for Gun Violence Reporting 2025).

The impacts of gun violence are inherently intersectional, and trauma resulting from such incidents can intensify other pre-existing social vulnerabilities and needs.

Figure 4-45. Gun Violence Victims in Philadelphia by Race/Ethnicity



Source: Philadelphia Center for Gun Violence Reporting 2025

General Building Stock

The entire general building stock inventory in the City is exposed and vulnerable to the threat of gun violence and criminal activity. This includes a wide range of structures, from residential buildings to commercial properties, all of which can suffer significant damage in the event of foreign attack or criminal activities such as vandalism and theft.

Structural impacts typically include damage to roofs, building frames, windows, and the contents within these buildings. Unfortunately, current modeling tools are not sophisticated enough to estimate specific losses from such hazards accurately.

Community Lifelines and Other Critical Facilities

As previously mentioned, gun violence and criminal activity can severely impact community lifelines of the City, which include essential services such as healthcare, emergency services, transportation, and utilities. High crime rates can strain emergency services, diverting resources away from other critical needs and potentially delaying response times. Healthcare facilities may become overwhelmed with treating victims of violence, affecting their capacity to provide routine care. Public transportation systems can be disrupted by criminal activities, leading to decreased accessibility and mobility for residents. Additionally, utilities and infrastructure can be targeted or damaged, causing widespread disruptions. Overall, the pervasive effects of crime can undermine the stability and resilience of these vital community lifelines, affecting the quality of life for all residents (Outlaw 2023).

Economy

Gun violence and criminal activity can significantly impact the economy of the City. High crime rates can deter businesses from investing in the area, leading to reduced economic growth and job opportunities. Property values may decline in neighborhoods with high crime rates, resulting in lower tax revenues for the City. Additionally, the costs associated with law enforcement, legal proceedings, and incarceration place a substantial financial burden on public resources. The fear and insecurity generated by criminal activity can also reduce consumer spending and hinder tourism, further affecting the local economy. Overall, the economic costs of crime extend beyond immediate losses, contributing to long-term economic challenges for the City (PBS, NPR 2012).

Natural, Historic and Cultural Resources

Natural

Gun violence and criminal activity generally does not significantly impact the natural built environment. However, in extreme cases such as war, chemical warfare can be employed using gas, explosives, large bombs, and more. These actions have a detrimental effect on the environment and can drastically alter the local ecosystem. Many animals and plants may perish in instances of war and chemical warfare.

Historic

Historical structures often become targets for criminal activity or warfare, particularly involving explosives. These older structures hold significant cultural value to the community and can be targeted through terrorist attacks or arson.

Cultural

Similar to historical structures, cultural structures and spaces are often targets for criminal activity and foreign attacks due to their significant value to the community. These sites are typically publicly accessible and attract both visitors and residents. When these assets are impacted, it is usually widely reported in the media and news.

4.3.18.3 Future Changes That May Affect Risk

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

Potential or Planned Development

As discussed and illustrated in Chapter 3 (City Profile), areas targeted for future growth and development have been identified across the City. Any areas of growth could be impacted by gun violence and criminal activity because the entire City is exposed and vulnerable.

Projected Changes in Population

It is probable that the City will continue to see an increase in population growth throughout the next several decades as the economy continues to flourish. Criminal activity has the potential to impact a growing population by increasing their vulnerability through public events such as sporting events, public spaces, schooling, and more. Further mitigation and planning mechanisms for safety and emergency personnel on how to prevent and respond to criminal activity should be implemented within the City to combat these impacts on residents.

Climate Change

The entire Commonwealth will see an increase in average annual temperatures and precipitation. Although it is unknown the amount of impact climate change will have on the severity and frequency of gun violence and criminal activity. It can be assumed that climate change can have a negative impact, as it increases civil unrest and can cause panic through natural disasters which may leave a community more vulnerable to gun violence and criminal activity.

Research conducted by Rutgers-Camden examined the relationship between atypical temperature fluctuations and the incidence of homicide, assault, and robbery. The study identified a correlation indicating that significant temperature variability is associated with an uptick in violent crimes such as homicide, robbery, and aggravated assault. The analysis included data from 28 U.S. cities spanning from 2015 to 2021 and demonstrated that warmer-than-average days, particularly in winter months, notably elevate the risk of violent crimes. These findings align with the routine activities theory, which posits that increased outdoor activity during warmer weather creates greater opportunities for crime. (Thomas and Wolff 2023)

Additional Data and Next Steps

As gun violence and criminal activity continues to be a concern within the community, the City will work to increase mitigation and planning mechanisms for safety and emergency personnel to protect its ever-growing population.

4.4 HAZARD VULNERABILITY SUMMARY

4.4.1 Methodology

A risk assessment is the process of evaluating the potential loss of life, personal injury, and economic and property damage that could result from identified hazards. Identifying potential hazards and vulnerable assets allows planning personnel to address and reduce hazard impacts and allows emergency management personnel to establish early response priorities. Results of the risk assessment are used in subsequent mitigation planning processes, including determining and prioritizing mitigation actions that reduce the City's risk from each hazard. Past, present, and future conditions must be evaluated to assess risk most accurately for the City. The process focuses on the following elements:

- **Identify Hazards of Concern**—Use all available information to determine what types of hazards may affect a jurisdiction.
- **Profile Each Hazard**—Understand each hazard in terms of:
  - Extent—The potential severity of each hazard
  - Location—Geographic area most likely to be affected by the hazard
  - Previous occurrences and losses
  - Impacts of Climate Change
  - Probability of future hazard events
- **Assess Risk**—Use all available information to estimate to what extent populations and assets may be adversely affected by a hazard:
  - Determine vulnerability—Estimate the total number of assets in the jurisdiction that are likely to experience a hazard event if it occurs by overlaying hazard maps with the asset inventories.
  - Estimate potential impacts—Assess the impact of hazard events on the people, property, economy, and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.
  - Evaluate future changes that may affect vulnerability and impacts—Analyze how demographic changes, projected development and climate change impacts can alter current vulnerability and potential impacts.

The City of Philadelphia risk assessment was updated using the following best-available information:

- A new building stock inventory was generated using the citywide inventory from 2022 in conjunction with the 2024 structure inventory and tax assessor information as provided by the City of Philadelphia; and market value information inflated to current standards using the U.S. Bureau of Labor Statistics, in addition to 2024 RS Means values for those structures without a market value.
- 2018-2022 American Community Survey 5-year Population Estimates were utilized.
- A critical facilities inventory was developed and reviewed by the Steering Committee, All-Stakeholder Workgroup, and the City.
- Lifelines were identified in the critical facility inventory to align with FEMA's community lifeline definition.
- FEMA's Hazus program was used to estimate potential impacts from the flood, wind, and seismic hazards.
- Best-available hazard data were used, as described in this section.

4.4.1.1 Asset Inventories

City of Philadelphia assets were identified to assess potential vulnerability and impacts associated with the hazards of concern. For the HMP update, the City assessed vulnerability and potential hazard impacts for the following types of assets: population, buildings, critical facilities, community lifelines, the environment, and new development. Some assets may be more susceptible to impacts because of their physical characteristics or socio-economic uses. Each asset type is described below. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.

Population

Statistics from the 2018-2022 American Community Survey (ACS) 5-year estimate were used to estimate the vulnerability of and potential impacts on the City's population. Population counts at the city planning district level were averaged among the residential structures in the City to estimate the population at the structure level. This estimate provides a more precise distribution of population across the City compared to only using the Census block or Census tract boundaries. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

The risk assessment included the collection and use of an expanded and enhanced asset inventory to estimate hazard vulnerability and impacts.

FEMA's Hazus program was used to model estimated potential losses to flood, seismic and wind hazards, as discussed further later in this section. Hazus still contains 2020 U.S. Census data and was used to estimate sheltering and injuries as part of the hazard analysis.

As discussed in Chapter 3, City Profile, research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. Vulnerable populations in the City included in the risk assessment are children, older adults, population below the poverty level, non-English speaking individuals, and persons institutionalized with a disability.

Buildings

A custom general building stock was created citywide. The building stock update was performed using citywide inventory from 2022 in conjunction with the 2024 structure inventory and tax assessor information as provided by the City. Where information did not exist from 2022, attributes provided in the associated files were used to further define each structure, such as year built, number of stories, basement type, occupancy class, and square footage. Structural and content replacement cost values (RCV) were calculated for each building using the available market value information inflated to current standards using the U.S. Bureau of Labor Statistics, in addition to 2024 RS Means values for those structures without a market value. The analysis used a location factor associated by location zip-code, which produced location factors of 1.15 and 1.14 for residential and non-residential occupancy classes, respectively. RCV is the current cost of returning an asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of both the structural cost to replace a building and the estimate value of contents of a building. To ensure a more accurate depiction of building loss citywide, multiple commercial and non-single family residential structures located at the same address were aggregated down to a single address point using the attribute information associated with each individual unit. This process was performed for the purpose of Hazus analyzing these structures as a single occupancy. The occupancy classes available in Hazus were condensed into the categories of residential, commercial, industrial, agricultural, religious, governmental, and educational to facilitate analysis and presentation of results. Residential loss estimates addressed both multi-family and single-family dwellings.

Critical Facilities and Community Lifelines

A lifeline provides indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security (FEMA).

A critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities, was created by the Steering Committee, All-Stakeholder Workgroup, and the City. The development involved a review for accuracy, additions, or deletions of new or moved critical assets, identification of backup power for each asset (if known) and whether the critical facility is considered a lifeline in accordance with FEMA's definition (refer to Appendix G, Critical Facilities). To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

Environment and Land Use

National land use land cover data created by the U.S. Geological Survey (USGS) in 2021 was used to assess land use characteristics of the City. This dataset was converted from a raster to a vector polygon, which informed spatial areas of built and natural land use areas. The built land use areas were defined as urban areas and include developed open space, low, medium, and high intensity locations. Non-urban areas were extracted into agricultural, barren land, forest, rangeland, water, and wetlands land use categories.

New Development

In addition to assessing the vulnerability of the built environment, the City examined recent development over the last 5 years and anticipated new development in the next 5 years. The City was asked to provide a list by address of major development that has taken place within these timeframes. The location of new development projects were to be submitted via ArcGIS Survey123. No responses were received via this survey.

4.4.1.2 Methodology

City of Philadelphia used standardized tools, combined with local, state, and federal data and expertise to assess potential vulnerability and losses associated with hazards of concern. Three levels of analysis were used, depending upon the data available for each hazard:

- **Historical Occurrences and Qualitative Analysis** – This analysis includes an examination of historical impacts to understand potential impacts of future events of similar size. Potential impacts and losses are discussed qualitatively using best-available data and professional judgment.
- **Vulnerability Analysis** – This analysis involves overlaying available spatial hazard layers, for hazards with defined extent and locations, on asset mapping in GIS to determine which assets are located in the impact area of the hazard.
- **Loss Estimation** — The FEMA Hazus modeling software was used to estimate potential losses for the following hazards: flood, earthquake, and hurricane.

Table 4-132 summarizes the type of analysis conducted by hazard of concern.

Table 4-132. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities
Drought	Q	Q	Q
Earthquake	H	H	H
Extreme Temperature	Q	Q	Q
Flood, Flash Flood, Ice Jam	V, H	V, H	V, H
Hurricane, Tropical Storm, Nor'easter	H	H	H
Tornado, Windstorm	Q	Q	Q
Winter Storm	Q	Q	Q
Building and Structure Collapse	Q	Q	Q
Dam Failure	V	V	V
Gun Violence and Criminal Activity	Q	Q	Q
Environmental Hazards - Hazardous Material Release	V	V	V
Terrorism	Q	Q	Q
Urban Fire and Explosion	Q	Q	Q
Civil Disturbance	Q	Q	Q
Cyber Terrorism	Q	Q	Q
Substance Abuse Disorder	Q	Q	Q
Pandemic and Infectious Disease	Q	Q	Q
Subsidence, Sinkhole	Q	Q	Q

Note: V = Vulnerability analysis; H = Hazus analysis; Q = Qualitative analysis

Hazus

Hazus is a GIS-based software tool developed by FEMA that applies engineering and scientific risk calculations, which have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

Hazus uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, Hazus uses default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. Hazus' open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. More information on Hazus is available at http://www.fema.gov/hazus.

In general, modeled losses were estimated in the program using depth grids for the flood analysis and probabilistic analyses were performed to develop expected or estimated distribution of losses (mean return period losses) for hurricane wind and seismic hazards. The probabilistic model generates estimated damages and losses for specified

return periods (e.g., 100- and 500-year). Table 4-133 displays the levels of analysis that can be conducted using the Hazus software.

Table 4-133. Summary of Hazus Analysis Levels

Level 1	Hazus provides hazard and inventory data with minimal outside data collection or mapping.
Level 2	Analysis involves augmenting the Hazus provided hazard and inventory data with more recent or detailed data for the study region, referred to as "local data"
Level 3	Analysis involves adjusting the built-in loss estimation models used for the hazard loss analyses. This Level is typical done in conjunction with the use of local data.

Hazard-Specific Methodologies

Drought

All of the City is at risk from the impacts of drought events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Earthquake

A probabilistic assessment was conducted for the City for the 500-year and 2,500-year mean return period events through a Level 2 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historical earthquakes and inferred faults, locations, and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract.

As noted in the Hazus Earthquake User Manual, "*Although the software offers users the opportunity to prepare comprehensive loss estimates, it should be recognized that uncertainties are inherent in any estimation methodology, even with state-of-the-art techniques. Any region or city studied will have an enormous variety of buildings and facilities of different sizes, shapes, and structural systems that have been constructed over a range of years under diverse seismic design codes. There are a variety of components that contribute to transportation and utility system damage estimations. These components can have differing seismic resistance*" (FEMA 2020). However, Hazus' potential loss estimates are acceptable for the purposes of this HMP.

Ground shaking is the primary cause of earthquake damage to built structures and soft soils amplify ground shaking. One contributor to the site amplification is the velocity at which the rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reductions Program (NEHRP) has developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class D and E NEHRP soils are the two classes most susceptible to amplified ground motion during an earthquake.

The default assumption is a magnitude 7.0 earthquake for all return periods. Although damages are estimated at the census tract level, results were presented at the municipal level. Because there are multiple Census tracts that contain more than one planning district, an area analysis was used to extract the percent of each tract that falls within individual planning districts. The percentage was multiplied against the results calculated for each tract and summed for planning district.

Damage estimates are calculated for losses to buildings (structural and non-structural) and contents; structural losses include load carrying components of the structure, and non-structural losses include those to architectural,

mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boils, etc.

Extreme Temperature

All of the City is at risk from the impacts of extreme temperature events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Flood, Flash Flood, Ice Jam

The 1- and 0.2-percent annual chance flood events were examined to evaluate the City's risk from the flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as NFIP.

The following data were used to evaluate vulnerability and determine potential future losses for this plan update:

- The City of Philadelphia FEMA Effective Digital Flood Insurance Rate Map (DFIRM) dated November 18, 2025.
- A depth grid was created by using the preliminary DFIRMs and 1-meter resolution Digital Elevation Model (DEM) obtained through USGS (2020) and integrated into the HAZUS-MH v6.1 riverine flood model used to estimate potential losses for the 1-percent and 0.2-percent annual chance flood events.
- A depth grid obtained from the NOAA Office of Coastal Management (2022) to estimate potential losses for the 3-foot sea level rise event.

To estimate vulnerability to the 1-percent- and 0.2-percent annual chance flood events, the DFIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, critical facilities, and new development). Centroids that intersected the flood boundaries were totaled to estimate the building RCV and population vulnerable to the flood inundation areas. A Level 2 Hazus riverine flood analysis was performed. Both the critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System. Once updated with the inventories, the Hazus riverine flood model was run to estimate potential losses in the City for the 1-percent and 0.2-percent annual chance flood events. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2020 U.S. Census data across dasymetric blocks), potential damages to the general building stock, and potential damages to critical facility inventories based on the depth grids generated and the default Hazus damage functions in the flood model.

In addition, projected 3-foot sea-level rise data available from the NOAA Office of Coastal Management (2022) was considered and used for this analysis. Asset data (population, building stock, critical facilities) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to sea-level rise, the City's assets were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to sea-level rise. A Level 2 Hazus riverine flood analysis was performed; while sea level rise data was available through NOAA, a coastal flood analysis was not available through Hazus. Both the critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System. Once updated with the inventories, the Hazus riverine flood model was run to estimate potential losses in the City for the 3-foot sea level rise event. A user-defined analysis was also performed for the building stock. Buildings located within the sea level rise hazard area were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2020 U.S. Census data across dasymetric

blocks), potential damages to the general building stock, and potential damages to critical facility inventories based on the depth grid generated and the default Hazus damage functions in the flood model.

Hurricane, Tropical Storm, Nor'easter

A HAZUS-MH v6.1 probabilistic analysis was performed to analyze the wind hazard losses for the City. The probabilistic hurricane hazard activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with the City. HAZUS-MH contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Annualized losses and the 100- and 500-year mean return periods (MRPs) were examined for the hurricane hazard. The default demographic information in HAZUS-MH v6.1 along with the custom building and critical facility inventories were used for the analysis.

Tornado, Windstorm

All of the City is at risk from the impacts of tornado and windstorm events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Winter Storm

All of the City is exposed and vulnerable to the winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Building and Structure Collapse

All of the City is at risk from the impacts of building and structure collapse events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Dam Failure

An exposure analysis was conducted for the City's assets (population, building stock, critical facilities) using the Dam Inundation Zones provided by the City. There were two dam inundation areas in total. To conduct analysis, a composite dam failure inundation area was developed for all available dams. Therefore, if an asset is indicated as exposed, it is at minimum located in one dam failure inundation area. The areas evaluated in this analysis were: Belmont, Philadelphia Mills, and Queen Lane.

Asset centroids that intersected the combined dam inundation area were totaled to estimate the building replacement cost value and population vulnerable to dam failure.

Environmental Hazards - Hazardous Materials Releases

The transportation data obtained through the City was used to define the hazard area around major roadways and railways. The hazard area was defined as a 0.5-mile buffer around the Interstate, State, and U.S. roadways and railways where hazardous materials may be in transit to estimate areas that may be directly or indirectly impacted by a release.

The City also provided a spatial layer for Tier II sites. Like with the major roadways & railways, the hazard area was defined as a 0.5-mile buffer around these features.

The defined hazard areas were overlaid upon the asset data (population, building stock, critical facilities) to estimate the exposure to each hazard. Centroids that intersected the hazardous materials buffer boundary were totaled to estimate the building replacement cost value and population vulnerable to hazardous material release.

Terrorism

All of the City is at risk from the impacts of terrorism events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Urban Fire and Explosion

All of the City is at risk from the impacts of urban fire and explosion events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Civil Disturbance

All of the City is at risk from the impacts of civil disturbance events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Cyber Terrorism

All of the City is at risk from the impacts of cyber terrorism events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Substance Abuse Disorder

All of the City is at risk from the impacts of substance abuse disorder events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Pandemic and Infectious Disease

All of the City is at risk from the impacts of pandemic and infectious disease events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Subsidence, Sinkhole

All of the City is at risk from the impacts of subsidence and sinkhole events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

Gun Violence and Criminal Activity

All of the City is at risk from the impacts of gun violence and criminal activity events. A qualitative analysis was conducted to assess the City's vulnerability to this hazard of concern.

4.4.1.3 Rating Probability of Occurrence

Based on records of previous hazard events and consideration of potential future changes that could affect the frequency of future events, the risk assessment for each hazard assigns a rating for the probability of occurrence of that hazard in the future. These ratings were assigned as follows:

- Unlikely—not likely to occur or less than 1% annual chance of occurring
- Rare—between 1 and 10% annual chance of occurring
- Occasional—between 10 and 100% annual chance of occurring
- Frequent—100% chance occurring; occurs multiple times a year

4.4.1.4 Considerations for Mitigation and Next Steps

The following items are to be discussed for considerations for the next plan update to enhance the risk assessment:

- All Hazards
  - Create an updated user-defined general building stock dataset using up-to-date parcels, footprints, tax assessor information, and RS Means values.
  - Utilize updated and current demographic data.
- Earthquake
  - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response or recovery efforts at these properties can be developed.
- Extreme Temperature
  - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at-risk areas.
- Flood
  - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
  - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10- and 50-year flood events).
  - Conduct a repetitive loss area analysis.
  - Continue to expand and update urban flood areas to further inform mitigation.
  - As more current FEMA floodplain data become available (i.e., DFIRMs), update the vulnerability analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Hurricane
  - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
  - Integrate evacuation route data that are currently being developed.
- Dam Failure
  - Maintain dam inundation hazard boundary data for high hazard dams
- Environmental Hazards - Hazardous Materials Releases

- Utilize the most recent roadway, railway, and hazardous materials site location data.

4.4.1.5 Hazard Ranking Methodology

To this end, a relative hazard risk ranking process was conducted for the City using the Risk Factor (RF) methodology identified in Section 5 and Appendix 9 of the Pennsylvania Emergency Management Agency's (PEMA) All-Hazard Planning Standard Operating Guide (PEMA 2020). The guidance states:

- The RF approach produces numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). RF values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and duration.
- To calculate the RF value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final RF value:

Risk Factor Methodology Equation

RF Value = [(Probability x 0.30) + (Impact x 0.30) + (Spatial Extent x 0.20) + (Warning Time x 0.10) + (Duration x 0.10)]

- Hazards identified as high-risk have RFs greater than or equal to 2.5. RFs ranging from 2.0 to 2.4 are considered moderate-risk hazards. Hazards with RFs less than 2.0 are considered low risk.

Table 4-134 identifies the five risk assessment categories, the criteria and associated risk level indices used to quantify their risk, and the suggested weighting factor (weight value) applied to each risk assessment category.

Table 4-134. Summary of RF Approach

Risk Assessment Category	Degree of Risk			
	Level	Criteria	Index	Weight Value
PROBABILITY **What is the likelihood of a hazard event occurring in a given year?**	Unlikely	Less than 1% annual probability.	1	30%
	Possible	Between 1% and 49.9% annual probability.	2	
	Likely	Between 50% and 90% annual probability.	3	
	Highly Likely	Greater than 90% annual probability.	4	
IMPACT **In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard occurs?**	Minor	Very few injuries, if any, only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple death and/or injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths and/or injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
SPATIAL EXTENT	Negligible	Less than 1% of area affected.	1	20%

Risk Assessment Category	Degree of Risk			
	Level	Criteria	Index	Weight Value
How large of an area could be impacted by a hazard event? Are impacts localized or regional?	Small	Between 1% and 10.9% of area affected.	2	
	Moderate	Between 11% and 25% of area affected.	3	
	Large	Greater than 25% of area affected.	4	
WARNING TIME* **Is there usually some lead time associated with the hazard event? Have warning measures been implemented?**	More than 24 hours	Self-defined.	1	10%
	12 to 24 hours	Self-defined.	2	
	6 to 12 hours	Self-defined.	3	
	Less than 6 hours	Self-defined.	4	
DURATION* **How long does the hazard event usually last?**	Less than 6 hours	Self-defined.	1	10%
	Less than 24 hours	Self-defined.	2	
	Less than 1 week	Self-defined.	3	
	More than 1 week	Self-defined.	4	

Source: PEMA 2020

* *Levels of warning and duration criteria that define them may be adjusted based on hazard addressed.*

4.4.2 Ranking Results

Hazard rankings have been used as one of the bases for identifying the hazard mitigation strategies. As discussed in Chapter 5, Identification of Hazards of Concern, the City selected and considered a comprehensive range of natural and non-natural hazards that pose significant risk to the City.

4.4.2.1 Hazard Ranking Results

Using the methodology described above, the hazard ranking for the identified hazards of concern was determined. The hazard ranking for the City of Philadelphia is detailed in the following tables that present the rankings:

- Table 4-135 shows the initial values of five risk assessment categories for each of the identified hazards and each hazard's RF.
- Table 4-136 displays the finalized risk ranking for the City of Philadelphia which takes into account review comments from the Core Planning Team, Steering Committee, All-Stakeholders Workgroup, and Public Steering Committee (refer to Appendix B to review applicable meeting notes). The following hazards received adjustments in ranking:
  - The Hurricane, Tropical Storm, Nor'easter hazard was increased from 2.4 to 2.7 due to the potential for increased impacts across the City from the hazard.
  - The Substance Use Disorder hazard was increased from 2.4 to 3.2 due to the frequency of occurrence and the widespread opioid epidemic in the City.
  - The Subsidence, Sinkhole hazard was decreased from 2.9 to 2.1 due to the typically small areas impacted by the hazard and the duration which it takes to make repairs.
  - The Gun Violence and Criminal Activity hazard was increased from 2.2 to 3.1 due to the probability and frequency of gun violence occurring in the City, in addition to the extent being widespread.

Table 4-135. Initial Risk Ranking for the City of Philadelphia

Hazard Risk	Hazards	Risk Assessment Category					
		Probability	Impact	Spatial Extent	Warning Time	Duration	RF
HIGH	Flood, Flash Flood, Ice Jam	4	3	3	3	3	3.3
	Cyberterrorism	3	3	4	4	3	3.3
	Subsidence, Sinkhole	3	2	3	4	4	2.9
	Pandemic and Infectious Disease	2	3	4	2	4	2.9
	Extreme Temperature	4	2	4	1	2	2.9
	Winter Storm	3	3	3	1	3	2.8
	Env Haz - HAZMAT	4	2	2	4	2	2.8
	Urban Fire and Explosion	4	2	2	3	2	2.7
	Building and Structure Collapse	4	2	2	3	2	2.7
MODERATE	Hurricane, Tropical Storm, Nor'easter	3	2	3	1	2	2.4
	Substance Use Disorder	4	1	2	1	4	2.4
	Gun Violence and Criminal Activity	2	2	2	3	3	2.2
	Tornado, Windstorm	3	2	2	2	1	2.2
	Terrorism	2	2	2	4	2	2.2
	Civil Disturbance	3	1	2	3	3	2.2
	Drought	3	1	2	1	4	2.1
	Earthquake	2	2	2	4	1	2.1
LOW	Dam Failure	1	2	2	2	2	1.7

Table 4-136. Final Risk Ranking for the City of Philadelphia

Hazard Risk	Hazards	Risk Assessment Category					
		Probability	Impact	Spatial Extent	Warning Time	Duration	RF
HIGH	Flood, Flash Flood, Ice Jam	4	3	3	3	3	3.3
	Cyberterrorism	3	3	4	4	3	3.3
	Substance Use Disorder	4	3	3	1	4	3.2
	Gun Violence and Criminal Activity	4	3	2	4	2	3.1
	Pandemic and Infectious Disease	2	3	4	2	4	2.9
	Extreme Temperature	4	2	4	1	2	2.9
	Winter Storm	3	3	3	1	3	2.8
	Env Haz - HAZMAT	4	2	2	4	2	2.8
	Hurricane, Tropical Storm, Nor'easter	3	2	4	2	2	2.7
	Urban Fire and Explosion	4	2	2	3	2	2.7
	Building and Structure Collapse	4	2	2	3	2	2.7
MODERATE	Tornado, Windstorm	3	2	2	2	1	2.2
	Terrorism	2	2	2	4	2	2.2
	Civil Disturbance	3	1	2	3	3	2.2
	Subsidence, Sinkhole	2	1	3	4	2	2.1
	Drought	3	1	2	1	4	2.1
	Earthquake	2	2	2	4	1	2.1
LOW	Dam Failure	1	2	2	2	2	1.7

Based on these results, there are 11 high-risk hazards, six moderate-risk hazards, and one low-risk hazard in the City of Philadelphia. Mitigation actions were developed for all hazards (see Chapter 6.5).

4.4.3 Potential Loss Estimates

Potential loss estimates for hazard events help a community understand the monetary value of what might be at stake during a hazard event. Estimates are considered *potential* in that they generally represent losses that could occur in a countywide hazard scenario. Localized events could yield lower losses, while regional events could yield higher losses.

The data utilized to conduct the vulnerability assessment came from a variety of sources, as noted throughout each hazard profile. As summarized in the Methodology subsection, the 2018-2022 American Community Survey (ACS) 5-year estimates demographic data, Hazus v6.1 default building inventory and its associated replacement cost value of the structures and contents, and the comprehensive critical facility inventory update in Hazus v6.1 were used for the City.

Potential loss estimates provided in Section were based on historical losses, current-condition losses, and/or predictive losses by performing spatial analyses in GIS and hazard probabilistic modeling. Hazus v6.1 was used to estimate potential losses for the earthquake; flood, flash flood, ice jam; and hurricane, tropical storm, and nor'easter. For many of the hazards evaluated, historical data are not adequate to model future losses at this time. For these hazards, areas and inventory susceptible to specific hazards were mapped, and exposure was evaluated to help

guide mitigation efforts. Spatial analyses were conducted to assess potential exposure for hazards of concern with delineated hazard areas: flood, flash flood, and ice jam; dam failure; and environmental hazards – hazardous material release. Where GIS data are not available for some hazards, a qualitative analysis was conducted using the best available data and professional judgment.

4.4.4 Future Development and Vulnerability

Risk and vulnerability to natural and human-caused hazard events will increase or decrease with changes in land use, development, and population. Population change and the age of the housing stock are the main drivers of vulnerability change. Estimated population projections provided by the Center of Rural Pennsylvania indicate that the City's population will continue to increase into 2040, increasing total population to approximately 1,772,833 persons; this is approximately a 10.53 percent increase from the City's 2020 population of 1,603,797 (Center for Rural Pennsylvania 2020). Changes to vulnerability are discussed further in each hazard profile.

The City's vulnerability is expected to increase as future development continues, particularly in areas targeted for industrial expansion. This growth is attracting industries and activities that may elevate the risk of human-caused hazards, such as hazardous material releases, transportation accidents, or infrastructure failures. As industrial zones expand, they may encroach upon residential or mixed-use neighborhoods, compounding the potential impact of such risks. Proactive planning and risk mitigation strategies will be essential to ensure that development does not compromise public safety or environmental health.

5. CAPABILITY ASSESSMENT

A capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out (FEMA 2003). This assessment is an integral part of the planning process. It enables identification, review, and analysis of current local and state programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation. Through assessing its capabilities, a jurisdiction learns how or whether it can implement certain mitigation actions by determining the following:

- Limitations that may exist on undertaking actions
- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions
- Types of mitigation actions that may be technically, legally, administratively, politically, or fiscally challenging or infeasible
- Opportunities to enhance local capabilities to support long-term mitigation and risk reduction

This chapter presents a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, city) that reduce hazard risks and support hazard mitigation within the planning area. These capabilities are presented in three categories:

- Planning and regulatory capabilities
- Administrative and technical capabilities
- Fiscal capabilities

5.1 UPDATE PROCESS SUMMARY

The contracted consultant met with the City to review the capability assessment from the 2022 HMP, evaluating the effectiveness of their capabilities in supporting hazard mitigation and identifying opportunities to enhance capabilities and updating accordingly. The City identified how it has integrated hazard mitigation into its existing planning, regulatory, and operational/administrative framework and how it intends to promote ongoing integration. The consultant also reviewed plans, codes, and ordinances to enhance the information provided by the City. The findings from this assessment are presented in the following sections.

5.2 PLANNING AND REGULATORY CAPABILITY

Planning and regulatory capabilities are based on ordinances, policies, local laws, state statutes, plans, and programs that relate to managing growth and development. Planning and regulatory capabilities refer not only to current plans and regulations, but also to the City's ability to change and improve those plans and regulations as needed. This section summarizes planning and regulatory capabilities for the City of Philadelphia.

5.2.1 Federal

There are several national programs that incentivize or support mitigation activities, including the NFIP and CRS. These programs are a key component of hazard mitigation capabilities.

5.2.1.1 Biggert-Waters National Flood Insurance Reform Act of 2012

Under the Biggert-Waters National Flood Insurance Reform Act of 2012, long-term changes to the NFIP have been adopted that have increased rates overall to reflect the flood risk more accurately to buildings in flood hazard areas. This has significantly influenced construction and reconstruction within flood hazard areas.

Property owners are encouraged to consider long-term insurance costs when undertaking reconstruction or elevation of damaged buildings. An investment to reconstruct the lowest floor of a building an additional foot or two higher today may translate into significant future flood insurance savings.

5.2.1.2 Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004

The Flood Insurance Reform Act of 2004 amended the National Flood Insurance Reform Act of 1968 to reduce losses to properties for which repetitive flood insurance claim payments have been made. This Act established a program for mitigation of severe repetitive loss properties and gave FEMA the authority to fund mitigation activities for individual repetitive loss claims properties. The Act provides additional coverage for compliance with land-use and control measures.

PEMA is the lead coordinator of the Commonwealth's NFIP efforts. PEMA's Mitigation Insurance and Resilient Communities (MIRC) Office is the agency working with Commonwealth communities with severe repetitive loss properties. This Statute helps Commonwealth residents with affordable flood insurance and gives additional tools to the states and communities to mitigate severe repetitive loss properties.

5.2.1.3 Code of Federal Regulations, Standard State Mitigation Plans (44 CFR PART 201.4)

The Code of Federal Regulations, Standard State Mitigation Plans (44 CFR PART 201.4) provides actions based on risk assessments and capabilities of the State to achieve and fund mitigation activities based on those actions. Both the law and regulations have encouraged the counties to prepare plans. FEMA has prepared policies and procedures for FEMA's review and approval of state and local emergency all-hazard mitigation plans.

5.2.1.4 Disaster Mitigation Act of 2000

The Disaster Mitigation Act of 2000 (DMA) is the current federal legislation addressing hazard mitigation planning. DMA 2000 provides an opportunity for states, tribes, and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Stafford Act) by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of mitigation plan requirements (Section 322). This new section emphasizes the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance (HMA) grant funds are available to communities. HMPs designed to meet the requirements of DMA will remain eligible for future FEMA HMA funds. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

The PEMA MIRC Office is the lead agency within the Commonwealth to promote mitigation planning. The law sets forth a more granular review of mitigation planning. Once approved, the applicant is eligible to apply for federal funds for mitigation of hazards. The rules provide detailed guidance on what applicants should include in a plan.

5.2.1.5 Disaster Recovery Reform Act

This bill amends the Stafford Act to modify the Pre-disaster Hazard Mitigation Grant Program to permit the use of technical and financial assistance to establish and carry out enforcement activities to implement codes, specifications, and standards that incorporate the latest hazard-resistant designs; direct the president to establish a National Public Infrastructure Pre-disaster Mitigation Fund; authorize the president's contribution to the cost of hazard mitigation measures to be used to increase resilience in any area affected by a major disaster; and direct FEMA to issue a final rulemaking that defines the terms "resilient" and "resiliency."

From a mitigation perspective of the Act, PEMA's MIRC Office is the lead agency that reviews, submits, and administers federal funding to programs that mitigate hazards. These programs help find projects that are cost beneficial to help reduce damages from hazards.

5.2.1.6 Emergency Support Function #14, Long-Term Recovery Planning

Emergency Support Function (ESF) #14 Long-Term Recovery Planning provides a mechanism for coordinating Federal support to State, tribal, regional, and local governments, non-governmental organizations (NGOs), and the private sector to enable community recovery from the long-term consequences of extraordinary disasters. ESF #14 accomplishes this by identifying and facilitating availability and use of sources of recovery funding and providing technical assistance (such as impact analyses) for community recovery and recovery planning (FEMA 2008).

ESF #14 may be activated for incidents that require a coordinated Federal response to address significant long-term impacts (e.g., impacts on housing, government operations, agriculture, businesses, employment, community infrastructure, the environment, human health, and social services) to foster sustainable recovery (FEMA 2008).

Actions coordinated under ESF #14 include pre-incident planning and coordination, immediately prior to the incident, post-event planning, and operations (FEMA 2008).

Through ESF 14, Long-Term Recovery Planning, PEMA works with the Office of Homeland Security and Preparedness to have a plan for long-term planning and recovery prior to a disaster or emergency. One of the areas of planning includes mitigation. This coordination allows for another Statewide plan to incorporate mitigation principles and planning.

5.2.1.7 Homeowner's Flood Insurance Affordability Act

This 2014 law repeals and modifies certain provisions of the Biggert-Waters Flood Insurance Reform Act, which was enacted in 2012, and makes additional program changes to other aspects of the program not covered by that Act. The new law lowers the recent rate increases on some policies, prevents some future rate increases, and implements a surcharge on all policyholders. The Act also repeals certain rate increases that have already gone into effect and provides for refunds to those policyholders. The Act also authorizes additional resources for the National Academy of Sciences (NAS) to complete the affordability study.

FEMA, Congress, the private Write-Your-Own insurance companies, and other stakeholders work together to implement these Congressionally mandated reforms and to work toward shared goals of helping families maintain affordable flood insurance, ensuring the financial stability of the NFIP, and reducing the risks and consequences of flooding nationwide.

5.2.1.8 National Flood Insurance Program

The U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages (FEMA 2024). The flood hazard profile in Chapter 4.3.4 provides further information on the NFIP as implemented in the City of Philadelphia.

There are three components to the NFIP: flood insurance, floodplain management and flood hazard mapping. Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage in the U.S. is reduced by nearly $1 billion each year through communities implementing sound floodplain management requirements and property owners purchasing flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 65 percent less damage annually than those not built in compliance (FEMA 2024).

The City of Philadelphia actively participates in the NFIP, noting the Commissioner of Licenses and Inspections is appointed as the Floodplain Administrator; however, these duties are carried out by the Program Manager for the Flood Resilience and Compliance Strategy. The City's latest effective Flood Insurance Rate Map is dated November 18, 2025. As of March 20, 2025, there were 1,095 NFIP policies-in-force. There have been 1,455 claims made, totaling over $24.7 million for damages to structures and contents. There are 130 NFIP Repetitive Loss (RL) properties in the City. Further details on the City's flood vulnerability may be found in the flood hazard profile in Chapter 4.3.4.

The state and municipalities within it may adopt higher regulatory standards when implementing the provisions of the NFIP. The following list summarizes elements of these standards that may be altered to strengthen floodplain regulations:

- **Base Flood Elevation (BFE)**: The elevation of surface water due to flooding that has a 1 percent chance of being equaled or exceeded in any given year.
- **Freeboard:** By law, Pennsylvania requires Base Flood Elevation plus 1.5 feet (BFE+1.5) for all construction. When there is a base flood elevation available, the lowest floor, including any basement, must be at or above the base flood elevation. Elevation may be by means of properly compacted fill, a solid slab foundation, or a "crawl space" foundation, which contains permanent openings to let flood waters in and out. Non-residential structures may be flood-proofed in lieu of elevation. Where a local floodplain administrator has information to estimate a base flood elevation, such as historical flood records or a hydraulic study, that elevation must be used. Communities may go beyond this requirement, providing for additional freeboard (Commonwealth of Pennsylvania 2016).
- **Cumulative Substantial Improvements/Damages:** The NFIP allows improvements valued at up to 50 percent of the building's pre-improvement value to be permitted without meeting the flood protection requirements. Over the years, a community may issue a succession of permits for different repairs or improvement to the same structures. This can greatly increase the overall flood damage potential for structures within a community. The community may wish to deem "substantial improvement" cumulatively so that once a threshold of improvement within a certain length of time is reached, the structure is considered to be substantially improved and must meet flood protection requirements.

To assist with floodplain management administration and enforcement, the City's Department of Licenses (L&I) and Inspections published a Guide for Development in the Floodplain. The guide provides information on the process for community members to obtain zoning and building permits, requesting construction inspections, and seeking FEMA and PA DEP approvals when necessary. In addition to this information, the guide provides detailed information on the City's process for Substantial Improvements and Substantial Damage determinations. The guide defines Substantial Improvement and Substantial Damage and explains what actions may trigger a review. When a property owner applies for a repair or reconstruction permit following damage to a building located within the SFHA, L&I evaluates whether the proposed work triggers a Substantial Damage review. This review follows the NFIP's 50 percent rule, under which a structure is deemed substantially damaged if the cost to restore it to pre-damage condition equals or exceeds 50 percent of the structure's market value before the event. L&I may require contractor estimates, market value documentation, and floodplain consistency review, and it conducts site inspections to confirm damage conditions, especially for structures that fall within the 40 to 60 percent damage range, which FEMA and Pennsylvania state guidance identify as requiring careful evaluation. Philadelphia's process aligns with FEMA requirements, which affirm that only local jurisdictions make Substantial Damage determinations, often using tools such as the FEMA Substantial Damage Estimator to ensure consistency. Once the City determines a structure is substantially damaged, L&I issues a formal determination letter to the owner outlining the decision, required floodplain compliance actions (which may include elevation, floodproofing, or demolition), and appeal procedures, consistent with FEMA guidance.

5.2.1.9 Community Rating System

As an additional component of the NFIP, the CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: reduce flood losses; facilitate accurate insurance rating; and promote the awareness of flood insurance (FEMA 2024). The City does not currently participate in the CRS program but is exploring the program requirements of the CRS through technical expertise.

5.2.1.10 Presidential Policy Directive 8

Presidential Policy Directive 8 (PPD-8) requires that a Threat Hazard Identification and Risk Assessment (THIRA) be developed for a state to remain eligible for Homeland Security Grant Program (HSGP) and Emergency Management Program Grant (EMPG) funding.

PEMA is the lead agency in preparing the Commonwealth's THIRA. The Commonwealth's last THIRA was completed in 2017.

5.2.1.11 Risk Mapping, Assessment, and Planning

FEMA works with federal, state, tribal, and local partners across the nation to identify flood risk and promote informed planning and development practices to help reduce that risk through the Risk Mapping, Assessment, and Planning (Risk MAP) program. Risk MAP provides high-quality flood maps and information, tools to better assess the risk from flooding, and planning and outreach support to communities to help them take action to reduce (or mitigate) flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.

According to the Risk MAP Progress interactive map available online at the time of this plan update (August 2024), there are numerous active projects taking place throughout Pennsylvania; however, there are not any projects occurring within the City (FEMA n.d.). FEMA coordinates and works directly with municipal floodplain managers

during the Risk MAP project process. The State NFIP Coordinator is kept apprised of project activities and consults as needed.

5.2.1.12 Risk Rating 2.0: Equity in Action

Since the 2022 HMP, FEMA introduced Risk Rating 2.0: Equity in Action to consider specific characteristics of a building to provide a more modern, individualized, and equitable flood insurance rates. The new rating methodology considers frequency of flooding, multiple flood types, proximity to flood sources, and building characteristics such as first floor heights and costs to rebuilt. The update was rolled out in October 2021 through April 2022 and has been fully implemented (FEMA 2022). Homeowners that elect to drop NFIP insurance policies will no longer have access to FMA funding for future mitigation efforts. At the time of this HMP update, it is difficult to determine what the aggregate cost increase through Risk Rating 2.0 will be on post-mitigation properties.

5.2.1.13 Robert T. Stafford Disaster Relief and Emergency Assistance Act

The Stafford Act provides an orderly and continuing means of assistance by the federal government to state and local governments in carrying out their responsibilities to alleviate the suffering and damage that results from disasters. The provisions of the Act include the following objectives:

- Revising and broadening the scope of existing disaster relief programs
- Encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by state and local governments
- Achieving greater coordination and responsiveness of disaster preparedness and relief programs
- Encouraging individuals, and state and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance
- Encouraging hazard mitigation measures to reduce losses from disasters, including development of land-use and construction regulations
- Providing federal assistance programs for both public and private losses sustained in disasters

From a mitigation perspective of the Stafford Act, the PEMA MIRC Office is the lead agency that reviews, submits, and administers federal funding to programs that mitigate hazards. These programs help find projects that are cost beneficial to help reduce damages from hazards.

5.2.1.14 Clean Water Act Section 404(e)

Under Section 404(e) of the Clean Water Act, the U.S. Army Corps of Engineers (USACE) can issue general permits to authorize activities that have only minimal individual and cumulative adverse environmental effects. There are three types of USACE permits: standard, nationwide, and regional. Standard permits are individual permits that involve full public interest review of an individual permit application and includes the issuance of a public notice for any project that does not meet the terms and conditions of an NWP or a Letter of Permission (LOP). Regional general permits are for small, specialized projects.

A nationwide permit (NWP) is a general permit that authorizes activities across the country unless a district or division commander revokes the nationwide permit in a state or other geographic region. There are 54 nationwide permits, and they authorize a wide variety of activities, including linear transportation projects, bank stabilization activities, residential development, commercial and industrial developments, aids to navigation and certain maintenance activities (USACE 2017).

5.2.2 State

The following summarizes the planning and regulatory capabilities available to the City of Philadelphia at the state level.

5.2.2.1 Counterterrorism Planning, Preparedness and Response Act

The Counterterrorism Planning, Preparedness and Response Act of December 16, 2002 (Act 227) provides for counterterrorism planning, preparedness, and response; imposing powers and duties on PEMA, Department of Health (DOH), counties, and municipalities; and providing for the organization of various response teams. Act 227 states the responsibilities of regional counter-terrorism task force groups, the urban search and rescue task force, and specialized response teams, and provides immunity from liability.

5.2.2.2 Marcellus Shale Drilling Regulations

Oil and gas exploration in Pennsylvania is regulated through the Oil and Gas Act, the Coal and Gas Resource Coordination Act, the Oil and Gas Conservation Law, the Clean Streams Law, the Dam Safety and Encroachments Act, the Solid Waste Management Act, and the Water Resources Planning Act. The Oil and Gas Act (Act 13 of 2012) presented major changes to the oil and gas industry in Pennsylvania, including the authorization for local governments to adopt an impact fee and the provision of stronger environmental protections.

The Bureau of Oil and Gas Management in the Pennsylvania Department of Environmental Protection (DEP) along with county conservation districts and the Susquehanna River Basin Commission or the Delaware River Basin Commission, if applicable geographically, have authority to regulate the oil and gas industry in Pennsylvania to protect the environment and citizens of the Commonwealth.

5.2.2.3 Nutrient Management Law

Act 38 was signed into law on July 6, 2005, replacing Act 6 which was Pennsylvania's first nutrient management law. This act deals with local regulation of agricultural operations. It requires that concentrated animal operations develop and maintain a nutrient management plan, which includes best management practices to minimize environmental impact from nutrients on a farm. Act 38 Nutrient Management Plans are required to receive permits for concentrated animal feeding operations can be populated with livestock.

5.2.2.4 Pennsylvania Code Title 58

Sections of this code (§ 71.6 and § 73.1.) prohibit the possession, transport, or introduction of more than ten invasive species. This includes Zebra Mussels, Quagga Mussels, and all species of crayfish.

5.2.2.5 Pennsylvania Construction Code Act

The Pennsylvania Construction Code Act (Act 45) of 1999 (as amended) establishes the basic requirements for the Uniform Construction Code (UCC), which applies to the construction, alteration, repair, demolition, or change of occupancy of buildings. Enforcement of the UCC began in April 2004. Utilization of the UCC provides for the protection of life, health, property, and the environment on a daily basis as well as during disasters by establishing construction standards. Pennsylvania is protected by the guidelines set forth in the UCC, with over 90 percent of Pennsylvania's 2,562 municipalities administering compliance locally either through their own staff or third-party agencies (Commonwealth of Pennsylvania 2024). The Department of Labor & Industry has no code enforcement authority beyond the municipality lacing a certified "Accessibility Inspector/Plans Examiner."

Recent changes to the act include Acts 35 and 36 of 2017. Act 35 provided exclusions for certain agricultural buildings. Act 36 resulted in a lot of changes, including requiring a re-review of the 2015 International Code Council, changing the makeup of the UCC Review and Advisory Council, permitting Philadelphia to pass an ordinance adopting the 2018 commercial ICC codes, changes to permitting fees, creating a local board of appeals, and establishing a six-month statute of limitations for permit submissions after updated building codes go into effect (Commonwealth of Pennsylvania 2024). On October 26, 2022, the Commonwealth Court ruled that all enforcement of the 2021 accessibility standards must cease and revert to 2018 requirements.

5.2.2.6 Pennsylvania Emergency Management Service Code, Title 35

Pennsylvania's Emergency Management Service Code, Title 35, covers PEMA's overall legal responsibilities for emergency management. PA CS Title 35 Section 7102 defines emergency management as "the judicious planning, assignment and coordination of all available resources in an integrated program of prevention, mitigation, preparedness, response and recovery for emergencies of any kind, whether from attack, Human-caused or natural sources." Section 7311 establishes that PEMA was created "to assure prompt, proper and effective discharge of basic Commonwealth responsibilities relating to civil defense and disaster preparedness, operations and recovery." Title 35 addresses PEMA's responsibilities before, during, and after a disaster.

5.2.2.7 Pennsylvania Flood Plain Management Act

The Pennsylvania Flood Plain Management Act (Act 166) encourages sound land use practices within the floodplain. The Act requires which municipalities with Special Flood Hazard Areas (SFHA) to participate in the NFIP meeting the minimum standards. The Act establishes higher regulatory standards for hazardous materials and high-risk land uses and designates the state agency responsible for NFIP coordination and oversight. Previously held by the Department of Community and Economic Development (DCED), the Flood Plain Management Act was amended in July 2022 to designate PEMA as the State NFIP Coordinator.

In addition to the work PEMA does, there are local floodplain managers that have the training and authority to help enforce regulations. Managers are encouraged to enroll in FEMA training courses and even obtain their Certified Floodplain Manager (CFM) certification. PEMA's Orientation Guide describes the job as having four main roles: Coordinator, Regulator, Educator, and Planner. They work continuously with federal, state, and local stakeholders to ensure development in the floodplain is done properly.

5.2.2.8 Pennsylvania Hazardous Material Emergency Planning and Response Act

The federal requirements associated with the Superfund Amendments and Reauthorization Act 165 are implemented at the state level through Act 165 (i.e., Pennsylvania Hazardous Material Emergency Planning and Response Act, 1990-165). Act 165 creates a strong working relationship between business and industry, the Commonwealth, counties, and local municipalities to protect citizens from the dangers of hazardous materials.

The Superfund Amendments and Reauthorization Act 165 (SARA) has several provisions, including requirements for reporting releases of chemicals and requirements for the protection of responders. However, SARA Title III (i.e., the Federal Emergency Planning and Community Right-to-Know Act), relating to emergency planning and community right-to-know, has the greatest impact on local governments.

5.2.2.9 Pennsylvania Municipalities Planning Code Act

Per the Pennsylvania Municipalities Planning Code Act, boroughs, townships, and counties have the authority to prepare zoning, subdivision, land development, floodplain management, and other ordinances, as well as official zoning maps, all of which can be used individually or jointly as tools to guide growth and minimize development in

hazard prone areas. Act 247 also requires counties to create and adopt a comprehensive plan and encourages municipalities to adopt municipal or joint municipal comprehensive plans generally consistent with the county comprehensive plan.

5.2.2.10 Pennsylvania Radiation Protection Act

Act 147 (i.e., Pennsylvania Radiation Protection Act, 1984-147) deals specifically with radiation, control of radioactive sources, and accidental releases of radiation from any of the nuclear-powered electric generating facilities in Pennsylvania. The act was most recently amended in 2007 with Act 31. This law empowers the DEP to implement a comprehensive statewide radiation protection program and enables PEMA to develop a radiological emergency response program with plans for each fixed nuclear power generating facility. In implementing the radiological emergency response program, PEMA has planned for evacuation or protection of persons in the area immediately surrounding a given facility with a 10-mile radius. Each of the affected municipalities has a plan that addresses accidental releases of radiation at the facility. The law requires periodic exercise of these plans; every 2 years there is a full-scale exercise involving several hundred people to test the plan and response capabilities.

Act 147 also created a Radiation Emergency Response Fund and a Radiation Transportation Emergency Response Fund, which receives money from nuclear facility operators, spent fuel storage facilities, and spent nuclear fuel shippers. PEMA then distributes this money to affected counties where it is then distributed to municipalities. Funds are distributed based on grant applications submitted by counties to reimburse expenses involved in preparing plans, providing equipment, and involved in training and exercising the radiological emergency response program

5.2.2.11 Public Safety Emergency Telephone Act

Act 78 (i.e., the Public Safety Emergency Telephone Act, 1990-78), as amended, is designed to provide a toll-free standard number (911) accessible from both land and cellular phones for any individual in the Commonwealth to gain rapid, direct access to emergency services. The act was amended in 1998 with Act 17. The act places responsibility for developing a 911 system on county government. The act also allows for end-user contributions based on the number of lines of telephone service. Act 78 establishes technical, training, and certification guidelines and minimum standards to be met in developing the county 911 system. Additionally, the act encourages the development of enhanced 911 systems and constant improvement of existing systems (PEMA 2024).

In fall 2020, the Commonwealth announced the selection of a contractor to implement and operate the Next Generation 911 (NG911) system, a fully fiber-based emergency service internet protocol network that is structurally resilient and brings high data transfer speeds to the deepest reaches of the Commonwealth. Efforts to continue implementing NG911 are ongoing. In 2023, Governor Shapiro secured additional funding to implement the NG911 system (Commonwealth of Pennsylvania 2023).

5.2.2.12 Storm Water Management Act

The Storm Water Management Act (Act 167) was enacted in 1978 to counter the effects of land development on storm water runoff. Act 167 requires all counties in Pennsylvania to prepare and adopt watershed-based storm water management plans and requires municipalities to adopt and implement ordinances to regulate development in a way which is consistent with the local Act 167 plan.

5.2.3 City

The following summarizes the planning and regulatory capabilities available to the City. Under the Constitution and laws of the Commonwealth of Pennsylvania, the City has the authority of local self-government and has complete

powers of legislation and administration in relation to its municipal functions. The City has the power to enact ordinances and to make rules and regulations necessary and proper for carrying into execution its powers.

5.2.3.1 Building Code Enforcement Evaluation Report

This report was created specifically for the City based on a Building Code Effectiveness Grading Schedule (BCEGS) survey conducted on October 20, 2019. This report can help evaluate the community's building-code enforcement services utilizing benchmark data collected throughout the country. The report is designed to give management teams an expanded prospective for dealing with the important issues surrounding effective building code enforcement. This is accomplished through comparisons of the City's code enforcement to that of others in the region and Commonwealth. The analysis goes further to allow the City to compare itself to other jurisdictions across the Commonwealth with similar permit, plan review, and inspection activity. The survey conducted has resulted in a BCEGS Class 3 for one- and two-family dwellings and a Class 2 for all other construction.

5.2.3.2 Climate Vulnerability Assessment

The City of Philadelphia Division of Aviation (DOA), which operates Philadelphia International Airport, conducted a Climate Vulnerability Assessment in 2019. The assessment helps DOA better understand and prepare for the impacts of climate change on the airport's employees and visitors, services, neighbors, facilities, and assets.

5.2.3.3 Close to Home: The Health of Philadelphia's Neighborhoods

Close to Home: The Health of Philadelphia's Neighborhoods details health outcomes and health factors for Philadelphia's 46 neighborhoods to understand each area's unique needs and better direct action to improve and protect residents' health.

5.2.3.4 Community Development Block Grant – Disaster Response, Public Action Plan

The U.S. Department of Housing and Urban Development (HUD) announced that the City will receive $163,204,000 in funding to support long-term recovery efforts following the remnants of Hurricane Ida and Disaster Declaration FEMA-4618-DR. Community Development Block Grant - Disaster Recovery (CDBG-DR) funding is designed to address needs that remain after all other assistance has been exhausted. This plan details how funds will be allocated to address remaining unmet need in Philadelphia.

5.2.3.5 Community Empowerment and Opportunity Strategic Framework

The Office of Community Empowerment and Opportunity (CEO) provides leadership on issues of economic justice by advancing racial equity and inclusive growth to ensure that all Philadelphians might share in the City's prosperous future.

The Strategic Framework describes CEO's work within the broader context of City government and the City as a whole, and responds to the current climate of burgeoning, yet uneven economic growth. It articulates a mission in which CEO leads, educates, enables and learns how to support greater mobility out of poverty, with a focus on programs and initiatives that address benefits access, financial empowerment, housing security, and other priorities that may emerge over time.

5.2.3.6 Community Health Assessment

The Community Health Assessment (CHA) is a systematic assessment of population health in Philadelphia, highlighting key public health challenges and assets and informing local public health programs, policies, and

partnerships. The CHA includes more than 60 indicators reflecting health behaviors, health conditions, health care factors, and social and environmental determinants of health.

5.2.3.7 Community Health Improvement Plan

The Community Health Improvement Plan (CHIP) was developed by a diverse group of organizations representing various sectors in Philadelphia, including public health, education, community development, health care, business, and social service. The CHIP was based, in part, on data from Philadelphia's Community Health Assessment.

The CHIP identifies a set of priorities and strategies for improved health in Philadelphia, highlighting the role of non-governmental organizations. The three priorities of the CHIP are access to care, behavioral health, and chronic disease related to poor diet and physical inactivity.

5.2.3.8 Community Plans

The Philadelphia City Planning Commission (PCPC) creates plans for neighborhoods and other areas of the City. When they are finished, they may become amendments to the City's Comprehensive Plan. Neighborhood associations and other nonprofits also create plans to improve neighborhoods. If the PCPC and other City agencies were invited to participate, and if the plans do not conflict with the City's Comprehensive Plan, they might guide City policies. The list below identifies the completed community plans in the City.

- Along the Avenue: An Economic Plan for Germantown & Lehigh (2012)
- Callowhill-Chinatown North Strategic Plan (2013)
- Central Germantown Business District Beautification Plan (2012)
- Chinatown Neighborhood Plan (2017)
- East Kensington Transportation and Community Development Plan (2013)
- Frankford Creek Greenway Advance Feasibility Study (2018)
- Frankford Creek Greenway Feasibility Study (2014)
- HACE 2025 Neighborhood Plan (2016)
- Hunting Park Neighborhood Strategic Plan 2022 (2012)
- Lower Frankford Creek Watershed Brownfields Area Wide Plan (2015)
- Make Some Noise for Logan (2016)
- Market Street Corridor in West Philadelphia (2013)
- Mt. Airy 2025: An Action Plan for Our Future (2016)
- Nicetown Economic Development and Housing Strategy (2012)
- North of Lehigh Neighborhood Revitalization Plan (2013)
- Philadelphia 30th Street Station District Plan (2016)
- Project Reclaim: 4200 Block of Viola Street (2013)
- Promise Zone Comprehensive Housing Strategy Report (2017)
- Repositioning Declining Shopping Centers: Executive Summary (2020)
- Repositioning Declining Shopping Centers: Full Report (2020)
- Tioga Goals Strategies Report (2016)
- We Are Mantua: Mantua Transformation Plan (2013)
- Wissahickon Gateway Plan (2018)

5.2.3.9 Connect: Philadelphia's Strategic Transportation Plan

Connect is the City of Philadelphia's Strategic Transportation Plan for 2019 through 2025. It highlights the transportation opportunities and challenges that the City faces. This plan has five identified goals:

- Work towards the goal of zero traffic deaths by 2030
- Move people equitably, affordably, and reliably around a growing city
- Invest in well-maintained streets to serve people using all modes of transportation
- Support communities and commerce with a reliable and efficient transportation system
- Deliver transportation services and projects efficiently and transparently for residents

5.2.3.10 Department of Public Health Strategic Plan

The Department of Public Health Strategic Plan for 2022 through 2026 provides a brief background on key health problems facing people in Philadelphia and external factors that may affect their health in the future. The most recent long-term strategic plan includes the following priorities for the Department of Public Health to achieve by 2026:

- Center equity in all the Department's work
- Improve workplace wellbeing and staffing levels
- Focus on strategies to ease administrative barriers to day-to-day operations within the Department and enhance teamwork across divisions
- Prepare for future public health emergencies with a focus on equity
- Address the environmental factors impacting the health of Philadelphia's children
- Ensure that all Philadelphians have access to primary care
- Use data informed strategies to inform the Department's work on major causes of early death and disability
- Achieve accreditation by 2025 and build public trust in the Medical Examiner's Office

5.2.3.11 Economic Opportunity Plans

The Office of Economic Opportunity is a division of the Department of Commerce. An Economic Opportunity Plan is a document created to ensure use of minority, women, and disabled-owned businesses on contracts over $100,000. Reports have been performed for several City agencies (Division of Aviation, Department of Public Property, Procurement, Department of Street, and Water Department), quasi-governmental agencies (Philadelphia Authority for Industrial Development, Philadelphia Industrial Development Corporation, and Philadelphia Redevelopment Authority), and private nonprofits.

5.2.3.12 Emergency Plans

Animal Plan

This plan outlines roles and responsibilities and gives senior-level managers, agency emergency management liaisons, and private and non-profit agencies guidance in making the many complex decisions that may be necessary during situations in which companion animals accompany displaced individuals as well as the inclusion of animal issues in larger emergency management operations.

CHEMPACK Distribution Plan

CHEMPACKs are containers of nerve agent antidotes placed in secure locations in local jurisdictions around the country to allow rapid response to a chemical incident. These medications treat the symptoms of nerve agent exposure and can be used even when the actual agent is unknown. This plan establishes a mechanism to provide emergency medical personnel and hospital staff the ability to treat individuals exposed to nerve agents. This plan

defines the processes for recognizing an incident requiring the use of nerve agent antidote as well as establishing procedures for responding to a nerve agent release and for managing and maintaining CHEMPACK materials.

Continuity of Operations Plan

This plan addresses the continuity of operations in emergencies from an all-hazards approach. It establishes agency policy and guidance to ensure the execution of mission-essential functions and directs the relocation of personnel and resources to an alternate facility capable of supporting operations.

Damage Assessment Plan

This plan establishes a scalable framework to coordinate the citywide response to an event that causes significant damage to City buildings and infrastructure and/or to private property. This plan includes information on the coordination of the activities between multiple agencies to facilitate recovery; supports other response and recovery activities, such as debris removal, transportation management, interim and long-term housing, and utility restoration; and supports requests for local, state, and federal resources, including disaster declaration assistance.

Debris Management Plan

This plan establishes a scalable framework to coordinate the citywide response to events that generate significant amounts of debris. This plan includes information on the organizational structure and guidelines for the clearance, removal, staging, reduction, recycling, processing, and disposal of disaster debris; the plan maximizes reimbursement opportunities through FEMA Public Assistance by ensuring debris management operations are conducted in accordance with program guidelines.

Electricity Disruption Plan

This plan defines the policies and procedures for managing response activities and recovery operations related to power disruptions. This plan complements federal, state, private sector, and departmental operational procedures by integrating them into a citywide response rubric. Additionally, this plan outlines agency roles and responsibilities and provides decision-making guidance for senior-level managers.

Emergency Alert System Plan

This plan provides operational guidance on how and when to utilize the Emergency Alert System (EAS) for the City of Philadelphia. The plan illustrates the responsibilities of agencies directly involved with EAS message transmission in Philadelphia, including OEM, the PEMA, and the National Weather Service.

Emergency Operations Plan

The City of Philadelphia's Emergency Operations Plan establishes the doctrine and principles for the City's emergency management program. This foundational document describes how City government organizes and acts to protect lives and property in the event of emergencies and disasters. The Emergency Operations Plan details policies and procedures that are applicable to the management of all-hazard events including natural disasters, diseases, accidents, and terrorist or significant criminal incidents.

Energy Assurance Plan

This plan has been developed through coordination with the private and public sectors to enhance Philadelphia's readiness for energy emergencies of all causes. The plan describes energy systems (primarily electricity, natural

gas, and petroleum), identifies current local capabilities and gaps, and develops strategies to address capability gaps.

Excessive Heat Plan

This plan outlines roles and responsibilities and establishes a coordinated approach to the management of excessive heat events. The plan describes the City's actions relating to preparedness, response, and post-event response and review procedures.

Family Assistance Services Plan

This plan establishes a scalable framework to coordinate the delivery of family assistance services immediately following a significant incident through short-term recovery. Those services include the facilitation of family reunification; provision of mental health support including bereavement support, counseling, and spiritual care; and delivery of reliable and timely information about response and recovery efforts.

Hazardous Materials Plan

This plan establishes a coordinated approach to the management of hazardous material incidents within the City. This approach includes interagency coordination and decision-making among City, state, and federal policymakers during hazardous materials incidents, the process of requesting additional resources from state, federal, and military agencies, using human and material resources to identify hazardous materials released and appropriate decontamination procedures, establishing a public information protocol for hazardous materials incidents, and identifying considerations to assist with the mitigation of groundwater, sewer, and water supply contamination risks.

Healthcare Facility Evacuation Plan

This plan outlines agency-specific roles and responsibilities and establishes a coordinated approach to the shelter-in-place or evacuation of a healthcare facility. This plan includes an explanation of the process for notification and initial response by City agencies and response partners to assist healthcare facilities during an incident, describing the role of the Healthcare Coordination Desk to support affected healthcare facilities, identifying supporting transportation and resources available to support evacuation operations, and outlining the process for tracking patient movement.

Human Services Recovery Plan

This plan is designed to be scalable and address different human services needs that may arise in a disaster. This plan does not address long-term recovery operations; but focuses on the short-term provision of human recovery resources. The plan is also designed to complement other existing emergency plans.

Limited English Proficiency Plan

This plan establishes effective guidelines, consistent with Title VI of the Civil Rights Act of 1964 and the Mayor's Executive Order of September 29, 2008, for personnel in OEM to follow when providing services to, or interacting with, individuals who have limited English proficiency.

Mass Care and Shelter Plan

This plan establishes a coordinated approach to the citywide response to events that have the potential to create the need for temporary shelter, congregate feeding, basic first aid, and related services during a large-scale event.

The Mass Care and Shelter Plan is designed to be scalable and address sheltering operations from small no-notice operations that require a single shelter to citywide events requiring the opening of multiple shelters. This plan exclusively focuses on service provision in congregate care settings.

Mass Casualty Plan

This plan outlines roles and responsibilities and establishes a coordinated approach to the management of an event with a large number of casualties. The plan ensures prompt notification of all response partners of a Mass Casualty Incident; establishes a mechanism to establish on-scene command, facilitate interagency coordination, and ensure the safety of responders and the public; outlines the triage, treatment, and transport of patients from the scene to definitive care; institutes a process for supporting hospitals; and clarifies the procedure to activate mutual aid and pre-designated non-municipal ambulance companies.

Mass Fatality Plan

This plan establishes a scalable framework to coordinate the citywide response to an event that causes a significant number of fatalities. Specifically, the plan ensures that the City will conduct an initial assessment of the scene, develop an operational plan to address each function of the mass fatality response, and then brief leadership from key stakeholder agencies. The plan also ensures that the City conducts fatality recovery operations, conducts morgue operations, and addresses the basic needs of family members in the aftermath of a mass fatality incident.

Mental Health Response Plan

This plan outlines the resources and services available during a major incident requiring mental health support. This plan may be implemented as part of a larger incident or may be activated independently.

Public Assistance Plan

OEM developed this plan to coordinate the FEMA Public Assistance program. This plan reviews the roles and responsibilities of OEM, City partners, and eligible private nonprofit (PNP) organizations to apply for, manage, and receive Public Assistance following a major disaster.

Public Information and Joint information Center Plan

This plan establishes the coordination of public information activities during emergencies, disasters, and other situations, such as pre-planned, large-scale special events. This plan provides a detailed overview of activating, managing, staffing, and deactivating a Joint Information Center as well as detailed information on disseminating messages to the public, media, and other key stakeholders, including those with functional needs, using a variety of communications tools.

Reparation Operations Plan

This plan outlines the return of citizens to the United States; the provision of temporary services, care, and support to United States citizens upon their return to the United States; coordination with Federal, Commonwealth, City, and private nonprofit response partners; and the rapid activation and stand-down of repatriation operations.

Resource Management Plan

This plan establishes the foundations of a citywide resource management system. This system establishes a common operating picture for select high demand/limited supply resource availability, clarifies emergency unmet

needs request procedures, establishes resource request prioritization criteria, and promotes real-time tracking of requests from inception through fulfillment and demobilization.

Severe Weather Plan

This plan outlines critical roles and responsibilities and establishes a coordinated approach to the management of severe weather events. The plan establishes a process for monitoring weather conditions and identifies triggers for enhanced coordination; coordinates field operations during all phases of a severe weather event; outlines opportunities for post-disaster Federal assistance; and describes processes for the development and dissemination of information to the public during all phases of a severe weather event.

Steam Disruption Plan

The plan outlines agency-specific roles and responsibilities and establishes a unified approach to the management of steam disruption events. Specifically, the plan establishes a process for notifying City agencies and critical steam users of a disruption; coordinates impact assessments; outlines opportunities for supporting impacted facilities; and describes processes for requesting assistance in locating and obtaining resources to support facility operations and steam system restoration.

Volunteer and Donations Management Plan

This plan establishes a scalable framework to coordinate all types of volunteers and donations after a significant incident through short-term recovery. This plan provides the City with a clear understanding of voluntary agencies' capabilities; establishes a process for accepting spontaneous volunteers and donations; and identifies potential volunteer roles to support disaster response and recovery.

Winter Weather Plan

This plan outlines agency-specific roles and responsibilities and establishes a citywide approach to the management of winter weather events. The plan establishes a process for monitoring weather conditions and triggers for enhanced coordination; coordinates ongoing field operations; outlines opportunities and procedures for providing disaster assistance; and reviews processes for developing and disseminating information to the public during all phases of a weather event.

5.2.3.13 Energy Poverty Alleviation Strategy

The Energy Poverty Alleviation Strategy is a roadmap to ensure that all Philadelphians, especially those most impacted by and vulnerable to climate change, can participate in and benefit from the City's clean energy transition. It provides a near-term action plan to address the challenges of energy insecurity and clean energy access in Philadelphia.

The Office of Sustainability developed the strategy with feedback from energy-burdened communities and in collaboration with government departments, community groups, and stakeholders.

5.2.3.14 Growing Stronger: Toward a Climate-Ready Philadelphia

Growing Stronger: Toward a Climate-Ready Philadelphia assesses vulnerabilities and preparation opportunities for municipal government and identifies relatively low-barrier and high-impact internal actions which can be taken while identifying how to assess and minimize risks to environmental health, neighborhood investments, and quality of life.

5.2.3.15 Guide to Flooding in Philadelphia

This guide was designed by the Philadelphia Citywide Flood Risk Management Task Force as a tool for property owners and residents. It can help understand flood risk, how to prepare property and persons for floods, and find out what to do if experiencing flooding.

5.2.3.16 Housing for Equity: An Action Plan for Philadelphia

For Philadelphia to continue to grow it must have housing that meets the needs of all its residents. The Housing Action Plan identifies strategies to house the City's most vulnerable residents, stop the loss of affordable housing, preserve existing affordable housing, and increase housing opportunities at all income levels. This plan highlights the steps the City proposes to take over the next ten years to address its housing needs.

5.2.3.17 Land Bank Strategic Plan

The Land Bank Strategic Plan identifies opportunities to turn vacant land into affordable and market-rate housing, into community gardens, and into side and rear yards. It also identifies opportunities to leverage vacant properties into economic development, especially economic development that creates jobs.

5.2.3.18 Language Access Plans

Language Access Plans are provided by City agencies and are required by the Philadelphia Home Rule Charter Section 8-600. The purpose of Language Access Plans are to establish an effective plan and protocol to follow when providing services to, or interacting with, individuals who have limited English proficiency.

5.2.3.19 Master Plan for the Central Delaware

With the support of the City, partners, and residents, Delaware River Waterfront Corporate (DRWC) created the Master Plan for the Central Delaware, a viable, flexible roadmap to guide all waterfront development between Port Richmond and Pennsport.

The goal of the Master Plan is to transform a six-mile length of Philadelphia's Central Delaware River waterfront into an authentic extension of the thriving City and vibrant neighborhoods immediately to its west.

The Master Plan identifies policy changes and investment strategies for economic development, community development, and open space along the waterfront and provides DRWC and the City with the tools necessary to make Philadelphia's original waterfront a treasured public amenity.

5.2.3.20 Municipal Clean Fleet Plan

The Municipal Clean Fleet Plan provides guidance and recommendations on how the City can transition its vehicles to electric options. It also makes recommendations to set clear procurement targets, institutionalize procurement policies and procedures that focus on clean vehicles, and build out charging infrastructure in an efficient and cost-effective manner.

5.2.3.21 Municipal Energy Master Plan

The Office of Sustainability released the Municipal Energy Master Plan for the Built Environment in 2017. This plan provides City-owned buildings a roadmap for increased energy efficiency, renewable energy generation, and energy resiliency in municipal buildings and the built environment in Philadelphia.

The plan outlines how City government will reach these goals by reducing energy use and cleaning the energy supply. Because energy plays an important role in climate change and disaster preparedness, the plan also informs City government's climate mitigation and adaptation work.

The plan sets four goals for City government's owned and operated built environment:

- Reduce greenhouse gas emissions by 50 percent by 2030
- Reduce energy use by 20 percent by 2030
- Generate or buy 100 percent of all electricity from renewable resources by 2030
- Maintain or reduce the cost of energy at facilities

5.2.3.22 Municipal Waste Management Plan 2019-2028

While a primary purpose for this Plan update included updating information for the City's current disposal and recyclables processing contracts, the Plan additionally updates solid waste generation, disposal and recycling data, waste generation projections, and recycling initiative information. This Plan update aligns with the goals and objectives identified in broader City policy documents, including the Zero Waste and Litter Action Plan (2017) and Philadelphia GreenWorks (2016 update). This Plan covers the 2019 through 2028 planning period. Under this non-Substantial Plan revision, the City does not propose to develop, own, or operate new or expanded municipal solid waste disposal or processing infrastructure, and no major recycling programs are being introduced or discontinued.

5.2.3.23 Pedestrian and Bicycle Plan

The Pedestrian and Bicycle Plan identifies strategies to increase the number and frequency of people walking and bicycling in the City by improving the connectivity, safety, convenience, and attractiveness of the pedestrian and bicycle networks.

Pedestrian-oriented recommendations promote a safe, comfortable, efficient, and attractive pedestrian transportation system. The proposed expanded bikeway network will make bicycling safer and more convenient and will help to promote wider recognition and acceptance of bicycling as a mode of transportation. Beyond recommendations for improvements to the walking and bicycling networks, the Plan presents a framework for pedestrian and bicycle planning, development and maintenance that includes:

- A street classification system with design standards for sidewalks, which reflects the interplay between roadway function, pedestrian activity, and adjacent land use.
- A set of policies and programs to enhance pedestrian and bicycle facilities and to support walking and bicycling through improved maintenance, monitoring, enforcement, encouragement, and safety education.
- Strategies for implementing bicycle and pedestrian network recommendations.

5.2.3.24 Philadelphia 2035: The Comprehensive Plan

The PCPC creates and updates the City's Comprehensive Plan. The current Comprehensive Plan is "Philadelphia 2035: The Comprehensive Plan" and consists of two parts: the Citywide Vision sets out policies and goals, and the 18 District Plans give recommendations for each section of the City.

This plan is used to guide decisions made by various City offices. The Comprehensive Plan makes recommendations and lists steps to make them happen. There are many groups involved in creating the Comprehensive Plan, including residents, businesses, universities, cultural institutions, and City agencies.

Citywide Vision

The Citywide Vision is the over-arching policy document for Philadelphia 2035,. The Citywide Vision sets out a blueprint for how the City should grow and develop over the next 25 years. It establishes policy for the City to follow so that the City can be as sustainable and equitable as possible for residents, business owners and institutions. The recommendations in the Citywide Vision are the basis for the more detailed District Plans.

The Citywide Vision describes strategies for improving the quality and diversity of housing; locations and connections between neighborhood centers, commercial corridors, and transit hubs; key areas to expand access to neighborhood parks and open space, and a framework for implementing policy goals and priority projects.

18 District Plans

Each District Plan is organized around three themes: Thrive, Connect, and Renew.

Thrive addresses housing, jobs, and vacant land. The recommendations will help Philadelphia build healthy neighborhoods that have affordable housing choices and convenient local shopping options. The plan includes ways to support recreation centers, libraries, and other neighborhood places. There are also recommendations to create jobs and bring new companies to the City or grow existing ones. This section also talks about vacant land and new development.

Connect has recommendations for public transportation and utilities. They include safety improvements for pedestrians and bicyclists. There are recommendations to improve the subway, buses, trolleys, and trains. The plan also calls for ways to adapt utilities for more users and better energy consumption.

Renew focuses on nature and history in the City. For example, the plan might recommend expanding parks and trails along the river to provide access to clean water and air. Parks and trails also give residents opportunities for recreation. The historic preservation recommendations are to save and reuse important neighborhood buildings and places. There are also recommendations in the plan to improve the City's sidewalks, parks, and public spaces.

5.2.3.25 Philadelphia Climate Action Playbook

The Philadelphia Climate Action Playbook outlines the actions Philadelphia is taking to respond to climate change through 2050. The playbook compiles actions from existing plans across City departments, providing a comprehensive view of how the City is working to achieve its climate goals. The playbook also outlines how climate change will impact the City.

5.2.3.26 Philadelphia Combined Sewer Overflow Long Term Control Plan Update

The City of Philadelphia has undertaken an update to its Combined Sewer Outflow Long Term Control Plan commitment – first adopted in 1997. This update furthers the City's commitment to watershed-based planning and implementation. The Philadelphia Water Department (PWD) has adopted a restoration strategy that acknowledges the inseparable linkage between land use and water resource protection. When cities invest in green stormwater infrastructure and other innovative, cost-saving strategies to manage their stormwater, they are not only ensuring the rebirth of the ecological resources of the City's waterways but are also striving to provide a host of other environmental, social and economic benefits that will preserve the vitality of our nation's cities.

5.2.3.27 Philadelphia GreenWorks

Greenworks, a sustainability plan, aims to make Philadelphia a sustainable city for all by reaching ambitious visions on the topics of food and water, air, energy, climate, natural resources, transportation, waste, and civic engagement. Each Greenworks vision will help create a city where all Philadelphians enjoy benefits from sustainability, including improved public health, a clean environment, and opportunities to learn, work, and prosper. The eight visions are listed below:

- All Philadelphians have access to healthy, affordable, and sustainable food and drinking water
- All Philadelphians breathe healthy air inside and outside
- All Philadelphians efficiently use clean energy that they can afford
- All Philadelphians are prepared for climate change and reduce carbon pollution
- All Philadelphians benefit from parks, trees, storm-water management, and healthy waterways
- All Philadelphians have access to safe, affordable, and low-carbon transportation
- All Philadelphians waste less and keep our neighborhoods clean
- All Philadelphians benefit from sustainability education, employment, and business opportunities

5.2.3.28 Philadelphia Trail Master Plan

The PCPC, Department of Parks and Recreation, and Office of Transportation and Infrastructure Systems created an inventory of trails and a strategy for creating new ones. City agencies involved in trail planning and construction use this as a guide to prioritize building new trails.

The Trail Master Plan outlines four overarching goals of the Philadelphia trail network: connectivity, safety, encouragement of physical activity, and open space. The purpose of the City trail planning process is to ensure that proposed trail development projects in Philadelphia meet these goals. As the status of the trail network is constantly changing, annual updates offer the opportunity to document and re-evaluate these priorities from year to year in order to provide Philadelphians with a connected and comprehensive system of trails.

5.2.3.29 Philadelphia Transit Plan

The Philadelphia Transit Plan is the City's guide for improving public transit. This plan focuses on developing a policy platform to make transit more convenient, comfortable, and intuitive, investing in bus infrastructure that will make the network faster and more reliable, and investing in high-capacity transit infrastructure that will prepare the region to meet the challenges of the 21st century.

The plan was developed by the Office of Transportation and Infrastructure Systems with input from several City and partner agencies.

5.2.3.30 Philadelphia Upward Mobility Action Plan

Philadelphia was chosen to participate in the Urban Institute's Upward Mobility Cohort. The Philadelphia Upward Mobility Action Plan builds on the insights of other U.S. cities to identify barriers to mobility from poverty and recommend steps the City can take to help residents thrive. The Action Plan recommends four strategies the City can implement to improve the effectiveness of its current programs and policies.

5.2.3.31 Philly Tree Plan

The Philly Tree Plan outlines a life-changing investment in public health and quality of life for Philadelphia neighborhoods. This document is a 10-year strategic plan for the planting and care of Philadelphia's urban forest. It was created by a Project Team of City, state, federal, and non-profit partners, along with multiple subcommittees, a Community Voices Stakeholder Steering Committee, and a consultant team, all guided by values of environmental justice, community engagement, and sustainability. The Plan has the following goals:

- Coordinate support for trees
- Protect the existing and future urban forest
- Grow the urban forest equitably across the City
- Reduce the burden of trees on residents
- Invest in people and communities
- Communicate with residents and improve customer service
- Advocate for communities to benefit from the urban forest
- Celebrate and support the ways communities are engaging with trees

5.2.3.32 Powering Our Future: A Clean Energy Vision for Philadelphia

Powering Our Future: A Clean Energy Vision for Philadelphia is a roadmap for the City that highlights current and expected trends in the energy system and identifies opportunities for all Philadelphians to each lead on achieving climate and energy goals.

5.2.3.33 Priority Climate Action Plan

The Delaware Valley Regional Planning Commission, in collaboration with the Wilmington Area Planning Council and South Jersey Transportation Organization, has led the development of this Priority Climate Action Plan (PCAP) for the Philadelphia Metropolitan Statistical Area (MSA). It meets the requirements of the U.S. Environmental Protection Agency's (EPA's) Climate Pollution Reduction Grant program. The program provides funding to states, local governments, tribes, and territories to develop and implement plans for reducing greenhouse gas emissions and other harmful air pollution.

The PCAP is a document that identifies near-term activities that can be undertaken to achieve greenhouse gas emissions (GHG) reductions for the MSA. For this PCAP, climate action "measures" encompass relatively broad categories of potential GHG reduction actions, including expanding and/or creating projects, programs, and policies. The identification and selection of measures was informed by actions and goals outlined in state and local climate action plans, as well as input from community stakeholders from across the MSA, as described below in the Approach to PCAP Development section. Where possible, opportunities for regional collaboration have been identified to increase accessibility to collective resources and ensure that measures have widespread impact across the MSA. All measures described in this PCAP have the potential to positively impact climate actions in multiple states, counties, and cities across the MSA. Several actions within the measures can also be crosscut across the entire MSA to enhance efficiency and collaboration.

5.2.3.34 Regional Community Health Needs Assessment

The Southeastern Pennsylvania Regional Community Health Needs Assessment fulfills federal requirements through the Patient Protection and Affordable Care Act for non-profit hospitals to complete a Community Health Needs Assessment and implementation plan to inform their community benefit and community building activities.

Coordinated by the Health Care Improvement Foundation and in collaboration with the Department of Public Health and other partners, the assessment evaluates population health and social needs indicators for geographic communities and engages community residents and stakeholders to gain their perspective on community assets, needs, and proposed solutions.

5.2.3.35 Safety and Congestion Omnibus Action Plan

As congestion increased in the years leading up to the 2020 COVID-19 pandemic, the City of Philadelphia set goals to improve mobility by providing a reliable and efficient transportation system in CONNECT: Philadelphia's Strategic Transportation Plan. In response to the COVID-19 crisis, rising traffic fatalities, and urgency to improve racial justice, the need for equitable policies is even more crucial. This plan identifies three main causes of traffic fatalities and congestion in Philadelphia and an action plan of specific steps to address these issues.

5.2.3.36 Stormwater Management Guidance Manual

The Philadelphia Stormwater Management Guidance Manual is a comprehensive resource for complying with the PWD stormwater regulations, criteria for stormwater retrofits, and designing stormwater management on private property to improve the health and vitality of Philadelphia's waterways along with the City's own sizable clean water investments. The Manual provides detailed guidance for the applicant on how to quickly and efficiently comply with the Stormwater Regulations or meet PWD design criteria for Development, Stormwater Retrofits, and other construction projects.

5.2.3.37 Title 14: Zoning and Planning

This Zoning Code is the first comprehensive revision to Philadelphia's zoning laws in nearly 50 years. The earlier code, dating from 1963, was updated in 1991 when the zoning rules governing Center City were significantly reformulated. However, most modifications to the Zoning Code have occurred in small increments or through a myriad of individual ordinances and overlays, resulting in a very complicated document that was increasingly unable to meet the demands of an evolving city. In 2007, the voters of the City decided to create a Zoning Code Commission and charged this 31-member body with the task of writing a new Zoning Code. The result is this Zoning Code. It is enacted to guide the land use and development of the City and in so doing, promote the public health, safety, and general welfare of its citizens and visitors. The provisions of the Zoning Code are designed to achieve the following goals. With these goals in mind, the members of the Zoning Code Commission intend for this to be a living document that will propel the City to a higher quality of life.

5.2.3.38 Zero Waste and Litter Action Plan

The Zero Waste and Litter Action Plan is organized around five subject areas and includes the recommendations, policy objectives, and coordinated initiatives that the Zero Waste and Litter Cabinet has identified as the key components to achieving a Zero Waste and litter-free city. While a number of the items in this action plan are informed by new methods to manage waste and litter, other items are currently in existence in some form as programs or policy and require scaling up.

5.3 ADMINISTRATIVE AND TECHNICAL CAPABILITY

This section summarizes administrative and technical capabilities that can be leveraged by City of Philadelphia.

5.3.1 Federal

Numerous federal agencies have specific capabilities that support pre- and post-disaster hazard management in the City of Philadelphia.

5.3.1.1 Federal Emergency Management Agency

The FEMA is responsible for providing assistance before, during, and after disasters. FEMA is the federal reviewer of hazard mitigation plans and sets federal standards for local and state hazard mitigation plans.

Community Assistance Visits and Community Assistance Contacts

FEMA evaluates NFIP minimum compliance through compliance audits known as Community Assistance Visits (CAVs) or Community Assistance Contacts (CACs). CAVs and CACs are performed to ascertain community compliance with the NFIP, at entry into the CRS, and to maintain participation in the CRS. FEMA may conduct these with Region 3 staff, with DEP staff under the Compliance Assistance Program – State Support Services Element (CAP-SSSE) grant, or with private contractors. While there is some flexibility in how a CAV or a CAC is conducted, CAVs are generally more rigorous than CACs.

FEMA evaluates the following key areas in a compliance audit:

- The Community's Flood Damage Prevention Ordinance
- Mapping Products and other Ordinances used to regulate floodplain development
- Floodplain Development Permitting Procedures
- Floodplain Permit Applications and other Forms/Records, including Substantial Damage and Improvement Determinations
- Floodplain Development Review and Performance Standards
- Floodplain Development Permits Issued to Applicants

5.3.1.2 HURREVAC

HURREVAC is the decision support tool of the National Hurricane Program, administered by FEMA, USACE, and the National Atmospheric and Oceanic Administration (NOAA) National Hurricane Center (HURREVAC n.d.). HURREVAC allows PEMA and counties to work as a unified team, coordinating notification, communication, activations, public warning, and evacuation and sheltering efforts. By operating together, the Commonwealth and the counties serve the public better by providing the same advisories and actions.

5.3.1.3 National Weather Service

The NWS monitors weather and delivers weather forecasting for Pennsylvania. The Commonwealth is serviced by the Philadelphia/Mount Holly weather forecast office. PEMA uses conference calling with the NWS and county OEMs to share specific information and needs when severe weather is forecast. When an approaching storm warrants monitoring, PEMA sends out e-mails with Emergency Operations Center (EOC) status information and advice embedded in jpeg files to keep all emergency managers statewide up to date with PEMA's direction. Resources are deployed as early as possible to prepare for storm impacts. The NWS also offers various education and training programs on weather-related hazards.

5.3.1.4 StormReady Program

The NWS operates the StormReady Program, which encourages communities to take a new, proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations. To be recognized by the program, a community must establish a 24-hour warning point and emergency operations center; have more than one way to receive severe weather warnings and forecasts and to alert the public; create a system that monitors weather conditions locally; promote the importance of public readiness through community seminars; and develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises (NWS n.d.). The City of Philadelphia is a StormReady community, and Main Line Health, a non-profit health system located within the City, is a supporter of the program.

5.3.1.5 U.S. Army Corps of Engineers

USACE works to strengthen the nation's security by building and maintaining America's infrastructure and providing military facilities where servicemembers train, work, and live. Projects include dredging, storm damage reduction, and ecosystem restoration in and near waterways (USACE n.d.). The City is serviced by the Philadelphia District. USACE has numerous initiatives to support hazard mitigation measures, including the Silver Jackets, planning assistance, and inspections and repair of flood control structures. USACE also maintains the National Inventory of Dams and the National Levee Database.

Silver Jackets

Silver Jackets, developed by USACE, is the state-level implementation program for the National Flood Risk Management Program. The program focuses on promoting interagency collaboration to combine resources such as funding, programs, and technical expertise. The program's goals are to leverage information and resources from federal, state, and local agencies to improve flood risk management; improve public risk communication through a united effort; and create a mechanism to collaboratively solve issues and implement initiatives beneficial to local communities. The USACE Philadelphia District organizes this program in the City.

Members of the Silver Jackets represent local, state, and federal agencies, as well as other non-governmental groups with an interest in hazard mitigation, response, and recovery. The Pennsylvania Silver Jackets are led by the USACE and are focused primarily on flooding. The Pennsylvania Silver Jackets hold two webinars and one live meeting each quarter and invite participants from non-member organizations when the program may align with their interests. The Silver Jackets also assist FEMA with the High-Water Mark Initiative, which helps communities to remind residents of past flooding in the area and to encourage residents to take steps to mitigate against future flood losses.

Climate Preparedness and Resilience Community of Practice

The Practice develops and implements practical, nationally consistent, and cost-effective approaches and policies to reduce potential vulnerabilities to the nation's water infrastructure resulting from climate change and variability (USACE n.d.).

Planning Assistance to States Program

Section 22 of the 1974 Water Resources Development Act provides authority for the USACE to assist states, local governments, Native American tribes, and other non-federal entities in the preparation of comprehensive plans for the development and conservation of water and related land resources. Types of work that can be done include

Water Quality Studies, Flood Plain Management Studies, Harbor/Port Studies, or other water resource planning investigations. The individual non-federal sponsors determine the needed planning assistance (USACE n.d.).

Floodplain Management Services Program

Section 206 of the 1960 Flood Control Act (PL 86-645), as amended, provides the authority for the USACE to provide assistance and guidance on all aspects of floodplain management planning. The program develops or interprets site-specific data on obstructions to flood flows, flood formation, and timing and the extent, duration, and frequency of flooding. Upon request, program services are provided to the state, regional, and local governments, Native American tribes, and other non-federal public agencies without charge (USACE n.d.).

Inspection of Completed Works Program

Civil works structures whose failure or partial failure could jeopardize the operational integrity of the project, endanger the lives and safety of the public, or cause substantial property damage, are periodically inspected, and evaluated to ensure their structural stability, safety, and operational adequacy. For those structures constructed by the USACE and turned over to others for operation and maintenance, the operating entity is responsible for periodic inspection and evaluation. The USACE may conduct the inspection on behalf of the project sponsor provided appropriate reimbursement to the USACE is made. However, the USACE may participate in the inspection with the operating entity at the government's expense.

Rehabilitation and Inspection Program

The Rehabilitation and Inspection Program is a USACE program that provides for inspection of flood control projects, the rehabilitation of damaged flood control projects, and the rehabilitation of federally authorized and constructed hurricane or shore protection projects.

Dam Safety Program

The USACE is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety.

5.3.1.6 U.S. Geological Survey

U.S. Geological Survey (USGS) maintains a network of gauges across Pennsylvania that continuously measure lake, reservoir table, stream, and tidal levels. These data sets are transmitted to the USGS and made available over the Internet. As project needs and funding levels change, gauges may be added or deactivated, and deactivated gauges may be reactivated (USGS 2023). USGS provides data to the Department of Environmental Protection for drought determinations. USGS also recovers high water marks post-coastal flooding (USGS 2018).

5.3.2 State

Numerous Commonwealth agencies have specific capabilities that support pre- and post-disaster hazard management in the City of Philadelphia.

5.3.2.1 Pennsylvania Construction Codes Academy

The Pennsylvania Construction Codes Academy offers training tailored to becoming certified as a Building Code Official. The program provides interactive education focused on the practical application of the UCC regulations. Courses are held both in-person and online and address a number of building related topics.

5.3.2.2 Pennsylvania Department of Community & Economic Development

The mission of the Pennsylvania Department of Community & Economic Development is to encourage the shared prosperity of all Pennsylvanians by supporting good stewardship and sustainable development initiatives across the Commonwealth. With a keen eye toward diversity and inclusiveness, the Department acts as advisors and advocates, providing strategic technical assistance, training, and financial resources to help communities and industries flourish.

5.3.2.3 Pennsylvania Department of Environmental Protection

The DEP's mission is to protect Pennsylvania's air, land, and water from pollution and to provide for the health and safety of its citizens through a cleaner environment. The DEP partners with individuals, organizations, governments, and businesses to prevent pollution and restore our natural resources. The DEP's mission is integral to hazard mitigation in Pennsylvania as it implements flood control projects, monitors, and conducts outreach for radon, participates in emergency response, and regulates safe practices for several industries.

Bureau of Clean Water

The Bureau of Clean Water administers the National Pollutant Discharge Elimination System (NPDES) permitting and compliance programs for commercial and municipal stormwater in PA. In general, permit coverage is five years. For commercial activities, permits are focused on industrial waste and large-scale earthmoving activities from construction. Municipalities and other public institutions like universities must maintain their own storm sewer systems according to their permits, ensuring that any water discharged into public waterways meets standards. DEP is also charged with the implementation of Act 167 stormwater management programs, which were discussed earlier in this section. Proper stormwater management not only impacts water quality across the Commonwealth but also impacts the severity of flooding in areas.

Bureau of Radiation Protection

The DEP Bureau of Radiation Protection provides expertise in radiation protection and nuclear safety and possesses the equipment and personnel for radiation monitoring. Hazard mitigation is integrated into the Bureau's plans and procedures. This Bureau also participates in training programs, drills, and exercises, and has a public outreach program regarding radon.

Bureau of Waterways, Engineering, and Wetlands

The DEP Bureau of Waterways, Engineering, and Wetlands plans, designs, and manages the construction of flood control projects. Completed projects are inspected annually by either DEP or USACE, while DEP reviews H20 project and flood mitigation grant applications. DEP also has numerous fact sheets on their programs and hosts annual flood protection workshops for municipal sponsors. DEP provides project sponsors with the Emergency Action Plan Guidelines for flood protection projects, and the Division of Dam Safety within the Bureau approves dam emergency action plans, completes design and construction review, inspects dams for safety, and requires dams to be upgraded or repaired when warranted, under the authority of the Dam Safety and Encroachments Act and the Pennsylvania Code. The bureau is also involved in levee safety, even though FEMA and USACE are known

for levee monitoring and certification. As noted above, USACE partners with the DEP for annual levee safety workshops and inspections at federal and state constructed flood protection projects, which includes most of Pennsylvania's levee systems.

Emergency Response Program

The DEP Emergency Response Program helps achieve the Department's overall mission by providing timely responses to incidents which require the immediate presence of Department personnel to ensure the health and safety of the environment and the public. Responses typically include gathering critical evidence or information which may be transient, perishable, or otherwise unobtainable if a timely response is not made. The Emergency Response Program maintains the Department's Emergency Operations Plan, sends representatives to the PEMA Commonwealth Response Coordination Center (CRCC), participates in PEMA/FEMA trainings, drills, and conferences, shares incident notifications, has partnerships with neighboring states, and provides public information, as needed.

5.3.2.4 Pennsylvania Department of General Services

The Pennsylvania Department of General Services attempts to provide built-in hazard mitigation for new or retrofit construction via the Bureau of Engineering and Architecture and attempts to avoid leasing facilities in hazardous areas via the Bureau of Real Estate.

5.3.2.5 Pennsylvania Department of Health

The mission of the DOH is to promote healthy behaviors, prevent injury and disease, and to assure the safe delivery of quality health care for all people in the Commonwealth of Pennsylvania. DOH is home to several bureaus that provide pre-disaster capabilities.

Bureau of Communicable Diseases

The Bureau of Communicable Diseases' mission is to reduce the incidence and prevalence of communicable diseases in the Commonwealth of Pennsylvania by providing a wide range of prevention and intervention strategies that incorporate all aspects of government and community partnerships.

Bureau of Emergency Medical Services

The Bureau of Emergency Medical Services leads the Commonwealth in preventing, responding to, and reducing the public health and medical consequences of emergencies and disasters.

Bureau of Health Promotion and Risk Reduction

The Bureau of Health Promotion and Risk Reduction supports community partners in implementing evidence-based prevention strategies, using current data and research for chronic disease, injury, and violence to foster healthy and resilient communities across the Commonwealth. The department also contributes to the Lyme and Other Tickborne Diseases Interagency Workgroup, which consists of members from the Department of Agriculture, Education, Environmental Protection, Conservation of Natural Resources, the Fish and Boat Commission, and the Game Commission that help coordinate the commonwealth's response.

5.3.2.6 Pennsylvania Department of Transportation

The Pennsylvania Department of Transportation (PennDOT) coordinates transportation projects and maintains state-owned infrastructure across the Commonwealth. Their role in hazard mitigation is to promote safety and implement plans, procedures, and projects that improve transportation safety. In addition, the Southeastern Regional Traffic Management Center has monitoring capabilities of the region's core network to improve situational awareness. PennDOT maintains the Pennsylvania Mobility Plan, Electric Vehicle Mobility Plan, Pennsylvania Transportation Security Plan, Winter Services Strategic Plan, and more. They are also engaged in the Federal Highway Administration's Alternative Fuels Corridor Program, which focuses on providing access to electric vehicle charging and hydrogen, propane, and natural gas fueling stations. Currently, I-78, I-80, and I-81 are engaged in efforts to create these corridors.

5.3.2.7 Pennsylvania Department of Labor and Industry

The Pennsylvania Department of Labor and Industry (DLI) administers benefits to unemployed individuals, oversees workers' compensation benefits for job-related injuries, and provides vocational rehabilitation for people with disabilities

Bureau of Occupational & Industrial Safety

The Bureau of Occupational & Industrial Safety serves as the data repository for the Pennsylvania Tier II System (PATTS) Hazardous Chemical Reports available to PEMA and to county local emergency planning committees that participate in the online PATTS Enterprise Program. Numerous facilities also upload their emergency response plans to this system.

5.3.2.8 Pennsylvania Emergency Management Agency

PEMA helps communities and citizens mitigate against, prepare for, respond to, and recover from emergencies including natural disasters, acts of terrorism, or other human-caused disasters.

PEMA supports emergency management agencies by coordinating and engaging the whole community including:

- Federal and state partners
- Volunteer organizations involved in disasters
- Private sector business community
- Citizens

Community Emergency Response Team

The Community Emergency Response Team (CERT) Program educates people about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others in their neighborhood or workplace following an event when professional responders are not immediately available to help. CERT members also are encouraged to support emergency response agencies by taking a more active role in emergency preparedness projects in their community.

Hazard Mitigation, NFIP Management, and Disaster Trainings

PEMA provides various trainings and presentations to community officials and local emergency management staff in support of local hazard mitigation, NFIP management, and disaster preparedness. PEMA holds three two-day

trainings each quarter in the east, west, and central regions of Pennsylvania, which are typically attended by local emergency managers. Other attendees include local emergency managers, other emergency management staff, and related planners.

Mitigation Insurance and Resilient Communities Office

Mitigation is managed through the Mitigation Insurance and Resilient Communities (MIRC) Office, which provides and participates in hazard mitigation and disaster trainings, disaster exercises, and conferences. MIRC staff support the identification and implementation of potential mitigation projects and provide various tools and technical assistance for local agencies on PEMA's Hazard Mitigation webpage and in-person. MIRC supports two full-time positions for NFIP program management. These positions are an NFIP Coordinator and a Deputy Coordinator who, along with support from other staff within MIRC, have contributed to an increased capacity for NFIP management.

ReadyPA

ReadyPA is a statewide outreach program launched in September 2008 and supported by PEMA, Pennsylvania Citizen Corps, DOH, and volunteer organizations aiming to motivate Pennsylvanians to take action to prepare for a disaster. This program encourages all Pennsylvanians to "Be Informed, Be Prepared, and Be Involved." ReadyPA is coordinated between the Citizen Corps and the PEMA press office, which in turn coordinate with the counties, local government, state agencies, U.S. Department of Homeland Security, and other organizations and agencies. The website, www.readypa.org, provides the latest guidance on disaster and emergency preparedness for the public, children, individuals with disabilities, older residents, pet owners, etc. To reach those communities that speak other languages, the site is available in 133 different languages. It disseminates risk information and tools such as an emergency preparedness guide that includes supply kit checklists, emergency contact forms, and other printable information which can be used to reduce the risk of damage, injury, and death during a disaster event. The site also provides valuable information about making emergency plans and how people can become involved with their local Citizen Corps Councils or register to assist during a disaster through the State Emergency Registry of Volunteers in Pennsylvania.

Regional Task Forces

PEMA regularly coordinates with the eight Regional Task Forces across Pennsylvania. These task forces are regional entities that assist in regional planning, maintain shared equipment, and provide trainings and exercises to bolster the region's ability to respond to hazards. Many of the task forces began as units working within the counterterrorism and critical infrastructure protection space, but since evolved into an all-hazards mindset. Task Forces may consist of various capabilities such as Hazmat Teams, Bomb Disposal Teams, Water Response Teams, Search and Rescue, Dive Teams, SWAT Teams, and more. These taskforces play an important role in ensuring regional public safety communications infrastructure is maintained, improved, and effective when needed. Funding is partly provided via the Homeland Security Grant Program (HSGP).

5.3.2.9 Pennsylvania Housing Finance Agency

The Pennsylvania Housing Finance Agency staffs the Joint Field Office, serves on the statewide disaster planning committee, and partners with PEMA, Pennsylvania Department of Community & Economic Development, and DPW on an apartment locator service.

5.3.2.10 Pennsylvania Insurance Department

The Pennsylvania Insurance Department's role in hazard mitigation is to educate the public on resources that may be available for hazard mitigation such as insurance and FEMA grants. In pursuit of this goal, the Pennsylvania

Insurance Department posts fact sheets and press releases on their website on how to prepare and respond to disasters.

5.3.2.11 Pennsylvania Spatial Data Access

Pennsylvania Spatial Data Access is the Commonwealth's official public access open geospatial data portal, developed in 1995 by Pennsylvania State University ("Penn State"). It is currently run as a cooperative project between Penn State's Institution of Energy and the Environment, the Governor's Office of Administration, and the Office for Information Technology. Penn State contributes system administration support and infrastructure while the Office for Information Technology provides funding.

The keystones of Pennsylvania Spatial Data Access are collaboration, cooperation, continuity, active engagement, efficiency, and free access. The data is provided by federal, state, local and regional government agencies, non-profit organizations, and academic institutions.

5.3.2.12 Pennsylvania State Geospatial Coordinating Board

The Pennsylvania State Geospatial Coordinating Board was established within the Office of Administration by Act 178 of 2014 to "provide advice and recommendations to the Governor and the citizens of this commonwealth on geospatial issues and provide uniform data standards, coordination and efficiency in geospatial policy and technology issues among Federal, State and local government agencies, academic institutions and the private sector." In June 2020, the operations of the Board were re-authorized through the enactment of Act 37 of 2020. The Board includes data access and sharing resources as well as a variety of reports in the Geoboard Library (Commonwealth of Pennsylvania 2024).

5.3.2.13 Pennsylvania State System of Higher Education

Each university in the Pennsylvania State System of Higher Education has a university-specific hazard mitigation plan, and Millersville University includes a Center for Disaster Research and Education.

5.3.2.14 Pennsylvania Treasury

The Pennsylvania Treasury evaluates the financial risk and consequences that can occur after a major disaster. The department also considers hazards that could put essential functions, such as payment processing, at risk. Also, staff members attend and practice table-top drills and exercises and train employees on emergency roles and home preparedness.

5.3.3 City

The City of Philadelphia has several capabilities to support pre- and post-disaster hazard management.

5.3.3.1 CityGeo

CityGeo helps departments share data used for mapping, analysis, and City services. Its team of analysts, application developers, and project managers create applications to analyze and show geographic data, perform geographic and statistical analyses for departmental projects, publish much of the geographic data created by City departments as open data, coordinate major spatial technology contracts for the City, manage large data integrations, and support standards for how geographic data is mapped, shared, and managed.

5.3.3.2 Administrative Board

The Administrative Board consists of the mayor, the managing director, and the director of finance. It oversees the basic organizational and procedural policies of City government. The board:

- Approves administrative rules and policies of departments, boards, and commissions.
- Sets its own administrative rules and policies.
- Investigates the efficiency of the organization and administration of departments, boards, and commissions.
- Reviews changes to the civil service regulations as approved by the Civil Service Commission.
- Conducts other business as outlined in the Philadelphia Home Rule Charter, Chapter 3

5.3.3.3 Board of Building Standards

The Board of Building Standards reviews appeals related to building safety and the application of the City's Building Code, makes recommendations on regulations and standards to the Commissioner of Licenses and Inspections (L&I), and reviews new building products for compliance with City safety standards. The board also hears appeals related to structures cited by L&I as being unsafe or imminently dangerous.

5.3.3.4 Board of Safety and Fire Prevention

The Board of Safety and Fire Prevention is an advisory board to the Philadelphia Fire Department. The board hears appeals of violations of the Philadelphia Fire Code issued to a property owner by the Department of Licenses and Inspections (L&I), recommends actions on appeals of Fire Code violations to the commissioner of the Philadelphia Fire Department, offers advice on the interpretation and the application of the Philadelphia Fire Code on various matters associated with fire safety and prevention, and makes suggestions on possible changes to the Fire Code.

5.3.3.5 Board of Surveyors

The Board of Surveyors consists of Department of Streets leadership and staff. The board's responsibilities include holding public hearings on changes to street system plans, confirming or rejecting plans or revisions to the street system, and approving bridge, street railway, and railroad plans, and grade crossing elimination projects. The board meets on the first and third Monday of the month at 2 p.m.

5.3.3.6 Department of Behavioral Health and Intellectual disAbility Services

The Department of Behavioral Health and Intellectual disAbility Services (DBHIDS) works with the Philadelphia School District, child welfare and judicial systems, and with families and communities to provide care and services for people with mental illness, struggling with addictions, and those with intellectual disabilities.

DBHIDS embraces a vision of recovery, resilience, and self-determination through a model of care that is directed by the person in recovery. In this model, professional treatment, along with family, individual, and other resources, allows people to manage their own conditions and build their own recovery resources. DBHIDS also helps people with intellectual disabilities live self-determined lives in their communities by providing quality support and services.

5.3.3.7 Department of Licenses and Inspections

The Department of Licenses and Inspections (L&I) helps people comply with building safety standards and other code requirements. Contractors, business and property owners, landlords, tenants, and other members of the public are all served by L&I. The Department performs the following activities:

- Inspect construction projects so they meet construction and fire codes.
- Inspect higher-risk properties for compliance with fire codes.
- Respond to complaints regarding many code violations.
- Inspect, monitor, seal, and demolish vacant and/or dangerous buildings.
- Review plans and issue permits according to building, zoning, plumbing, and electrical codes.
- Issue trade and business licenses.
- Help landlords and tenants understand their responsibilities.

5.3.3.8 Department of Planning and Development

The Department of Planning and Development works in collaboration with communities to promote, plan, preserve, and develop successful neighborhoods for all. Reaching these goals requires City agencies to work together with residents, businesses, developers, advocates, funders, and each other.

Philadelphia Art Commission

The Art Commission is Philadelphia's design review board. It ensures that development in Philadelphia is beautiful, orderly, and appropriate so that the City is a desirable place to live, visit, and do business. As part of its duties, the commission reviews the designs of the following:

- All construction projects located on City property or funded with City money.
- Anything constructed or installed on or over the public right-of-way.
- All public art to be acquired by the City or placed on public property.

Philadelphia City Planning Commission

The PCPC is a bridge between the public and the government. PCPC guides investment and growth in Philadelphia with the goal to create neighborhoods that are well-connected, affordable, and desirable places to live and work. As outlined in the City's charter, PCPC oversees the following:

- Physical development plan of the City, or the Comprehensive Plan (a policy document that focuses on land-based issues)
- Zoning ordinances, maps, and amendments
- Capital Program and Budget
- Streets and land subdivisions
- Recommendations to City Council related to zoning and development legislation

Division of Development Services

the Division of Development Services provides information about permits and approvals for developments. It also helps individual projects get through the approval process in the most efficient way possible. It answers questions, provides feedback, makes connections with City departments, and helps solve new or unique issues on complicated projects. The Division offers the following:

- General information about development processes
- Reviews of preliminary plans and proposals to offer project feedback

- Introductory meetings with City departments
- Development Services Committee meetings for large and complicated real estate projects

Division of Housing and Community Development

The Division of Housing and Community Development (DHCD) funds programs that help Philadelphia offer homes for people at all income levels and support commercial corridors with thriving businesses and healthy neighborhoods.

The programs DHCD supports help people buy their first homes or repair their current home, save families from foreclosure and eviction, help individuals who are unhoused with HIV/AIDS find permanent housing and people with disabilities live more independently, and support small businesses and tend to Philadelphia's vacant lots.

DHCD funding helps developers build new affordable homes and preserve existing ones. Those projects also create jobs in neighborhoods across the City. Funding from the Division helps create better designed neighborhoods with engaged residents.

Philadelphia Historical Commission

The Philadelphia Historical Commission protects the City's historic resources. Together with its advisory committees, the commission identifies and designates historic landmarks, maintains the Philadelphia Register of Historic Places, hosts public meetings about historic properties, and works with property owners to protect landmarks.

The commission staff reviews building permit applications and nominations to the register. When needed, they forward applications to the appropriate committee. Staff approves over 90 percent of building permit applications without referral to a committee, informs the public about the commission's rules and processes, gives advice on preservation techniques, and helps the public research the history of their properties.

Zoning Board of Adjustment

The Zoning Board of Adjustment (ZBA) is an independent board within the Department of Planning and Development. It has those powers set forth in the Home Rule Charter and the Philadelphia Code. It conducts its work with the guidance of its rules and regulations. The ZBA hears appeals of the following:

- L&I refusal or referral of a zoning permit application.
- Any decision made by L&I in accordance with the Zoning Code, including issuance of by-right permits and zoning-related violation notices.

The Zoning Code regulates development within the City. Zoning regulations govern property uses, height, size, and spacing of buildings and other structures, parking requirements, and signage size and placement.

5.3.3.9 Department of Public Health

The mission of the Department of Public Health is to protect and promote the health of all Philadelphians and to provide a safety net for people who are disproportionately impacted by societal factors that limit their access to healthcare and other resources necessary for optimal health.

The Department provides high-quality medical care at City health centers, prevents the spread of illness and infectious disease, protects against environmental hazards, encourages healthy behaviors to prevent chronic

disease, plans and responds to health emergencies, ensures the quality and accessibility of health services, sets health policy, and collects, analyzes, and reports on a variety of public health data.

Air Pollution Control Board

The Air Pollution Control Board advises the Department of Public Health on air quality issues, and promotes regulations that protect air quality standards, control air contaminants, and establish air quality objectives. Meetings of the Air Pollution Control Board are open to the public.

Board of Health

The Board of Health approves and promotes the health regulations of the Department of Public Health. These regulations establish standards to control public health hazards and protect the health of Philadelphians. Board members review advances in public health, to ensure regulations reflect best practices.

The Board includes the Health Commissioner, who serves as President, and seven mayoral appointees. Three of the members must be physicians, one of whom must have a Doctor or Master of Public Health degree. Another must be a dentist with a Doctor or Master of Public Health degree.

5.3.3.10 Department of Public Property

The Department of Public Property (DPP) manages the buildings and structures where City employees work and where City equipment is kept. Our department buys, sells, leases, designs, constructs, renovates, and maintains City properties. DPP makes sure that facilities operated by the City are in safe condition, are accessible, and that they function well. The Divisions within the Department work together to manage City properties, provide customer service, and plan for future building needs.

Administration

The Administration Division manages the operations of DPP. It contains the Human Resources, Fiscal/Budget, and Inventory/Procurement Units.

Real Estate and Planning

The Real Estate Division guides the use, purchase, and sale of City property. The division's responsibilities include lease negotiations and contracting for the City, changing vacant land from public to private ownership, getting property for City projects, planning and designing space used by City departments, and staff relocations.

Capital Programs

Capital programs are major construction, renovation, and rehabilitation projects that improve City facilities. They exceed $15,000 and have a useful life of at least five years. To make the most of the City's investments, the Capital Programs Division uses budget planning, financial controls, and project management.

Facilities Management

The Facilities Management Divisions make sure the City's work environments are clean and safe. Division responsibilities include maintenance, renovations, janitorial services, special events, and building security. The Division is further split into Field Operations and Quad Plex. Field Operations supports locations for Police, Fire,

the Managing Director's Office, Fleet, Riverview, and the Department of Licenses and Inspections. Quad-Plex handles City Hall, One Parkway Building, Municipal Services Building, and Criminal Justice Center.

5.3.3.11 Mayor's Commission on Aging

The Mayor's Commission on Aging serves seniors in Philadelphia with programs and information to enhance their quality of life. The commission is part of the Mayor's Office within the Health and Human Service Cabinet. The commission provides Philadelphia's seniors with access to benefits and programs, employment and financial services, access to food and meal delivery, health and senior centers, and housing security (foreclosure prevention).

5.3.3.12 Mayor's Office for People with Disabilities

The Mayor's Office for People with Disabilities houses the Mayor's Commission on People with Disabilities and the Office of Americans with Disabilities Act (ADA) Compliance. Both offices work to make Philadelphia a better place for people with disabilities. The Mayor's Commission on People with Disabilities provides the following services:

- Advocates for policies, programs, and systemic changes that maximize independence and community integration for Philadelphians with disabilities.
- Provides resources and referrals to local organizations that support residents with disabilities.
- Educates the community on the Americans with Disabilities Act, the Fair Housing Act, and other laws that protect the civil rights of people with disabilities.

The Office of ADA Compliance has the following responsibilities:

- Writes policies and procedures and develops resources to ensure equal access to City-provided services, programs, and activities for people with disabilities.
- Educates employees and City entities on disability-related laws.
- Oversees the Philadelphia transition plan and structural access within City buildings.
- Responds to grievances from residents with disabilities who feel discriminated against.

Together, these two offices help ensure those with disabilities have equal and equitable access to employment opportunities, accessible and affordable housing, elementary and secondary education, health care, recreation, arts, and culture, and government services and buildings.

5.3.3.13 Mayor's Office of Public Engagement

The Office of Public Engagement enhances community outreach and engagement in Philadelphia, empowering residents to connect and make City government accessible to all, ensuring everyone's voice is heard. The Office of Public Engagement partners with the Office of Civic Engagement and Volunteer Service, Office of Immigrant Affairs, Office of Diversity, Equity and Inclusion, Philadelphia Commission on Human Relations, and other key offices to carry out our mission. Initiatives like the Black + Gold Series help foster cross-racial dialogue to promote mutual understanding between diverse communities in Philadelphia.

Mayor's Office of Black Male Engagement

The Mayor's Office of Black Male Engagement works to close the opportunity divide for men and boys of color. The Office strives to better the communities where they live and reduce the economic and social disparities that affect them. It coordinates My Brother's Keeper Philadelphia, a program that aims to dismantle systems of inequality.

Mayor's Office of Engagement for Women

The Office of Engagement for Women promotes economic, educational, and social opportunities for Philadelphia's women, girls, and individuals who identify as female. The Office supports the efforts of the Philadelphia Commission for Women and works on public policy and advocacy initiatives relating to leadership development, education, health and wellness, civic engagement, gender equality, and social justice.

Mayor's Office of Youth Engagement

The Office of Youth Engagement knows that young people have important ideas about how to make the City a better place to live. The Office supports the efforts of the Philadelphia Youth Commission and the Millennial Advisory Committee. By participating in these groups, young people can develop leadership skills, bridge gaps between generations, and suggest ways for City government to better serve its residents.

Faith-Based and Interfaith Affairs

Faith-Based and Interfaith Affairs ensures that Philadelphia's diverse faith communities have a seat at the table and are represented in the administration's decision-making process. This collaborative work is key to addressing issues that affect communities and to strengthening the connection between residents of all backgrounds and the government.

5.3.3.14 Office of Arts, Culture, and the Creative Economy

The Office of Arts, Culture, and the Creative Economy promotes arts, culture, and the creative industries. The Office partners with for-profit and nonprofit organizations to make culture and creativity essential parts of the City's strategy for revitalizing communities, improving education, and promoting economic development. It links Philadelphians to cultural resources and opportunities, manages City arts programs, and advises the administration on arts and cultural policy.

5.3.3.15 Office of Children and Families

The Office of Children and Families aligns the City's policies, resources, and services for children and families. The Office administers a number of City-supported programs, including Out-of-School Time, Career Connected Learning PHL, Community Schools, and PHLpreK. The office also oversees the Department of Human Services (DHS), Philadelphia Parks & Recreation, and the Free Library of Philadelphia.

Department of Human Services

Philadelphia's DHS is the child welfare and juvenile justice agency and is overseen by the Office of Children and Families. The Department's mission is to provide and promote safety, permanency, and well-being for children and youth at risk of abuse, neglect, and delinquency. The Department's main service areas include the following areas:

- *Prevention* – DHS works with families to safely care for children in their own home to reduce child abuse and neglect.
- *Child Welfare* – The Department operates Philadelphia's child abuse hotline, investigate allegations of child abuse and neglect, and help children involved with DHS achieve a permanent home. DHS manages the private organizations (Community Umbrella Agencies) that provide case management and other support services in 10 geographic regions throughout Philadelphia.
- *Foster and Adoption* – DHS contracts with state-licensed agencies who certify homes as placements for children and youth who are not safe in their own homes. The goal of foster care is to reunite children with

their families. When this is not possible, as determined by the courts, many resource parents choose to adopt the children who are in their care.

- *Juvenile Justice* – DHS operates the juvenile detention facility, manages contracts for court-ordered youth programs, and works to divert youth from the formal justice system through intensive prevention services.

Philadelphia Parks & Recreation

Philadelphia Parks & Recreation connects City residents to the natural world, each other, and fun things to do and see. Staff help manage parks, rec centers, playgrounds, and pools, permits for picnics, sports fields, and important venues, creative and inclusive programs, signature City events and important historic and cultural sites, trees in parks and along the public right of way, capital and natural lands projects, recreation paths, trails, and boat launches, community gardens, farms, and orchards, and special venues such as environmental education centers, the Dell Music Center, and ice skating rinks and golf courses.

Free Library of Philadelphia

The mission of the Free Library of Philadelphia is to advance literacy, guide learning, and inspire curiosity. Its vision is to build an enlightened community devoted to lifelong learning.

5.3.3.16 Office of Community Empowerment and Opportunity

The Office of Community Empowerment and Opportunity (CEO) is the Community Action Agency (CAA) for Philadelphia. As a CAA since 1964, the agency has a unique role in promoting racial equity, greater financial stability, and self-sufficiency for the City's most vulnerable populations. CEO's goal is to ensure that all Philadelphians can share in the City's prosperous future.

CEO advocates for, invest in, and hold gatherings around programs, policies, and initiatives that advance benefits access, financial empowerment, housing security, and workforce development.

As a CAA, the agency awards grant funding to organizations that serve thousands of Philadelphians each year. We also support and coordinate with other City agencies and institutions with similar goals.

5.3.3.17 Office of Diversity, Equity, and Inclusion

The Office of Diversity, Equity, and Inclusion (DEI) works with City departments, external partners, and community members to dismantle institutional and structural barriers that have held back many Philadelphia residents for too long. The office works to create a more equitable Philadelphia, where race, ethnicity, disability, gender, gender identity, sexual orientation, income, or neighborhood are not a determinant of success. It requires City government's policies, services, and distribution of resources to account for the distinct histories, challenges, and needs of different communities it serves. DEI focuses on several core priorities:

- Building a workforce that reflects the diversity of the communities served and a workplace culture that values inclusion and racial equity as both a process and outcome.
- Advancing a shared framework to embed racial equity as a governing principle in the City's budgeting, community engagement, service delivery, and significant strategic initiatives.
- Promoting equitable procurement, contracting, and entrepreneurship outcomes so that every person and every business has the chance to grow successfully including supporting commerce in neighborhoods that have been harmed by unequal lending practices.

- Working collaboratively with City departments, community partners, and other institutions to understand institutional racism, eliminate racial inequity, and improve outcomes for all, while paying closer attention to communities who are worse off.

5.3.3.18 Office of Emergency Management

OEM works to ensure the City of Philadelphia is ready for any kind of emergency. OEM works with organizations throughout the City to prepare for possible emergencies in the City, lessen their impact, and recover as quickly as possible. OEM teaches the public how to prepare for emergencies, develops public safety plans for major events within the City, oversees development of the City's plans for large-scale emergencies and disasters, conducts training and exercises to test the effectiveness of plans and policies, collects, analyzes, and disseminates incident information, coordinates, and supports responses to and recovery from emergencies, and obtains funding in support of preparedness for Philadelphia.

Operations Division

The Operations Division develops and applies technical infrastructure, systems and processes, and equipment to advance the preparedness mission of OEM. Operations contains the physical footprint of OEM and manages the City's Emergency Operations Center, Regional Integration Center, Mobile Command Post, response vehicle fleet, and warehouse. The division also focuses heavily on incorporating and innovating technology platforms and geospatial data to provide emergency responders and officials with prompt and comprehensive information on incidents. Operations directly supports the work of the Planning and Public Affairs divisions to ensure that emergency plan needs are met with reliable systems and equipment.

Planning Division

OEM's Planning Division leads citywide efforts developing strategies that address the risks posed by natural disasters, accidents, and human-caused incidents. These professionals conduct all-hazards planning and develop programs for health and human services, critical infrastructure protection and homeland security, public works and recovery, and training and exercises. As part of this process, they collaborate with departments and agencies from all levels of government and a range of non-governmental organizations.

Typical projects that OEM planners oversee include how the City handles incidents with mass casualties, mass fatalities, neighborhood and citywide evacuations, debris management, resource recovery, and evaluating public schools for use as emergency shelters.

Public Engagement Team

The Public Engagement team focuses on increasing community engagement and public awareness of emergency planning, preparedness, response, and recovery. Additionally, the public engagement team also focuses on increasing Philadelphia's emergency preparedness via the READYHome and READYBusiness workshops, and the READYCommunity program.

ReadyPhiladelphia

ReadyPhiladelphia is the City's notification system that provides emergency information. Some alerts may include for evacuations and shelter in place instructions, and the locations of emergency evacuation shelters for the public.

Information comes directly from the source: National Weather Service, Philadelphia Police, Philadelphia Fire, SEPTA, and the prisons in Northeast Philadelphia. The Philadelphia Department of Prisons oversees the testing and messaging for their alerts.

5.3.3.19 Office of Homeless Services

The Office of Homeless Services works with more than 60 individuals who are housing and service providers, as well as city, state, and federal governments. This system provides individuals who are unhoused prevention and diversion aid, as well as emergency and temporary housing, to people who are experiencing individuals who are unhoused and those at risk of individuals who are unhoused.

5.3.3.20 Office of Human Resources

The Office of Human Resources (OHR) works with City departments, agencies, boards, and commissions to attract and keep a talented and diverse workforce for the City of Philadelphia. The City employs over 25,000 people in more than 1,000 different job categories. OHR is committed to developing careers that make a difference in the lives of others. OHR promotes employee growth and development, ensures a supportive work environment, provides education and training programs, manages employee benefits, and makes sure employees understand City policies.

5.3.3.21 Office of Immigrant Affairs

The mission of the Office of Immigrant Affairs is to promote the well-being of Philadelphia's immigrant communities by recommending and developing policies and programs, which in turn provide opportunity and access to services. The Office helps facilitate the successful inclusion of immigrants into the civic, economic, and cultural life of the City.

5.3.3.22 Office of Innovation and Technology

The Office of Innovation and Technology (OIT) drives the City's technology strategy. The office creates innovative solutions to make government services more efficient and transparent. OIT manages major technology projects for the City and encourages municipal employees and the public to engage with technology in useful ways. OIT's responsibilities include:

- Setting and driving a technology strategy for the City of Philadelphia
- Providing for the technology needs of City departments and their employees
- Modernizing and securing the City's technology infrastructure
- Ensuring continuity of the City's technology operations
- Designing, developing, and supporting the City's web presence
- Managing technology programs and services to better serve residents

5.3.3.23 Office of LGBT Affairs

The Office of LGBT Affairs works to foster equitable working and living conditions for lesbian, gay, bisexual, transgender, and queer (LGBTQ) people and to advocate for LGBTQ issues in all areas of City government. Created in 2008 by mayoral executive order, the Office of LGBT Affairs became a permanent part of the City's charter in 2015. The office aims to develop City policy regarding civil rights issues affecting LGBTQ people, help enact policies and programs to meet the City's diversity, equity, inclusion goals, coordinate among City departments, agencies, and offices to improve LGBTQ access to services, and to promote equity and safety for LGBTQ people, support the

growth and development of the City's LGBTQ communities and serve as a liaison between the area's LGBTQ communities and the City, and provide education about the needs of the LGBTQ community.

5.3.3.24 Office of Policy and Strategic Initiatives for Criminal Justice and Public Safety

The Office of Policy and Strategic Initiatives for Criminal Justice and Public Safety (CJPS) develops and implements reforms in an equitable fashion informed by decades of systemic oppression, racism, and poverty. CJPS is focused on enhancing the well-being of communities by uplifting solutions to reduce violence, strengthening the bridge between neighborhoods and City government, and amplifying support for returning citizens and families impacted by the criminal justice system.

Office of Violence Prevention

The Office of Violence Prevention implements strategies and initiatives to prevent, reduce, and end violence in Philadelphia. The Office is particularly focused on addressing gun violence. The Office works to create safer communities by partnering with law enforcement, City agencies, and the community to develop and implement The Philadelphia Roadmap to Safer Communities, using data and research to inform our investments in violence prevention, and mobilizing supports and providing positive alternatives in communities to help boost resilience among residents impacted by violence.

Office of Criminal Justice

The Office of Criminal Justice (OCJ) advances the administration's goals of public safety and community well-being by reforming Philadelphia's criminal and juvenile justice systems. OCJ advances collaborative and data-driven strategies that foster meaningful community partnerships, identify and break down barriers to racial equity, increase opportunities for diversion away from the justice system, and safely reduce the jail population.

Office of Reentry Partnerships

The Office of Reentry Partnerships elevates and organizes citywide reentry efforts by serving as the City's hub for referrals, resources, and training. The goals of the Office of Reentry Partnerships are to:

- Set a clear vision and direction for a measurable citywide approach to improving reentry outcomes.
- Drive and sustain an unprecedented level of coordination between the local government, other government partners, service providers, education and training programs, employers, and community members.
- Ensure that City reentry initiatives are research- and data-driven.

Town Watch Integrated Services

Town Watch Integrated Services trains, organizes, and provides equipment to residents who want to be a part of Town Watch groups in their community. Town Watch volunteers patrol areas and document and report any suspicious or criminal activities. Membership includes law enforcement agencies, neighborhood and community groups, state and regional crime prevention associations, and a variety of businesses and civic groups.

Office of the Victim Advocate

The Office of the Victim Advocate works on behalf of victims of violent crime in Philadelphia. The Office assists victims and their loved ones, also known as co-victims, by assessing their needs, identifying viable short-term and long-term solutions, and connecting them with resources and services.

5.3.3.25 Office of Risk Management

The Office of Risk Management analyzes the City's insurance and other risk exposure issues, including managing claims, workers' compensation, and service-connected disabilities. The Office provides safety and loss prevention programs. The mission of the Office of Risk Management is to reduce the financial impact of claims, lawsuits, and employee injuries to the City, reduce the corresponding frequency and severity of these events through the application of professional risk management techniques, and provide a safe environment for employees to work and the public to enjoy.

5.3.3.26 Office of Sustainability

The Office of Sustainability (OOS) works with partners around the City to improve quality of life in all of Philadelphia neighborhoods through addressing environmental justice, reducing the City's carbon emissions, and preparing Philadelphia for a hotter and wetter future.

Environmental Justice Team

The Environmental Justice Team advances environmental justice through education, policy advising, directly resourcing frontline communities, and supporting the resident-led Environmental Justice Advisory Commission.

Climate Solutions Team

The Climate Solutions Team advances Philadelphia's citywide equitable clean energy transition to meet climate goals through building energy benchmarking and performance policies and is developing an energy poverty alleviation strategy through philanthropic support and funding opportunities, such as the Inflation Reduction Act.

Municipal Energy Office

The Municipal Energy Office reduces the City's carbon footprint through strategic management of its energy portfolio by reducing energy use, using smart procurement, and increasing the use of renewable sources.

Office of Climate Resilience

The Office of Climate Resilience communicates climate risk and develops programs, policies, and place-based strategies that reduce risk, protect residents, address historic injustice, and improve quality of life.

5.3.3.27 Office of Transportation and Infrastructure Systems

The Office of Transportation and Infrastructure Systems (OTIS) drives change through Philadelphia's transportation and infrastructure. OTIS works with local and national organizations to advance the City's interests. Through policies and programs, OTIS provides cost-effective, quality services with a focus on residents.

Office of Multimodal Planning

The Office of Multimodal Planning manages many initiatives of the City's Complete Streets program. Complete Streets are designed and operated to ensure safe access for all users, including pedestrians, bicyclists, motorists, and transit riders, regardless of age and physical ability.

Department of Streets

The Department of Streets designs, builds, and repairs the City's streets and roadways. In addition to picking up trash and recycling, we maintain and operate streetlights and traffic control devices. To help keep the City clean, safe, and moving, the Department performs the following actions:

- Construct and maintain 320 bridges and 2,525 miles of streets and highways.
- Gather data on traffic and evaluate causes of crashes.
- Manage programs like the Philadelphia More Beautiful Committee and SWEEP.
- Provide all surveying functions for the City of Philadelphia.
- Plan the location, time, and methods for street reconstruction.

Administration

The Administrative Division provides support services through the administrative services unit (budget and accounting), human resources unit, information services and technology unit and planning and public affairs unit.

Sanitation

The Sanitation Division manages the City's solid waste management system. The system includes trash and recycling collection and waste disposal. The division also cleans illegal dumping sites and disposes of abandoned tires, bulk items, and household hazardous waste.

The division manages community outreach and initiatives to encourage recycling and reduce litter. This includes Philadelphia More Beautiful Committee (PMBC), Streets, Walkways, Education, and Enforcement Program (SWEEP), Philly Spring Cleanup, and Philly Future Track.

Transportation

The Transportation Division is made up of the following:

- The Highways Unit safely maintains Philadelphia streets. The unit constructs, repairs, and maintains City streets, determines how and when streets are excavated, and responds to weather events like snow and ice. The Highways Unit also includes the Right-of-Way (ROW) Unit. The ROW Unit processes permit applications for street closures and temporary occupancies, like block parties and utility work, reviews plans for projects that impact the sidewalk and/or street, and reviews plans for capital improvement projects that affect transportation infrastructure.
- The Survey, Design & Construction Bureau designs City streets and highways. It also plans and constructs City bridges, through its Bridges Unit. The Survey, Design & Construction Bureau performs all surveying functions for the City, including supplying lines and grades, preparing street maps, creating plans and other land records, and maintaining all road records and street opening data.
- The Traffic Engineering Unit determines the type and location of all signs, signals, markings, and devices for regulating traffic.
- The Street Lighting Unit manages the City's street lighting system. The unit designs and maintains a network of over 100,000 lights, including roadway lights, pedestrian-scale lights, and alley lights.
- The Planning and Analysis Unit provides strategic planning and analysis support for the other units. Its work includes:

- Coordinating the bidding of all public works contracts and the solicitation of all professional services contracts for the department.
- Providing administrative support and coordination for all grant-funded Department of Streets projects.
- Coordinating new technology solutions for transportation operations and divisions.
- Coordinating the annual paving program and ADA curb ramp program, including the review of moratorium conflicts on recently paved streets.
- Reviewing all design plans and accepting as-built inspection records for all ADA curb ramp construction in the City.

Philadelphia Water Department

PWD serves over 2 million people in Philadelphia, Montgomery, Delaware, and Bucks counties. PWD works to deliver safe water to homes and businesses, protect our region's watersheds and the natural environment, maintain our sewer system so communities stay healthy, manage runoff from storms to prevent pollution and flooding, and keep thousands of miles of pipes in good operating condition.

5.3.3.28 Office of the Director of Finance

The Office of the Director of Finance (Finance) is charged with overseeing the City's financial, accounting, and budgetary functions, including establishing fiscal policy guidelines, overseeing the City's budget and financial management programs, and recording and accounting all City financial activities.

Finance administers the City's payroll activities and risk management functions, issues financial reports, and oversees expenditures and reports on all grants. Finance strives to ensure that the City maintains long-term fiscal stability while meeting its policy goals.

5.3.3.29 Solid Waste and Recycling Advisory Committee

The Solid Waste and Recycling Advisory Committee assists and advises the City on its waste management and recycling plans, policies, and programs. Its members include representatives from environmental groups, civic organizations, recycling and solid waste industry, and City agencies.

The mayor appoints Committee members based on recommendations from the Department of Streets commissioner and others.

5.3.3.30 City Treasurer's Office

The City Treasurer's Office (CTO) manages new and outstanding debt for the City, serves as the disbursement agent for all City-related payments, invests reserves and excess investment operating funds, and works to improve and maintain the credit rating for the City, Water Department, Gas Works, and Division of Aviation.

5.3.3.31 Delaware River Waterfront Corporation

The Delaware River Waterfront Corporation (DRWC) is a 501(c)3 nonprofit corporation organized exclusively for the benefit of the City of Philadelphia and its citizens. DRWC acts as the steward of the Delaware River waterfront to provide a benefit to all the citizens and visitors of the City.

The fundamental purpose of DRWC is to design, develop and manage the central Delaware River waterfront in Philadelphia between Oregon and Allegheny Avenues. DRWC intends to transform the central Delaware River

waterfront into a vibrant destination for recreational, cultural, and commercial activities for the residents and visitors of Philadelphia. DRWC will serve as a catalyst for high-quality investment in public parks, trails, maritime, residential, retail, hotel, and other improvements that create a vibrant amenity, extending the City of Philadelphia to the river's edge.

5.3.3.32 Philadelphia City Council

The 1951 Home Rule Charter established Council as the legislative arm of Philadelphia municipal government, consisting of seventeen members. Ten Councilmembers are elected by district and seven from the City-at-large. Each is elected for a term of four years with no limitations as to the number of terms that may be served. Under the rules of Council, regular public sessions of Council are held weekly.

5.3.3.33 Philadelphia Fire Department

The Philadelphia Fire Department (PFD) provides fire protection and emergency medical services (EMS) to the City of Philadelphia. The PFD is the largest fire department in Pennsylvania, with one of the busiest EMS divisions in the country. Members of the Fire Department fight fires, provide emergency medical treatment, and rescue people from dangerous situations. Engines, ladders, and ambulances are housed at 63 stations across the City. The PFD has specialized divisions that investigate fires, deal with hazardous materials, and help protect Philadelphia International Airport.

5.3.3.34 Philadelphia Gas Commission

The Philadelphia Gas Commission has general responsibility for overseeing the management and operation of the Philadelphia Gas Works (PGW) by the Philadelphia Facilities Management Corporation (PFMC) as pertaining to PGW's fiscal year budgets, real estate transactions, and procurement processes. The Pennsylvania Public Utility Commission has oversight over all other aspects of PGW's operations, including rate making and customer service/billing issues. PGW is a natural gas distribution operation owned by the City of Philadelphia. The PFMC is a non-profit corporation which operates PGW under contract with the City.

5.3.3.35 Philadelphia Housing Authority

The Philadelphia Housing Authority (PHA) develops, acquires, leases, and operates affordable housing for City residents with limited incomes. PHA works in partnership with City and State governments, as well as private investors for funding, though most funding comes from the Federal government.

5.3.3.36 Philadelphia Housing Development Corporation

The Philadelphia Housing Development Corporation (PHDC) is Philadelphia's full-service community development organization. PDHC repairs homes and finance affordable housing; help residents, community groups, businesses and developers repurpose vacant land; and support amenities that make neighborhoods great places to live.

Philadelphia Land Bank

The Philadelphia Land Bank manages most publicly owned land in Philadelphia. It is governed by an independent board of directors whose members are appointed by Philadelphia's Mayor and Council President.

Philadelphia Redevelopment Authority

The Philadelphia Redevelopment Authority (PRA) helps the City achieve its community development goals. It is governed by an independent five-member board appointed by the Mayor of Philadelphia.

5.3.3.37 Philadelphia Industrial Development Corporation

The Philadelphia Industrial Development Corporation (PIDC) is a nonprofit organization founded by the City of Philadelphia and the Chamber of Commerce for Greater Philadelphia in 1958. PIDC seeks to grow a global economy through inclusive economic development that ultimately achieves a high quality of life for all who live and work in Philadelphia. PIDC works with companies of all sizes driving growth to every corner of Philadelphia.

PIDC offers flexible financing tools, a targeted portfolio of industrial and commercial real estate, and decades of Philadelphia-based knowledge to help clients invest, develop, and grow. PIDC also structures and invests in public-private partnerships for key City policy areas and development priorities.

5.3.3.38 Philadelphia International Airport

Philadelphia International Airport is owned and operated by the City of Philadelphia. The Airport is self-supporting and does not use local tax dollars for its operation. Philadelphia International Airport is a major economic engine, generating more than $16.8 billion annually for the region's economy and supporting more than 106,000 full-time jobs in the 11-county Philadelphia MSA.

5.3.3.39 Philadelphia Police Department

The Philadelphia Police Department (PPD) is the nation's fourth-largest police department, with more than 6,000 sworn officers and 800 civilian employees. The department is divided into six police divisions, which are further divided into 21 police districts. PPD's mission is to make Philadelphia one of the safest cities in the country. The police department partners with communities across the City to:

- Fight crime, the fear of crime, and terrorism.
- Enforce laws while safeguarding people's constitutional rights.
- Provide quality service to all Philadelphia residents and visitors.
- Recruit, train, and develop an exceptional team of employees.

5.3.3.40 Philadelphia Regional Office of Emergency Medical Services

The Philadelphia Regional Office of Emergency Medical Services (PROEMS) is the "Regional EMS council." PROEMS is defined by PA Code, Title 28, § 1021.2 as a nonprofit incorporated entity or appropriate equivalent.

PROEMS plans, develops, and maintains EMS systems in the City of Philadelphia. It represents health professions and organizations involved with EMS in the City. PROEMS responsibilities include EMS agency licensing, ambulance inspection and licensing, medical command facility licensing and inspection, special event reporting, EMS education and certification, continuing education, and data collection.

5.3.3.41 PHLgovTV

PHLgovTV (formerly Channel 64) is part of the Philadelphia Cable Television Franchise Authority and is the broadcast network for City government agencies and departments. The goal of this channel is to provide information

about City services, attractions, and activities. Programming includes news, legislative affairs, announcements, and public notices from the City of Philadelphia.

5.3.3.42 Philly311

The Philly311 contact center is Philadelphia's customer service center for non-emergency inquiries. Requests for service can be submitted via telephone, mobile application, and web application. Philly311 directs requests to the right department and provides updates as the situation changes. Philly311 can help submit a service request or report an issue, track status updates for requests submitted, look at nearby community requests, and find frequently asked-for information.

5.3.3.43 School District of Philadelphia

All sectors of public education in Philadelphia work with urgency to provide every student with the opportunity to achieve positive life outcomes in partnership with diverse families, educators, and community members who are valued and respected. The School District seeks to prepare students to imagine and realize any future they desire.

5.3.3.44 SEPTA

SEPTA (Southeastern Pennsylvania Transportation Authority) is one of the largest transit systems in the country. SEPTA supports five counties in the Greater Philadelphia area and connects to regional transit systems in Delaware and New Jersey. Services include regional rail, buses, trolleys, subways, and a high-speed line. A 15-member board runs SEPTA; and City, county, and state officials choose the members.

5.4 FINANCIAL CAPABILITY

This section summarizes fiscal capabilities in the City of Philadelphia. The *Capability Assessment* section of the Pennsylvania 2023 State Hazard Mitigation Plan features a section on mitigation-related funding administered by state agencies that eligible jurisdictions can use to fund mitigation actions.

5.4.1 Federal

As noted on the FEMA hazard mitigation assistance website, FEMA administers five programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages (FEMA n.d.). The programs are the Hazard Mitigation Grant Program (HMGP), and the HMGP Post Fire Grant, the Flood Mitigation Assistance (FMA) Program, and the Pre-Disaster Mitigation (PDM) Program. Table 5-1 provides an overview of program funding eligibility and cost share.

Table 5-1. FEMA HMA Grant Cost Share Requirements

Programs	Cost Share (% of Federal / Non-Federal Share)
HMGP	75 / 25
HMGP Post Fire	75 / 25
FMA (community flood mitigation, project scoping, individual mitigation of insured properties, and planning grants)	75 / 25
FMA—repetitive loss property[2]	90 / 10

Programs	Cost Share (% of Federal / Non-Federal Share)
FMA—severe repetitive loss property[2]	100 / 0
PDM	75 / 25
PDM—small and impoverished community	Up to 90 / 10

Source: FEMA 2023; FEMA 2023

Sub-applicants should consult their State Hazard Mitigation Officer (SHMO) for the amount of percentage of HMGP subrecipient management cost funding their State has determined to be passed through subrecipients.

To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

HMGP assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. PDM provides funds for hazard mitigation planning and projects on an annual basis. FMA provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the NFIP on an annual basis (FEMA 2023).

HMGP funding is generally 15 percent of the total amount of Federal assistance provided to a State, Territory, or federally recognized tribe following a major disaster declaration. PDM and FMA funding depends on the amount congress appropriates each year for those programs.

Individual homeowners and business owners may not apply directly to FEMA. Eligible local governments may apply on their behalf (FEMA 2023).

Federal mitigation grant funding is available to all communities with a current hazard mitigation plan (this plan); however, most of these grants require a “local share” in the range of 10-25 percent of the total grant amount. The FEMA mitigation grant programs are described below.

5.4.1.1 FEMA

Assistance to Firefighters Grant Program

The goal of the Assistance to Firefighters Grants is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated emergency medical services organizations, and state fire training academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.

Emergency Management Performance Grants Program

The Emergency Management Performance Grant (EMPG) provides state, local, tribal, and territorial emergency management agencies with the resources required for implementation of the National Preparedness System and works toward the national preparedness goal of a secure and resilient nation. The EMPG’s allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery mission areas.

Extraordinary Circumstances

For FMA project subawards, the FEMA Region may apply extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

For HMGP and FMA, extraordinary circumstances exist when a determination is made by the Applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the State (Standard or Enhanced) Mitigation Plan and that the jurisdiction meets at least one of the criteria below. If the jurisdiction does not meet at least one of these criteria, the Region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; however, for FMA the Region must coordinate and seek concurrence prior to granting an exception:

- The jurisdiction meets the small, impoverished community criteria (see Part VIII, B.2).
- The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.
- The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the State, federally recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or Tribal Mitigation Plan.

For HMGP and FMA, the Applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement and identifies the specific actions or circumstances that eliminated the deficiency.

When an HMGP project funding is awarded under extraordinary circumstances, the Recipient shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The Recipient must provide a work plan for completing the local or Tribal Mitigation Plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements if a planning subaward is also awarded).

Flood Mitigation Assistance Program

The FMA program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP-insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75 percent. At most, 25 percent of the total eligible costs must be provided by a non-federal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. The PEMA serves as the grantee and program administrator for the FMA program.

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard-prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements, and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved hazard mitigation plan (this plan).

Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to PEMA and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available.

Homeland Security Grant Program

The Homeland Security Grant Program (HSGP) plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. The program supports efforts to build and sustain core capabilities across the Prevention, Protection, Mitigation, Response, and Recovery mission areas. This includes two priorities: building and sustaining law enforcement terrorism prevention capabilities and maturation and enhancement of state and major urban area fusion centers. HSGP is composed of three interconnected grant programs including the State Homeland Security Program, Urban Areas Security Initiative (UASI), and Operation Stonegarden. Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration.

Rehabilitation of High Hazard Potential Dams Program

The Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.

The HHPD Grant Program will provide assistance for technical, planning, design, and construction activities toward repair, removal, and structural/nonstructural rehabilitation of eligible high hazard potential dams.

State and Local Cybersecurity Grant Program

The State and Local Cybersecurity Grant Program provides funding to eligible entities to address cybersecurity risks and threats to information systems owned or operated by, or on behalf of, state, local, or tribal governments.

5.4.1.2 Disaster and Recovery Assistance Programs

Following a disaster, various types of assistance may be made available by local, state, and federal governments. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. Among the general types of assistance that may be provided should the President of the United States declare the event a major disaster includes the following:

Individual Assistance

Individual Assistance (IA) provides help for homeowners, renters, businesses, and some nonprofit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration and facilitated by FEMA. For homeowners and renters, those who suffered uninsured or underinsured losses may be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals may borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property, and an additional 20 percent for mitigation. For businesses, loans may be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Nonprofit organizations such as charities, churches, private universities, etc. are also eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster. These loans are restricted, by law, to small businesses only.

Public Assistance

Public Assistance (PA) provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain nonprofit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required.

Small Business Administration Loans

The Small Business Administration (SBA) provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Homeowners may apply for up to $200,000 to replace or repair their primary residence. Renters and homeowners may borrow up to $40,000 to replace or repair personal property (such as clothing, furniture, cars, and appliances) damaged or destroyed in a disaster. Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations.

5.4.1.3 National Park Service

Land and Water Conservation Fund

The Land and Water Conservation Fund (LWCF) was established by Congress in 1964 to fulfill a bipartisan commitment to safeguard natural areas, water resources, and cultural heritage, and to provide recreation opportunities. Using no taxpayer dollars, the LWCF invests earnings from offshore oil and gas leasing to help strengthen communities, preserve history, and protect the national endowment of lands and waters. The LWCF program is divided into the “State Side,” which provides grants to State and local governments, and the “Federal Side,” which is used to acquire lands, waters, and interests therein necessary to achieve the natural, cultural, wildlife, and recreation management objectives of federal land management agencies. The LWCF was permanently reauthorized in 2019 and permanently funded in August 2020.

5.4.1.4 Restore America's Estuaries

Coastal Watersheds Grant Program

Restore America's Estuaries, in close coordination with and financial support from EPA, administers the National Estuary Program (NEP) Coastal Watersheds Grant Program. This grant program funds projects within the geographic areas shown here and supports the following Congressionally set priorities:

- Loss of key habitats resulting in significant impacts on fisheries and water quality such as seagrass, mangroves, tidal and freshwater wetlands, forested wetlands, kelp beds, shellfish beds, and coral reefs.
- Recurring harmful algae blooms.
- Unusual or unexplained marine mammal mortalities.
- Proliferation or invasion of species that limit recreational uses, threaten wastewater systems, or cause other ecosystem damage.
- Flooding and coastal erosion that may be related to sea-level rise, changing precipitation, or salt marsh, seagrass, or wetland degradation or loss.
- Impacts of nutrients and warmer water temperatures on aquatic life and coastal ecosystems, including low dissolved oxygen conditions in estuarine waters.
- Contaminants of emerging concern found in coastal and estuarine waters such as pharmaceuticals, personal care products, and microplastics.

5.4.1.5 U.S. Department of Agriculture

Community Facilities Direct Loan and Grant Program

This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area and does not include private, commercial, or business undertakings. Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment, and pay related project expenses. Rural areas including cities, villages, townships, towns, and federally recognized tribal lands, with no more than 20,000 residents according to the latest U.S. Census, are eligible for this program.

Emergency Loan Program

The Emergency loan program is triggered when a natural disaster is designated by the Secretary of Agriculture, or a natural disaster or emergency is declared by the President under the Stafford Act. These loans help producers who suffer qualifying farm-related losses directly caused by the disaster in a county declared or designated as a primary disaster or quarantine area. Also, farmers located in counties that are contiguous to the declared, designated, or quarantined area may qualify for emergency loans.

For production losses, a 30 percent reduction in a primary crop in a designated or contiguous county is required. Losses to quality, such as receiving a 30 percent reduced price for flood-damaged crops, may be eligible for assistance, too.

Emergency Watershed Protection Program

The Emergency Watershed Protection (EWP) Program, a federal emergency recovery program, helps local communities recover after a natural disaster. The EWP program offers technical and financial assistance to help local communities relieve imminent threats to life and property caused by floods, fires, windstorms, and other natural disasters that impair a watershed. EWP does not require a disaster declaration by federal or state government officials for program assistance to begin. The Natural Resources Conservation Service (NRCS) state conservationist can declare a local watershed emergency and initiate EWP program assistance in cooperation with an eligible sponsor. The sponsor must sign a cooperative agreement with NRCS. The EWP program offers financial and technical assistance for various activities, including the following:

- Removal of debris from stream channels, road culverts, and bridges
- Reshape and protect eroded streambanks
- Correct damaged or destroyed drainage facilities
- Establish vegetative cover on critically eroding lands
- Repair levees and structures
- Repair certain conservation practices
- Buyouts

Additional information regarding the EWP is detailed below and available on the website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/.

EWP – Recovery

The EWP – Recovery program is aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that must be a legal subdivision of the state, such as a city, county, township, or conservation district, and Native American Tribes or Tribal governments. NRCS will pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

EWP – Recovery work is not limited to any one set of measures. The program is designed for the installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a Damage Survey Report, which provides a case-by-case investigation of the work necessary to repair or protect a site. Watershed impairments that the EWP Program addresses are debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructures, wind-borne debris removal, and damaged upland sites stripped of protective vegetation by fire or drought.

EWP – Floodplain Easement

Privately owned lands or lands owned by local and state governments might be eligible for participation in the EWP – Floodplain Easement program. To be eligible, lands must meet one of the following criteria:

- Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years
- Other lands within the floodplain that would contribute to the restoration of flood storage and flow, provide for control of erosion, or improve the practical management of the floodplain easement
- Lands that would be inundated or adversely impacted as a result of a dam breach

Through this program, easements are restored to the natural environment to the extent practicable. Work can include both structural and nonstructural practices to restore flood storage and flow, control erosion, and improve the practical management of the easement.

Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand the collective ability to address on-farm, watershed, and regional natural resource concerns. Through this program, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.

5.4.1.6 U.S. Department of Health and Human Services

Social Services Block Grant Program

The Social Services Block Grant program is a flexible funding source that allows states and territories to tailor social service programming to their population's needs. Through this program, states provide essential social services that help achieve a myriad of goals to reduce dependency and promote self-sufficiency; protect children and adults from neglect, abuse, and exploitation; and help individuals who are unable to take care of themselves to stay in their homes or to find the best institutional arrangements.

5.4.1.7 U.S. Department of Housing and Urban Development

Community Development Block Grants

Community Development Block Grants (CDBG) are federal funds intended to provide low- and moderate-income households with viable communities, including decent housing, as suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements. In limited instances, and during the times of "urgent need" (e.g., post-disaster) as defined by the CDBG National Objectives, CDBG funding may be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. Additional information regarding CDBG is available on the website: https://www.hudexchange.info/programs/cdbg-entitlement/.

Community Development Block Grant Disaster Recovery (CDBG-DR) grant funds are appropriated by Congress and allocated by HUD to rebuild disaster-impacted areas and provide crucial seed money to start the long-term recovery process. These flexible grants help cities, counties, Indian tribes, and States recover from presidentially declared disasters, especially in low-income areas, subject to the availability of supplemental appropriations. Since CDBG-DR assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources.

Disaster Housing Assistance Program

The Disaster Housing Assistance Program provides emergency assistance for housing, including minor repairs of the home to establish livable conditions, mortgage, and rental assistance.

HOME Investment Partnerships Program

The HOME Investment Partnerships Program (HOME) provides grants to states and localities that communities use—often in partnership with local nonprofit groups—to fund a wide range of activities, including building, buying, and/or rehabilitating affordable housing for rent or homeownership or providing direct rental assistance to low-income people. HOME is the largest federal block grant to state and local governments designed exclusively to create affordable housing for low-income households. HOME funds are awarded annually as grants to participating jurisdictions. The program's flexibility allows states and local governments to use HOME funds for grants, direct loans, loan guarantees or other forms of credit enhancements, or rental assistance or security deposits.

The program's requirement that participating jurisdictions match 25 cents of every dollar in program funds mobilizes community resources in support of affordable housing.

Section 108 Loan Guarantee Program

The Section 108 Loan Guarantee Program (Section 108) provides communities with a source of low-cost, long-term financing for economic and community development projects. Section 108 financing provides an avenue for communities to undertake larger, more costly projects, where they may have limited resources to invest upfront.

Section 108 can fund economic development, housing, public facilities, infrastructure, and other physical development projects, including improvements to increase resilience against natural disasters. This flexibility of use makes it one of the most potent and important public investment tools that HUD offers to states and local governments.

Section 108 assistance can be deployed in two ways:

- Directly by the community or its governmental or non-profit partner to carry out an eligible project
- Indirectly with a community or its partner re-lending (or, in limited circumstances, granting) the funds to a developer or business to undertake an eligible project

5.4.1.8 U.S. Department of Transportation

Federal Highway Administration Emergency Relief

Federal Highway Administration (FHWA) Emergency Relief is a grant program that can be used for the repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of a disaster. The program is appropriated $100 million annually. For information regarding the FHWA Emergency Relief Program, refer to the following link: https://www.fhwa.dot.gov/programadmin/erelief.cfm

Federal Transit Administration Emergency Relief

Federal Transit Authority (FTA) Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the FTA and directly allocated to mass transit and port authorities, this transportation-specific fund was created as an alternative to FEMA's PA. Additional information regarding the FTA Emergency Relief Program is available on the website: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program.

Federal Highway Administration Recreational Trails

The Recreational Trails Program is an assistance program that provides funds to states to develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized recreational trail uses. The program requires that states use 30 percent of funds for non-motorized recreation, 30 percent for motorized recreation, and 40 percent for diverse recreational trail use.

Hazardous Materials Emergency Preparedness Planning and Training Grants

Federal Hazardous Material Law authorizes the U.S. Department of Transportation (USDOT) to aid public sector employees through planning and training grants to states, territories, and Native American tribes for emergency response.

The purpose of this grant program is to increase effectiveness in safely handling hazardous materials accidents and incidents, enhance implementation of the Emergency Planning and Community Right-to-Know Act of 1986, and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations.

The USDOT Research and Special Programs Administration, under a program that began in 1993, provides a reimbursable grant to every state to assist in hazardous materials response planning and related training activities.

Rebuilding American Infrastructure with Sustainability and Equity Grant Program

The Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant program provides an opportunity for the USDOT to invest in road, rail, transit, and port projects that promise to achieve national objectives. The RAISE program enables USDOT to examine these projects on their merits to help ensure that taxpayers are getting the highest value for every dollar invested.

The eligibility requirements of RAISE allow project sponsors at the state and local levels to obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional USDOT programs. RAISE can provide funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, or others, in contrast to traditional federal programs that provide funding to very specific groups of applicants (mostly state departments of transportation and transit agencies). This flexibility allows RAISE and USDOT partners at the state and local levels to work directly with a host of entities that own, operate, and maintain much of that nation's transportation infrastructure but otherwise cannot turn to the federal government for support.

5.4.1.9 U.S. Economic Development Administration

The U.S. Economic Development Administration (USEDA) is an agency of the U.S. Department of Commerce that supports regional economic development in communities around the country. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States. Through its Public Works Program, USEDA invests in key public infrastructure, such as in traditional public works projects, including water and sewer systems improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications, and development facilities. Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business, in areas that have experienced or are under threat of serious structural damage to the underlying economic base.

Public Works Program

Through its Public Works Program, USEDA invests in key public infrastructure, such as traditional public works projects, including water and sewer system improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications facilities, and development facilities.

Economic Adjustment Program

Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business in areas that have experienced or are under threat of serious structural damage to the underlying economic base.

5.4.1.10 U.S. Environmental Protection Agency

Smart Growth Implementation Assistance Program

The Smart Growth Implementation Assistance program focuses on complex issues such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under four categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting.

Clean Water Act Section 604(b) Water Quality Planning Grants

Water Quality Planning Grants provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. Funds are to be used for water quality management planning activities, including tasks to determine the nature, extent, and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.

5.4.1.11 U.S. Fish and Wildlife Service

Partners for Fish and Wildlife

The Partners for Fish and Wildlife Program provides free technical and financial assistance to landowners, managers, tribes, corporations, schools, and nonprofits interested in improving wildlife habitat on their land. These projects range in size from a wetland of a few acres to a grassland restoration covering several hundred thousand acres.

Many Partners for Fish and Wildlife projects take place on working landscapes such as forests, farms, and ranches. Efforts are focused on areas of conservation concern, such as upland forests, wetlands, native prairies, marshes, rivers, and streams. Projects are designed to benefit federal trust species including migratory birds and endangered, threatened, or at-risk species.

5.4.2 State

5.4.2.1 Department of Community and Economic Development

Business Financing

Several programs under the DCED general program category could be used to help businesses finance a mitigation-related activity. All projects must demonstrate that a certain number of jobs will either be retained or created. These programs have not been itemized for this plan because of the wide variety of state programs in existence. Each application for these state funds must be customized and/or tailored to fit the economic development criteria. Therefore, it is recommended that each applicant meet with the central office or field economic development staff specialists of the department before completing online applications.

H2O PA

This program, offered through the DCED, provides single-year or multi-year grants to the Commonwealth, independent agencies, municipalities, or municipal authorities for the construction, improvement, repair, or rehabilitation of all or part of a flood control system. Funding is for a minimum of $500,000 or more and a maximum amount of $20 million for any project. Types of flood control projects may include channel improvements, compacted earth levees, concrete channels, concrete floodwalls, detention dams, non-structural measures, or any combination of these project types. Major repairs or rehabilitation of an existing flood protection project would also be eligible.

Keystone Communities Program

This program provides a funding pathway for local initiatives that are focused on developing neighborhoods through social and economic diversity and revitalization. Communities can obtain a designation that opens them up for targeted investment for specific needs or development.

Land Use Planning & Technical Assistance Program

This program provides grants for comprehensive plans and for the preparation of local zoning or subdivision. The leading mitigation technique associated with this program is Local Plans and Regulations as it provides funding to amend or develop comprehensive plans to include an assessment of hazard vulnerability and take appropriate mitigation measures.

Local Municipal Resources and Development Program

The program provides grants from a minimum of $5,000 up to $25,000 for infrastructure rehabilitation, acquisition and demolition of structures, and revitalization of community facilities.

Abandoned Mine Drainage Abatement and Treatment Program

Act 13 of 2012 establishes the Marcellus Legacy Fund and allocates funds to the Commonwealth Financing Authority for abandoned mine drainage, abatement, and treatment with the Abandoned Mine Drainage Abatement and Treatment Program. Abandoned mine drainage is one of the largest sources of stream impairment in the Commonwealth of Pennsylvania. Billions of gallons of abandoned mine drainage impair over 5,500 miles of streams within the Commonwealth.

Baseline Water Quality Data Program

Act 13 of 2012 establishes the Marcellus Legacy Fund and allocates funds to the Authority to be used fund statewide initiatives to establish baseline water quality data on private water supplies using the Baseline Water Quality Data Program.

Flood Mitigation Program

Act 13 of 2012 allocates funds to the Authority for funding statewide initiatives to assist with flood mitigation projects.

Greenways, Trails, and Recreation Program

Act 13 of 2012 allocates funds to the Authority for planning, acquisition, development, rehabilitation, and repair of greenways, recreational trails, open space, parks, and beautification projects under the Greenways, Trails, and Recreation Program. Projects can involve development of or rehabilitation and improvements to public parks, recreation areas, greenways, and trails; and designing river conservation methods.

Orphan or Abandoned Well Plugging Program

Act 13 of 2012 establishes the Marcellus Legacy Fund and allocates funds to the Authority for funding orphan or abandoned well plugging projects using the Orphan or Abandoned Well Plugging Program. Pennsylvania has had hundreds of thousands of oil and gas wells drilled since 1859. This program provides a mechanism to plug abandoned and orphaned wells that have the potential to cause health, safety, or environmental concerns.

Sewage Facilities Program

Act 13 of 2012 establishes the Marcellus Legacy Fund and allocates funds to the Authority for statewide initiatives for complying with the Act of January 24, 1966, known as the Pennsylvania Sewage Facilities Act.

Watershed Restoration and Protection Program

Act 13 of 2012 establishes the Marcellus Legacy Fund and allocates funds to the Authority for watershed restoration and protection projects. The overall goal of this program is to restore and maintain restored stream reaches impaired by the uncontrolled discharge of non-point source polluted runoff, and ultimately to remove these streams from the DEP's Impaired Waters list.

Municipal Assistance Program

The program provides funding to help local governments to plan for and efficiently implement a variety of services and improvements and soundly manage development with an emphasis on intergovernmental approaches. Funding is available for three groups of activities: shared services, community planning, and floodplain management.

- Shared service activities: consolidating or regionalizing shared services among multiple counties and municipalities boundary change studies, shared personnel, and shared equipment. New or expanded intergovernmental initiatives that promote local governmental efficiencies and effectiveness.
- Community planning: comprehensive plans and parts thereof, land use ordinances, Transit Revitalization Investment District planning studies and entrepreneurial/innovative plans that support community and economic development improvements with an emphasis on multi-municipal plans.
- Floodplain management: reimbursement for costs of preparation, enactment, administration, and enforcement of floodplain management regulations pursuant to the Floodplain Management Act.

Grants of up to 50 percent eligible costs are available; the program is administered by the Governor's Center for Local Government Services within the Department of Community and Economic Development.

Pennsylvania Technical Assistance Program

The Pennsylvania Technical Assistance Program helps Pennsylvania companies improve their competitiveness, by providing a limited amount of free technical assistance to resolve specific technical questions or needs, while it facilitates connections to other relevant information, resources and/or programs. This program is a statewide network of geographically dispersed technical specialists with expertise in a variety of focus areas, including advanced information technology, environmental compliance, energy efficiency and conservation, operations improvement, occupational safety and health, product development, federal Small Business Innovation Research/Small Business Technology Transfer proposal development, technology transfer and commercialization. The program focuses on smaller businesses that typically lack the expertise and/or resources to address these types of issues in-house.

5.4.2.2 Department of Conservation and Natural Resources

Community and Watersheds Forestry Program

Through this program, the Department of Conservation and Natural Resources (DCNR) provides financial assistance to riparian forest buffer installations, lawn conversions, community tree-planting, and other projects that produce buffers in an effort to protect water resources. Grants can be used for research, development, design, and implementation.

Community Conservation Partnerships Program

Through this program, the DCNR provides a wide range of technical assistance and grants for land acquisition, park rehabilitation and development, and small community development projects.

Emergency Solutions Grant

Emergency Solutions Grant is a grant providing funding to assist with the rapid rehousing of individuals who are unhoused, street outreach, homelessness prevention, and emergency shelter activities. Funds may also be used to support the maintenance of a homelessness management information system (HMIS) and administration. This program is authorized by McKinney-Vento Homeless Assistance Act as amended by the Homeless Emergency Assistance and Rapid Transition to Housing Act of 2009.

Grant Equity Workshop

The DCNR chairs a statewide grant equity workgroup, primarily working with state agencies on terminology and opportunities to increase in the grant administration and implementation process. In the Fall of 2021, the agency surveyed 541 agencies including county and local governments, for- profit and non-profit agencies, religious organizations, grant and financial consultants, education institutions, and other agencies. The survey included questions about what populations the entities serve, how, and then a number of questions about the Commonwealth's grant process. Respondents noted challenges with securing matching funds, obtaining cost estimates, and obtaining supplemental documentation (maps, construction drawings, resolutions). Many of the respondents scored determining eligibility and obtaining letters of support as very easy.

For the Commonwealth to make finding grants easier, participants recommended clear grant listings and a central site/ unified system to house funding opportunities by category, workforce development, vocational training, women

in the workplace, etc. Those surveyed also requested getting reimbursed within 30 days, increasing the limit of allowable expenditures on personnel, and decreasing the reporting requirements for awards under $5,000. There was also a request to designate funds for smaller projects.

Keystone Communities Program

The Keystone Communities Program (KCP) program is designed to encourage the creation of partnerships between the public and private sectors that jointly support local initiatives such as the growth and stability of neighborhoods and communities; social and economic diversity; and a strong and secure quality of life. The program allows communities to tailor the assistance to meet the needs of its specific revitalization effort.

Communities may wish to consider designation through the KCP program as a Keystone Main Street, Keystone Elm Street, Keystone Enterprise Zone, or Keystone Community. Designation is an opportunity for targeted investment and development including the identification of specific needs for investment and/or development and the design and implementation of a strategy to address those needs.

Local Share Account – Philadelphia

The DCED established the Local Share Account—a Philadelphia program to distribute a portion of slot machine license operation fees from Category 1 or 2 facilities operating within the City of Philadelphia. Funds are available for economic development, neighborhood revitalization, community improvement, and other projects in the public interest within the City of Philadelphia.

Multifamily Weatherization Assistance Program

Pennsylvania's Multifamily Weatherization Assistance Program provides a cost-effective approach to lowering operating expenses, maintaining affordability, and creating healthier, more comfortable living environments for low-income families living in buildings with 5 or more units.

Pennsylvania Recreational Trails Program

The Pennsylvania Recreational Trails (PRT) Program is an assistance program of the USDOT FHWA. FHWA provides funds to states to develop and maintain recreational trails and trail-related facilities for motorized and non-motorized recreational trail uses. The DCNR has been designated as the state agency responsible for administering this federal program in Pennsylvania.

Pennsylvania Rivers Conservation Program

The Department of Conservation and Natural Resources administers this program to provide technical and financial assistance to municipalities and river support groups to carry out planning, implementation, acquisition, and development activities to preserve and enhance river resources. Grants can be used for planning, implementation, development, and acquisition.

5.4.2.3 Department of Drug and Alcohol Programs

Pennsylvania's Recovery Housing Program

This program supports demolition, debris removal, rehabilitation improvements, environmental remediation costs, construction, and inspections needed for existing or new recovery housing facilities to meet Pennsylvania's

Recovery Housing licensure requirements. Also, financial assistance is available for those seeking recovery housing program licensure.

Regional Recovery Hubs Grant Program

Nine Regional Recovery Hubs will be established to work in partnership with recovery community leaders to conduct ongoing needs assessment through surveys and focus groups and provide technical assistance to organizations providing recovery supports that will enhance and promote recovery within each region. There are nine grants available, one for each region.

Services to Black, Indigenous, and People of Color Communities Grant Program

This program provides funding for organization to establish or expand substance use disorder services, community outreach, and education to Black, Indigenous, and People of Color (BIPOC) communities to reduce racial inequalities in outcomes. Eligible activities include harm reduction services, promoting access to treatment and recovery support, and offender reentry support. Funds can be used for construction, infrastructure, staffing, and evidence-based programming.

5.4.2.4 Department of Environmental Protection

Act 13 Impact Fee (Oil and Gas Act 13 of 2012)

Impact fees support county conservation districts, the Pennsylvania Fish and Boat Commission, PUC, DEP, PEMA, the Pennsylvania Office of State Fire Commissioner, and PennDOT to address statewide issues and local municipalities to address water, wastewater, and road infrastructure maintenance and improvements; emergency preparedness; environmental programs; tax reductions; increased safe/affordable housing; employee training; or planning initiatives.

Flood Protection Program

This program, offered through the DEP, responds to requests from municipalities, state and federal legislators, county and state government officials, and private residents to investigate flood problems within the Commonwealth of Pennsylvania and determine the feasibility of providing a solution to these flood problems. The program considers long term structural solutions to a community's flood problem by evaluating the magnitude and frequency of flooding, performing a hydrologic and hydraulic analysis, evaluating flood protection alternatives, estimating construction costs, assessing environmental impacts, performing an economic analysis, determining local sponsor responsibilities, and designing and constructing the project.

Growing Greener Plus Grants Program

Pennsylvania's Growing Greener Plus Program provides grants to assist individuals, groups, and businesses in addressing a host of environmental issues. The Growing Greener Plus Program remains the largest single investment of state funds in Pennsylvania's history to address Pennsylvania's critical environmental concerns of the 21st century. The program encourages partnerships between counties, municipalities, county conservation districts, watershed organizations, and other groups to restore and protect the environment.

Mine Subsidence Insurance

In 1961, the Commonwealth of Pennsylvania established the Mine Subsidence Insurance Fund to provide a reliable source of insurance against losses caused by underground coal and clay mine subsidence. The Mine Subsidence

Insurance Board, through the DEP, administers this nonprofit insurance fund, which is sustained by its policyholders' premiums. Mine Subsidence Insurance provides property owners with insurance coverage if they are located within coal mining regions of Pennsylvania. Property owners can use a website at https://gis.dep.pa.gov/pamsi/index.html to check for local mine conditions, submit Mine Subsidence Insurance coverage applications or they can call 1-800-922-1678 to speak to a program representative.

Non-Point Source Implementation Program (Section 319)

This program provides funding to assist in implementing Nonpoint Source Management Program. This includes funding for abandoned mine drainage, agricultural and urban run-off, and natural channel design/stream bank stabilization projects, as well as for development of watershed-based restoration plans.

Small Business Advantage Grant

The Small Business Advantage Grant provides reimbursement grants ranging from 50 to 80 percent of eligible project costs to Commonwealth small businesses to improve energy efficiency or reduce pollution or waste by upgrading or replacing equipment or supplies; improving processes; or reducing runoff into affected waterways.

Steam Improvement Program

This DEP program offers assistance by designing and constructing small projects to reduce flooding, protect structures from streambank erosion, and to restore degraded stream channels.

5.4.2.5 Department of Health

Environmental Health Capacity Program

This program is funded by the Centers for Disease Control (CDC) and aims to detect, prevent, and control environmental health hazards by partnering with state agencies, universities, non-profit partners, and community-based advocates and stakeholders. Current initiatives and focuses include:

- Environmental Health Indicators (EHI) Map
- Harmful Algal Blooms
- Families with Young Children
- Private Well Water

Health Assessment Program

This program begun in 1989 to publish reports on toxic waste sites and other environmental hazards in Pennsylvania. It is funded by the Agency for Toxic Substances and Disease Registry. Community members, health care professionals, private organizations, and other government agencies may request an assessment or health consultation to better understand the public health impact of an environmental issue. The three types of documents it produces range from short letters to comprehensive and lengthy reports, depending on the issue.

Pennsylvania Substance Use Navigation

This initiative started in 2021 to enhance treatment options for patients with substance use disorder by increasing access to medication-assisted treatment. The program offers Emergency Departments free technical assistance, consultation, and support from expert opioid medical consultant clinicians to increase the overall preparedness of these departments in initiating and facilitating treatment.

5.4.2.6 Department of Human Services

Emergency Rental Assistance Program

The Emergency Rental Assistance Program (ERAP) was created in order to allocate the approximately $1.3 billion in funding received from the Consolidated Appropriations Act of 2021 and the American Rescue Plan Act to assist renters affected by the COVID-19 pandemic and economic insecurity. The initial phase of the program, ERAP1, ran from March 8, 2021 to September 30, 2022. ERAP2, an expanded version that allowed more funding for administration and housing stability services along with direct to tenant payments, was actively taking applications during the development of this plan. As of September 30, 2022, counties had processed hundreds of thousands of applications, kept more than 182,000 households in their homes, and granted over $1 billion in funds. The Pennsylvania Department of Human Services (PADHS) provided trainings and presentations on how counties could utilize funds and ways to create synergies with other existing housing programs, especially for those that focus on vulnerable populations like veterans, those with disabilities, and older adults.

Heating Assistance/Low-Income Home Energy Assistance Program

This program helps low-income families, both renters and owners, pay heating bills through cash grants in the form of a one-time payment sent directly to utility companies or fuel providers. Households in immediate danger of being without heat can also qualify for crisis grants; instances include broken heating equipment, lack of fuel, and imminent service termination.

5.4.2.7 Pennsylvania Broadband Development Authority

Affordable Connectivity Program

This program, through the Federal Communications Commission (FCC), provides eligible households $30 each month off their internet bills and a one-time discount of up to $100 to purchase a laptop, desktop computer, or tablet. To be eligible for the program, a household must meet one of the following criteria:

- A household income at or below 200 percent of Federal Poverty Guidelines
- A member of the household is eligible for a participating provider's existing low-income internet program
- A member of the household participants in an eligible federal assistance program such as Medicaid or Public Housing
- A member of the household received a Federal Pell Grant during the current award year

In addition to funding service and device discounts, the program also provides outreach grants so that eligible households may be notified to apply. The current income limits by household size and qualifying federal assistance programs can be found at: https://dced.pa.gov/programs-funding/broadband-in-pennsylvania/affordable-connectivity-program/

COVID-19 American Rescue Plan Act Pennsylvania Broadband Infrastructure Program

This program utilizes funds from the COVID-19 Capital Project Fund established under the American Rescue Plan Act of 2021 to target locations across Pennsylvania that do not currently have access to reliable service. Examples of activities the program will fund include extension of existing cable modems and fiber-to-the-premise broadband networks along with large-scale regional projects to increase availability. The program will prioritize projects that involved networks owned, operated, or affiliated with local governments, non-profits, cooperatives, and those with commitments to serving entire communities.

5.4.2.8 Pennsylvania Emergency Management Agency

Radiation Emergency Response Fund

The Radiation Emergency Response Fund, supported by fees assessed to nuclear power plants, is designed to provide financial assistance to the 26 designated risk and support counties, municipalities, school districts, volunteer organizations and state agencies in order to carry out the purposes of the Radiation Emergency Response Program.

The Radiation Emergency Response Program provides for the development of a detailed fixed nuclear emergency response plan for areas surrounding each nuclear electrical generation facility, nuclear fabrication and away-from-reactor storage facility located in the commonwealth, the training and equipping of state and local emergency response personnel, the periodic exercise of the accident scenarios designated in the Nuclear Regulatory Commission emergency response plan applicable to each fixed nuclear facility, and the procurement of specialized supplies and equipment.

5.4.2.9 Pennsylvania Historical and Museum Commission

Keystone Historic Preservation Planning Grants

As established under the Keystone Recreation, Park and Conservation Fund, the Keystone Historic Preservation Planning Grant program makes funding available to nonprofit organizations and local governments for the planning and development for publicly accessible historic resources listed in or eligible for listing in the National Register of Historic Places.

The purpose of the grant is to support projects that identify, preserve, promote, and protect historic and archaeological resources of Pennsylvania for both the benefit of the public and the revitalization of communities. These guidelines address only historic preservation projects under the planning category. Please review the separate guidelines for the Keystone Historic Preservation Construction Grants for information pertaining to the bricks and mortar program.

The Pennsylvania Historical and Museum Commission also annually uses a portion of the realty transfer tax revenue to rehabilitate and maintain Commonwealth-owned historic sites and museums.

5.4.2.10 PENNVEST

PENNVEST provides low-interest loans to communities to fund sewer, stormwater, and drinking water projects throughout the Commonwealth. PENNVEST is responsible for administering the Clean Water State Revolving Fund, the Drinking Water State Revolving Fund, and the American Recovery and Reinvestment Act of 2009 funds. Stormwater improvement projects by PENNVEST represent significant funding for Pennsylvania. The total funding from 1993 through 2022 is $211,776,165.00. Table 5-2 provides details on the location, title, and funding for each stormwater project in the City of Philadelphia since 1993.

Table 5-2. PENNVEST Stormwater Projects in Philadelphia, 1993-2022

Project Name	Approval Date	Amount
Stormwater Drainage System for Spectrum II Arena	11/10/1993	$2,341,467
Green Infrastructure for Stormwater Management	4/20/2009	$30,000,000
The Cobbs Creek, West Philadelphia - Storm Water Mitigation Project	7/21/2009	$136,429
Green Infrastructure Tree Plantings	7/21/2009	$1,655,249

Project Name	Approval Date	Amount
Lawncrest Southwest - Stormwater	1/20/2021	$5,794,470.00
GSI in Packer Park, South Philly, Overbrook, Lawndale, and Holmesburg	1/19/2022	$8,221,985.00
GSI in Saunders Park, Fairmount, South Philly, and Harrowgate	1/19/2022	$7,545,605.00
Total Funding		**$55,695,205**

Source: Commonwealth of Pennsylvania 2023

5.4.2.11 State Conservation Commission

Conservation Excellence Grant Program

Created by Act 39 of 2019, this program provides financial and technical assistance for Best Management Practices (BMPs) in priority locations, including those identified in the DEP Chesapeake Bay Phase 3 Watershed Implementation Plan. The qualifying BMPs include streambank restoration, stream-side buffers, and conservation/agricultural erosion and sedimentation plans.

Dirt and Gravel Maintenance Program

The State Conservation Commission (SCC) receives an annual apportionment from the Commonwealth to administer this program, which provides funding for the maintenance and improvement of dirt and gravel roads. The SCC allocates monies to county conservation districts to assist with implementing the program at the local level. Grants are awarded to municipalities and state agencies that maintain dirt and gravel roads to carry out environmentally sound maintenance practices to correct pollution problems related to the roadway.

Resource Enhancement and Protect Program

The SCC provides tax credits to Clean Stream compliant farming operations that implement BMPs to reduce nitrogen, phosphorus, and sediment pollution, including the installation of forested riparian buffers along streams.

5.4.3 City

The City of Philadelphia is able to fund mitigation projects though existing budgets, appropriations (including referendums and bonding), and a variety of federal and state loan and grant programs. In an effort to overcome fiscal challenges, the City has continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and interjurisdictional cooperation are beneficial in obtaining grants.

5.4.3.1 Philadelphia Housing Development Corporation

Environmental Assessment Program Grants/Low-Cost Loans

The Philadelphia Housing Development Corporation (PHDC) has a limited pool of funds available for grants or low-cost loans to address environmental conditions at potential development sites for affordable/workforce housing and on vacant lots that may be used for urban agriculture or community gardens. PHDC is able to provide this assistance thanks to grant support from the EPA. PHDC has engaged consultants to conduct these assessments. Eligible activities include Environmental Phase I and Phase II assessments. The program is on a first come first serve basis and will be funded until all funds are expired for the extent of the program availability.

5.4.3.2 Philadelphia Water Department

Rain Check

PWD started the Rain Check program in 2012 to help residents manage stormwater and contribute to the health of local rivers and streams. Through the Rain Check Program, the PWD will help pay for the cost of several stormwater tools, including rain gardens, rain barrels, permeable pavers, and metal downspout planters. PWD funds this program as part of its overall plan to improve stormwater management in the City and to educate Philadelphia residents on the importance of managing stormwater runoff. Rain Check fits into the mission of the Department to provide high quality drinking water, wastewater, and stormwater services to the Philadelphia region.

Basement Backup Protection Program

The Basement Backup Protection Program helps prevent home flooding by providing free backwater valve installation to reduce backups and free downspout modifications, if needed. To be eligible for this program, the property's water bill must be current. Any violations issued by the PWD or other City agencies must be addressed before participating. Licensed contractors perform installations, and the work has a one-year warranty. Residents are responsible for repairs or maintenance after the warranty expires.

Homeowner's Emergency Loan Program

The Homeowner's Emergency Loan Program (HELP) offers zero-interest loans for repairs to water service lines and sewer lines. PWD customers are responsible for repairing the pipes and fixtures that carry water from the City's water mains to their home. Customers often use HELP loans to fix problems with water service lines or sewer lines that connect homes to City pipes. This loan can also be used to replace water service lines that are made of lead, which may pose a health risk.

5.4.3.3 Office of Policy and Strategic Initiatives for Criminal Justice & Public Safety

Targeted Community Investment Grant

The Targeted Community Investment Grant program funds community-based violence prevention programs and activities that improve public safety, increase opportunities for self-development and care, and build a stronger sense of community throughout neighborhoods most impacted by gun violence.

Program grantees have trauma-informed approaches to gun violence, build resiliency in their communities, mediate conflicts, and promote social or economic empowerment. Examples of past programs include, but are not limited to resource fairs, outreach events, job training and career development, neighborhood and community beautification, education events and workshops, and community engagement.

Community Expansion Grant

The Community Expansion Grant program is a grant program that launched in 2021 and that directly funded and supported organizations that are focused on reducing violence through trauma-informed healing and restorative practices and safe havens and mentorship. Grant awards were between $100,000 and $1,000,000 and went to 31 organizations.

Grants are provided to organizations that have annual operating budgets below $15 million and a proven track record working in neighborhoods vulnerable to gun violence. By targeting funding towards established community-based organizations, the City is putting this money in the hands of organizations with a proven track record of

delivering quality, culturally relevant services while making sure those applying already have the infrastructure in place to be successful. The focus of the Community Expansion Grants is to provide direct trauma-informed healing and restorative practices or safe havens and mentorship programs.

5.4.3.4 Office of Community Empowerment and Opportunity

Promise Zone Sustainability Fund

The Promise Zone Sustainability Fund will provide one-time grants to community groups and non-profit organizations that are located within or that serve the West Philadelphia Promise Zone. The fund's goal is to support organizations and programs that advance the community's shared vision for a safe, healthy, affordable, and prosperous West Philadelphia.

The West Philadelphia Promise Zone aims to reduce poverty and bring greater opportunity to people living and working in West Philadelphia. The initiative helps organizations work together to connect residents to high-quality education, family-sustaining jobs, affordable housing, and health services. Since the Zone's inception in 2014, CEO has served as the backbone organization for this collaborative work, providing support, leadership, and connection to resources.

5.5 EDUCATION AND OUTREACH CAPABILITY

This section summarizes education and outreach capabilities performed by the City since the 2022 HMP update and discusses methods used to update the City's capabilities for this 2026 HMP.

5.5.1 Exercise and Trainings

The Office of Emergency Management (OEM) continuously performs analyses to identify potential areas for improvement, and conducts multi-agency exercises and training to test, validate and improve its plans.

OEM conducted numerous exercises and trainings since 2022, including a multi-agency full-scale hazardous materials and building collapse exercise, a multi-agency full-scale Dense Urban Terrain Exercise, a water-land rescue exercise with local responders at the Philadelphia International Airport, ICS trainings, among others. Exercises and trainings also assist in response readiness. OEM has bi-weekly internal 'Training Tuesdays,' which cover a variety of topics including urban search and rescue, special events and emergency operations center activations, and 'Stop the Bleed.'

OEM, in conjunction with the Mayor's Office of Recovery and Grants, have worked to create a more coordinated, city-wide approach towards pursuing mitigation funding. This includes hosting annual mitigation grants workshops trainings for City partners with presentations from PEMA and FEMA. In addition to the workshops, OEM has provided one-on-one technical assistance to City agencies interested in applying for BRIC, FMA, and HMGP.

5.5.2 Surveys

On July 8, 2024, OEM released a public survey to gather information on general emergency preparedness and community concerns. The survey was created and advertised in nine different languages, including English, Spanish, French, Haitian Creole, Portuguese, Russian, Swahili, Vietnamese, Arabic, and Chinese (simplified). Members of the public without digital access, or who required the survey in a different language, were able to call

Philly311 for support filling out the survey. These surveys were open until December 31, 2024 and feedback received in the survey directly informed the update of the plan.

On September 30, 2024, an All-Stakeholder Work Group meeting was held to discuss capabilities within the City of Philadelphia. Members from 20 organizations were asked several discussion questions. These questions and the received responses are shown below.

- Are there new plans, resources, studies, capabilities, etc. that are not currently captured that should be included?
  - The Philly Tree Plan is written, not an operational plan. The plan mostly focuses on capacity building. Also, an Urban Agriculture Plan was released in 2023 called Growing for the Root.
  - The Water Department's Climate Change Adaptation Program has guidance geared toward water design and planning. An external version was just released about a week or two ago, but there is an internal version available.
  - The Climate Resilience plan should be released in the next couple of years.
  - East Falls and Manayunk worked with the City and hired contractors to create a flood study for the neighborhood, kind of set up like a flood-focused HMP. Outlines what can be done to make the area more resilient to floods.
  - The Clean Waters Task Force Strategy Action Plan will also be released soon; I just received a draft version.
  - There is a steep slope protection ordinance which is built into the City's zoning code. If you want to reach out later, I can note it out for you. I also think there are a handful of organizations who have commendation power, but I am not sure how deep you wanted to go, but the reclamation authority should likely be included in there as well.
  - LEED ordinance and high-performance building guidelines.
  - We are on the 2018 building codes but working to update to the 2021 building codes.
- What gaps may exist that decrease an underserved community's ability to access resources and plan for risk reduction?
  - Air quality has not had too much attention, especially in the past few years with wildfire impacts on top of areas which already experience poor air quality.
- What are the current gaps and unmet needs based on the capabilities assessment review?
  - There is ongoing flooding at major roadway intersections.
  - There needs to be a focus on risk reduction for cultural and natural resources.
  - Identifying opportunities for regional scale mitigation actions that are multi-jurisdictional.
  - A Debris Management Plan is needed; especially subsequent to the I-95 collapse.
  - A lot of outreach around different planning processes. Would love to see more resources go to organizations, so they can develop their own plans and priorities. More specific and granular plans could be developed at the neighborhood level to address specific neighborhood vulnerabilities. These plans could potentially be 'nested' meaning a city-wide plan could be scaled down to a planning district and then a neighborhood. Focusing on extreme heat in Northern Philly.
- How can we address those gaps? What specific action or resource is required?
  - Currently exploring the potential to install devices that will assist with reducing flooding at major roadway intersections.

  - PennDOT maintains a list of roadways that experience frequent flooding and crosschecks that list when funding opportunities are available.
  - The City's Percent for Art Ordinance requires new City construction or major renovation projects to include site-specific public art in the amount of up to one percent of the total budget. A funding source is needed to support documentation and planning for cultural resources.
  - A planning representative could be assigned to each planning district to serve as a liaison between the project team and vulnerable populations. Find more opportunities for neighborhood-community driven work.
- What capabilities are needed to continue reducing risk to people, property, the environment, and the economy? How must these capabilities evolve to adapt to a changing climate?
  - Hiring of additional personnel and funding for staff and outreach.
  - Staffing capabilities – Specifically with the Department of Licenses and Inspections (L&I)- how do they feel about their capabilities towards staffing/manpower, building permits, gaps, etc.
  - Aligned response to disasters. Need for translators. FEMA's language is different especially with licensing and inspection procedures.
  - L&I is also behind on digitizing documents. It would be beneficial to engage with L&I.
  - Response can be more proactive, such as permits for debris removal. Need to plan ahead but that requires staffing, time, and resources.
  - Efforts with the Office of Sustainability (OOS) have been great. There has been improvement and efforts have been easier since in place.
- What specific capabilities are required to provide protection to underserved communities and socially vulnerable populations?
  - Funding sources for energy assistance. Structures are aging and may not be able to handle the energy demand of residents. There are funding streams available to address these issues, but they are very strict and not very flexible.
  - Tying disaster recovery efforts to hazard mitigation efforts. When a place has been impacted, how do we make sure recovery is done overall?
  - Coordination between existing efforts. Having a sense of future hazard climates. Needs flexible funding. The restrictions on federal funding makes it challenging.
  - One example, Germantown neighborhood, not in a floodplain, had several initiatives over the years, but the studies take a while to complete. There are ongoing efforts underway, but nothing successful yet until projects are in the works. Susan with the Water Department will send a list of projects over to TT.

On September 30, 2024, OEM sent a Capability Assessment Survey to individuals from partner and stakeholder organizations and encouraged agencies to provide feedback. OEM received four responses to this survey. A copy of the Capability Assessment Survey is available in Appendix C. This survey asked participants to identify the planning and regulatory, administrative, technical, financial, and education and outreach capabilities within their organization.

On October 21, 2024, a Public Steering Committee was held where a discussion on existing City capabilities took place. Members of this committee were asked three discussion questions. These questions and the received responses are shown below.

- What resources are available at the community level to help address risk (e.g., resilience hubs, food banks/distribution, CERT, etc.)?
  - Cooling centers during heat events.
  - Libraries and church bank (food sharing)
  - Not many air quality systems
  - Food share, state offices, church banks, and places offering trainings
  - Community Development Corporations (CDCs)
  - Hyperlocal social media
  - Food share, Philabundance, purple air for air quality
- How can the City support community capabilities?
  - Money
  - Staff
  - List of access
- What are the unmet needs and gaps that need to be addressed at the community level?
  - Political climate restricts some work to be done, this is a pretty loaded question. There are some sensitivities. Overall removing the political-ness of the City.
  - Be more focused on the information across each neighborhood. We can visually see something happening, but there is not data or resources to support what we are seeing.
  - CDCs have surveys performed to get this feedback to accurately capture this information for each neighborhood.
  - A comprehensive database of services, by neighborhood, available in any language and working GIS system.

5.5.3 Public Involvement and Education

The City of Philadelphia conducts numerous forms of education and outreach to citizens for activities that fall under mitigation projects, initiatives, or plans with mitigation components. The City of Philadelphia's capability to conduct public education and outreach is directly correlated with the programs, organizations, and agencies that support these services. City agencies that provide mitigation-related education and outreach activities include, but are not limited to:

- Office of Emergency Management
- Philadelphia Police Department
- Philadelphia Fire Department
- Philadelphia Water Department
- Mayor's Office of Sustainability
- Philadelphia City Planning Commission
- Philadelphia Department of Public Health

In addition to these efforts, Philadelphia participates in several programs and organizations that support mitigation-related education and outreach activities as shown below:

- Natural disaster school programs
- Safety-related training and school programs
- Ongoing public education on:
  - Responsible water use
  - Watershed initiatives
  - Green initiatives
- Business continuity programs
- Personal preparedness programs
- Ongoing targeted outreach to communities
- Fire preparedness training and outreach

Several of OEM's partner stakeholders provide resources and public engagement tools to increase public preparedness for emergencies. Philadelphia Department of Public Health (PDPH) promotes emergency planning tools for organizations on their website (Philadelphia Department of Public Health 2024). In addition, PDPH maintains its Community Response Partner Network, a network of community partners who can disseminate information to their members and neighbors during public health emergencies. The Philadelphia Fire Department also offers various fire preparedness workshops for individuals of all ages.

5.6 PLAN INTEGRATION

Integration of hazard mitigation principles into other local planning mechanisms (comprehensive plans, transportation plans, floodplain ordinances, etc.) and vice versa is vital to building a safer, more resilient community. This two-way exchange of information supports community-wide risk reduction before and after disasters occur. Through this process, the community's planning efforts become better integrated and there is a higher level of interagency coordination. Many existing City of Philadelphia plans and programs support hazard risk management, and it is critical that this HMP integrate and coordinate with those mechanisms.

The CPT and Steering Committee aim to incorporate hazard mitigation as an integral component of daily government operations. Steering Committee members will work with local government officials to integrate the updated hazard mitigation goals and actions into the general operations of government and partner organizations.

The City of Philadelphia has made a concerted effort since the previous adoption of the HMP, to reduce vulnerability to hazards through their planning and daily operations and by implementing mitigation programs and projects. It is the intent of the City to strengthen this focus on mitigation by continuing existing policies and implementing the mitigation actions presented in this HMP. Information from the previous hazard mitigation plan, and from this update, have been, and are, actively being integrated into other planning mechanisms in the City, including:

- Philadelphia 2050 – The City's Comprehensive Plan used to guide decisions made by various City offices. Philadelphia 2050 is currently being updated by the Philadelphia City Planning Commission. Philadelphia OEM is attending monthly meeting for this plan update to assist in the integration of hazard mitigation principles.
- Climate Action Plan – The City's Climate Action Plan, updated in the 2025, provides a strategic framework for reducing greenhouse gas emissions, adapting to a hotter and wetter climate, and centering equity in all initiatives.

- Tree Plan – The City's Tree Plan, developed in 2023, is a citywide, equity-driven effort to grow a denser, cooler, and healthier urban forest, ensuring that every Philadelphian can enjoy the shade, air quality, and climate resilience that trees provide.

Future integration activities will include incorporating the goals of the HMP into ongoing planning, zoning, building, and engineering activities. Specifically, the City will promote and encourage the following actions:

- Fund hazard mitigation projects or actions in operating budgets to the extent possible.
- Notify City agencies about grant and other funding opportunities as they arise.
- Use data and maps from this HMP as supporting documentation in grant applications.
- Review mitigation actions when allocating funding for City budgets.
- Include hazard mitigation when updating local ordinances.
- Identify hazard areas in updates of comprehensive plans to identify land use issues.
- Review the HMP prior to land use or zoning changes and permitting or development decisions.

The information on hazards, risk, vulnerability, and mitigation contained in this HMP is based on the best science and technology available at the time of the plan's preparation. This information can be invaluable in making decisions under comprehensive, capital improvement, and emergency management plans.

6. MITIGATION STRATEGY

This section describes the process by which the City of Philadelphia will reduce or eliminate potential losses from the natural and non-natural hazards identified in Chapter 5 of this Hazard Mitigation Plan (HMP). The mitigation strategy focuses on existing and potential future mitigation actions to alleviate the effects of hazards on City's population, economy, and general building stock.

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as revisions to land-use planning, training and education, and structural and nonstructural safety measures.

This chapter provides a summary of the 2026 HMP update process, outlines the mitigation goals and objectives set forth in the 2026 HMP update, describes the process for identifying and analyzing mitigation techniques, and provides the mitigation action plan.

6.1 UPDATE PROCESS SUMMARY

The goals and objectives listed in the City of Philadelphia HMP were examined annually by the Hazard Mitigation Steering Committee, with the most recent report sent to PEMA and on April 8th, 2024. This report was used as a baseline to begin the review of the Mitigation Strategy. During the 5-year review, the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee members were afforded the opportunity to comment on the goals, objectives, and actions that were listed in the existing HMP.

The general mitigation planning approach used to develop this plan is based on the FEMA publication, "Local Mitigation Planning Handbook" (FEMA 2023) and the Pennsylvania All-Hazard Mitigation Planning Standard Operating Guide (SOG) (PEMA 2020):

- **Review of Existing Mitigation Plan Goals, Objectives, and Mitigation Action Plan:** Existing mitigation goals and objectives, and the 2022 HMP mitigation actions were first examined at the Steering Committee Goals, Objectives, and 2022 Mitigation Strategy Review Meeting and revisited during the All-Stakeholder Workgroup: Mitigation Strategy Workshop and the Public Steering Committee: Mitigation Strategy Workshops. The Steering Committee thoroughly reviewed and updated the mitigation goals and objectives utilizing the latest information gathered through the hazard profiles, vulnerability assessments, and the risk assessment; the mitigation goals and objectives were also compared to the State HMP goals and objectives. The updated goals and objectives were then presented at the Mitigation Strategy Workshops for final review and approval. Plan participants continued to review and provide progress on the 2022 mitigation actions throughout the planning process.
- **Develop and Update Mitigation Strategies:** Mitigation actions were identified based on the risk assessment, mitigation goals and objectives, existing policies, and input from the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee.
- **Mitigation Strategy Prioritization and Implementation:** The potential mitigation actions were qualitatively evaluated and are described in more detail in Chapter 6.5 of this HMP. Mitigation actions were prioritized into three categories: high, medium, and low. High priority and medium priority mitigation actions are recommended for implementation before low priority actions; however, based on specific needs, cost estimation, and available funding, some low priority mitigation actions may be addressed first.

- **Document the Mitigation Planning Process:** The entire mitigation planning process is documented throughout this HMP, particularly in Section 2.

This section summarizes past mitigation goals and past mitigation action status and provides an update of mitigation strategies and additional past mitigation accomplishments.

6.2 PAST MITIGATION ACTION STATUS AND UPDATE OF MITIGATION STRATEGIES

In the 2022 HMP, the City of Philadelphia identified 163 actions and initiatives to support an improved understanding of hazard risk and vulnerability, to enhance mitigation capabilities, and/or to reduce vulnerability of infrastructure. Progress on the 2022 mitigation actions was evaluated during the 2026 update process.

The City, via various representatives on the input from the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee, were provided the opportunity to review City actions and initiatives from the 2022 HMP, and suggest new mitigation actions, during the All-Stakeholder Workgroup: Mitigation Strategy Workshop and the Public Steering Committee: Mitigation Strategy Workshop; a second Mitigation Strategies Workshop was held for the Public Steering Committee.

Using the April 8th, 2024 Hazard Mitigation Steering Committee report from the Office of Emergency Management, the status of each previous action (“No Progress/Unknown,” “In Progress/Not Yet Complete,” “Continuous,” “Completed,” or “Discontinued”) was indicated and review comments were provided where applicable.

The completed Mitigation Action Plan Review Worksheet from the April 8th, 2024 Hazard Mitigation Steering Committee report is provided in Table 6-1. Projects and initiatives identified as “Complete” and “Discontinued” have been removed from this plan update. The actions that the City has identified as “No Progress/Unknown” or “In Progress/Not Yet Complete” have been carried forward in the updated mitigation strategy for this HMP (unless otherwise determined by the City to be a discontinued project). The language in some actions being carried over has been adjusted to reflect changes to City needs and capabilities. Some actions were also merged to reduce redundant efforts on behalf of the City.

Table 6-1. Past Mitigation Action Status

Initiative #	Description	Status	Review Comments
1.1.1	Continue to maintain and update the City's All-Hazard Mitigation Plan with a focus on plan integration and implementation.	Ongoing	OEM finalized a grant agreement with PEMA in 2023 for funds that will support the next plan update. The City released an intent to contract with Tetra Tech, Inc. to support project work. A plan kickoff is tentatively planned for late spring/early summer 2024. Additionally, OEM is coordinating with OOS on a Climate Resilience Plan update, PCPC on a Comprehensive Plan update, and City Finance on the allocation of the CDBG-DR funding as specified in the City's HUD approved action plan.
1.1.2	Develop and implement a drought contingency plan. PWD will update the existing Drought Contingency Plan with pertinent policy and regulatory updates, improved science and technical tools, and with a greater understanding of how Delaware Watershed policies can impact Philadelphia's water supply during critical drought conditions such as reduced water super availability.	In Progress	No update at this time
1.1.3	Invest resources to plan and staff initiatives to reduce hazard risks citywide. This includes development of and coordination for Cybersecurity Incident Response and Recovery Plan and Training; a Philadelphia Economic Recovery Plan; a Regional Disaster Housing Plan, and pandemic response planning.	Ongoing	

Initiative #	Description	Status	Review Comments
1.1.4	PDPH Pandemic Planning and Implementation: Update and implement the Pandemic Response, Mass Prophylaxis and Immunization, and other plans to reflect best practices and lessons learned during the COVID-19 response. This includes identifying sites to administer vaccine and/or dispense medical countermeasures during public health emergencies; coordination with other human services partners to ensure inclusion of persons who are unhoused in pandemic response planning; and other preparations for outbreak related response activities.	Ongoing	Update as follows for 2026: PDPH Pandemic Planning and Implementation: Update and implement key plans including pandemic response, mass prophylaxis and immunization, and others to reflect best practices and lessons learned during COVID-19and other disease outbreak responses. This encompasses incorporating high-consequence pathogen planning and readiness, including biohazard considerations and healthcare coordination ; identifying sites to administer vaccine and/or dispense medical countermeasures during public health emergencies; coordinating with other human services partners to ensure inclusion of special populations such as children, persons experiencing homelessness, and persons with access and functional needs; identifying isolation and quarantine locations and potential wraparound services; ensuring a standardized process for public data dashboard development and discontinuation; and other preparations for outbreak related response activities.
1.1.5	Expand lab capacity to rapidly identify and subtype organisms.	Ongoing	
1.1.6	Improve access to primary medical care citywide and improve the quality of primary care by expanding the scope of services and building facility capacity for City Health Centers.	In Progress	
1.1.7	Improve environmental conditions to foster a sense of safety in neighborhoods, connectedness among neighbors, and reduce the locations where illegal guns are stored and where illegal activity occurs. Projects include addressing blighted buildings, cleaning abandoned lots, improving lighting, and other initiatives to improve environmental conditions.	In Progress	No update at this time
1.1.8	Implement Roadmap to Safer Communities programs including Group Violence Intervention, Community Crisis Intervention Program, and Operation Pinpoint.	In Progress	No update at this time
1.1.9	Identify and implement short-term flood proofing tools for at-risk communities.	Ongoing	

Initiative #	Description	Status	Review Comments
1.1.10	Climate Resilience Plan Update: Update the City's Climate Resilience Plan to include updated climate projections, a heat and flooding vulnerability analysis, new community-informed climate actions, and increased community engagement. Results of the updated climate resilience plan will be used to inform the Hazard Mitigation Plan.	Not Started	Added as new project in 2024 internal review
1.1.11	Climate Resilience Place-based Program Expansion: Expand Office of Sustainability's climate resilience place-based program which will include identifying communities with climate needs.	Not Started	Added as new project in 2024 internal review
1.2.1	Conduct outreach and coordinate personnel to keep the Philadelphia unhoused population safe during extreme cold and extreme heat events.	In Progress	No update at this time
1.2.2	Continue to deploy trauma kits to School District of Philadelphia facilities and buses, as well as conduct trainings with faculty and staff.	Completed	
1.2.3	Reduce Opioid Overdose Deaths and the number of people Initiating Use of illicit opioids by increasing harm reduction and treatment resources.	Ongoing	Do not include in 2026 update.
2.1.1	Assess properties that may benefit from long-term flood resilience measures including elevation, acquisition, relocation, mitigation reconstruction, and additional adaptive/adaptation measures	In Progress	
2.1.2	Implement long-term flood resilience measures including elevate, acquire, relocate, retrofit, floodproof, complete mitigation reconstruction, and adapt properties that benefit from elevation, acquisition, relocation, completing mitigation reconstruction, or additional adaptive/adaptation measures.	Not Started	
2.1.3	Assess reuse of City properties that have assets that are prone to damage from flooding	Not Started	
2.1.4	Bartram's North and South Flood Mitigation: Examine and implement mitigation methods that protects buildings and access without providing any adverse impact to upstream or downstream properties along the western bank of the Schuylkill River.	In Progress	No update at this time
2.1.5	Demolish Philadelphia owned 4910 Botanic site structures, remediate known environmental contamination, and convey the riverfront portion of the site to PPR/Schuylkill River Trail/Bartram's Garden to decrease flood risks, risk of criminal activity, and risk of building collapse.	In Progress	No update at this time
2.1.6	Align reviews of City floodplain regulation and guidance with the International Code Council (ICC) tri-annual updates of the building codes. Follow and educate people in building profession on required and recommended strategies to mitigate hazards and increase resilience.	In Progress	
2.1.7	Complete outstanding follow-up items from the most recent Community Assistance Visit.	Completed	The Department of Licenses and Inspections (L&I) completed this major undertaking in November 2023.

Initiative #	Description	Status	Review Comments
2.1.8	Develop a software platform to share flooding event information across departments in real-time as well as historically.	Not Started	
2.1.9	Maintain enrollment in NFIP by implementing floodplain management initiatives, reducing the City's flood risk, and allowing residents to receive discounted flood insurance.	Ongoing	
2.1.10	Interim flood mitigation to provide short-term relief to flooding in Eastwick while a community-driven long-term flood resilience strategy is being developed. Initial analysis indicates one such measure could be a soil-filled flood barrier (for example, using HESCO Floodline) along the Cobbs Creek in Eastwick where riverine flooding typically overflows into the Eastwick community.	In Progress	Waiting for funding
2.1.11	Retain consultant services for the Philadelphia Dept of License & Inspections in their Floodplain Administration duties to provide additional oversight and recommendations in the review of Hydrologic and Hydraulic (H&H) engineering analysis modeling submissions provided with applications that affect coastal floodplains, regulated floodways and riverine floodways without regulatory floodways. Over the span of this project, we intend for these services to help identify current gaps in the review processes of applications that require an H&H engineering analysis under International Building Code, Sections G103.4, G103.5, G103.6 & G103.7 and our local floodplain ordinance, and to develop/identify new engineering resources/tools to assist in more effective enforcement and administration of these floodplain provisions.	In Progress	Waiting for funding
2.2.1	Conduct a Mitigation Feasibility Study to determine the best approach for implementation of mitigation actions on private homes and businesses, including building elevations, retrofits, and acquisitions. Feasibility study will include a peer review of other large jurisdiction's approaches and will address Philadelphia specific challenges to implementation. Feasibility study will provide recommendations for next steps in implementation, and recommendations for how to make the process equitable and inclusive of population most at risk to hazards.	Completed	The Office of Sustainability (OOS) completed this study in 2023. Further analysis is required to move to the program implementation stage.
2.2.2	Increase bridge inspection training and conduct bridge inspections.	Ongoing	
2.2.3	Analyze the impact of natural and human-caused hazards and threats on critical infrastructure that supports supply chain systems through the update of the Freight (Truck) Network.	Not Started	

Initiative #	Description	Status	Review Comments
2.2.4	Develop a Trail Resiliency Plan and identify flood mitigation strategies for Philadelphia's extensive trail network. Trails often follow streams and rivers in Philadelphia. Recreation and travel can be a suitable use of the floodplain. However, trail infrastructure represents a significant investment from City, State and Federal partners. OTIS would like to examine how trail infrastructure can be built resiliently to protect the investment while also protecting the ability of the floodplain to absorb water. The study will consider vulnerable assets, best practices in materials and construction suitable to a floodplain, and overall trail network resiliency. Trails provide a travel mechanism that does not contribute to climate change and provides healthy recreational options for residents.	Not Started	
2.2.5	Create a hazard event database to capture description, severity, location, impact, and potential loss/damage estimate from an event. This data will be used to update the hazard analysis and mitigation actions for Philadelphia, as well as allow the City to be better prepared for future events.	Not Started	
2.2.6	Enhance THIRA process to identify gaps in mitigation capabilities, and to better align the THIRA with the HMP Planning Process.	In Progress	
2.2.7	Maintain Tier II Reporting and GIS program.	Ongoing	
2.2.8	Update the Tier II emergency response plan process/template to provide more situational awareness on chemical inventories across the City for OEM/PFD and its partners.	Ongoing	
2.2.9	Improve floodplain mapping to support vulnerability assessments for critical infrastructure and City initiated letters of map correction (LOMCs), using updated inundation mapping	In Progress	
2.2.10	Use damage assessment data to conduct in depth GIS analysis of impacts from past flooding and storms events to better predict future impacts from similar storm events and inform severe weather preparedness planning, alert & warning messaging, and mitigation initiatives in those areas.	Ongoing	
2.2.11	Utilize the results of the 2022 Hazus analysis to identify new mitigation projects.	Ongoing	
2.2.12	Support the USACE production of inundation level mapping for the Schuylkill River alongside the remapping of the floodplain, to reflect the impact levels available for USGS gauge 01474500	In Progress	
2.2.13	Navy Yard Resilience Study: A comprehensive Resilience Study at the Navy Yard will be critical to inform the implementation of HMP projects 4.2.15 and 4.2.16. The study will analyze existing conditions; assess all potential risks & vulnerabilities; identify resiliency projects; and advance at least one early-action resiliency project.	Not Started	Added as new project in 2024 internal review

Initiative #	Description	Status	Review Comments
2.2.14	Cobbs Creek Multiuse Trails: Due to the Cobbs Creek frequent floods, there are access and maintenance issues for the multiuse Cobbs Creek trail system. Resilient planning and design will be explored as part of the construction and future maintenance plan of the Cobbs Creek trail.	Not Started	Added as new project in 2024 internal review
2.2.15	Initiating Delaware River Long-Term Flood Protection Feasibility Solutions Study to address tidal surge flooding. Depending on feasibility study results, DOA may select one or more phases to design and construct.	Not Started	Added as new project in 2024 internal review
2.2.16	Eastwick Priority Roadway Flood Study: Evaluate priority roadways in Eastwick that are in the floodplain for potential for flood risk reduction measures. In particular, assess feasibility of redesigning 84th Street/Hook Rd bridge over Cobbs Creek	Not Started	Added as new project in 2024 internal review
2.3.1	Conduct or update natural hazard vulnerability assessments for critical facilities throughout the Philadelphia.	Completed	
2.3.2	Continue to enhance citywide COOP-COG program to minimize disruptions and support continuation of essential City services during and following a disaster.	Ongoing	
2.3.3	Maintain and utilize early warning system.	Ongoing	
2.3.4	Procure and utilize long range drone(s) to assess areas of concern before and after hazardous events (and if possible during events).	In Progress	No update at this time
2.3.5	Purchase two VMS signs for deployment prior to and during emergencies and events to promote public safety and awareness.	Not Started	
2.3.6	Procure additional units of level B PPE for surge operators.	In Progress	No update at this time
2.3.7	PWD Cybersecurity Upgrades: Replace and upgrade PWD software that stores critical infrastructure information that is vulnerable to cyber terrorism attacks.	Not Started	
2.3.8	Ensure DOA's compliance with EPA's Resource Conservation and Recovery Act (RCRA) by disposing of waste responsibly and inspecting systems proactively to mitigate the potential for a hazardous materials release.	Not Started	Added as new project in 2024 internal review
2.4.1	Planning and Land Use Regulation and Incentive Alignment: Align the City's comprehensive plan, district plans, zoning regulations, development incentives, and other land use related programs with the City's efforts to reduce flood risk, based on up-to-date flood risk projections. This may include designation of local flood zones and related permitting requirements.	Not Started	Added as new project in 2024 internal review
2.4.2	Resilient Design Guidelines: Collaborate with related City agencies on the creation of consistent, coordinated design guidelines documents to demonstrate possible strategies for resilience to current and future hazards for building design and the public realm. Build from existing base of guidelines created by various departments.	Not Started	

Initiative #	Description	Status	Review Comments
2.4.3	Include risk and resiliency considerations as comprehensive planning moves forward, including use of risk analysis by planning districts created for 2022 HMP update.	In Progress	
2.4.4	Examine and evaluate the strategy of using rolling easements to assist in adapting to the potential consequences of sea level rise.	Discontinue	
2.4.5	Philadelphia Creek Protection Study: Update the Wissahickon Watershed zoning overlay and steep slope protection areas, which promotes disaster resilient land use decisions in the area and apply these protections consistently throughout the City of Philadelphia.	Not Started	
2.4.6	PHL Climate Resilient Design Standards: Adopt Climate Resilient Design Standards at PHL airport to reduce the risk of flooding which will be exacerbated by climate change.	Not Started	Added as new project in 2024 internal review
2.5.1	Design and improve Eastwick drainage and flooding prevention infrastructure.	In Progress	
2.5.2	Airport Drainage Infrastructure: Design additional and improve current PHL airport drainage infrastructure	Not Started	Added as new project in 2024 internal review
2.6.1	Develop and implement the Climate Adaptation and Resiliency Plan (CARP). DOA is in the midst of evaluating its climate risks. Building on this baseline assessment, DOA will align findings with the Master Plan Update currently underway; identify and prioritize climate adaptation strategies; and implement the identified strategies and priority investments.	In Progress	
2.6.2	Assess, Design, Procure, and Construct Upgrades and Overhauls for Vent Wells, Emergency Exits, and Station Head Houses to protect and armor them against future flooding.	In Progress	No update at this time
2.6.3	Conduct --and implement recommendations from--a Philadelphia International Airport Hydrologic and Hydraulic Resiliency Study to assess current and projected flood risk and identify resiliency strategies to address risks. Key steps include a review of existing conditions, coastal analysis, HEC-RAS analysis, development of preliminary adaptation study, determination of potential adaptation and mitigation measures, modeling of those potential measures, and a final technical report. DOA will then seek to implement recommended measures.	In Progress	
2.6.4	Invest in transmission main condition assessments to improve understanding of probability of failure in the transmission system and install and/or upgrade priority transmission, water, and discharge mains to improve system redundancy, improve water flows, improve water quality, enhance capacity, and address other system needs.	Ongoing	
2.6.5	Construct ground water interceptors to capture water seeping from rock outcrops to prevent constant ice accumulation on Lincoln and Kelly Drives.	Not Started	Do not include in 2026 update.
2.6.6	Design, procure, and install electric switch heaters for priority sites.	In Progress	No update at this time

Initiative #	Description	Status	Review Comments
2.6.7	Plan and implement waterproofing for all Railroad and Transit Tunnels within City limits—Broad Street, Market-Frankford Subway Elevated (MFSE), Trolley Tunnel, Railroad.	In Progress	No update at this time
2.6.8	Update the 2016 Wastewater Master Plan: Update with a focus on PWD's Water Pollution Control Plants and Pumping Stations. As part of the update, PWD will: identify and develop a prioritized schedule of asset replacements based on condition and age; identify and prioritize current regulations and potential future regulations; develop scenarios to meet goals related to regulatory compliance; evaluate and develop solutions for reducing greenhouse gas emissions where possible; and evaluate and develop potential solutions for protecting wastewater infrastructure against climate change impacts. Based on these evaluations, PWD will develop a list of needs (projects) and then will develop and implement a 25-year Capital Improvement Plan.	In Progress	
2.6.9	Risk & Resiliency Assessments: Characterize and evaluate current and future coastal flood risk for PWD's water and wastewater treatment facilities on the tidal Delaware River (4 total), taking into account sea level rise projections and storm surge impacts. Through the risk assessment process, identify potential flood risk mitigation alternatives (considering adaptive management strategies where feasible), engage with key local and regional stakeholders, and explore partnership building opportunities.	In Progress	
2.6.10	Enlarge culverts of the Poquessing Creek tributaries to protect roadways and residences without providing any adverse impact to upstream or downstream properties.	Discontinue	Removed in previous annual reviews
2.6.11	Ensure adequate material and equipment is available to repair and replace streetlights and traffic poles & signs.	Ongoing	
2.6.12	Equip drawbridges with back-up generators.	Not Started	
2.6.13	Implement emergency and non-emergency generator engine rehabilitation and electrical upgrades.	Completed	
2.6.14	Install battery back-up traffic signal controllers to at least 10% of signals in City.	Ongoing	
2.6.15	Install electrical substation upgrades with flood control at A-East	Completed	
2.6.16	Maintain portable generators for key traffic intersections.	Ongoing	
2.6.17	Maintain safe roadways and bridges through roadway milling and paving capital projects.	Ongoing	
2.6.18	Procure wastewater system HME sensors	In Progress	No update at this time
2.6.19	Purchase and maintain hyper-local street level weather stations to assist in salting, flooding, and plowing operations.	Not Started	

Initiative #	Description	Status	Review Comments
2.6.20	Purchase and maintain drop-gates for known dangerous roads during emergency events, particularly along Cobbs Creek, for Bells Mill Road, and on Delaware Ave.	Not Started	
2.6.21	Redesign roadways and bridges to lessen the occurrence/impact of flooding.	Ongoing	
2.6.22	Replace the fence around the Upper Roxborough water facility to prevent theft of chemicals, contamination of treated drinking water, and damage to critical infrastructure.	Completed	
2.6.23	Strengthen the traffic signals beyond the national standards in reference to wind tolerance.	Ongoing	
2.6.24	Upgrade equipment and resources necessary to respond to flooding, winter storms, and developing or unforeseen hazards.	Ongoing	
2.6.25	Design and construct of a highway cap over the Vine Street Expressway between 13th and 10th Streets to reconnect the Chinatown and Chinatown North communities. The project represents a significant infrastructure investment that seeks to improve community access to green spaces, reduce noise and air pollution, manage stormwater, mitigate urban heat island effects, and improve traffic and pedestrian safety.	In Progress	
2.6.26	Removal and replacement of lead service lines	Not Started	Added as new project in 2024 internal review
2.6.27	Bridge Sustainability in Northwest Philadelphia: Proximity to the Wissahickon Creek leaves the Bells Mill Road Bridge and Valley Green Road Bridge vulnerable to storm and flooding events and structural degradation. This project aims to repurpose and rehabilitate the two Wissahickon Creek bridges, promote recreational activity for residents and park visitors, and enable community members in disadvantaged Census tracts to access park amenities.	Not Started	Added as new project in 2024 internal review
2.6.28	Maintain, replace, and upgrade existing electric grid infrastructure to reduce the probability of failure during severe weather events and extreme temperatures, improve system redundancy to reduce downtimes in severe weather events, enhance capacity, and address other system needs	Not Started	Added as new project in 2024 internal review
2.6.29	Initiate design to replace the Fort Mifflin tide gate and install a new equalizer pipe to control high tides of the Delaware River to reduce area inundation and balance water surface elevations	Not Started	Added as new project in 2024 internal review
2.7.1	Develop and implement individual hazard management plans for City owned and operated historic structures and their surrounding landscapes. Plans should consider both natural hazards, climate change impacts, and human-caused hazards.; if necessary, consider moving the structure to a safer location. Build on Manayunk pilot for historic preservation.	In Progress	No update at this time
2.7.2	Implement various mitigation and resiliency measures identified in the Fairmount Water Works Resiliency Plan to prevent future repetitive losses from flood events.	In Progress	Waiting for funding

Initiative #	Description	Status	Review Comments
2.7.3	Conduct citywide survey to identify and document all historic properties in the City (private and city-owned) in order to assess risk, vulnerability, and mitigation strategies for properties. Study should take into account all hazards, including building collapse, urban conflagration, and other human-caused and natural hazards.	Ongoing	
2.8.1	Integrate equity and social vulnerability indicators more prominently into OEM's planning and operational products to better predict, prioritize, and support community needs during disasters and emergencies to reduce risk. Form and compensate a community panel making up a diverse group of public representatives to review, provide feedback on, and participate in OEM's planning processes including the Hazard Mitigation Plan.	In Progress	
2.8.2	Public Health Climate Vulnerability Data and Assessments: Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during a flooding and other climate hazards.	Ongoing	Include in 2026 update as follows: Public Health Vulnerability Data and Assessments: Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.
2.8.3	Eastwick Place-Based Climate Risk, Adaption, and Resiliency Planning: Conduct community-based planning in one of the most vulnerable communities to climate change impacts, Eastwick. To support community resilience to flooding and other hazards, the planning efforts will focus on the identification of long-term mitigation efforts and development of mechanisms to implement them. This planning will build off the experience of a pilot community planning effort in Hunting Park, Beat the Heat, which addresses extreme heat. In Eastwick, the City will pilot a place-based flooding framework and seek funding to implement the planning process outcomes. The City also plans to expand the place-based extreme heat resiliency framework to other communities beyond Hunting Park.	In Progress	OOS was awarded FEMA Flood Mitigation Assistance funding in 2023 to develop a community-driven Flood Resilience Strategy in partnership with Eastwick community leaders. The Flood Resilience Strategy aims to bring various ideas and partners involved in Eastwick into one dedicated planning process with Eastwick residents steering decision-making on how to move forward. This will be a two-year effort kicking off in Spring 2024.
2.8.4	Healthy Corridors Project: Expand cool roadways pilot program and stormwater management projects in heat and flood vulnerable neighborhoods.	In Progress	

Initiative #	Description	Status	Review Comments
2.8.5	Lower South Infrastructure Resilience Roadmap and Implementation: A multi-departmental initiative focused on creating the strategic direction and tools needed to prepare the Lower Schuylkill area for present and future climate risks. The down-scaled understanding of specific climate risks and the potential solutions to address them will inform the master plans, building designs, and infrastructure plans currently underway or planned in this area, resulting in development that is more resilient to flooding and other risks.	In Progress	
2.8.6	Opioid Community Support: Launch multiple, intersectional programs that provide support to communities living with the direct and indirect consequences of the Opioid Overdoes Crisis, including targeting and expanded community engagement, services to families impacted by opioid misuse, and increased serve provisions and provision of City services at critical “hot spot” locations.	Ongoing	Include in 2026 update as follows: Launch multiple, intersectional programs that provide support to communities living with the direct and indirect consequences of the Substance Use Overdose Crisis, including targeting and expanded community engagement, services to families impacted by substance use, and increased city services at critical “hot spot” locations.
2.8.7	Bartram’s Safety : Build sidewalks, curb cuts, and pedestrian crossings, and install new lighting, gateway treatments, and (potentially) cameras to improve safety and reduce short dumping and crime along the Woodland Avenue / Grays Avenue / Lindbergh Blvd corridor in Kingsessing, Philadelphia.	In Progress	No update at this time
2.8.8	Cohocksink Multi-hazard Mitigation Project: The final phase of a six-phase flood mitigation project proposes new sewer infrastructure and green stormwater infrastructure systems in the Northern Liberties and South Kensington commercial and residential neighborhoods.	In Progress	
2.8.9	Compound fluvial-coastal flood modeling study in the Eastwick neighborhood of Philadelphia. The study is aimed at better understanding current and future flood risks and evaluating the effectiveness of potential flood mitigation solutions developed in coordination with Eastwick community members.	Completed	
2.8.10	USACE is currently conducting a study of the Eastwick neighborhood to determine feasible flood mitigation alternatives. City agencies will work in collaboration with the community to determine next steps for implementation of flood mitigation initiatives upon completion of this study.	In Progress	USACE released a draft feasibility report in Fall 2023 that recommended a levee on the Cobbs Creek. USACE will release a final report and recommendation after addressing public comments and following further analysis of induced flooding and complementary measures.

Initiative #	Description	Status	Review Comments
2.8.11	Continue the Philadelphia Fire Department's initiative to conduct education and outreach out fire prevention and provide and install free smoke alarms to Philadelphia homeowners upon request. A number of adaptive alarms are made available to residents with hearing or vision loss.	In Progress	No update at this time
2.8.12	Evaluate the feasibility of and potential form for a Community Resilience HUB for Philadelphia.	In Progress	No update at this time
2.8.13	Conduct a comprehensive review and evaluation of existing flood mitigation alternatives in Eastwick through engineering and environmental studies, benefit cost analysis, hydrologic and hydraulic modeling, and stakeholder engagement	In Progress	
3.1.1	Assess business risk to potential threats and hazards in Philadelphia and identify actionable solutions to support business response, recovery, and mitigation. This includes an analysis of past impacts to the business community and development of guidance on how businesses can leverage available mitigation funding and resources to be more prepared and resilient for the next disaster, including businesses that own or operate out of historic structures or historic districts.	Not Started	
3.1.2	Develop Regional Disaster Supply Chain Resilience Plan.	In Progress	
3.1.3	Establish open end contracts with construction companies for emergency bridge and road repairs.	Ongoing	
3.1.4	Citywide Streets Vulnerability Assessment: Document institutional knowledge of flood prone roadways and road closures from severe weather events. Develop system for tracking future storm impacts to inform mitigation actions, planning, and response related activities.	Ongoing	
3.1.5	Establish a smart detour plan for flooding of Wissahickon Creek, Schuylkill River, Cobbs Creek, and Delaware River (particularly along Delaware Avenue/Columbus Boulevard).	Not Started	
3.1.6	Develop Cyber Security Incident Response and Recovery Plan, including education and outreach to stakeholders and the public.	Not Started	
3.2.1	Establish a Resilient Infrastructure Fund to fill in funding gaps for municipal capital projects to proactively implement best practice mitigation/adaptation measures for resilient infrastructure.	In Progress	No update at this time
3.2.2	Resilience Hubs: Design and implement a resilience hub model specific to Philadelphia to support residents, before, during, and after disasters. This action includes identifying and implementing mitigation measures needed so that locations identified as hubs can remain operational during times of disaster. Structural measures may include but are not limited to backup generators/ emergency power supply, heating/cooling equipment, air filtration systems, etc.	Not Started	Added as new project in 2024 internal review

Initiative #	Description	Status	Review Comments
3.2.3	Eastwick Emergency Preparedness Capacity Building	Not Started	Added as new project in 2024 internal review
3.2.4	Manayunk/East Falls Flood Preparedness & Mitigation Study: Community-led study to identify flood preparedness and mitigation strategies in these neighborhoods	Not Started	Added as new project in 2024 internal review
3.3.1	Create Community Resilience and Environmental Action Fund to direct funding to impacted communities to implement projects that draw upon their place-based knowledge of environmental hazards and community resilience.	In Progress	No update at this time
3.3.2	Study of climate change / hazard vulnerability of police and fire facilities. Potentially expand the study to include other key civic priority facilitates. DPP will release an RFP and contract for a climate vulnerability assessment and report with maps and recommendations. This assessment will be updated on a regular basis.	In Progress	No update at this time
3.3.3	Maintaining relationships with universities and colleges within Philadelphia to support mitigation, emergency planning, training, and exercises between the City and higher educational facilities.	Ongoing	
3.3.4	Risk & Resiliency Assessments: Characterize and evaluate current and future coastal flood risk for PWD's water and wastewater treatment facilities on the tidal Delaware River (4 total), taking into account sea level rise projections and storm surge impacts. Through the risk assessment process, identify potential flood risk mitigation alternatives, considering adaptive management strategies where feasible, engage with key local and regional stakeholders, and explore partnership building opportunities.	In Progress	
3.3.5	Build collaborative opportunities with university programs interested in hazard mitigation planning. Collaboration could take the form of sharing research, students completing analysis and mapping for HMP plan updates, City presentations to classes, identifying university led mitigation actions, and internships.	Ongoing	
4.1.1	Mapping Stormwater Flooding Risk: Better define urban flood risk in areas not covered by FEMA floodplain mapping through more comprehensive mapping of sewer system flood risk in other areas of the City. PWD has already studied flash flooding risk in Wingohocking Sewershed but hopes to expand these efforts. Share results as appropriate online for community-based planning.	In Progress	
4.1.2	Perform comprehensive study of the stormwater infrastructure of the Centennial District to identify necessary improvements in park infrastructure.	In Progress	
4.1.3	Complete stream restoration projects in West Fairmount Park whose impact is localized to discreet areas to eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	Not Started	

Initiative #	Description	Status	Review Comments
4.1.4	Advance the comprehensive planning, technical analyses, and stakeholder engagement in Germantown for a storm flood risk reduction and combined sewer overflow mitigation project within the Wingohocking and the Tookany/Tacony-Frankford (TTF) Watersheds.	In Progress	
4.1.5	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Cobbs Creek Reaches 1 to 3 and Cobbs Creek Reaches 6 to 8 in Phase 2.	Not Started	
4.1.6	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Tacony Creek.	In Progress	
4.1.7	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Valley Green Road and Spring Lane.	In Progress	
4.1.8	Identify additional stream and creek restoration projects to aid in eliminating historic flooding hazards through area studies. Consider appropriate nature-based solutions (natural infrastructure, elevated berm/park space, living shoreline, etc.) to assist in adapting to flooding impacts today and from sea-level rise (SLR).	Not Started	
4.1.9	Eastwick Nature Based Solutions Feasibility Study for Flood Risk Reduction	Not Started	Added as new project in 2024 internal review
4.2.1	Conduct hydraulic modeling.	Ongoing	
4.2.2	Ongoing identification of larger infrastructure projects whose impact affects large areas of the City through PWD studies.	Ongoing	
4.2.3	Examine the impacts of all dams that are considered HHPD both in Philadelphia and that have inundation areas impacting Philadelphia, including the assets and populations at risk of dam inundation. Plan appropriate mitigation efforts and apply for FEMA HHPD funding.	Not Started	
4.2.4	Implement PWD's Drinking Water Revitalization Plan (WRP) and related 25-year Capital Improvement Plan, which focuses on PWD's Drinking Water Treatment Plants, Pumping Stations, and Conveyance Systems. Implementation projects are planned projects to meet goals (in categories including system redundancy, resiliency, water quality, water quantity, and service pressure) and mitigate risks (e.g., aging infrastructure, current and future regulations, climate change, and environmental risks) identified in the 2019 Water Master Plan. WRP projects currently in Planning/Design phases include water treatment plant expansion, pumping station rehabilitation and construction, storage facility reconstruction, and transmission piping additions. All WRP projects are planned to mitigate risks on both the system and facility level.	In Progress	
4.2.5	Conduct study to identify stream restoration projects in West Fairmount Park along with the goal to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	In Progress	No update at this time

Initiative #	Description	Status	Review Comments
4.2.6	Complete wetland creation projects in FDR Park to eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas and connect park users to the water.	In Progress	
4.2.7	Perform Shedbrook Creek Stream Rehabilitation to aid in eliminating historic flooding hazards, improve safety of structure or surrounding areas, eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas.	In Progress	
4.2.8	Perform structural repairs to dams and/ or removal of fishway structure at Fairmount Dam to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	In Progress	No update at this time
4.2.9	Perform structural repairs to dams and/ or removal of Flat Rock Dam, a HHPD to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	In Progress	
4.2.10	Perform Tacony Creek Stream Rehabilitation Reaches 4 and 5 to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	In Progress	
4.2.11	Complete smaller sewer and green infrastructure projects whose impact is localized to discreet areas. Over one hundred are currently in design stages.	Ongoing	
4.2.12	Addition of effluent and outfall pumping station to Northeast Water Pollution Control Plant Outfall and Effluent Pumping Station to pump treated water to the river during extreme wet weather events and high tide. Benefits estimated 852,900 Phila residents, and an estimate 221,000 residents from 1) Abington Township; 2) Bensalem Township; 3) the Bucks County Water and Sewer Authority (including all or parts of the Townships of Bristol, Falls, Lower Wakefield, Middletown, Newtown, and Northampton and the Boroughs of Hulmeville, Langhorne, Langhorne Manor, Newtown, and Penndel); 4) Cheltenham Township, 5) Lower Moreland Township, and 6) Lower Southampton	In Progress	
4.2.13	Addition of wastewater and stormwater pumps and storage in various locations throughout the system and facilities to send more water to the water pollution control plants during wet weather events.	In Progress	
4.2.14	Build additional water mains to provide better system redundancy and resiliency.	In Progress	
4.2.15	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Historic District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	Not Started	

Initiative #	Description	Status	Review Comments
4.2.16	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Mustin District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	Not Started	
4.2.17	Improve and upgrade water security system to prevent theft of chemicals, contamination of treated drinking water, and damage to critical infrastructure. Projects considered for 29th Street Complex Storage Units, Baxter and Belmont Water Treatment Plants, and Northeast and Southwest Water Pollution Control Plants.	Completed	
4.2.18	Install backup generators and switchgear at Queen Lane Raw Pump Station to ensure operations during power outages.	In Progress	
4.2.19	Install backup generators at West Oak Lane to ensure operations during power outages.	Completed	
4.2.20	Make stormwater sewer improvements to reduce the combined sewer overflows affecting approximately 109 properties in the area between 1651 and 1851 Christopher Columbus Blvd during extreme rain events.	Discontinue	
4.2.21	Moore St. drainage from Christopher Columbus to River infrastructure project to improve capabilities in the area.	In Progress	
4.2.22	Phase V of Northern Liberties infrastructure projects, which affects Northern Liberties and surrounding neighborhoods water drainage system capabilities.	Completed	
4.2.23	Rehabilitate Queen Lane Raw Water Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	In Progress	
4.2.24	Relocate Belmont Raw Water Pump Station Intake to ensure reliable source during droughts and winter storms.	In Progress	
4.2.25	Restore approximately 12,000 linear feet of stream channel and 25-40 acres of wetlands on the Cobbs Creek Golf Course to maximize flood storage potential and create a stable, natural floodplain.	In Progress	
4.2.26	Upgrade Lardner's Point Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	In Progress	
4.2.27	Upgrade Mingo Creek Pumping Station to handle increased flows from wet weather events.	In Progress	
4.2.28	Upgrade of various wastewater and stormwater pump stations to handle increased flows from wet weather events.	In Progress	
4.2.29	Upgrade P-796 at the Navy Yard Design to handle increased flows from wet weather events.	In Progress	

Initiative #	Description	Status	Review Comments
4.2.30	Coordinate with Pennsylvania DEP and Franklin Mills Limited Partnership on future plan updates regarding HHPD standards and planning.	Not Started	
4.2.31	Replace 1,860 linear feet of 4'0" brick sewer with 72" reinforced concrete pipe sewer along a segment of 21st Street in the Germantown Neighborhood	In Progress	
4.2.32	Increase sedimentation tank Capacity and mitigate flood risks, provide community and economic resiliency, and improve water quality.	In Progress	
4.3.1	Establish a policy based on need and funding availability for a regular pruning cycle for City trees.	In Progress	
4.3.2	Complete sewer and green infrastructure projects whose impact is localized to discreet areas in West Fairmount Park.	In Progress	
4.3.3	Inspect trees within 100 ft. of walkways and roadways for signs of the emerald ash borer and treat affected trees every three years.	Ongoing	
4.3.4	Monitor new tree watering contracts to ensure the trees have sufficient time to take root and establish themselves under warmer temperatures.	In Progress	
4.3.5	Pilot study the growth of Southern plant species with sustainable planting practices in preparation for increasing temperatures over the next century.	In Progress	
4.3.6	Utilize City Works Trees to track real-time response and management of downed trees and vegetation prior to, during, and following events.	Completed	
4.3.7	Decrease the backlog of 2,000+ tree maintenance and removal projects to reduce unpruned and dead trees falling on power lines during storm events.	In Progress	No update at this time
4.3.8	Montgomery Creek infrastructure repair at approach to Black Road and I-76	In Progress	
4.3.9	City tree planting and maintenance: Planting and care of street and park trees throughout the City of Philadelphia to reduce the impacts of heat islands.	Not Started	Added as new project in 2024 internal review
4.4.1	Develop a continuously updated Climate Data tool for screening infrastructure projects and planning processes against the best available climate projections for the City and region.	In Progress	
4.4.2	Update an Indego Bike Share Comprehensive Hazard Mitigation Plan based on best practices for operational practices that mitigate identified hazards.	Completed	
4.4.3	Develop phased implementation strategy for optimizing use of biogas at NEWPCP and SWWPCP, including better utilization of biogas today and developing a plan for the future (including upgrading biogas to Renewable Natural Gas).	In Progress	
4.5.1	Examine mitigation opportunities that address flooding and rising water tables from increased precipitation and sea level rise inundating brownfields and releasing hazardous materials into local waterways.	In Progress	No update at this time

Initiative #	Description	Status	Review Comments
4.5.2	Construction of additional chemical dosing boosters and flushers throughout the City to maintain water quality.	Discontinue	Removed in previous annual reviews
4.5.3	Secure intake booming materials.	In Progress	No update at this time
4.5.4	Remove oil storage facility (tank farm).	In Progress	No update at this time
4.5.5	Remediation of lagoons at Southwest Water and Northeast Water Pollution Control Plan	In Progress	
5.1.1	Conduct active shooter training for City staff.	In Progress	No update at this time
5.1.2	Employ a READYEmployee process to alert over 7,000 City employees that work in the Center City Quadplex buildings—City Hall, Municipal Services Building (MSB), One Parkway Building (OPB), Juanita Kidd Stout Center for Criminal Justice (SCCJ)—of emergencies and quickly gather an accountability report.	Not Started	
5.1.3	Expand Multi-Assault, Counter Terrorism Action Capabilities (MACTAC) training program for patrol officers.	In Progress	No update at this time
5.1.4	Expand and continue training for all PPD personnel including, but not limited to: SPOT Training, Prevention and Deterrence of Terrorism Training, Advanced Trauma Training, Mass Casualty Awareness Training, Customized Alarm Response Training, Site Protection by Observational Techniques Training, Protest Awareness Training, Customized Alarm Response Training, Tourniquet Training, Field Force Operations Training, Field Force Extraction Training, Field Force Command Planning Training.	In Progress	No update at this time
5.1.5	Upkeep PFD Hazmat training and equipment.	In Progress	No update at this time
5.2.1	Deploy a stream flood gauge on the Darby Creek near the Eastwick neighborhood.	In Progress	
5.2.2	Inclusive and Equitable Public Health Notification, Engagement, Partnership and Awareness: Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; a “Be a Buddy” program to empowering residents to support neighbors who may be at risk for adverse health outcomes; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around extreme weather; community-based health bulletins; and a risk communication playbook for high priority public health hazards.	Ongoing	Include in 2026 update as follows: Inclusive and Equitable Public Health Notification, Engagement, Partnership and Awareness: Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.

Initiative #	Description	Status	Review Comments
5.2.3	Revamp and update Philadelphia OEM's Alert and Warning Plan for the City, along with associated frameworks and deliverables. Create a social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	In Progress	OEM applied for and received an Operations Transformation Grant (OTF) via an internal City process for $500,000 to update the City's alert and warning program in the Eastwick neighborhood. This project includes additional flood monitoring technology, place-based messaging with specific instructions for Eastwick residents and multiple language options. This project kicked off in 2023 and is currently on-going.
5.3.1	Create a Flood and Hurricane Preparedness Campaigns promoting mitigation efforts residents and businesses can take prior to flooding events, including print material and digital and social media content that focus on steps people can take to prepare for severe storms. This also includes development of new innovative messaging to promote in-person preparedness workshops to assist in preparing citizens for hurricane season and messaging to support the Community Outreach Team attracting participants to hurricane season at tabling events.	Ongoing	
5.3.2	Provide public outreach throughout Philadelphia with READYHome, READYCommunity, and READYBusiness to increase community preparedness and mitigation.	Ongoing	
5.3.3	Promote post disaster mitigation strategies throughout SEPA region, targeting communities that are most vulnerable. VOAD (Voluntary Organizations Active in Disaster) partner agencies may implement mitigation strategies.	Not Started	
5.3.4	Update OEM's Ready programs, including READYBusiness to focus on COOP Planning and risk mitigation strategies for small to medium-size businesses, and READYKids in partnership with MDO Head Start & PFD Prevention Division.	Ongoing	
5.3.5	Employ spatial data to inform OEM's community preparedness outreach to help OEM better understand where preparedness outreach is occurring and ultimately focus on areas most at risk.	Ongoing	
5.4.1	Bring in subject-matter experts to conduct trainings on benefit-cost analysis (BCA) for Philadelphia partners to support development of grant applications for mitigation projects.	Completed	
5.4.2	Develop and socialize guide and calendar of all available mitigation funding resources. Continue to develop and implement coordinated City approach to pursue mitigation funding.	In Progress	
5.4.3	Meet quarterly with VOAD partners to maintain preparedness, ensure situational awareness, identify resource capabilities, and build stakeholder relationships pre-disaster.	Ongoing	

Initiative #	Description	Status	Review Comments
5.4.4	Revitalize the Philadelphia Emergency Management Council from a 6+ year hiatus. This local council will consist of key City leadership and will focus on strategic emergency management issues including long-term risk reduction and risk/hazard education at a senior level	In Progress	No update at this time
5.4.5	Research and plan to increase the reach and timeliness of Regional Integration Center (RIC) research products (situational awareness reports, pre-event briefings, weather reports, etc.) before and during an event.	In Progress	

6.3 MITIGATION GOALS AND OBJECTIVES

This section describes the mitigation goals and objectives set forth in the 2026 HMP update.

- **Goals** are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).
- **Objectives** are short-term aims that form a strategy or course of action to meet a goal. Unlike goals, objectives are stand-alone measurements of the effectiveness of a mitigation action. The objectives also are used to help establish priorities. Broadly defined mitigation objectives were eliminated from the updated strategy unless accompanied by discrete actions.

6.3.1 2026 Mitigation Goals

The Stakeholder Steering Committee and plan stakeholders reviewed the 2022 HMP goals to determine their continuing applicability to City mitigation needs and decided to update them. The Stakeholder Steering Committee reviewed and approved the updated goals for the 2026 HMP. The 2026 City of Philadelphia HMP goals are in line with the State HMP mitigation goals, embody the overarching needs and concerns of the City and address both natural and non-natural hazard risk reduction.

The mitigation goals identified in the 2022 version of the HMP are listed below:

- Goal 1: Protect all life and reduce risks that exacerbate inequities in health safety.
- Goal 2: Build the resilience of community assets, including property, infrastructure, and cultural resources.
- Goal 3: Foster an economy that promotes mitigation and reduces impacts from hazards.
- Goal 4: Restore and enhance the natural ecology.
- Goal 5: Create awareness and demand for mitigation and adaptation as a standard of practice.

The Steering Committee was asked to evaluate the 2022 HMP goals and objectives to determine their continuing applicability to City mitigation needs and decided to update them by answering the questions displayed in Table 6-2. The Steering Committee reviewed and approved the updated goals for the 2026 HMP. The 2026 City of Philadelphia HMP goals are in line with the State HMP mitigation goals, embody the overarching needs and concerns of the City and address both natural and non-natural hazard risk reduction.

Table 6-2 shows the results of the Steering Committee review. The Steering Committee elected to keep the goals and objectives the same as the 2022 HMP.

> "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards."
>
> *44 CFR 201.6(c)(3)(i)*

Table 6-2. Evaluation of 2022 Goals and Objectives

Question	Goal 1			Goal 2			Goal 3			Goal 4			Goal 5		
	Yes	No	Not Sure	Yes	No	Not Sure	Yes	No	Not Sure	Yes	No	Not Sure	Yes	No	Not Sure
Does the goal and objectives address current and expected conditions?	6	0	0	3	0	0	4	1	0	5	0	0	5	0	0
Does the goal and objectives reflect current hazard risk?	6	0	0	3	0	0	4	1	0	4	1	0	5	0	0
Did the goal and objectives lead to mitigation projects and/or changes in policy that helped to reduce vulnerability?	3	0	3	2	0	1	0	1	4	4	0	1	4	0	1
Does the goal and objectives support changes in mitigation priorities?	6	0	0	3	0	0	2	2	1	4	0	1	4	0	1
Does the goal and objectives reflect the 2023 State HMP goals?	3	0	3	1	0	2	2	0	3	4	0	1	2	0	3
Is there new information or knowledge that needs to be incorporated into the goal or objectives?	2	3	1	1	2	0	2	1	2	2	1	2	2	0	2

Note: Not all participants engaged in the polling. For goal #5, a response to the last question was not received from one of the participants.

6.3.2 2026 Mitigation Objectives

The goals listed above were used to develop relevant objectives. The objectives address the results of the vulnerability assessment in more specific terms and reflect the possible effects that can be mitigated for the identified hazards, as well as existing limitations in available data and information. The objectives that were originally identified during the 2022 HMP update process were reviewed by the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee and updated to reflect changes in City priorities and capabilities since the HMP was written in 2022. Objectives related to each of the goals are listed below, and Table 6-2 summarizes the evaluation of all goals and objectives from the 2022 HMP.

- **Goal 1: Protect all life and reduce risks that exacerbate inequities in health safety.**
  - Objective 1.1—Develop and implement strategies to reduce Philadelphians' risk to natural and human-made hazards.
  - Objective 1.2—Prioritize mitigation actions that affect populations most at-risk and that prioritize equity and accessibility.
- **Goal 2: Build the resilience of community assets, including property, infrastructure, and cultural resources.**
  - Objective 2.1—Implement projects and programs that protect property against flooding.
  - Objective 2.2—Assess vulnerability of infrastructure to identify where to prioritize mitigation actions.
  - Objective 2.3—Develop and implement mitigation programs and strategies that protect critical facilities and services.
  - Objective 2.4—Integrate hazard and risk information into land use planning decisions.
  - Objective 2.5—Promote post-disaster mitigation as part of restoration, recovery, and resilience building.
  - Objective 2.6—Repair, restore, and maintain existing infrastructure.
  - Objective 2.7—Identify, plan for, and protect historic properties and cultural resources.
  - Objective 2.8—Address historic drivers of vulnerability and invest in community assets.
- **Goal 3: Foster an economy that promotes mitigation and reduces impacts from hazards.**
  - Objective 3.1—Prioritize mitigation strategies that support the continuation of critical business operations during and following a disaster.
  - Objective 3.2—Sustain, promote, and enhance partnerships with external public and private entities to identify and share resources.
  - Objective 3.3—Form partnerships to leverage and share resources to address hazard risks today and projected from climate change.
- **Goal 4: Restore and enhance the natural ecology.**
  - Objective 4.1—Promote nature-based solutions to manage stormwater and reduce the impacts of flooding and SLR.
  - Objective 4.2—Support projects that address water holistically including water quality, stormwater management, dam safety, and flood mitigation.
  - Objective 4.3—Restore and enhance green spaces and prioritize communities overburdened by environmental hazards.
  - Objective 4.4—Support the transition away from fossil fuels and other greenhouse gases that impact health and safety and exacerbate climate change.

- Objective 4.5—Improve air, water, and soil quality across the City starting with environmental justice communities.

- **Goal 5: Create awareness and demand for mitigation and adaptation as a standard of practice.**
  - Objective 5.1—Tailor mitigation training to public officials, businesses, organizations, and the public emphasizing equity and inclusion.
  - Objective 5.2—Improve existing and put in place necessary warning systems.
  - Objective 5.3—Increase public's awareness of hazards, mitigation, and other protective measures, including those related to the projected impacts of climate change.
  - Objective 5.4—Continue and expand coordination efforts to plan for cross-agency mitigation efforts.

6.4 IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

Concerted efforts were made to ensure that the City developed updated mitigation strategies. Updated strategies included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance, "Local Mitigation Planning Handbook." Mitigation action types listed in the FEMA guidance include the following (FEMA 2023):

- Local Plans and Regulations: These actions include government authorities, policies, or codes that influence the way land and buildings are being developed and built.
- Structure and Infrastructure Projects: These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. These project types could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- Natural Systems Protection: These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.
- Education and Awareness Programs: These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as NFIP and CRS, StormReady (NOAA), and Firewise (National Fire Protection Association [NFPA]) Communities.

The participants of the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee identified actions that relate to the techniques listed above. Table 6-3 identifies which mitigation techniques are applicable for the hazards included in the 2026 HMP. In some cases, the mitigation techniques identified for a particular hazard reflect ongoing mitigation capabilities, not specific projects included in the updated HMP.

Table 6-3. Mitigation Technique Matrix

Hazard	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs
Building and Structure Collapse	X	X		X
Civil Disturbance	X	X		X
Cyberterrorism	X	X	X	X
Dam Failure	X	X		X
Drought	X	X	X	X
Earthquake	X	X		X

Hazard	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs
Environmental Hazards - Hazardous Materials Release	X	X	X	X
Extreme Temperatures	X	X	X	X
Flood	X	X	X	X
Gun Violence and Criminal Activity	X	X		X
Hurricane, Tropical Storm, Nor'easter	X	X	X	X
Pandemic and Infectious Disease	X	X		X
Subsidence, Sinkhole	X	X		X
Substance Use Disorder	X	X		X
Terrorism	X	X		X
Tornado, Windstorm	X	X	X	X
Winter Storm	X	X	X	X
Urban Fire and Explosion	X	X		X

6.5 MITIGATION ACTION PLAN

Representatives from the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee selected mitigation strategies and initiatives to pursue until the next plan update. These actions also include some actions identified during the 2022 update that are still relevant or in progress. This section describes 2026 mitigation initiatives, mitigation strategy prioritization and implementation, and prioritization of mitigation actions.

6.5.1 2026 Mitigation Initiatives

Table 6-4 summarizes the updated mitigation strategies identified by the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee, including the following information:

- Mitigation actions for individual and multiple hazards
- Mitigation action type
- Department or agency primarily responsible for project initiation and/or implementation
- Estimated cost for the mitigation action and identification of known or potential sources of funding
- Implementation schedule
- Implementation priority

The updated mitigation actions were documented using the Mitigation Action Worksheet. Refer to Appendix E for a blank version of the Mitigation Action Worksheet. Specific mitigation actions were identified to prevent future losses; potential funding sources (see Section 5.4) are indicated to support future implementation.

The Steering Committee, All-Stakeholders Work Group, and Public Steering Committee prioritized proposed mitigation actions during the All-Stakeholder Workgroup: Mitigation Strategy Workshop and the Public Steering Committee: Mitigation Strategy Workshops. In general, mitigation actions ranked as highest priorities should be addressed first, depending upon funding. However, medium- or low priority mitigation actions will be considered for

implementation as funding becomes available. Therefore, the ranking levels should be considered as a preliminary ranking, which will evolve based on prevailing priorities and discretion of local governments, the public, the Pennsylvania Emergency Management Agency (PEMA), and FEMA as the plan update is implemented.

Table 6-4. Hazard Mitigation Strategy

Note: Some of the identified mitigation initiatives in Table 6-4 are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in City priorities. Actions that have been carried over from the 2022 version of the HMP may have been reworded and given a new initiative designation to conform to current needs and procedures.

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
Goal 1: Protect all life and reduce risks that exacerbate inequities in health safety.												
Objective 1.1: Develop and implement strategies to reduce Philadelphians' risk to natural and human-made hazards.												
1.1.1	Continue to maintain and update the City's All-Hazard Mitigation Plan with a focus on plan integration and implementation.	N/A	All Hazards	OEM	N/A	Medium	Low	Staff time, Agency operating budget, HMA	Long	High	LPR	PM
1.1.2	Develop and implement a drought contingency plan. PWD will update the existing Drought Contingency Plan with pertinent policy and regulatory updates, improved science and technical tools, and with a greater understanding of how Delaware Watershed policies can impact Philadelphia's water supply during critical drought conditions such as reduced water super availability.	N/A	Drought	PWD	OEM, DRBC	Medium	Low	Bureau of Reclamation WaterSMART	Short	Medium	LPR	PM
1.1.3	Invest resources to plan and staff initiatives to reduce hazard risks citywide. This includes development of and coordination for Cybersecurity Incident Response and Recovery Plan and Training; a Philadelphia Economic Recovery Plan; a Regional Disaster Housing Plan, and pandemic response planning.	N/A	All Hazards	OEM	N/A	High	Medium	FEMA State and Local Cybersecurity Grant Program (SLCGP)	Long	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
1.1.4	PDPH Pandemic Planning and Implementation: Update and implement key plans including pandemic response, mass prophylaxis and immunization, and others to reflect best practices and lessons learned during COVID-19and other disease outbreak responses. This encompasses incorporating high-consequence pathogen planning and readiness, including biohazard considerations and healthcare coordination ; identifying sites to administer vaccine and/or dispense medical countermeasures during public health emergencies; coordinating with other human services partners to ensure inclusion of special populations such as children, persons experiencing homelessness, and persons with access and functional needs; identifying isolation and quarantine locations and potential wraparound services; ensuring a standardized process for public data dashboard development and discontinuation; and other preparations for outbreak related response activities.	N/A	Pandemic and Infectious Disease	PDPH	N/A	High	Medium	Grants	Short	High	LPR	PM
1.1.5	Expand lab capacity to rapidly identify and subtype organisms.	Existing	Pandemic and Infectious Disease	PDPH	N/A	High	High	HHS Grants, Capital Budget	Short	Medium	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
1.1.6	Improve access to primary medical care citywide and improve the quality of primary care by expanding the scope of services and building facility capacity for City Health Centers.	Both	Pandemic and Infectious Disease	PDPH	N/A	High	High	HHS Grants, Capital Budget	Long	High	SIP	PM
1.1.7	Improve environmental conditions to foster a sense of safety in neighborhoods, connectedness among neighbors, and reduce the locations where illegal guns are stored and where illegal activity occurs. Projects include addressing blighted buildings, cleaning abandoned lots, improving lighting, and other initiatives to improve environmental conditions.	Existing	Building and Structure Collapse, Hazardous Materials Releases, Urban Fire and Explosion, Gun Violence and Criminal Activity	Office of Policy and Strategic Initiatives	OOS	High	High	PA Redevelop-ment Assistance Capital Program, Infrastructure Investment and Jobs Act (IIJA) Healthy Streets, HMA	Long	High	SIP	PM
1.1.8	Implement Roadmap to Safer Communities programs including Group Violence Intervention, Community Crisis Intervention Program, and Operation Pinpoint.	N/A	Gun Violence and Criminal Activity	Office of Policy and Strategic Initiatives	N/A	High	High	PA Redevelopme nt Assistance Capital Program, IIJA Healthy Streets	Short	Medium	EAP	PI
1.1.9	Identify and implement short-term flood proofing tools for at-risk communities.	N/A	Flood, Hurricane	OEM	N/A	High	High	Agency Operating Budget	Short	Medium	SIP	PM/ ES

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
1.1.10	Climate Resilience Plan Update: Update the City's Climate Resilience Plan to include updated climate projections, a heat and flooding vulnerability analysis, new community-informed climate actions, and increased community engagement. Results of the updated climate resilience plan will be used to inform the Hazard Mitigation Plan.	Existing	All Natural Hazards	OOS	PCPC	High	Medium	Agency Operating Budget (funded by philanthropic funds and CBDG-DR funds)	Short	High	LPR	PM
1.1.11	Climate Resilience Place-based Program Expansion: Expand Office of Sustainability's climate resilience place-based program which will include identifying new communities with climate vulnerabilities and working closely with community based organizations to address those vulnerabilities and increase community resilience	N/A	All Natural Hazards	OOS	N/A	Medium	Low	Agency Operating Budget	Short	High	LPR	PM
1.1.12	Establish and maintain heating and cooling centers.	Both	Extreme Temperature	OEM	N/A	Medium	Low	Agency Operating Budget	Short	Medium	LPR	PM
Objective 1.2: Prioritize mitigation actions that affect populations most at-risk and that prioritize equity and accessibility.												
1.2.1	Conduct outreach and coordinate personnel to keep the Philadelphia unhoused population safe during extreme cold and extreme heat events.	N/A	Extreme Temperature	OHS	N/A	Medium	Low	Agency Operating Budget	Short	Medium	EAP	PI
1.2.2	Expand low barrier access to harm reduction resources in zip codes with high rates of unintentional fatal overdoses, particularly amongst communities of color.	N/A	Substance Use Disorder	SUPHR	N/A	High	Medium	Agency Operating Budget	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
1.2.3	Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	N/A	Extreme Temperature, Pandemic and Infectious Disease	PDPH	N/A	Medium	Low	Agency Operating Budget	Short	High	LPR	ES/ PM
1.2.4	Protect and ensure continuous service of municipal spaces and facilities that serve vulnerable populations in Philadelphia, particularly during extreme heat and flooding events. Identify priority municipal sites that serve vulnerable populations, such as libraries, health centers, incarceration facilities, and recreation centers. Develop recommended mitigation and resilience actions based on the facility assessments.	N/A	Extreme Temperature, Flood, Hurricane	OOS	OEM	High	Medium	Agency Operating Budget	Long	High	SIP	ES/ SFCP
Goal 2: Build the resilience of community assets, including property, infrastructure, and cultural resources.												
Objective 2.1: Implement projects and programs that protect property against flooding.												
2.1.1	Assess properties that may benefit from long-term flood resilience measures including elevation, acquisition, relocation, mitigation reconstruction, and additional adaptive/adaptation measures	Existing	Flood, Hurricane	OOS	DHCD, PHDC, OEM	High	Medium	Operating budgets, HMA, CBDG-DR	Short	High	SIP	PP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.1.2	Implement long-term flood resilience measures including elevate, acquire, relocate, retrofit, floodproof, complete mitigation reconstruction, and adapt properties that benefit from elevation, acquisition, relocation, completing mitigation reconstruction, or additional adaptive/adaptation measures.	Existing	Flood, Hurricane	DHCD, PHDC OOS	N/A	High	Medium	Staff time, HMA	Long	High	SIP	PP
2.1.3	Assess reuse of City properties that have assets that are prone to damage from flooding	Existing	Flood, Hurricane	OEM	L&I, Department of Planning and Development (DPD), PWD, FRMTF	High	High	Operating budgets	Long	High	SIP	PM
2.1.4	Bartram's North and South Flood Mitigation: Examine and implement mitigation methods that protects buildings and access without providing any adverse impact to upstream or downstream properties along the western bank of the Schuylkill River.	Existing	Flood, Hurricane	PIDC	N/A	High	High	PA Redevelop-ment Assistance Capital Program (RACP)	Short	High	SIP	PM/ SFCP
2.1.5	Demolish Philadelphia owned 4910 Botanic site structures, remediate known environmental contamination, and convey the riverfront portion of the site to PPR/Schuylkill River Trail/Bartram's Garden to decrease flood risks, risk of criminal activity, and risk of building collapse.	Existing	Flood, Hurricane, Gun Violence and Criminal Activity, Building and Structural Collapse	PIDC	PPR, Schuylkill River Development Corporation, Bartram's Garden, PHA	High	High	PA RACP	Short	High	SIP	SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.1.6	Align reviews of City floodplain regulation with best practices and models from other peer city's and guidance with the International Code Council (ICC) tri-annual updates of the building codes. Follow and educate people in building profession on required and recommended strategies to mitigate hazards and increase resilience.	N/A	Flood, Hurricane	L&I, OOS	PCPC	Medium	Low	Agency Operating Budget, CAP-SSSE or CTP funding through PEMA	Short	High	LPR	PM
2.1.7	Develop a software platform to share flooding event information across departments in real-time as well as historically.	N/A	Flood, Hurricane	FRMTF	N/A	High	Medium	Agency Operating Budget	Short	Medium	LPR	PM
2.1.8	Maintain enrollment in NFIP and CRS by implementing floodplain management initiatives, reducing the City's flood risk, and allowing residents to receive discounted flood insurance.	N/A	Flood	L&I, OOS	Flood Risk Management Task Force (FRMTF)	Medium	Low	Agency Operating Budget, CAP-SSSE or CTP funding through PEMA	Long	Medium	LPR	PM
2.1.9	Implement interim flood mitigation to provide near-term relief to flooding in Eastwick while a community-driven long-term flood resilience strategy is being developed. The project will install a soil-filled flood barrier (for example, using HESCO Floodline) along the Cobbs Creek in Eastwick where riverine flooding typically overflows into the Eastwick community.	Existing	Flood, Hurricane	OOS	Streets, PPR, OEM, PWD	High	High	HMA, DEP, CDBG-DR	Short	High	SIP	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.1.10	Retain consultant services for the Philadelphia Dept of License & Inspections in their Floodplain Administration duties to provide additional oversight and recommendations in the review of Hydrologic and Hydraulic (H&H) engineering analysis modeling submissions provided with applications that affect coastal floodplains, regulated floodways and riverine floodways without regulatory floodways. Over the span of this project, we intend for these services to help identify current gaps in the review processes of applications that require an H&H engineering analysis under International Building Code, Sections G103.4, G103.5, G103.6 & G103.7 and our local floodplain ordinance, and to develop/identify new engineering resources/tools to assist in more effective enforcement and administration of these floodplain provisions.	N/A	Flood	L&I	N/A	High	High	Agency Operating Budget	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.1.11	Conduct a detailed climate risk characterization and assessment of the PWD collection system to determine priority areas for infrastructure and operational improvements. The assessment will inform future operation, planning, and design adaptation efforts to ensure continued reliability and system resilience under a changing climate.	N/A	All Natural Hazards	PWD	N/A	High	Medium	Agency Operating Budget	Short	High	LPR	PM
2.1.12	Ensure the flood resilience of PWD facilities by addressing risks associated with both coastal flooding (sea level rise and storm surge) and riverine flooding. This effort may include developing and implementing Adaptive Management Plans to proactively manage current and future flood-related impacts.	N/A	Flood, Hurricane	PWD	N/A	High	High	Agency Operating Budget	Short	High	LPR	PM
2.1.13	Development of a compound flood model to better understand flood risk today and in the future from all sources of flooding.	N/A	Flood	OOS	PWD, FRMTF	High	High	Agency Operating Budget	Short	High	LPR	PM
2.1.14	Evaluate a potential coastal levee in Eastwick that would mitigate future sea level rise and coastal storm surge events that are likely to impact the Eastwick neighborhood, the SEPTA tracks, the airport, and the Heinz Wildlife Refuge.	Existing	Flood, Hurricane	OOS, PHL	USFWS, SEPTA	High	High	HMA, USACE	Long	Medium	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.1.15	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement programs to inform surrounding private and commercial property owners of opportunities to elevate their structure and/or add flood protection measures, such as berms, floodwalls, or floodproofing, if the structure(s) are in a dam inundation zone for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	Existing	Dam Failure, Flood	OEM	PWD, L&I, PCPC, FRMTF, Dam Owners	High	Medium	Staff time, HMA, HHPD	Long	High	SIP	PP
Objective 2.2: Assess vulnerability of infrastructure to identify where to prioritize mitigation actions.												
2.2.1	Continue bridge inspection training and conduct bridge inspections.	Existing	Building and Structure Collapse	Streets	PennDOT	Medium	Low	Agency Operating Budget, PennDOT	Short	Medium	EAP	PM
2.2.2	Continue to analyze the impact of natural and human-caused hazards and threats on critical infrastructure that supports supply chain systems through the update of the Freight (Truck) Network.	N/A	All Hazards	OTIS	Streets	Medium	Low	Staff time, Agency operating budget, HMA	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.2.3	Develop a Trail Resiliency Plan and identify flood mitigation strategies for Philadelphia's extensive trail network. Trails often follow streams and rivers in Philadelphia. Recreation and travel can be a suitable use of the floodplain. However, trail infrastructure represents a significant investment from City, State and Federal partners. OTIS would like to examine how trail infrastructure can be built resiliently to protect the investment while also protecting the ability of the floodplain to absorb water. The study will consider vulnerable assets, best practices in materials and construction suitable to a floodplain, and overall trail network resiliency. Trails provide a travel mechanism that does not contribute to climate change and provides healthy recreational options for residents.	N/A	Flood, Hurricane	OTIS	PCPC, PPR, Streets	High	Medium	FEMA BRIC, Transportation Alternatives Program (TAP) via PennDOT, Potentially new IIJA Healthy Streets program	Short	High	LPR	PM
2.2.4	Create a hazard event database to capture description, severity, location, impact, and potential loss/damage estimate from an event. This data will be used to update the hazard analysis and mitigation actions for Philadelphia, as well as allow the City to be better prepared for future events.	N/A	All Hazards	OEM	PCPC, OOS	Medium	Low	HSGP	Short	Medium	LPR	PM
2.2.5	Enhance THIRA process to identify gaps in mitigation capabilities, and to better align the THIRA with the HMP Planning Process.	N/A	All Hazards	OEM	N/A	Medium	Low	HSGP	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.2.6	Maintain Tier II Reporting and GIS program.	N/A	Hazardous Materials, Urban Fire and Explosion	OEM	PFD, OIT	Medium	Low	HSGP	Short	Medium	LPR	PM
2.2.7	Update the Tier II emergency response plan process/template to provide more situational awareness on chemical inventories across the City for OEM/PFD and its partners.	N/A	Hazardous Materials, Urban Fire and Explosion	OEM	N/A	Medium	Low	Agency Operating Budget, HSGP	Short	Medium	LPR	PM
2.2.8	Improve floodplain mapping to support vulnerability assessments for critical infrastructure and City initiated LOMCs, using updated inundation mapping.	N/A	Flood, Hurricane	L&I	OOS, PWD, FRMTF	Medium	Low	PA Silver Jackets, CAP-SSSE or CTP funding through PEMA, Agency Operating Budget	Short	Medium	LPR	PM
2.2.9	Use damage assessment data to conduct in depth GIS analysis of impacts from past flooding and storms events to better predict future impacts from similar storm events and inform severe weather preparedness planning, alert & warning messaging, and mitigation initiatives in those areas.	N/A	Flood, Hurricane, Subsidence and Sinkhole	OEM	OIT	High	Medium	Agency Operating Budget	Short	Medium	LPR	PM
2.2.10	Utilize the results of the 2025 Hazus analysis to identify new mitigation projects.	N/A	All Hazards	OEM	HM Steering Committee	Medium	Low	Agency Operating Budget	Short	Medium	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.2.11	Support the USACE production of inundation level mapping for the Schuylkill River alongside the remapping of the floodplain, to reflect the impact levels available for USGS gauge 01474500	N/A	Flood	PWD	USACE	High	Medium	USACE	Short	Medium	LPR	PM
2.2.12	Navy Yard Resilience Study: A comprehensive Resilience Study at the Navy Yard will be critical to inform the implementation of HMP projects. The study will analyze existing conditions; assess all potential risks & vulnerabilities; identify resiliency projects; and advance at least one early-action resiliency project.	N/A	All Hazards	PIDC	N/A	High	High	Agency Operating Budget, HMA	Short	High	LPR	PM
2.2.13	Cobbs Creek Multiuse Trails: Due to the Cobbs Creek frequent floods, there are access and maintenance issues for the multiuse Cobbs Creek trail system. Resilient planning and design will be explored as part of the construction and future maintenance plan of the Cobbs Creek trail.	N/A	Flood, Hurricane	OTIS	PCPC	High	High	Agency Operating Budget, HMA	Short	Medium	LPR	PM
2.2.14	Initiating Delaware River Long-Term Flood Protection Feasibility Solutions Study to address tidal surge flooding. Depending on feasibility study results, DOA may select one or more phases to design and construct.	N/A	Flood, Hurricane	PHL-DOA	N/A	High	High	Agency Operating Budget, HMA, DEP	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.2.15	Design and implement improvements to 84th Street, a priority roadway in Eastwick, by combing traffic calming and flood resilience measures. Interventions may include increasing vegetation throughout the corrdior, elevating the bridge approaches out of the floodplain and improving bike and pedestrian facilities.	N/A	Flood	OMP, OOS	PennDOT, OTIS, PWD, PCPC	High	High	Agency Operating Budget, HMA, DEP, US DOT	Short	High	LPR	PM/ SFCP
2.2.16	Develop and implement innovative, nature-based, and engineered flood resilience measures to protect flood-prone neighborhoods from pluvial flooding caused by extreme rainfall events. Opportunities include green infrastructure, stormwater management improvements, and comprehensive planning and technical analyses to design effective mitigation strategies.	N/A	Flood, Hurricane	FRMTF	OOS, PCPC, PWD	High	High	Agency Operating Budget, HMA	Long	High	LPR	PM/ SFCP
Objective 2.3: Develop and implement mitigation programs and strategies that protect critical facilities and services.												
2.3.1	Continue to enhance Citywide COOP-COG program to minimize disruptions and support continuation of essential City services during and following a disaster.	N/A	All Hazards	OEM	DPP, Fleet, OIT	Medium	Low	Capital Budget, UASI, SLCGP	Long	High	LPR	PM
2.3.2	Maintain and utilize early warning system.	New	All Hazards	OEM	N/A	High	Medium	EPA grant, industry user funding, PWD general fund	Short	Medium	EAP	ES/ PI
2.3.3	Procure and utilize long range drone(s) to assess areas of concern before and after hazardous events (and if possible, during events).	New	All Hazards	SEPTA	N/A	High	Medium	HSGP, Agency Operating budget	Short	High	SIP	ES

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2.3.4	Purchase two VMS signs for deployment prior to and during emergencies and events to promote public safety and awareness.	New	All Hazards	OEM	N/A	High	Medium	HSGP, DOT	Short	Medium	SIP	ES
2.3.5	Procure additional units of level B PPE for surge operators.	Both	Hazardous Materials	PFD	PPD, OEM	High	Medium	HSGP	Short	Medium	SIP	ES
2.3.6	PWD Cybersecurity Upgrades: Replace and upgrade PWD software that stores critical infrastructure information that is vulnerable to cyber terrorism attacks.	Existing	Cyberterrorism, Terrorism	PWD	N/A	High	Medium	Agency operating budget, BRIC	Short	High	SIP	PM
2.3.7	Ensure DOA's compliance with EPA's Resource Conservation and Recovery Act (RCRA) by disposing of waste responsibly and inspecting systems proactively to mitigate the potential for a hazardous materials release.	N/A	Hazardous Materials	PHL-DOA	N/A	Medium	Low	Agency operating budget	Short	Medium	LPR	PM
2.3.8	Upgrade electrical feeds to prevent power loss due to reliance on a single feed line into various buildings (e.g., student housing, admin, and academic).	Existing	Hurricane, Tornado and Windstorm, Winter Storm	Temple University Office of Facilities Management	PECO	High	High	University budget, PECO	Short	Medium	SIP	PM

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2.3.9	Utilize drug checking surveillance to identify changes in the illicit drug supply and mitigate the risks associated with emerging substances. Opportunities include detecting and analyzing emerging substances that alter the local drug landscape, addressing the rapid increase in fatal overdoes, preventing the overwhelming of medical providers, and ensuring the availability and effectiveness of harm reduction supplies.	Existing	Substance Use Disorder	SUPHR	N/A	High	High	Agency operating budget	Short	Low	SIP	PM
Objective 2.4: Integrate hazard and risk information into land use planning decisions.												
2.4.1	Planning and Land Use Regulation and Incentive Alignment: Align the City's comprehensive plan, district plans, zoning regulations, development incentives, and other land use related programs with the City's efforts to reduce flood risk, based on up-to-date flood risk projections. This may include designation of local flood zones and related permitting requirements.	N/A	Flood	PCPC	Commerce, L&I, OOS	High	High	PA Silver Jackets, CAP-SSSE or CTP funding through PEMA, Agency Operating Budget	Short	High	LPR	PM
2.4.2	Resilient Design Guidelines: Collaborate with related City agencies on the creation of consistent, coordinated design guidelines documents to demonstrate possible strategies for resilience to current and future hazards for building design and the public realm. Build from existing base of guidelines created by various departments.	N/A	All Hazards	L&I	PCPC, OOS, PWD	High	High	PA Silver Jackets, CAP-SSSE or CTP funding through PEMA, Agency Operating Budget	Short	High	LPR	PM

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2.4.3	Include risk and resiliency considerations as comprehensive planning moves forward, including use of risk analysis by planning districts created for 2026 HMP update.	N/A	All Hazards	PCPC	OEM, Streets, PPE	Medium	Low	Agency operating budget, Transportation and Community Development Initiative	Short	High	LPR	PM
2.4.4	Philadelphia Creek Protection Study: Update the Wissahickon Watershed zoning overlay and steep slope protection areas, which promotes disaster resilient land use decisions in the area and apply these protections consistently throughout the City of Philadelphia.	N/A	Subsidence and Sinkhole	DPD	PCPC	High	Medium	Agency Operating budget, HMA	Short	High	LPR	PM
2.4.5	PHL Climate Resilient Design Standards: Adopt Climate Resilient Design Standards at PHL airport to reduce the risk of flooding which will be exacerbated by climate change.	Both	Flood, Hurricane	PHL-DOA	N/A	Medium	Low	PHL Operating budget	Short	High	LPR	PM
2.4.6	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, to develop land use ordinance(s) in the dam inundation zones for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin. The City will adopt and enforce the developed land use ordinance(s).	Existing	Dam Failure, Flood	OEM	PWD, L&I, PCPC, FRMTF, Administrative Board	High	Low	Staff time, HMA, HHPD	Long	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
Objective 2.5: Promote post-disaster mitigation as part of restoration, recovery, and resilience building.												
2.5.1	Design and improve Eastwick drainage and floodwater conveyance infrastructure.	Both	Flood, Hurricane	PWD	OOS	High	High	PWD Operations, Capital Budget, Grant Funding	Short	High	SIP	PM/ SFCP
2.5.2	Airport Drainage Infrastructure: Design additional and improve current PHL airport drainage infrastructure	Existing	Flood, Hurricane	PHL-DOA	N/A	High	High	PHL Operating budget, BRIC	Short	High	SIP	PM/ SFCP
Objective 2.6: Repair, restore, and maintain existing infrastructure.												
2.6.1	Develop and implement the Climate Adaptation and Resiliency Plan (CARP). DOA is in the midst of evaluating its climate risks. Building on this baseline assessment, DOA will align findings with the Master Plan Update currently underway; identify and prioritize climate adaptation strategies; and implement the identified strategies and priority investments.	N/A	All Natural Hazards	PHL-DOA	N/A	High	High	DOA Operating Budget (for planning), DOA Capital Budget and federal and state grants to support implementation	Short	High	LPR	PM
2.6.2	Assess, Design, Procure, and Construct Upgrades and Overhauls for Vent Wells, Emergency Exits, and Station Head Houses to protect and armor them against future flooding.	Both	Flood, Hurricane	SEPTA	N/A	High	High	BRIC, IIJA Capital Investment Grants and State of Good Repair Grants	Short	High	SIP	PM/ SFCP

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2.6.3	Conduct —and implement recommendations from—a Philadelphia International Airport Hydrologic and Hydraulic Resiliency Study to assess current and projected flood risk and identify resiliency strategies to address risks. Key steps include a review of existing conditions, coastal analysis, HEC-RAS analysis, development of preliminary adaptation study, determination of potential adaptation and mitigation measures, modeling of those potential measures, and a final technical report. DOA will then seek to implement recommended measures.	N/A	Flood, Hurricane	PHL-DOA	N/A	High	High	DOA Operating Budget (for planning), DOA Capital Budget and federal and state grants to support implementation	Long	Medium	LPR	PM/ SFCP
2.6.4	Invest in transmission main condition assessments to improve understanding of probability of failure in the transmission system and install and/or upgrade priority transmission, water, and discharge mains to improve system redundancy, improve water flows, improve water quality, enhance capacity, and address other system needs.	N/A	Flood, Hurricane	PWD	N/A	High	High	Capital budget, PWD Capital	Short	High	SIP	PM
2.6.5	Design, procure, and install electric switch heaters for priority sites.	Existing	Extreme Temperature, Winter Storm	SEPTA	N/A	High	High	User Fees, SEPTA	Short	High	SIP	PM
2.6.6	Plan and implement waterproofing for all Railroad and Transit Tunnels within City Limits — Broad Street, MFSE, Trolley Tunnel, Railroad.	Existing	Flood, Hurricane, Winter Storm	SEPTA	N/A	High	High	User Fees, SEPTA	Long	High	SIP	PM/ SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.6.7	Ensure adequate material and equipment is available to repair and replace streetlights and traffic poles & signs.	Existing	Tornado and Windstorm	Streets	N/A	High	Medium	Agency Operating Budget, Grants	Short	Medium	SIP	ES
2.6.8	Install battery back-up traffic signal controllers to at least 10% of signals in City.	Existing	Flood, Hurricane, Winter Storm, Tornado and Windstorm, Earthquake	Streets	N/A	High	Medium	Grants	Short	High	SIP	ES
2.6.9	Maintain portable generators for key traffic intersections.	Both	Flood, Hurricane, Winter Storm, Tornado and Windstorm, Earthquake	Streets	N/A	High	High	Agency Operating Budget	Short	High	SIP	ES
2.6.10	Maintain safe roadways and bridges through roadway milling and paving capital projects.	Existing	Building and Structure Collapse	Streets	N/A	High	Medium	Special gas tax	Short	Medium	SIP	PM
2.6.11	Purchase and maintain hyper-local street level weather stations to assist in salting, flooding, and plowing operations.	New	Winter Storm	Streets	N/A	High	Medium	Capital Budget	Short	Medium	SIP	ES/ PM
2.6.12	Purchase and maintain drop-gates for known dangerous roads during emergency events, particularly along Cobbs Creek, for Bells Mill Road, and on Delaware Ave.	New	Flood, Hurricane	Streets	N/A	High	High	Capital Budget	Short	High	SIP	ES/ PM
2.6.13	Redesign roadways and bridges to lessen the occurrence/impact of flooding.	Existing	Flood, Hurricane	Streets	N/A	High	High	Grants	Long	High	SIP	PM/ SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.6.14	Strengthen the traffic signals beyond the national standards in reference to wind tolerance.	Existing	Hurricane, Tornado and Windstorm	Streets	N/A	High	High	Grants	Short	Medium	SIP	PM
2.6.15	Upgrade equipment and resources necessary to respond to flooding, winter storms, and developing or unforeseen hazards.	Existing	Flood, Hurricane, Winter Storm	SEPTA	N/A	Medium	Low	Agency Operating Budget	Short	High	SIP	ES/ PM
2.6.16	Design and construct of a highway cap over the Vine Street Expressway between 13th and 10th Streets to reconnect the Chinatown and Chinatown North communities. The project represents a significant infrastructure investment that seeks to improve community access to green spaces, reduce noise and air pollution, manage stormwater, mitigate urban heat island effects, and improve traffic and pedestrian safety.	New	Flood, Hurricane, Extreme Temperature	OTIS	N/A	High	High	BRIC, DOT	Long	Medium	SIP	PM/ SFCP
2.6.17	Removal and replacement of lead service lines	Existing	Hazardous Materials Release	PWD	N/A	High	High	User Fees, Operating budget	Long	High	SIP	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.6.18	Bridge Sustainability in Northwest Philadelphia: Proximity to the Wissahickon Creek leaves the Bells Mill Road Bridge and Valley Green Road Bridge vulnerable to storm and flooding events and structural degradation. This project aims to repurpose and rehabilitate the two Wissahickon Creek bridges, promote recreational activity for residents and park visitors, and enable community members in disadvantaged Census tracts to access park amenities.	Existing	Flood, Hurricane	OTIS	N/A	High	High	BRIC, HMGP	Long	Medium	SIP	PM/ SFCP
2.6.19	Maintain, replace, and upgrade existing electric grid infrastructure to reduce the probability of failure during severe weather events and extreme temperatures, improve system redundancy to reduce downtimes in severe weather events, enhance capacity, and address other system needs	Existing	Extreme Temperature, Hurricane, Winter Storm	PECO	N/A	High	High	User Fees, PECO	Long	High	SIP	PM
2.6.20	Initiate design to replace the Fort Mifflin tide gate and install a new equalizer pipe to control high tides of the Delaware River to reduce area inundation and balance water surface elevations	Existing	Flood, Hurricane	PHL-DOA	N/A	High	High	DEP	Short	Medium	SIP	PM/ SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.6.21	Design and renovate buildings (City-owned facilities) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	Both	All Natural Hazards	Department of Public Property	OOS, L&I	High	High	HMA, Capital budgets, GESA (Guaranteed Energy Savings Act)	Long	Medium	SIP	PM/ SFCP
2.6.22	Design and renovate buildings (other public facilities, such as Parks and Recreation and Free Library locations) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	Both	All Natural Hazards	PPR, Free Library	OOS, L&I	High	High	HMA	Long	Low	SIP	PM/ SFCP
2.6.23	Replace antiquated fire protection and potable water systems at the Navy Yard to ensure safety, reliability, and environmental protection.	Existing	Urban Fire and Explosion	PIDC	PAID, PWD	High	High	HMA	Short	High	SIP	PM
2.6.24	Improve infrastructure to protect major intersections and roadways from increased street flooding due to severe storms and climate change. Problem areas include Kelly Drive and South Columbus Blvd and Eastwick at 84th Street and Hook Road.	Existing	Flood, Hurricane	OTIS	Streets, OOS, OEM, PennDOT, Office of Multimodal Planning, PWD	High	High	HMA	Short	High	SIP	SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.6.25	Enhance the reliability and functionality of the communications system by upgrading outdated equipment that will no longer be supported by the vendor.	Existing	All Hazards	PennDOT	Pennsylvania OA IT	High	High	Agency operating budget, HSGP, FHWA	Short	High	SIP	PM
2.6.26	Continue to inspect and perform regular maintenance as needed on High-Hazard Potential Dams in the City to reduce the risk of dam failure.	Existing	Dam Failure	PWD	N/A	Medium	Medium	Agency operating budget	Short	Medium	SIP	PM
Objective 2.7: Identify, plan for, and protect historic properties and cultural resources.												
2.7.1	Develop and implement individual hazard management plans for City owned and operated historic structures and their surrounding landscapes. Plans should consider both natural hazards, climate change impacts, and human-caused hazards.; if necessary, consider moving the structure to a safer location. Build on Manayunk pilot for historic preservation.	Existing	All Hazards	Philadelphia Historic Commission	OEM, USACE, PPR	High	High	NPS	Long	Medium	LPR	PM
2.7.2	Implement various mitigation and resiliency measures identified in the Fairmount Water Works Resiliency Plan to prevent future repetitive losses from flood events.	Existing	Flood, Hurricane	The Fund for the Water	PPR	High	High	HMA	Short	High	SIP	PM/ SFCP
2.7.3	Re-conduct a citywide survey to identify and document all historic properties in the City (private and City-owned) in order to assess risk, vulnerability, and mitigation strategies for properties. Study should take into account all hazards, including building collapse, urban conflagration, and other human-caused and natural hazards.	Existing	All Hazards	Philadelphia Historic Commission	DPD, L&I, DPP	High	Medium	HMA	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.7.4	Engage community members in identifying and protecting vulnerable community and City assets and valued cultural resources to reduce risk at the neighborhood level during hazard mitigation planning and recovery efforts. Include information about how to perform mitigation post-disaster to reduce future risk.	Existing	All Hazards	Philadelphia Historic Commission	PCPC, OOS, OEM	Medium	Low	Staff time	Short	High	LPR	PI/PM
Objective 2.8: Address historic drivers of vulnerability and invest in community assets.												
2.8.1	Integrate equity and social vulnerability indicators more prominently into OEM's planning and operational products to better predict, prioritize, and support community needs during disasters and emergencies to reduce risk. Form and compensate a community panel making up a diverse group of public representatives to review, provide feedback on, and participate in OEM's planning processes including the Hazard Mitigation Plan.	N/A	All Hazards	OEM	N/A	Medium	Low	Agency operating budget	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.8.2	Public Health Vulnerability Data and Assessments: Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	N/A	All Natural Hazards	PDPH	N/A	High	Medium	Grants	Short	High	LPR	PM
2.8.3	Eastwick Place-Based Climate Risk, Adaption, and Resiliency Planning: Conduct community-based planning in one of the most vulnerable communities to climate change impacts, Eastwick. To support community resilience to flooding and other hazards, the planning efforts will focus on the identification of long-term mitigation efforts and development of mechanisms to implement them. This planning will build off the experience of a pilot community planning effort in Hunting Park, Beat the Heat, which addresses extreme heat. In Eastwick, the City will pilot a place-based flooding framework and seek funding to implement the planning process outcomes. The City also plans to expand the place-based extreme heat resiliency framework to other communities beyond Hunting Park.	N/A	Extreme Temperature, Flood, Hurricane, Subsidence and Sinkhole	OOS	N/A	High	High	Capital Budgeted, William Penn Foundation, OTF, HMA, IIJA Healthy Streets	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.8.4	Sustainable Corridors Project: Expand cool roadways pilot program and stormwater management projects in heat and flood vulnerable neighborhoods.	Existing	Extreme Temperature, Flood	Streets	PWD, OOS, OMP	High	High	IIJA Healthy Streets	Short	High	SIP	PM/ SFCP
2.8.5	Lower South Infrastructure Resilience Roadmap and Implementation: A multi-departmental initiative focused on creating the strategic direction and tools needed to prepare the Lower Schuylkill area for present and future climate risks. The down-scaled understanding of specific climate risks and the potential solutions to address them will inform the master plans, building designs, and infrastructure plans currently underway or planned in this area, resulting in development that is more resilient to flooding and other risks.	N/A	Extreme Temperature, Flood, Hurricane	OTIS	PCPC, OOS, Streets	High	Medium	Capital Budget, HMA, PROTECT, USACE, NOAA Community-Based Restoration Project	Long	High	LPR	PM/ SFCP
2.8.6	Launch multiple, intersectional programs that provide support to communities living with the direct and indirect consequences of the Substance Use Overdose Crisis, including targeting and expanded community engagement, services to families impacted by substance use, and increased City services at critical “hot spot” locations.	N/A	Substance Use Disorder	ORU	PDPH	High	Medium	CDC Cooperative Agreement for Emergency Response and HHS Comprehensive Addiction and Recovery Act funding	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.8.7	Bartram's Safety: Build sidewalks, curb cuts, and pedestrian crossings, and install new lighting, gateway treatments, and (potentially) cameras to improve safety and reduce short dumping and crime along the Woodland Avenue / Grays Avenue / Lindbergh Blvd corridor in Kingsessing, Philadelphia.	Existing	Gun Violence and Criminal Activity	PIDC	SEPTA, PHA	High	High	Hope Grant, PIDC, Capital Budget	Long	Medium	SIP	PM
2.8.8	Cohocksink Multi-hazard Mitigation Project: The final phase of a six-phase flood mitigation project proposes new sewer infrastructure and green stormwater infrastructure systems in the Northern Liberties and South Kensington commercial and residential neighborhoods.	Existing	Flood, Hurricane	PWD	N/A	High	High	Staff time, Agency operating budget, Capital Budget, private donations, HMA, IIJA Section 50204 and 50205	Short	High	SIP	SFCP
2.8.9	Per the US Army Corps' Eastwick Flood Risk Management project, design and implement a levee along Cobbs Creek in collaboration with the community and stakeholders in neighboring Delaware County.	Existing	Flood, Hurricane	USACE	PWD, OOS	High	High	USACE	Long	High	LPR	PM/ SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
2.8.10	Continue the Philadelphia Fire Department's initiative to conduct education and outreach out fire prevention and provide and install free smoke alarms to Philadelphia home owners upon request. A number of adaptive alarms are made available to residents with hearing or vision loss.	N/A	Urban Fire and Explosion	PFD	N/A	Medium	Low	Agency operating budget	Short	High	EAP	ES/PI
2.8.11	Conduct a comprehensive review and evaluation of existing flood mitigation alternatives in Eastwick through engineering and environmental studies, benefit cost analysis, hydrologic and hydraulic modeling, and stakeholder engagement	N/A	Flood, Hurricane	OOS	N/A	High	High	Agency operating budget, HMA, DEP	Short	Medium	LPR	PM
Goal 3: Foster an economy that promotes mitigation and reduces impacts from hazards.												
Objective 3.1: Prioritize mitigation strategies that support the continuation of critical business operations during and following a disaster.												
3.1.1	Assess business risk to potential threats and hazards in Philadelphia and identify actionable solutions to support business response, recovery, and mitigation. This includes an analysis of past impacts to the business community and development of guidance on how businesses can leverage available mitigation funding and resources to be more prepared and resilient for the next disaster, including businesses that own or operate out of historic structures or historic districts.	Existing	All Hazards	OEM	N/A	Medium	Low	Staff time, Agency operating budget, HMA	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
3.1.2	Develop Regional Disaster Supply Chain Resilience Plan.	N/A	All Hazards	OEM	N/A	High	High	Regional Catastrophic Preparedness Grant Program (RCPGP)	Short	High	LPR	PM
3.1.3	Establish and maintain open end contracts with construction companies for emergency bridge and road repairs.	Existing	Flood, Subsidence and Sinkhole, Earthquake, Hurricane, Tornado and Windstorm, Urban Fire and Explosion, Building and Structural Collapse, Winter Storm	Streets	N/A	High	High	Staff time	Short	High	LPR	PM
3.1.4	Citywide Streets Vulnerability Assessment: Document institutional knowledge of flood prone roadways and road closures from severe weather events. Develop system for tracking future storm impacts to inform mitigation actions, planning, and response related activities.	Existing	Flood, Hurricane	Streets	OTIS, PWD, OEM	High	Medium	PennDOT, FEMA HMA	Long	High	LPR	PM
3.1.5	Establish a smart detour plan for flooding of Wissahickon Creek, Schuylkill River, Cobbs Creek, and Delaware River (particularly along Delaware Avenue/Columbus Boulevard).	Existing	Flood, Hurricane	Streets	PEM, PPD-Traffic,	High	High	FEMA, UASI	Short	Medium	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
3.1.6	Develop Cyber Security Incident Response and Recovery Plan, including education and outreach to stakeholders and the public.	Existing	Cyberterrorism	OEM	OIT	High	Medium	BRIC, HSGP, operating budget	Short	High	LPR	PM
3.1.7	Conduct a climate vulnerability assessment for airport assets such as substations, mechanical rooms, baggage tunnels, and basement tunnels that are at risk to floods and other hazards.	Existing	Flood, Hurricane, Winter Storm	PHL-DOA	N/A	High	Medium	Operating budget	Short	High	LPR	PM
3.1.8	Develop and implement long-term plans to safeguard the quality and quantity of Philadelphia's drinking water supply from the Schuylkill and Delaware rivers. Opportunities include implementing measures to prevent water quality degradation, developing strategies to ensure a sustainable water supply, and upgrading and protecting water infrastructure to support long-term water quality and quantity goals.	Existing	Flood, Hurricane	PWD	DRBC	High	High	Operating budget, grants	Short	Medium	LPR	PM
3.1.9	Install battery backup systems at all fiber network HUB locations to prevent communication loss during power outages, particularly for Intelligent Transportation System (ITS) devices.	Existing	Extreme Temperature, Winter Storm, Cyberterrorism, Hurricane, Tornado and Windstorm	PennDOT	PECO	High	High	HMA, User Fees, PennDOT, PECO	Short	Medium	SIP	ES
Objective 3.2: Sustain, promote, and enhance partnerships with external public and private entities to identify and share resources.												

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
3.2.1	Identify and implement a dedicated funding source for resiliency and energy projects. Funds could be used for resilient Infrastructure projects, coastal protection projects (where the risk does not belong to one department), operations and maintenance as needed, nature based solutions, energy efficiency upgrades, establishment of resilience hubs, community-level resilience actions and more. This fund would fill a funding gap for municipal capital projects to proactively implement best practice mitigation/adaptation measures for resilient infrastructure.	N/A	All Hazards	OOS	N/A	High	High	Capital Budget	Long	High	LPR	PM
3.2.2	Resilience Hubs: Design and implement a resilience hub model specific to Philadelphia to support residents, before, during, and after disasters. This action includes identifying and implementing mitigation measures needed so that locations identified as hubs can remain operational during times of disaster. Structural measures may include but are not limited to backup generators/ emergency power supply, heating/cooling equipment, air filtration systems, etc.	Existing	All Hazards	OEM	OOS	High	High	Agency operating Budget, HMA	Short	High	LPR	ES/ PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
3.2.3	Using the Eastwick Emergency Preparedness Capacity Building as a base, expand the work done in Eastwick to be more applicable to additional neighborhoods in the City that are at risk for various hazards.	Existing	All Hazards	OEM	N/A	High	High	Agency operating Budget, HMA	Short	Medium	SIP	PM
3.2.4	Manayunk/East Falls Flood Preparedness & Mitigation Study: Community-led study to identify flood preparedness and mitigation strategies in these neighborhoods	N/A	Flood, Hurricane	Manayunk Community Development, East Falls Community Development Corporation	N/A	High	Medium	Agency operating Budget, HMA	Short	High	LPR	PM
3.2.5	Continue to foster relationships and partnerships across all levels of government, the private sector, community-based organizations, and faith-based organizations to enhance the City's emergency management program, encompassing preparedness, mitigation, response, and recovery efforts.	N/A	All Hazards	OEM	OOS	Medium	Low	Agency operating budget	Short	High	EAP	PI
3.2.6	Enhance collaboration between health and human service providers, emergency management, law enforcement, and City administration to offer comprehensive support services for individuals who are unhoused. This includes securing government and law enforcement support for providing essential resources and information regarding shelter options.	N/A	All Hazards	OEM	PPD, PFD, City Administration, OHS, DBHIDS	High	Medium	Agency operating budget	Short	High	EAP	PI

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
3.2.7	Develop and implement a workshop to address scalable electricity disruptions and enhance response strategies in collaboration with partners. Conduct training sessions and simulation exercises during the workshop to test and improve capabilities. Key partners included utility providers, emergency management agencies, and community organizations.	N/A	All Hazards	PECO	OEM, OOS	High	High	Agency operating budget	Short	High	EAP	ES/ PI
3.2.8	Develop a Mid-Atlantic Regional Testbed to answer management questions around energy and water and to better understand Earth system changes and subsequent vulnerability and risk in Philadelphia	Both	Flood, Hurricane, Storms, Extreme Temperature, Tornados	OOS	OEM, PWD, Smart Cities, DOE, DRBC, DVRPC	Medium	High	DOE, Operating budgets, staff time	Short	High	EAP	PI
3.2.9	Establish a regional collaborative to coordinate actions and policies for sea level rise resilience	N/A	Flooding	OOS	OEM	Medium	Low	Staff Time	Long	Low	EAP	PI
Objective 3.3: Form partnerships to leverage and share resources to address hazard risks today and projected from climate change.												
3.3.1	Create a dedicated funding source to fund municipal climate resilience as well as community resilience and climate action. Funds would be used for projects to reduce vulnerability and increase resilience of Philadelphia's most vulnerable populations and community-led projects would draw upon their place-based knowledge of environmental hazards and community resilience.	N/A	Extreme Temperature, Flood, Hurricane	OOS	N/A	High	High	General Operating Budget	Long	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
3.3.2	Study of Climate Change / Hazard Vulnerability of Police and Fire facilities. Potentially expand the study to include other key civic priority facilitates. DPP will release an RFP and contract for a climate vulnerability assessment and report with maps and recommendations. This assessment will be updated on a regular basis.	N/A	All Natural Hazards	DPP	N/A	High	Medium	Capital Budget	Short	Medium	LPR	PM
3.3.3	Maintain relationships with universities and colleges within the Philadelphia region and beyond to support hazard mitigation, climate resilience, emergency planning, training, and exercises.	N/A	All Hazards	OEM	OOS	Medium	Low	Agency operating budget	Short	Medium	EAP	PI
3.3.4	Risk & Resiliency Assessments: Characterize and evaluate current and future coastal flood risk for PWD's water and wastewater treatment facilities on the tidal Delaware River (4 total), taking into account sea level rise projections and storm surge impacts. Through the risk assessment process, identify potential flood risk mitigation alternatives, considering adaptive management strategies where feasible, engage with key local and regional stakeholders, and explore partnership building opportunities.	N/A	Flood, Hurricane	PWD	N/A	High	High	Staff time, Agency operating budget, private donations, HMA	Long	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
3.3.5	Build collaborative opportunities with university programs interested in hazard mitigation planning. Collaboration could take the form of sharing research, students completing analysis and mapping for HMP plan updates, City presentations to classes, identifying university led mitigation actions, and internships.	N/A	All Hazards	OEM	OOS	Medium	Low	Agency operating budget	Short	Medium	LPR	PI
3.3.6	Develop a Climate Resilience Research Agenda to proactively work with Universities, ensuring research fills critical research gaps and needs within the city	N/A	All Natural Hazards	OOS	EJCRC	Medium	Low	Agency Operating Budget, Philanthropic	Short	Medium	EAP	PM
Goal 4: Restore and enhance the natural ecology.												
Objective 4.1: Promote nature-based solutions to manage stormwater and reduce the impacts of flooding and SLR.												
4.1.1	Mapping Stormwater Flooding Risk: Better define urban flood risk in areas not covered by FEMA floodplain mapping through more comprehensive mapping of sewer system flood risk in other areas of the City. PWD has already studied flash flooding risk in Wingohocking Sewershed but hopes to expand these efforts. Share results as appropriate online for community-based planning.	Existing	Flood, Hurricane	PWD	FRMTF, OOS	High	High	Staff time, Agency operating budget, private donations, HMA	Short	Medium	LPR	PM
4.1.2	Perform comprehensive study of the stormwater infrastructure of the Centennial District to identify necessary improvements in park infrastructure.	Existing	Flood, Hurricane, Subsidence and Sinkhole	PPR	Fairmount Park Conservancy	High	Medium	Grants, Capital Budget, Philanthropy	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.1.3	Complete stream restoration projects in West Fairmount Park whose impact is localized to discreet areas to eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	Existing	Flood, Hurricane	PPR	Fairmount Park Conservancy	High	High	Grants, Capital Budget, Philanthropy	Long	Medium	NSP	NRP
4.1.4	Advance the comprehensive planning, technical analyses, and stakeholder engagement in Germantown for a storm flood risk reduction and combined sewer overflow mitigation project within the Wingohocking and the Tookany/Tacony-Frankford (TTF) Watersheds.	Existing	Flood, Hurricane	PWD	N/A	High	High	Staff time, Agency operating budget, Capital Budget, private donations, HMA, IIJA Section 50204 and 50205	Short	High	SIP	PI/ PM
4.1.5	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Cobbs Creek Reaches 1 to 3 and Cobbs Creek Reaches 6 to 8 in Phase 2.	N/A	Flood, Hurricane	PWD	PPR	High	High	PWD Operations, Capital Budget, Grant Funding	Short	Medium	NSP	NRP
4.1.6	Complete stream and creek restoration projects to reduce the impact of historic flooding hazards along Tacony Creek.	N/A	Flood, Hurricane	PWD	N/A	High	High	PWD Operations, Capital Budget, Grant Funding	Short	Medium	NSP	NRP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.1.7	Complete stream and creek restoration projects to reduce the impact of historic flooding hazards along Valley Green Road and Spring Lane.	N/A	Flood, Hurricane	PWD	FOW, PPR	High	High	PWD Operations, Capital Budget, Grant Funding	Short	Medium	NSP	NRP
4.1.8	Identify additional stream and creek restoration projects to aid in eliminating historic flooding hazards through area studies. Consider appropriate nature-based solutions (natural infrastructure, elevated berm/park space, living shoreline, etc.) to assist in adapting to flooding impacts today and from SLR.	N/A	Flood, Hurricane	PWD	OEM	High	High	PWD Operations, Capital Budget, Grant Funding	Long	High	NSP	PM/ NRP
4.1.9	Restore tidal connections and increase flood storage capacity in the Lower Darby Creek area by restoring floodplain and wetlands in and around the John Heinz National Wildlife Refuge.	Existing	Flood, Hurricane	USFWS	OOS	High	High	HMA, NOAA, NFWF, Philanthropy	Short	Medium	LPR	NRP
Objective 4.2: Support projects that address water holistically including water quality, stormwater management, dam safety, and flood mitigation.												
4.2.1	Conduct hydraulic modeling.	N/A	Flood, Hurricane	PWD	N/A	High	Medium	PWD General Fund	Short	Medium	LPR	PM
4.2.2	Ongoing identification of larger infrastructure projects whose impact affects large areas of the City through PWD studies.	Existing	Drought, Flood, Hurricane, Dam Failure	PWD	N/A	High	High	PWD Operations, Capital Budget, HMA and HHPD funding	Long	High	SIP	PM/ SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.2.3	Examine the impacts of all dams that are considered HHPD both in Philadelphia and that have inundation areas impacting Philadelphia, including the assets and populations at risk of dam inundation. Plan appropriate mitigation efforts and apply for FEMA HHPD funding.	Existing	Dam Failure	PWD	OEM	High	High	PWD Operations, Capital Budget, FEMA HHPD funding	Long	High	LPR	PM
4.2.4	Implement PWD's Drinking Water Revitalization Plan (WRP) and related long-term Capital Improvement Plan, which focuses on PWD's Drinking Water Treatment Plants, Pumping Stations, and Conveyance Systems.	Existing	All Hazards	PWD	N/A	High	High	PWD Capital Funding, Capital Budget	Long	High	SIP	PM
4.2.5	Conduct study to identify stream restoration projects in West Fairmount Park along with the goal to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	Existing	Flood, Hurricane	PPR	Fairmount Park Conservancy	High	Medium	Grants, Capital Budget, Philanthropy	Short	Medium	LPR	PM/ NRP
4.2.6	Complete wetland creation projects in FDR Park to eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas and connect park users to the water.	Existing	Flood, Hurricane	PPR	Fairmount Park Conservancy	High	High	Capital budget, National Fish and Wildlife Foundation	Short	High	NSP	NRP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.2.7	Perform Shedbrook Creek Stream Rehabilitation to aid in eliminating historic flooding hazards, improve safety of structure or surrounding areas, eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas.	Existing	Flood, Hurricane	PPR	Fairmount Park Conservancy	High	High	Capital budget, National Fish and Wildlife Foundation	Short	Medium	NSP	NRP
4.2.8	Perform structural repairs to dams and fishway structure at Fairmount Dam to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	Existing	Drought, Flood, Hurricane, Dam Failure	PWD	N/A	High	High	Capital Budget	Short	High	NSP	SFCP
4.2.9	Complete smaller sewer and green infrastructure projects whose impact is localized to discreet areas. Over one hundred are currently in design stages.	Existing	Flood, Hurricane	PWD	N/A	High	High	PWD Operations, Capital Budget, Grant Funding	Short	High	SIP	NRP/ SFCP
4.2.10	Addition of effluent and outfall pumping station to Northeast Water Pollution Control Plant Outfall and Effluent Pumping Station to pump treated water to the river during extreme wet weather events and high tide.	Both	Flood, Hurricane	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	SFCP
4.2.11	Addition of wastewater and stormwater pumps and storage in various locations throughout the system and facilities to send more water to the water pollution control plants during wet weather events.	Both	Drought, Flood, Hurricane, Winter Storm	PWD	N/A	High	High	Capital Budget, HMA	Long	High	SIP	SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.2.12	Build additional water mains to provide better system redundancy and resiliency.	Both	Drought, Flood, Hurricane, Winter Storm	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	SFCP
4.2.13	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Historic District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	Both	Flood, Hurricane, Subsidence and Sinkhole	PIDC	OOS, OTID, Lower Schuylkill Collaboration	High	High	PENNVEST, FEMA BRIC	Short	High	SIP	PM/ SFCP
4.2.14	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Mustin District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	Both	Flood, Hurricane, Subsidence and Sinkhole	PIDC	OOS, OTID, Lower Schuylkill Collaboration	High	High	PENNVEST, FEMA BRIC	Short	High	SIP	PM/ SFCP
4.2.15	Install backup generators and switchgear at Queen Lane Raw Pump Station to ensure operations during power outages.	Both	Flood, Hurricane, Winter Storm	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	SFCP
4.2.16	Rehabilitate Queen Lane Raw Water Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	Existing	Drought, Flood, Hurricane, Winter Storm	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	ES/ SFCP
4.2.17	Relocate Belmont Raw Water Pump Station Intake to ensure reliable source during droughts and winter storms.	Existing	Drought, Flood, Hurricane, Winter Storm	PWD	N/A	High	High	Capital Budget, HMA	Long	High	SIP	ES/ SFCP

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.2.18	Upgrade Lardner's Point Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	Existing	Drought, Flood, Hurricane, Winter Storm	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	ES/ SFCP
4.2.19	Upgrade Mingo Creek Pumping Station to handle increased flows from wet weather events.	Existing	Flood, Hurricane	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	ES/ SFCP
4.2.20	Upgrade of various wastewater and stormwater pump stations to handle increased flows from wet weather events.	Existing	Flood, Hurricane	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	ES/ SFCP
4.2.21	Upgrade P-796 at the Navy Yard Design to handle increased flows from wet weather events.	Existing	Flood, Hurricane	PWD	N/A	High	High	Capital Budget, HMA	Short	High	SIP	ES/ SFCP
4.2.22	Coordinate with Pennsylvania DEP and Franklin Mills Limited Partnership on future plan updates regarding HHPD standards and planning.	N/A	Dam Failure	PWD	OEM	High	High	Staff time, Capital Budget	Short	Medium	SIP	PM
4.2.23	Replace 1,860 linear feet of 4'0" brick sewer with 72" reinforced concrete pipe sewer along a segment of 21st Street in the Germantown Neighborhood	Existing	Flood, Hurricane	PWD	N/A	High	High	Capital Budget, HMA	Long	High	SIP	SFCP
4.2.24	Increase sedimentation tank Capacity and mitigate flood risks, provide community and economic resiliency, and improve water quality.	Existing	Flood, Hurricane	PWD	N/A	High	High	Capital Budget, HMA	Short	High	NSP	SFCP
Objective 4.3: Restore and enhance green spaces and prioritize communities overburdened by environmental hazards.												

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.3.1	Establish a policy based on need and funding availability for a regular pruning cycle for City trees.	N/A	Extreme Temperature, Hurricane, Tornado and Windstorm	PPR	N/A	Medium	Low	Capital Budget, NPS, DCNR	Short	Medium	LPR	PM
4.3.2	Complete sewer and green infrastructure projects whose impact is localized to discreet areas in West Fairmount Park.	Existing	Flood, Hurricane	PPR	PWD, Fairmount Park Conservancy	High	Medium	Grants, Capital Budget, Philanthropy	Short	High	SIP	NRP/ SFCP
4.3.3	Inspect trees within 100 ft. of walkways and roadways for signs of the emerald ash borer and treat affected trees every three years.	N/A	Extreme Temperature, Hurricane, Tornado and Windstorm	PPR	N/A	High	Medium	Capital Budget, NPS, DCNR	Short	Medium	NSP	PM / NRP
4.3.4	Monitor new tree watering contracts to ensure the trees have sufficient time to take root and establish themselves under warmer temperatures.	N/A	Drought, Extreme Temperature	PPR	N/A	Medium	Low	Capital Budget	Short	Medium	NSP	PM/ NRP
4.3.5	Pilot study the growth of Southern plant species with sustainable planting practices in preparation for increasing temperatures over the next century.	N/A	Drought, Extreme Temperature	PPR	N/A	High	Medium	Capital Budget	Short	Medium	NSP	PM/ NRP
4.3.6	Decrease the backlog of 2,000+ tree maintenance and removal projects to reduce unpruned and dead trees falling on power lines during storm events.	N/A	Extreme Temperature, Hurricane, Tornado and Windstorm, Winter Storm	PPR	N/A	High	Medium	Capital Budget	Short	Medium	NSP	PM / NRP
4.3.7	Montgomery Creek infrastructure repair at approach to Black Road and I-76	Existing	Building and Structure Collapse	PPR	N/A	High	High	HMA	Short	Medium	SIP	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.3.8	City tree planting and maintenance: Planting and care of street and park trees throughout the City of Philadelphia to reduce the impacts of heat islands.	N/A	Extreme Temperature	PPR	N/A	High	Medium	Capital Budget	Short	Medium	NSP	PM / NRP
4.3.9	Develop and implement trail designs that ensure long-term viability in vulnerable areas, such as floodplains. Establish specific design standards for trails located in floodplains and other vulnerable areas to enhance resilience.	N/A	Flood	Streets	PPR, PCPC, PWD, PennDOT	High	Medium	Capital Budget	Short	Medium	LPR	PM / NRP
4.3.10	Explore the potential for vacant and underutilized properties in Eastwick to be converted to wetland and recreational space, including the former Pepper Middle School site.	Existing	Flood, Hurricane	OOS	School District, USFWS, PPR, PWD	High	High	HMA, NFWF, Philanthropic	Long	High	NSP	PM
Objective 4.4: Support the transition away from fossil fuels and other greenhouse gases that impact health and safety and exacerbate climate change.												
4.4.1	Develop a continuously updated Climate Data tool for screening climate vulnerability and risk of capital investments and planning processes against the best available climate projections for the City and region.	Existing	All Natural Hazards	OOS	N/A	High	Medium	Capital Budget, operating budget and staff time	Short	High	LPR	PM
4.4.2	Develop phased implementation strategy for optimizing use of biogas at NEWPCP and SWWPCP, including better utilization of biogas today and developing a plan for the future (including upgrading biogas to Renewable Natural Gas).	Existing	Hazardous Material	PWD	N/A	High	High	Agency operating budget	Short	Medium	LPR	PM
Objective 4.5: Improve air, water, and soil quality across the City starting with environmental justice communities.												

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
4.5.1	Examine mitigation opportunities that address flooding and rising water tables from increased precipitation and sea level rise inundating brownfields and releasing hazardous materials into local waterways.	N/A	Flood, Hurricane, Hazardous Materials	Brownfield Working Group	N/A	Medium	Low	Agency operating budget	Short	Medium	LPR	PM
4.5.2	Secure intake booming materials.	N/A	Hazardous Materials	PWD	N/A	High	High	Agency operating budget, EPA	Short	Medium	SIP	PM
4.5.3	Remove oil storage facility (tank farm).	Existing	Hazardous Materials	PIDC	N/A	High	High	EPA's Brownfields Program	Short	Low	SIP	PM
4.5.4	Remediation of lagoons at NEWPCP and SWWPCP	N/A	Hazardous Materials	PWD	N/A	High	High	Agency operating budget, EPA	Long	Medium	NSP	PM
Goal 5: Create awareness and demand for mitigation and adaptation as a standard of practice.												
Objective 5.1: Tailor mitigation training to public officials, businesses, organizations, and the public emphasizing equity and inclusion.												
5.1.1	Conduct active shooter training for City staff.	N/A	Gun Violence and Criminal Activity	PPD	OEM	Medium	Low	Staff time	Short	Low	EAP	ES/ PM
5.1.2	Employ a READYEmployee process to alert City Employees of threats and hazards that could impact them and their work spaces.	N/A	All Hazards	OEM	N/A	Medium	Low	UASI	Short	High	EAP	ES/PI
5.1.3	Expand Multi-Assault, Counter Terrorism Action Capabilities (MACTAC) training program for patrol officers.		Terrorism, Gun Violence and Criminal Activity	PPD	N/A	Medium	Low	HSGP	Short	Low	EAP	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
5.1.4	Expand and continue training for all PPD personnel including, but not limited to: SPOT Training, Prevention and Deterrence of Terrorism Training, Advanced Trauma Training, Mass Casualty Awareness Training, Customized Alarm Response Training, Site Protection by Observational Techniques Training, Protest Awareness Training, Customized Alarm Response Training, Tourniquet Training, Field Force Operations Training, Field Force Extraction Training, Field Force Command Planning Training.	N/A	Civil Disturbance, Hazardous Materials, Gun Violence and Criminal Activity, Terrorism	PPD	N/A	Medium	Low	HSGP	Short	Low	EAP	ES/ PM
5.1.5	Upkeep PFD Hazmat training and equipment.	N/A	Hazardous Materials, Terrorism, Urban Fire and Explosion, Building and Structure Collapse	PPD	N/A	Medium	Low	Agency Operating Budget	Short	Medium	EAP	PM
5.1.6	Conduct regular training sessions and simulation exercises to test and enhance the effectiveness of cybersecurity response plans, such as SEPA region's plans.	N/A	Cyberterrorism	SEPA	OEM	Medium	Low	Agency Operating Budget	Short	Medium	EAP	ES/ PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
5.1.7	Develop and deploy specialized messages for the over 7,000 City employees that work in the Center City Quadplex buildings (City Hall, MSB, OPB, SCCJ) to inform them of emergencies and quickly gather an accountability report.	N/A	All Hazards	OEM	N/A	Medium	Low	UASI	Short	High	EAP	ES/PI
Objective 5.2: Improve existing and put in place necessary warning systems.												
5.2.1	Deploy and maintain targeted flood monitoring technology across the City to better inform mitigation, preparedness, and response efforts.	N/A	Flood, Hurricane	OEM	NWS, Delaware County	High	Medium	NWS has in the past but funding has been cut recently	Short	Medium	EAP	ES
5.2.2	Inclusive and Equitable Public Health Notification, Engagement, Partnership and Awareness: Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	N/A	All Hazards	PDPH	N/A	High	Medium	HHS, CDC, HMA	Short	High	EAP	PI

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
5.2.3	Revamp and update Philadelphia OEM's Alert and Warning Plan for the City, along with associated frameworks and deliverables.	N/A	All Hazards	OEM	N/A	High	Medium	HMA, HSGP, USAI	Short	High	EAP	ES
5.2.4	Utilize the Eastwick Alerts system to notify residents of impending weather that could result in flooding, integrating advanced technology for automatic messaging and public information access (e.g., flood gauges, cameras). Integrate flood gauge information and camera footage on public-facing website.	N/A	Flood, Hurricane, Winter Storm	OEM	OOS	High	Low	Agency operating budget	Short	High	EAP	ES/PI
5.2.5	Create a social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	N/A	All Hazards	OEM	N/A	High	Medium	HMA, HSGP, USAI	Short	High	EAP	PI
5.2.6	Develop and implement an amplification strategy for Alert and Warning Messages using community groups and targeted partnerships to spread OEM messaging to groups that have historically hard to reach.	N/A	All Hazards	OEM	N/A	High	Medium	HMA, HSGP, USAI	Short	High	EAP	ES/PI
5.2.7	Update and expand the social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	N/A	All Hazards	OEM	N/A	High	Medium	Agency Operating Budget	Short	High	EAP	PI

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
Objective 5.3: Increase public's awareness of hazards, mitigation, and other protective measures, including those related to the projected impacts of climate change.												
5.3.1	Create a Multi-Hazard Preparedness Campaigns promoting mitigation efforts residents and businesses can take prior to hazard events, including print material and digital and social media content that focus on steps people can take to prepare for severe storms. This also includes development of new innovative messaging to promote in-person preparedness workshops to assist in preparing citizens for hurricane season and messaging to support the Community Outreach Team attracting participants to hurricane season at tabling events.	N/A	Flood, Hurricane	OEM	N/A	Medium	Low	HMA	Short	High	EAP	ES/PI
5.3.2	Provide public outreach throughout Philadelphia with READYHome, READYCommunity, and READYBusiness to increase community preparedness and mitigation.	N/A	All Hazards	OEM	N/A	Medium	Low	Staff time, Agency operating budget, FEMA U.S. DHS and HMA funding potential for larger campaigns	Short	High	EAP	ES/PI
5.3.3	Promote post disaster mitigation strategies throughout SEPA region, targeting communities that are most vulnerable. VOAD partner agencies may implement mitigation strategies.	N/A	All Hazards	OEM	N/A	High	Medium	HSGP	Short	High	EAP	ES/PI

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
5.3.4	Update OEM's Ready programs, including READYBusiness to include additional risk mitigation strategies for small to medium-size businesses.	N/A	All Hazards	OEM	N/A	Medium	Low	HMA	Short	High	EAP	ES/PI
5.3.5	Employ spatial data to inform OEM's community preparedness outreach to help OEM better understand where preparedness outreach is occurring and ultimately focus on areas most at risk.	N/A	All Hazards	OEM	GIS	Medium	Low	Agency operating budget	Short	Medium	EAP	PI
5.3.6	Enhance readiness for climate-related severe weather events by expanding internal response playbooks and implementing additional readiness activities.	N/A	Flood, Hurricane, Winter Storm, Tornado and Windstorm	OEM	N/A	Medium	Medium	Agency operating budget	Short	High	EAP	ES/PI
5.3.7	Continue and expand the centralized platform for community members to access emergency-related communications for all hazards, including alerts for extreme weather conditions, air quality concerns, and cyber terrorism. Continue to enhance initiatives to educate community members about the specific risks associated with hazard events and the vulnerabilities within the community that may amplify impacts. Prioritize language accessibility and localized messaging in outreach and communication efforts.	N/A	All Hazards	OEM	N/A	High	High	Agency operating budget	Short	High	EAP	ES/PI

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
5.3.8	Establish and promote a two-way communication system for community members to report impacts and hazard-related concerns. The system should also be capable of providing information on the follow-up actions taken by the relevant City agencies.	N/A	All Hazards	OEM	N/A	High	High	Agency operating budget	Long	Medium	EAP	ES/PI
5.3.9	Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	N/A	All Hazards	PDPH	N/A	Medium	Low	Agency operating budget	Short	High	EAP	PI
5.3.10	Further localize the STEP curriculum for schools and work to reestablish and develop a READYKids program in partnership with MDO Head Start & PFD Prevention Division.	N/A	All Hazards	OEM	N/A	High	High	Agency operating budget	Short	Medium	EAP	PI

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
5.3.11	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement public education and awareness campaigns surrounding dam safety for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	Existing	Dam Failure, Flood	OEM	PWD, L&I, PCPC, FRMTF	High	Low	Staff time, HMA, HHPD	Short	High	EAP	PI
Objective 5.4: Continue and expand coordination efforts to plan for cross-agency mitigation efforts.												
5.4.1	Develop and socialize guide and calendar of all available mitigation funding resources. Continue to develop and implement coordinated City approach to pursue mitigation funding.	N/A	All Hazards	OEM	Mayor's Office of Recovery and Grants	Medium	Low	Selected projects would be included in Capital Budget	Short	High	EAP	PI
5.4.2	Meet quarterly with VOAD partners to maintain preparedness, ensure situational awareness, identify resource capabilities, and build stakeholder relationships pre-disaster.	N/A	All Hazards	OEM	N/A	Medium	Low	Agency operating budget	Short	Medium	EAP	ES/PI
5.4.3	Revitalize the Philadelphia Emergency Management Council from a 6+ year hiatus. This local council will consist of key City leadership and will focus on strategic emergency management issues including long-term risk reduction and risk/hazard education at a senior level	N/A	All Hazards	OEM	N/A	Medium	Low	Agency operating budget	Short	High	LPR	PM

Initiative	Initiative Description	Applies to New and/or Existing Structures*	Hazards Mitigated	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category	CRS Category
5.4.4	Continue to use the Regional Integration Center (RIC) and their products (situational awareness reports, pre-event briefings, weather reports, etc.) to bring partners to the table to coordinate pre-disaster meetings and information sharing as well as immediate post-disaster recovery work.	N/A	All Hazards	OEM	N/A	High	Medium	Regional Catastrophic grant program	Short	High	LPR	ES
5.4.5	Develop and expedite a Cyber Readiness and Business Continuity program to address healthcare-related cyber incidents, improving resilience through collaboration with healthcare agencies and response partners.	N/A	Cyberterrorism	Healthcare Facility Owners and Operators	OEM	High	Medium	Agency operating budget	Short	High	LPR	PM

* *Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (N/A) is inserted if this does not apply.*

***Definitions**—DOF = Depending on funding; EMA = Emergency Management Agency; EMS = Emergency Medical Services; FEMA = Federal Emergency Management Agency; HMGP = Hazard Mitigation Grant Program; DEP = Pennsylvania Department of Environmental Protection; PDM = Pre-Disaster Mitigation Program; PEMA = Pennsylvania Emergency Management Agency; WWTP = Wastewater Treatment Plant*

***Costs**—Rough estimates to be used if actual project costs cannot reasonably be estimated at this time: Low = < $10,000; Medium = $10,000 to $100,000; High = > $100,000*

***Timeline**—Short Term = 1 to 5 years. Long Term = 5 years or greater.*

Mitigation Category:

Education and Awareness Programs (EAP)—Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities.

Local Plans and Regulations (LPR)—Actions include government authorities, policies, or codes that influence the way land and buildings are being developed and built.

Natural Systems Protection (NSP)—Actions that minimize damage and losses and also preserve or restore the functions of natural systems.

Structure and Infrastructure Project (SIP)—Actions that involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.

Community Rating System (CRS) Category:

Preventive Measures (PM)— Actions that guide or limit development in hazard-prone areas to reduce future risk. These measures typically include policies, codes, zoning regulations, and land-use planning tools that prevent the creation of new exposure to hazards.

Property Protection (PP)— Actions that directly protect individual buildings or assets from hazard impacts. These measures may involve elevating, retrofitting, relocating, or floodproofing structures to reduce vulnerability.

Natural Resource Protection (NRP)— Actions that protect, restore, or enhance natural areas that provide hazard-mitigation benefits. These efforts may include preserving floodplains, wetlands, dunes, forests, and riparian buffers, which help absorb floodwaters, reduce erosion, and sustain ecological functions.

Emergency Services (ES)— Actions that improve the ability of emergency responders and public safety agencies to prepare for, respond to, and recover from hazard events. These measures may include warning systems, response planning, equipment upgrades, evacuation planning, and coordination across agencies.

Structural Flood Control Projects (SFCP)— Actions that involve the construction, improvement, or maintenance of engineered structures intended to reduce hazard impacts. These may include levees, floodwalls, stormwater systems, channel improvements, dams, and drainage upgrades.

Public Information (PI)— Actions that provide residents, businesses, and community stakeholders with accurate, accessible information about hazards, risk reduction strategies, and preparedness. Public information initiatives may include outreach campaigns, floodplain map information services, technical assistance, and participation in programs that promote hazard awareness.

6.5.2 Mitigation Prioritization

Section 201.6(c) (3) (iii) of Title 44 Code of Federal Regulations (44 CFR) requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost-benefit review of the proposed projects and their associated costs. This allows the City to select the most cost-effective actions for implementation first, not only to use resources efficiently, but also to make a realistic start toward mitigating risks.

Mitigation benefits are defined as future damages and losses that would be eliminated and/or reduced by implementing the proposed mitigation project, and include physical damage to structures and infrastructure, loss of service or function, and emergency management costs. Particularly for physical ("shovel-in-the-ground") mitigation projects, stakeholders were encouraged to estimate project costs as well as to identify the anticipated benefits. Where exact project costs and potential benefits were not available, ranges were identified (high, medium, low) for each, allowing a qualitative evaluation of project cost-effectiveness.

PEMA has developed a mitigation actions evaluation and prioritization process to provide a consistent, uniform approach for counties and jurisdictions to use to consider, in a systematic way, the best mitigation strategies for their communities (PEMA 2020). Jurisdictions first evaluate feasibility of mitigation actions by using the following ten evaluation criteria:

- **Life Safety:** The Steering Committee assesses to what extent a mitigation action will protect individuals from being injured or killed by a hazard.
- **Property Protection:** The Steering Committee assesses to what extent the action will protect property, including homes, businesses, and critical infrastructure.
- **Technical:** It is important to determine whether the proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts. Here, the Steering Committee determines whether the alternative action is a whole or partial solution, or not a solution at all.
- **Political:** Understanding current opinions of community and state political leadership regarding issues related to the environment, economic development, safety, and emergency management will provide valuable insight into the level of political support offered for mitigation activities and programs. Proposed mitigation objectives sometimes fail because of a lack of political acceptability.
- **Legal:** Without the appropriate legal authority, the action cannot lawfully be undertaken. When considering this criterion, the Steering Committee determines whether a jurisdiction has the legal authority at the state, tribal, or local level to implement the action, or whether the jurisdiction must pass new laws or regulations. Each level of government operates under a specific source of delegated authority. As a general rule, most local governments operate under enabling legislation that gives them the power to engage in different activities. Jurisdictions should identify the unit of government undertaking the mitigation action and include an analysis of the inter-relationships between local, regional, state, and federal governments. Legal authority is likely to have a significant role later in the process when the state, tribe, or community determines the ways in which mitigation activities can best be carried out, and the extent to which mitigation policies and programs can be enforced.
- **Environmental:** Impact on the environment is an important consideration because of public desire for sustainable and environmentally healthy communities. In addition, many statutory considerations, such as the National Environmental Policy Act (NEPA), should be counted when using federal funds. Jurisdictions need to evaluate whether, when implementing mitigation actions, the potential negative consequences to environmental assets such as threatened and endangered species, wetlands, and other protected natural resources.

- **Social:** The public must support the overall implementation strategy and specific mitigation actions. Therefore, the projects have to be evaluated in terms of community acceptance. Likewise, the Steering Committee should determine if implementing a mitigation action will have a beneficial or negative effect on a particular segment of the population.
- **Administrative:** Under this part of the evaluation criteria, the Steering Committee examines the anticipated staffing, funding, and maintenance requirements for the mitigation action to determine whether the jurisdiction has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary.
- **Local Champion:** Having an individual who will lead the implementation of a project, particularly a complex project, is essential for implementing it.
- **Other Community Objectives:** The Steering Committee evaluates to what extent implementing the mitigation action supports other community objectives, such as increasing parks and recreation, quality of life, and economic development.

Table 6-5 shows the feasibility evaluation for each identified mitigation action. For each criterion, how feasible or effective the action is in the above criteria was indicated with a “1” (highly effective or feasible), “0” (neutral or not applicable), or a “-1” (ineffective or not feasible). All actions were deemed feasible.

Table 6-5. Evaluation of Mitigation Actions

Lead and Support Agencies	Initiative #	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
OEM	1.1.1	Continue to maintain and update the City's All-Hazard Mitigation Plan with a focus on plan integration and implementation.	1	1	1	1	1	1	1	1	1	1	10
PWD, OEM, DRBC	1.1.2	Develop and implement a drought contingency plan. PWD will update the existing Drought Contingency Plan with pertinent policy and regulatory updates, improved science and technical tools, and with a greater understanding of how Delaware Watershed policies can impact Philadelphia's water supply during critical drought conditions such as reduced water super availability.	1	0	1	1	1	1	1	1	0	0	7
OEM	1.1.3	Invest resources to plan and staff initiatives to reduce hazard risks citywide. This includes development of and coordination for Cybersecurity Incident Response and Recovery Plan and Training; a Philadelphia Economic Recovery Plan; a Regional Disaster Housing Plan, and pandemic response planning.	1	1	1	1	1	1	1	1	0	0	8
PDPH	1.1.4	PDPH Pandemic Planning and Implementation: Update and implement key plans including pandemic response, mass prophylaxis and immunization, and others to reflect best practices and lessons learned during COVID-19and other disease outbreak responses. This encompasses incorporating high-consequence pathogen planning and readiness, including biohazard considerations and healthcare coordination ; identifying sites to administer vaccine and/or dispense medical countermeasures during public health emergencies; coordinating with other human services partners to ensure inclusion of special populations such as children, persons experiencing homelessness, and persons with access and functional needs; identifying isolation and quarantine locations and potential wraparound services; ensuring a standardized process for public data dashboard development and discontinuation; and other preparations for outbreak related response activities.	1	0	1	1	1	0	1	1	0	0	6

Lead and Support Agencies	Initiative #	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
PDPH	1.1.5	Expand lab capacity to rapidly identify and subtype organisms.	1	0	1	1	1	0	1	1	0	0	6
PDPH	1.1.6	Improve access to primary medical care citywide and improve the quality of primary care by expanding the scope of services and building facility capacity for City Health Centers.	1	1	1	1	1	0	1	1	0	0	7
Office of Policy and Strategic Initiatives, OOS	1.1.7	Improve environmental conditions to foster a sense of safety in neighborhoods, connectedness among neighbors, and reduce the locations where illegal guns are stored and where illegal activity occurs. Projects include addressing blighted buildings, cleaning abandoned lots, improving lighting, and other initiatives to improve environmental conditions.	1	0	1	1	1	1	1	1	1	0	8
Office of Policy and Strategic Initiatives	1.1.8	Implement Roadmap to Safer Communities programs including Group Violence Intervention, Community Crisis Intervention Program, and Operation Pinpoint.	1	0	1	1	1	0	1	1	1	0	7
OEM	1.1.9	Identify and implement short-term flood proofing tools for at-risk communities.	1	1	1	1	1	1	1	1	0	0	8
OOS, PCPC	1.1.10	Climate Resilience Plan Update: Update the City's Climate Resilience Plan to include updated climate projections, a heat and flooding vulnerability analysis, new community-informed climate actions, and increased community engagement. Results of the updated climate resilience plan will be used to inform the Hazard Mitigation Plan.	1	1	1	1	1	1	1	1	1	0	9
OOS	1.1.11	Climate Resilience Place-based Program Expansion: Expand Office of Sustainability's climate resilience place-based program which will include identifying new communities with climate vulnerabilities and working closely with community based organizations to address those vulnerabilities and increase community resilience	1	1	1	1	1	1	1	1	1	0	9
OEM	1.1.12	Establish and maintain heating and cooling centers.	1	0	1	1	1	0	1	1	1	0	7

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OHS	1.2.1	Conduct outreach and coordinate personnel to keep the Philadelphia unhoused population safe during extreme cold and extreme heat events.	1	0	1	1	1	0	1	1	1	1	8
SUPHR	1.2.2	Expand low barrier access to harm reduction resources in zip codes with high rates of unintentional fatal overdoses, particularly amongst communities of color.	1	0	1	1	1	0	1	1	1	1	8
PDPH	1.2.3	Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	1	0	1	1	1	0	1	1	1	1	8
Office of Sustainability, OEM	1.2.4	Protect and ensure continuous service of municipal spaces and facilities that serve vulnerable populations in Philadelphia, particularly during extreme heat and flooding events. Identify priority municipal sites that serve vulnerable populations, such as libraries, health centers, incarceration facilities, and recreation centers. Develop recommended mitigation and resilience actions based on the facility assessments.	1	1	1	1	1	1	1	1	0	0	8
OOS, DHCD, PHDC, OEM	2.1.1	Assess properties that may benefit from long-term flood resilience measures including elevation, acquisition, relocation, mitigation reconstruction, and additional adaptive/adaptation measures	0	1	1	1	1	1	1	1	0	0	7
DHCD, PHDC, OOS	2.1.2	Implement long-term flood resilience measures including elevate, acquire, relocate, retrofit, floodproof, complete mitigation reconstruction, and adapt properties that benefit from elevation, acquisition, relocation, completing mitigation reconstruction, or additional adaptive/adaptation measures.	0	1	1	1	1	1	1	1	0	0	7
L&I, DPD, PWD, FRMTF	2.1.3	Assess reuse of City properties that have assets that are prone to damage from flooding	0	1	1	1	1	1	1	1	0	0	7

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PIDC	2.1.4	Bartrams North and South Flood Mitigation: Examine and implement mitigation methods that protects buildings and access without providing any adverse impact to upstream or downstream properties along the western bank of the Schuylkill River.	0	1	1	1	1	1	1	1	1	0	8
PIDC/ PPR, Schuylkill River Development Corporation, Bartram's Garden, PHA	2.1.5	Demolish Philadelphia owned 4910 Botanic site structures, remediate known environmental contamination, and convey the riverfront portion of the site to PPR/Schuylkill River Trail/Bartram's Garden to decrease flood risks, risk of criminal activity, and risk of building collapse.	0	1	1	1	1	1	1	1	1	0	8
L&I, OOS, PCPC	2.1.6	Align reviews of City floodplain regulation with best practices and models from other peer city's and guidance with the International Code Council (ICC) tri-annual updates of the building codes. Follow and educate people in building profession on required and recommended strategies to mitigate hazards and increase resilience. (wordsmith further - ICC is the baseline, minimum).	0	1	1	1	1	1	1	1	0	0	7
FRMTF	2.1.7	Develop a software platform to share flooding event information across departments in real-time as well as historically.	0	0	1	1	1	1	1	1	0	1	7
L&I, OOS, FRMTF	2.1.8	Maintain enrollment in NFIP and CRS by implementing floodplain management initiatives, reducing the City's flood risk, and allowing residents to receive discounted flood insurance.	0	1	1	1	1	1	1	1	0	1	8
OOS, Streets, PPR, OEM, PWD	2.1.9	Implement interim flood mitigation to provide near-term relief to flooding in Eastwick while a community-driven long-term flood resilience strategy is being developed. The project will install a soil-filled flood barrier (for example, using HESCO Floodline) along the Cobbs Creek in Eastwick where riverine flooding typically overflows into the Eastwick community.	1	1	1	1	1	1	1	1	0	0	8

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L&I	2.1.10	Retain consultant services for the Philadelphia Dept of License & Inspections in their Floodplain Administration duties to provide additional oversight and recommendations in the review of Hydrologic and Hydraulic (H&H) engineering analysis modeling submissions provided with applications that affect coastal floodplains, regulated floodways and riverine floodways without regulatory floodways. Over the span of this project, we intend for these services to help identify current gaps in the review processes of applications that require an H&H engineering analysis under International Building Code, Sections G103.4, G103.5, G103.6 & G103.7 and our local floodplain ordinance, and to develop/identify new engineering resources/tools to assist in more effective enforcement and administration of these floodplain provisions.	0	1	1	1	1	1	1	1	1	0	8
PWD	2.1.11	Conduct a detailed climate risk characterization and assessment of the PWD collection system to determine priority areas for infrastructure and operational improvements. The assessment will inform future operation, planning, and design adaptation efforts to ensure continued reliability and system resilience under a changing climate.	0	1	1	1	1	1	1	1	1	0	8
PWD	2.1.12	Ensure the flood resilience of PWD facilities by addressing risks associated with both coastal flooding (sea level rise and storm surge) and riverine flooding. This effort may include developing and implementing Adaptive Management Plans to proactively manage current and future flood-related impacts.	0	1	1	1	1	1	1	1	1	0	8
Office of Sustainability, PWD	2.1.13	Development of a compound flood model to better understand flood risk today and in the future from all sources of flooding.	0	1	1	1	1	1	1	1	1	0	8
OOS, PHL, USFWS, SEPTA	2.1.14	Evaluate a potential coastal levee in Eastwick that would mitigate future sea level rise and coastal storm surge events that are likely to impact the Eastwick neighborhood, the SEPTA tracks, the airport, and the Heinz Wildlife Refuge.	1	1	0	1	1	1	1	0	0	0	6

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OEM, PWD, L&I, PCPC, FRMTF, Dam Owners	2.1.15	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement programs to inform surrounding private and commercial property owners of opportunities to elevate their structure and/or add flood protection measures, such as berms, floodwalls, or floodproofing, if the structure(s) are in a dam inundation zone for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	0	1	1	1	0	1	1	1	0	0	6
Streets — Highway, PennDOT	2.2.1	Continue bridge inspection training and conduct bridge inspections.	0	1	1	1	1	0	1	1	1	0	7
OTIS, Streets	2.2.2	Continue to analyze the impact of natural and human-caused hazards and threats on critical infrastructure that supports supply chain systems through the update of the Freight (Truck) Network.	0	1	1	1	1	0	1	1	0	0	6
OTIS/ PCPC, PPR, Streets	2.2.3	Develop a Trail Resiliency Plan and identify flood mitigation strategies for Philadelphia's extensive trail network. Trails often follow streams and rivers in Philadelphia. Recreation and travel can be a suitable use of the floodplain. However, trail infrastructure represents a significant investment from City, State and Federal partners. OTIS would like to examine how trail infrastructure can be built resiliently to protect the investment while also protecting the ability of the floodplain to absorb water. The study will consider vulnerable assets, best practices in materials and construction suitable to a floodplain, and overall trail network resiliency. Trails provide a travel mechanism that does not contribute to climate change and provides healthy recreational options for residents.	1	1	1	1	1	1	1	1	0	1	9

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OEM, PCPC, OOS	2.2.4	Create a hazard event database to capture description, severity, location, impact, and potential loss/damage estimate from an event. This data will be used to update the hazard analysis and mitigation actions for Philadelphia, as well as allow the City to be better prepared for future events.	1	1	1	1	1	1	1	1	0	0	8
OEM	2.2.5	Enhance THIRA process to identify gaps in mitigation capabilities, and to better align the THIRA with the HMP Planning Process.	1	1	1	1	1	1	1	1	0	0	8
OEM, PFD	2.2.6	Maintain Tier II Reporting and GIS program.	1	1	1	1	1	1	1	1	0	0	8
OEM	2.2.7	Update the Tier II emergency response plan process/template to provide more situational awareness on chemical inventories across the City for OEM/PFD and its partners.	1	1	1	1	1	1	1	1	1	0	9
L&I, OOS, PWD, FRMTF	2.2.8	Improve floodplain mapping to support vulnerability assessments for critical infrastructure and City initiated LOMCs, using updated inundation mapping	1	1	1	1	1	1	1	1	0	0	8
OEM, OIT	2.2.9	Use damage assessment data to conduct in depth GIS analysis of impacts from past flooding and storms events to better predict future impacts from similar storm events and inform severe weather preparedness planning, alert & warning messaging, and mitigation initiatives in those areas.	1	1	1	1	1	1	1	1	1	0	9
OEM, HM Steering Committee	2.2.10	Utilize the results of the 2025 Hazus analysis to identify new mitigation projects.	1	1	1	1	1	1	1	1	1	1	10
PWD, USACE	2.2.11	Support the USACE production of inundation level mapping for the Schuylkill River alongside the remapping of the floodplain, to reflect the impact levels available for USGS gauge 01474500	1	1	1	1	1	1	1	0	0	0	7
PIDC	2.2.12	Navy Yard Resilience Study: A comprehensive Resilience Study at the Navy Yard will be critical to inform the implementation of HMP projects. The study will analyze existing conditions; assess all potential risks & vulnerabilities; identify resiliency projects; and advance at least one early-action resiliency project.	0	1	1	1	1	1	1	1	0	0	7

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OTIS, PCPC	2.2.13	Cobbs Creek Multiuse Trails: Due to the Cobbs Creek frequent floods, there are access and maintenance issues for the multiuse Cobbs Creek trail system. Resilient planning and design will be explored as part of the construction and future maintenance plan of the Cobbs Creek trail.	1	1	1	1	1	1	1	1	0	0	8
PHL-DOA	2.2.14	Initiating Delaware River Long-Term Flood Protection Feasibility Solutions Study to address tidal surge flooding. Depending on feasibility study results, DOA may select one or more phases to design and construct.	1	1	1	1	1	1	1	1	0	0	8
OMP, OOS, PennDOT, OTIS, PWD, PCPC	2.2.15	Design and implement improvements to 84th Street, a priority roadway in Eastwick, by combing traffic calming and flood resilience measures. Interventions may include increasing vegetation throughout the corrdior, elevating the bridge approaches out of the floodplain and improving bike and pedestrian facilities.	1	1	1	1	1	1	1	1	0	0	8
FRMTF, OOS, PCPC, PWD	2.2.16	Develop and implement innovative, nature-based, and engineered flood resilience measures to protect flood-prone neighborhoods from pluvial flooding caused by extreme rainfall events. Opportunities include green infrastructure, stormwater management improvements, and comprehensive planning and technical analyses to design effective mitigation strategies.	1	1	1	1	1	1	1	1	0	0	8
OEM, DPP, Fleet, OIT	2.3.1	Continue to enhance Citywide COOP-COG program to minimize disruptions and support continuation of essential City services during and following a disaster.	1	1	1	1	1	0	1	1	0	0	7
OEM	2.3.2	Maintain and utilize early warning system.	1	1	1	1	1	0	1	1	0	0	7
SEPTA	2.3.3	Procure and utilize long range drone(s) to assess areas of concern before and after hazardous events (and if possible, during events).	0	1	1	1	1	1	1	1	0	0	7
OEM	2.3.4	Purchase two VMS signs for deployment prior to and during emergencies and events to promote public safety and awareness.	1	1	1	1	1	0	1	1	0	0	7

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PFD, PPD, OEM	2.3.5	Procure additional units of level B PPE for surge operators.	1	0	1	1	1	0	1	1	0	0	6
PWD	2.3.6	PWD Cybersecurity Upgrades: Replace and upgrade PWD software that stores critical infrastructure information that is vulnerable to cyber terrorism attacks.	0	1	1	1	1	0	1	1	0	0	6
PHL-DOA	2.3.7	Ensure DOA's compliance with EPA's Resource Conservation and Recovery Act (RCRA) by disposing of waste responsibly and inspecting systems proactively to mitigate the potential for a hazardous materials release.	1	0	1	1	1	1	1	1	0	0	7
Temple University Office of Facilities Management, PECO	2.3.8	Upgrade electrical feeds to prevent power loss due to reliance on a single feed line into various buildings (e.g., student housing, admin, and academic).	0	1	1	1	1	0	1	1	0	0	6
SUPHR	2.3.9	Utilize drug checking surveillance to identify changes in the illicit drug supply and mitigate the risks associated with emerging substances. Opportunities include detecting and analyzing emerging substances that alter the local drug landscape, addressing the rapid increase in fatal overdoes, preventing the overwhelming of medical providers, and ensuring the availability and effectiveness of harm reduction supplies.	1	0	1	1	1	0	1	1	0	0	6
PCPC, Commerce, L&I, OOS	2.4.1	Planning and Land Use Regulation and Incentive Alignment: Align the City's comprehensive plan, district plans, zoning regulations, development incentives, and other land use related programs with the City's efforts to reduce flood risk, based on up-to-date flood risk projections. This may include designation of local flood zones and related permitting requirements.	1	1	1	1	1	1	1	1	0	0	8
L&I, PCPC, OOS, PWD	2.4.2	Resilient Design Guidelines: Collaborate with related City agencies on the creation of consistent, coordinated design guidelines documents to demonstrate possible strategies for resilience to current and future hazards for building design and the public realm. Build from existing base of guidelines created by various departments.	1	1	1	1	1	1	1	1	0	0	8

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PCPC, OEM, Streets, PPR	2.4.3	Include risk and resiliency considerations as comprehensive planning moves forward, including use of risk analysis by planning districts created for 2026 HMP update.	1	1	1	1	1	1	1	1	0	0	8
DPD, PCPC	2.4.4	Philadelphia Creek Protection Study: Update the Wissahickon Watershed zoning overlay and steep slope protection areas, which promotes disaster resilient land use decisions in the area and apply these protections consistently throughout the City of Philadelphia.	1	1	1	1	1	1	1	1	0	0	8
PHL-DOA	2.4.5	PHL Climate Resilient Design Standards: Adopt Climate Resilient Design Standards at PHL airport to reduce the risk of flooding which will be exacerbated by climate change.	0	1	1	1	1	1	1	1	0	0	7
OEM, PWD, L&I, PCPC, FRMTF, Administrative Board	2.4.6	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, to develop land use ordinance(s) in the dam inundation zones for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin. The City will adopt and enforce the developed land use ordinance(s).	1	1	1	1	1	1	1	1	0	0	8
PWD, OOS	2.5.1	Design and improve Eastwick drainage and floodwater conveyance infrastructure.	1	1	1	1	1	1	1	1	0	0	8
PHL-DOA	2.5.2	Airport Drainage Infrastructure: Design additional and improve current PHL airport drainage infrastructure	0	1	1	1	1	1	1	1	0	0	7
PHL-DOA	2.6.1	Develop and implement the Climate Adaptation and Resiliency Plan (CARP). DOA is in the midst of evaluating its climate risks. Building on this baseline assessment, DOA will align findings with the Master Plan Update currently underway; identify and prioritize climate adaptation strategies; and implement the identified strategies and priority investments.	0	1	1	1	1	1	1	1	0	0	7
SEPTA	2.6.2	Assess, Design, Procure, and Construct Upgrades and Overhauls for Vent Wells, Emergency Exits, and Station Head Houses to protect and armor them against future flooding.	0	1	1	1	1	0	1	1	0	0	6

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PHL-DOA	2.6.3	Conduct —and implement recommendations from—a Philadelphia International Airport Hydrologic and Hydraulic Resiliency Study to assess current and projected flood risk and identify resiliency strategies to address risks. Key steps include a review of existing conditions, coastal analysis, HEC-RAS analysis, development of preliminary adaptation study, determination of potential adaptation and mitigation measures, modeling of those potential measures, and a final technical report. DOA will then seek to implement recommended measures.	0	1	1	1	1	1	1	1	0	0	7
PWD	2.6.4	Invest in transmission main condition assessments to improve understanding of probability of failure in the transmission system and install and/or upgrade priority transmission, water, and discharge mains to improve system redundancy, improve water flows, improve water quality, enhance capacity, and address other system needs.	0	1	1	1	1	1	1	1	0	0	7
SEPTA	2.6.5	Design, procure, and install electric switch heaters for priority sites.	0	1	1	1	1	0	1	1	0	0	6
SEPTA	2.6.6	Plan and implement waterproofing for all Railroad and Transit Tunnels within City Limits — Broad Street, MFSE, Trolley Tunnel, Railroad.	1	1	1	1	1	1	1	1	0	0	8
Streets	2.6.7	Ensure adequate material and equipment is available to repair and replace street lights and traffic poles & signs.	0	1	1	1	1	0	1	1	0	0	6
Streets	2.6.8	Install battery back-up traffic signal controllers to at least 10% of signals in City.	0	1	1	1	1	0	1	1	0	0	6
Streets	2.6.9	Maintain portable generators for key traffic intersections.	0	1	1	1	1	0	1	1	0	0	6
Streets -Highway	2.6.10	Maintain safe roadways and bridges through roadway milling and paving capital projects.	0	1	1	1	1	0	1	1	0	0	6
Streets	2.6.11	Purchase and maintain hyper-local street level weather stations to assist in salting, flooding, and plowing operations.	0	1	1	1	1	1	1	1	0	0	7

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Streets	2.6.12	Purchase and maintain drop-gates for known dangerous roads during emergency events, particularly along Cobbs Creek, for Bells Mill Road, and on Delaware Ave.	1	1	1	1	1	1	1	1	0	0	8
Streets	2.6.13	Redesign roadways and bridges to lesson occurrence/impact of flooding.	1	1	1	1	1	1	1	1	0	0	8
Streets	2.6.14	Strengthen the traffic signals beyond the national standards in reference to wind tolerance.	1	1	1	1	1	1	1	1	0	0	8
Streets	2.6.15	Upgrade equipment and resources necessary to respond to flooding, winter storms, and developing or unforeseen hazards.	1	1	1	1	1	1	1	1	0	0	8
OTIS	2.6.16	Design and construct of a highway cap over the Vine Street Expressway between 13th and 10th Streets to reconnect the Chinatown and Chinatown North communities. The project represents a significant infrastructure investment that seeks to improve community access to green spaces, reduce noise and air pollution, manage stormwater, mitigate urban heat island effects, and improve traffic and pedestrian safety.	1	1	1	1	1	1	1	1	0	1	9
PWD	2.6.17	Removal and replacement of lead service lines	1	1	1	1	1	1	1	1	0	0	8
OTIS	2.6.18	Bridge Sustainability in Northwest Philadelphia: Proximity to the Wissahickon Creek leaves the Bells Mill Road Bridge and Valley Green Road Bridge vulnerable to storm and flooding events and structural degradation. This project aims to repurpose and rehabilitate the two Wissahickon Creek bridges, promote recreational activity for residents and park visitors, and enable community members in disadvantaged Census tracts to access park amenities.	1	1	1	1	1	0	1	1	0	1	8
PECO	2.6.19	Maintain, replace, and upgrade existing electric grid infrastructure to reduce the probability of failure during severe weather events and extreme temperatures, improve system redundancy to reduce downtimes in severe weather events, enhance capacity, and address other system needs	1	1	1	1	1	1	1	1	0	0	8

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PHL-DOA	2.6.20	Initiate design to replace the Fort Mifflin tide gate and install a new equalizer pipe to control high tides of the Delaware River to reduce area inundation and balance water surface elevations	1	1	1	1	1	1	1	1	0	0	8
Department of Public Property, Office of Sustainability, L&I	2.6.21	Design and renovate buildings (City-owned facilities) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	0	1	1	1	1	1	1	1	0	0	7
Capital Program Office (Palintino), Office of Sustainability, L&I	2.6.22	Design and renovate buildings (other public facilities, such as Parks and Recreation and Free Library locations) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	0	1	1	1	1	1	1	1	0	0	7
PIDC, PAID, PWD	2.6.23	Replace antiquated fire protection and potable water systems at the Navy Yard to ensure safety, reliability, and environmental protection.	1	1	1	1	1	1	1	1	0	0	8
OTIS, Streets Department, Office of Sustainability, Office of Multimodal Planning, OEM, PennDOT	2.6.24	Improve infrastructure to protect major intersections and roadways from increased street flooding due to severe storms and climate change. Problem areas include Kelly Drive and South Columbus Blvd and Eastwick at 84th Street and Hook Road.	1	1	1	1	1	1	1	1	0	0	8
PennDOT, Pennsylvania OA IT	2.6.25	Enhance the reliability and functionality of the communications system by upgrading outdated equipment that will no longer be supported by the vendor.	0	1	1	1	1	1	1	1	0	0	7

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PWD	2.6.26	Continue to inspect and perform regular maintenance as needed on High-Hazard Potential Dams in the City to reduce the risk of dam failure.	1	1	1	1	1	1	1	1	1	1	10
PHC, OEM, USACE, PPR	2.7.1	Develop and implement individual hazard management plans for City owned and operated historic structures and their surrounding landscapes. Plans should consider both natural hazards, climate change impacts, and human-caused hazards.; if necessary, consider moving the structure to a safer location. Build on Manayunk pilot for historic preservation.	1	1	1	1	1	1	1	1	0	0	8
The Fund for the Water PPR	2.7.2	Implement various mitigation and resiliency measures identified in the Fairmount Water Works Resiliency Plan to prevent future repetitive losses from flood events.	1	1	1	1	1	1	1	1	0	0	8
PHC, DPD, L&I, DPP	2.7.3	Re-conduct a citywide survey to identify and document all historic properties in the City (private and City-owned) in order to assess risk, vulnerability, and mitigation strategies for properties. Study should take into account all hazards, including building collapse, urban conflagration, and other human-caused and natural hazards.	1	1	1	1	1	1	1	1	0	0	8
Philadelphia Historic Commission, PCPC, OOS, OEM	2.7.4	Engage community members in identifying and protecting vulnerable community and City assets and valued cultural resources to reduce risk at the neighborhood level during hazard mitigation planning and recovery efforts. Include information about how to perform mitigation post-disaster to reduce future risk.	1	1	1	1	1	1	1	1	0	0	8
OEM	2.8.1	Integrate equity and social vulnerability indicators more prominently into OEM's planning and operational products to better predict, prioritize, and support community needs during disasters and emergencies to reduce risk. Form and compensate a community panel making up a diverse group of public representatives to review, provide feedback on, and participate in OEM's planning processes including the Hazard Mitigation Plan.	1	1	1	1	1	1	1	1	0	0	8

Lead and Support Agencies	Initiative #	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
PDPH	2.8.2	Public Health Vulnerability Data and Assessments: Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	1	0	1	1	1	1	1	1	0	0	7
OOS	2.8.3	Eastwick Place-Based Climate Risk, Adaption, and Resiliency Planning: Conduct community-based planning in one of the most vulnerable communities to climate change impacts, Eastwick. To support community resilience to flooding and other hazards, the planning efforts will focus on the identification of long-term mitigation efforts and development of mechanisms to implement them. This planning will build off the experience of a pilot community planning effort in Hunting Park, Beat the Heat, which addresses extreme heat. In Eastwick, the City will pilot a place-based flooding framework and seek funding to implement the planning process outcomes. The City also plans to expand the place-based extreme heat resiliency framework to other communities beyond Hunting Park.	1	1	1	1	1	1	1	1	0	0	8
Streets, PWD, OOS, OMP	2.8.4	Sustainable Corridors Project: Expand cool roadways pilot program and stormwater management projects in heat and flood vulnerable neighborhoods.	1	1	1	1	1	1	1	1	0	0	8
OTIS, PCPC, OOS, Streets	2.8.5	Lower South Infrastructure Resilience Roadmap and Implementation: A multi-departmental initiative focused on creating the strategic direction and tools needed to prepare the Lower Schuylkill area for present and future climate risks. The down-scaled understanding of specific climate risks and the potential solutions to address them will inform the master plans, building designs, and infrastructure plans currently underway or planned in this area, resulting in development that is more resilient to flooding and other risks.	1	1	1	1	1	1	1	1	0	0	8

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ORU, PDPH	2.8.6	Launch multiple, intersectional programs that provide support to communities living with the direct and indirect consequences of the Substance Use Overdose Crisis, including targeting and expanded community engagement, services to families impacted by substance use, and increased city services at critical “hot spot” locations.	1	0	1	1	1	0	1	1	0	0	6
PIDC, SEPTA, PHA, other community partners	2.8.7	Bartrams Safety: Build sidewalks, curb cuts, and pedestrian crossings, and install new lighting, gateway treatments, and (potentially) cameras to improve safety and reduce short dumping and crime along the Woodland Avenue / Grays Avenue / Lindbergh Blvd corridor in Kingsessing, Philadelphia.	1	1	1	1	1	1	1	1	0	0	8
PWD	2.8.8	Cohocksink Multi-hazard Mitigation Project: The final phase of a six-phase flood mitigation project proposes new sewer infrastructure and green stormwater infrastructure systems in the Northern Liberties and South Kensington commercial and residential neighborhoods.	1	1	1	1	1	1	1	1	0	0	8
USACE, PWD, OOS	2.8.9	Per the US Army Corps' Eastwick Flood Risk Management project, design and implement a levee along Cobbs Creek in collaboration with the community and stakeholders in neighboring Delaware County.	1	1	1	1	1	1	1	0	0	0	7
PFD	2.8.10	Continue the Philadelphia Fire Department’s initiative to conduct education and outreach out fire prevention and provide and install free smoke alarms to Philadelphia home owners upon request. A number of adaptive alarms are made available to residents with hearing or vision loss.	1	1	1	1	1	1	1	1	0	0	8
OOS, PWD, USACE, USFWS, PHDC, DHCD	2.8.11	Implement long-term flood mitigation measures as recommended in the Eastwick Flood Resilience Strategy	1	1	1	1	1	1	1	1	0	0	8

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OEM	3.1.1	Assess business risk to potential threats and hazards in Philadelphia and identify actionable solutions to support business response, recovery, and mitigation. This includes an analysis of past impacts to the business community and development of guidance on how businesses can leverage available mitigation funding and resources to be more prepared and resilient for the next disaster, including businesses that own or operate out of historic structures or historic districts.	0	1	1	1	1	1	1	1	0	0	7
OEM	3.1.2	Develop Regional Disaster Supply Chain Resilience Plan.	1	1	1	1	1	1	1	1	0	0	8
Streets	3.1.3	Establish and maintain open end contracts with construction companies for emergency bridge and road repairs.	0	1	1	1	1	0	1	1	0	0	6
Streets, OTIS, PWD, OEM	3.1.4	Citywide Streets Vulnerability Assessment: Document institutional knowledge of flood prone roadways and road closures from severe weather events. Develop system for tracking future storm impacts to inform mitigation actions, planning, and response related activities.	1	1	1	1	1	1	1	1	0	0	8
Streets, PEM, PPD-Traffic, SEPTA	3.1.5	Establish a smart detour plan for flooding of Wissahickon Creek, Schuylkill River, Cobbs Creek, and Delaware River (particularly along Delaware Avenue/Columbus Boulevard).	1	1	1	1	1	1	1	1	0	0	8
OEM, OIT	3.1.6	Develop Cyber Security Incident Response and Recovery Plan, including education and outreach to stakeholders and the public.	1	1	1	1	1	0	1	1	0	0	7
DOA	3.1.7	Conduct a climate vulnerability assessment for airport assets such as substations, mechanical rooms, baggage tunnels, and basement tunnels that are at risk to floods and other hazards.	1	1	1	1	1	1	1	1	0	0	8
PWD, DRBC	3.1.8	Develop and implement long-term plans to safeguard the quality and quantity of Philadelphia's drinking water supply from the Schuylkill and Delaware rivers. Opportunities include implementing measures to prevent water quality degradation, developing strategies to ensure a sustainable water supply, and upgrading and protecting water infrastructure to support long-term water quality and quantity goals.	1	1	1	1	1	1	1	1	0	0	8

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PennDOT, PECO	3.1.9	Install battery backup systems at all fiber network HUB locations to prevent communication loss during power outages, particularly for Intelligent Transportation System (ITS) devices.	1	1	1	1	1	0	1	1	0	0	7
OOS	3.2.1	Identify and implement a dedicated funding source for resiliency and energy projects. Funds could be used for resilient Infrastructure projects, coastal protection projects (where the risk does not belong to one department), operations and maintenance as needed, nature based solutions, energy efficiency upgrades, establishment of resilience hubs, community-level resilience actions and more. This fund would fill a funding gap for municipal capital projects to proactively implement best practice mitigation/adaptation measures for resilient infrastructure.	1	1	1	1	1	1	1	1	0	0	8
OEM, OOS	3.2.2	Resilience Hubs: Design and implement a resilience hub model specific to Philadelphia to support residents, before, during, and after disasters. This action includes identifying and implementing mitigation measures needed so that locations identified as hubs can remain operational during times of disaster. Structural measures may include but are not limited to backup generators/ emergency power supply, heating/cooling equipment, air filtration systems, etc.	1	1	1	1	1	0	1	1	0	0	7
OEM	3.2.3	Using the Eastwick Emergency Preparedness Capacity Building as a base, expand the work done in Eastwick to be more applicable to additional neighborhoods in the City that are at risk for various hazards.	0	1	1	1	1	1	1	1	0	0	7
Manayunk Development Corporation, East Falls Development Corporation	3.2.4	Manayunk/East Falls Flood Preparedness & Mitigation Study: Community-led study to identify flood preparedness and mitigation strategies in these neighborhoods	1	1	1	1	1	1	1	1	0	0	8

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OEM, OOS	3.2.5	Continue to foster relationships and partnerships across all levels of government, the private sector, community-based organizations, and faith-based organizations to enhance the City's emergency management program, encompassing preparedness, mitigation, response, and recovery efforts.	1	0	1	1	1	0	1	1	0	1	7
OEM, PPD, PFD, City Administration, OHS	3.2.6	Enhance collaboration between health and human service providers, emergency management, law enforcement, and City administration to offer comprehensive support services for individuals who are unhoused. This includes securing government and law enforcement support for providing essential resources and information regarding shelter options.	1	0	1	1	1	0	1	1	0	1	7
PECO, OEM, Office of Sustainability — Municipal Energy Office	3.2.7	Develop and implement a workshop to address scalable electricity disruptions and enhance response strategies in collaboration with partners. Conduct training sessions and simulation exercises during the workshop to test and improve capabilities. Key partners included utility providers, emergency management agencies, and community organizations.	1	1	1	1	1	0	1	1	0	0	7
OOS, OEM, PWD, Smart Cities, DOE, DRBC, DVRPC	3.2.8	Develop a Mid-Atlantic Regional Testbed to answer management questions around energy and water and to better understand Earth system changes and subsequent vulnerability and risk in Philadelphia	1	1	1	1	1	0	0	1	1	1	8
OOS, OEM	3.2.9	Establish a regional collaborative to coordinate actions and policies for sea level rise resilience	0	0	1	1	1	0	1	1	0	0	5
PWD, OEM	3.2.10	Establish working relationships with PA DEP's Dam Safety Program leaders and the public and private dam owners in City. Include these groups and individuals as stakeholders in the next HMP update.	0	0	1	1	1	0	1	1	1	1	7

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OOS	3.3.1	Create a dedicated funding source to fund municipal climate resilience as well as community resilience and climate action. Funds would be used for projects to reduce vulnerability and increase resilience of Philadelphia's most vulnerable populations and community-led projects would draw upon their place-based knowledge of environmental hazards and community resilience.	1	1	1	1	1	1	1	1	0	0	8
DPP	3.3.2	Study of Climate Change / Hazard Vulnerability of Police and Fire facilities. Potentially expand the study to include other key civic priority facilitates. DPP will release an RFP and contract for a climate vulnerability assessment and report with maps and recommendations. This assessment will be updated on a regular basis.	0	1	1	1	1	1	1	1	0	0	7
OEM	3.3.3	Maintain relationships with universities and colleges within the Philadelphia region and beyond to support hazard mitigation, climate resilience, emergency planning, training, and exercises.	1	1	1	1	1	0	1	1	0	1	8
PWD	3.3.4	Risk & Resiliency Assessments: Characterize and evaluate current and future coastal flood risk for PWD’s water and wastewater treatment facilities on the tidal Delaware River (4 total), taking into account sea level rise projections and storm surge impacts. Through the risk assessment process, identify potential flood risk mitigation alternatives, considering adaptive management strategies where feasible, engage with key local and regional stakeholders, and explore partnership building opportunities.	1	1	1	1	1	1	1	1	0	0	8
OEM, OOS	3.3.5	Build collaborative opportunities with university programs interested in hazard mitigation planning. Collaboration could take the form of sharing research, students completing analysis and mapping for HMP plan updates, City presentations to classes, identifying university led mitigation actions, and internships.	1	1	1	1	1	1	1	1	0	1	9

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OOS, EJCRC	3.3.6	Develop a Climate Resilience Research Agenda to proactively work with Universities, ensuring research fills critical research gaps and needs within the city	0	0	1	1	1	0	1	1	0	1	6
PWD, FRMTF, OOS	4.1.1	Mapping Stormwater Flooding Risk: Better define urban flood risk in areas not covered by FEMA floodplain mapping through more comprehensive mapping of sewer system flood risk in other areas of the City. PWD has already studied flash flooding risk in Wingohocking Sewershed but hopes to expand these efforts. Share results as appropriate online for community-based planning.	1	1	1	1	1	1	1	1	0	0	8
PPR, Fairmount Park Conservancy	4.1.2	Perform comprehensive study of the stormwater infrastructure of the Centennial District to identify necessary improvements in park infrastructure.	1	1	1	1	1	1	1	1	0	0	8
PPR, Fairmount Park Conservancy	4.1.3	Complete stream restoration projects in West Fairmount Park whose impact is localized to discreet areas to eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.1.4	Advance the comprehensive planning, technical analyses, and stakeholder engagement in Germantown for a storm flood risk reduction and combined sewer overflow mitigation project within the Wingohocking and the Tookany/Tacony-Frankford (TTF) Watersheds.	1	1	1	1	1	1	1	1	0	0	8
PWD, PPR	4.1.5	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Cobbs Creek Reaches 1 to 3 and Cobbs Creek Reaches 6 to 8 in Phase 2.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.1.6	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Tacony Creek.	1	1	1	1	1	1	1	1	0	0	8
PWD, FOW, PPR	4.1.7	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Valley Green Road and Spring Lane.	1	1	1	1	1	1	1	1	0	0	8

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PWD, OEM	4.1.8	Identify additional stream and creek restoration projects to aid in eliminating historic flooding hazards through area studies. Consider appropriate nature-based solutions (natural infrastructure, elevated berm/park space, living shoreline, etc.) to assist in adapting to flooding impacts today and from SLR.	1	1	1	1	1	1	1	1	0	0	8
USFWS, OOS	4.1.9	Restore tidal connections and increase flood storage capacity in the Lower Darby Creek area by restoring floodplain and wetlands in and around the John Heinz National Wildlife Refuge.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.1	Conduct hydraulic modeling.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.2	Ongoing identification of larger infrastructure projects whose impact effects large areas of the City through PWD studies.	1	1	1	1	1	1	1	1	0	0	8
PWD, OEM	4.2.3	Examine the impacts of all dams that are considered HHPD both in Philadelphia and that have inundation areas impacting Philadelphia, including the assets and populations at risk of dam inundation. Plan appropriate mitigation efforts and apply for FEMA HHPD funding.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.4	Implement PWD's Drinking Water Revitalization Plan (WRP) and related long-term Capital Improvement Plan, which focuses on PWD's Drinking Water Treatment Plants, Pumping Stations, and Conveyance Systems.	1	1	1	1	1	1	1	1	0	0	8
PPR, Fairmount Park Conservancy	4.2.5	Conduct study to identify stream restoration projects in West Fairmount Park along with the goal to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	1	1	1	1	1	1	1	1	0	0	8
PPR, Fairmount Park Conservancy	4.2.6	Complete wetland creation projects in FDR Park to eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas and connect park users to the water.	1	1	1	1	1	1	1	1	0	0	8

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PPR, Fairmount Park Conservancy	4.2.7	Perform Shedbrook Creek Stream Rehabilitation to aid in eliminating historic flooding hazards, improve safety of structure or surrounding areas, eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.8	Perform structural repairs to dams and fishway structure at Fairmount Dam to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.9	Complete smaller sewer and green infrastructure projects whose impact is localized to discreet areas. Over one hundred are currently in design stages.	0	1	1	1	1	1	1	1	0	0	7
PWD	4.2.10	Addition of effluent and outfall pumping station to Northeast Water Pollution Control Plant Outfall and Effluent Pumping Station to pump treated water to the river during extreme wet weather events and high tide. Benefits estimated 852,900 Phila residents, and an estimate 221,000 residents from 1) Abington Township; 2) Bensalem Township; 3) the Bucks County Water and Sewer Authority (including all or parts of the Townships of Bristol, Falls, Lower Wakefield, Middletown, Newtown, and Northampton and the Boroughs of Hulmeville, Langhorne, Langhorne Manor, Newtown, and Penndel); 4) Cheltenham Township, 5) Lower Moreland Township, and 6) Lower Southampton	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.11	Addition of wastewater and stormwater pumps and storage in various locations throughout the system and facilities to send more water to the water pollution control plants during wet weather events.	0	1	1	1	1	1	1	1	0	0	7
PWD	4.2.12	Build additional water mains to provide better system redundancy and resiliency.	1	1	1	1	1	1	1	1	0	0	8

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PIDC, OOS, OTIS	4.2.13	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Historic District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	1	1	1	1	1	1	1	1	0	0	8
PIDC, OOS, OTIS	4.2.14	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Mustin District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.15	Install backup generators and switchgear at Queen Lane Raw Pump Station to ensure operations during power outages.	1	1	1	1	1	0	1	1	0	0	7
PWD	4.2.16	Rehabilitate Queen Lane Raw Water Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.17	Relocate Belmont Raw Water Pump Station Intake to ensure reliable source during droughts and winter storms.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.18	Upgrade Lardner's Point Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.19	Upgrade Mingo Creek Pumping Station to handle increased flows from wet weather events.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.20	Upgrade of various wastewater and stormwater pump stations to handle increased flows from wet weather events.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.21	Upgrade P-796 at the Navy Yard Design to handle increased flows from wet weather events.	1	1	1	1	1	1	1	1	0	0	8
PWD, OEM	4.2.22	Coordinate with Pennsylvania DEP and Franklin Mills Limited Partnership on future plan updates regarding HHPD standards and planning.	1	1	1	1	1	1	1	1	0	1	9

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PWD	4.2.23	Replace 1,860 linear feet of 4’0” brick sewer with 72” reinforced concrete pipe sewer along a segment of 21st Street in the Germantown Neighborhood	1	1	1	1	1	1	1	1	0	0	8
PWD	4.2.24	Increase sedimentation tank Capacity and mitigate flood risks, provide community and economic resiliency, and improve water quality.	1	1	1	1	1	1	1	1	0	0	8
PPR	4.3.1	Establish a policy based on need and funding availability for a regular pruning cycle for City trees.	1	1	1	1	1	1	1	1	1	0	9
PPR, PWD, Fairmount Park Conservancy	4.3.2	Complete sewer and green infrastructure projects whose impact is localized to discreet areas in West Fairmount Park.	1	1	1	1	1	1	1	1	0	0	8
PPR	4.3.3	Inspect trees within 100 ft. of walkways and roadways for signs of the emerald ash borer and treat affected trees every three years.	1	1	1	1	1	1	1	1	1	0	9
PPR	4.3.4	Monitor new tree watering contracts to ensure the trees have sufficient time to take root and establish themselves under warmer temperatures.	1	1	1	1	1	1	1	1	1	0	9
PPR	4.3.5	Pilot study the growth of Southern plant species with sustainable planting practices in preparation for increasing temperatures over the next century.	1	1	1	1	1	1	1	1	1	0	9
PPR	4.3.6	Decrease the backlog of 2,000+ tree maintenance and removal projects to reduce unpruned and dead trees falling on power lines during storm events.	1	1	1	1	1	1	1	1	1	0	9
PPR	4.3.7	Montgomery Creek infrastructure repair at approach to Black Road and I-76	1	1	1	1	1	1	1	1	0	0	8
PPR	4.3.8	City tree planting and maintenance: Planting and care of street and park trees throughout the City of Philadelphia to reduce the impacts of heat islands.	1	1	1	1	1	1	1	1	1	0	9

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Streets, PPR, PCPC, PWD, PennDOT	4.3.9	Develop and implement trail designs that ensure long-term viability in vulnerable areas, such as floodplains. Establish specific design standards for trails located in floodplains and other vulnerable areas to enhance resilience.	1	1	1	1	1	1	1	1	0	0	8
OOS, School District, USFWS, PPR, PWD	4.3.10	Explore the potential for vacant and underutilized properties in Eastwick to be converted to wetland and recreational space, including the former Pepper Middle School site.	1	1	1	1	1	1	1	0	1	1	9
OOS	4.4.1	Develop a continuously updated Climate Data tool for screening climate vulnerability and risk of capital investments and planning processes against the best available climate projections for the City and region.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.4.2	Develop phased implementation strategy for optimizing use of biogas at NEWPCP and SWWPCP, including better utilization of biogas today and developing a plan for the future (including upgrading biogas to Renewable Natural Gas).	1	1	1	1	1	1	1	1	0	0	8
Brownfield Working Group	4.5.1	Examine mitigation opportunities that address flooding and rising water tables from increased precipitation and sea level rise inundating brownfields and releasing hazardous materials into local waterways.	1	1	1	1	1	1	1	1	0	0	8
PWD	4.5.2	Secure intake booming materials.	1	1	1	1	1	1	1	1	0	0	8
PIDC	4.5.3	Remove oil storage facility (tank farm).	1	1	1	1	1	1	1	1	0	0	8
PWD	4.5.4	Remediation of lagoons at NEWPCP and SWWPCP	1	1	1	1	1	1	1	1	0	0	8
PPD, OEM	5.1.1	Conduct active shooter training for City staff.	1	0	1	1	1	0	1	1	0	1	7
OEM	5.1.2	Employ a READYEmployee process to alert City Employees of threats and hazards that could impact them and their work spaces.	1	0	1	1	1	0	1	1	1	1	8
PPD	5.1.3	Expand Multi-Assault, Counter Terrorism Action Capabilities (MACTAC) training program for patrol officers.	1	1	1	1	1	0	1	1	0	1	8

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PPD	5.1.4	Expand and continue training for all PPD personnel including, but not limited to: SPOT Training, Prevention and Deterrence of Terrorism Training, Advanced Trauma Training, Mass Casualty Awareness Training, Customized Alarm Response Training, Site Protection by Observational Techniques Training, Protest Awareness Training, Customized Alarm Response Training, Tourniquet Training, Field Force Operations Training, Field Force Extraction Training, Field Force Command Planning Training.	1	1	1	1	1	0	1	1	0	1	8
PFD	5.1.5	Upkeep PFD Hazmat training and equipment.	1	1	1	1	1	0	1	1	1	0	8
SEPA Critical Infrastructure Sub-Committee, County OEMs	5.1.6	Conduct regular training sessions and simulation exercises to test and enhance the effectiveness of cybersecurity response plans, such as SEPA region's plans.	1	1	1	1	1	0	1	1	0	1	8
OEM	5.1.7	Develop and deploy specialized messages for the over 7,000 City employees that work in the Center City Quadplex buildings (City Hall, MSB, OPB, SCCJ) to inform them of emergencies and quickly gather an accountability report.	1	0	1	1	1	0	1	1	1	1	8
OEM, NWS, Delaware County DES	5.2.1	Deploy a stream flood gauge on the Darby Creek near the Eastwick neighborhood.	1	1	1	1	1	1	1	1	0	0	8
PDPH	5.2.2	Inclusive and Equitable Public Health Notification, Engagement, Partnership and Awareness: Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	1	1	1	1	1	0	1	1	0	0	7

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OEM	5.2.3	Revamp and update Philadelphia OEM's Alert and Warning Plan for the City, along with associated frameworks and deliverables.	1	0	1	1	1	0	1	1	0	0	6
OEM, OOS	5.2.4	Utilize the Eastwick Alerts system to notify residents of impending weather that could result in flooding, integrating advanced technology for automatic messaging and public information access (e.g., flood gauges, cameras). Integrate flood gauge information and camera footage on public-facing website.	1	1	1	1	1	0	1	1	0	0	7
OEM	5.2.5	Create a social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	1	0	1	1	1	0	1	1	1	1	8
OEM	5.2.6	Develop and implement an amplification strategy for Alert and Warning Messages using community groups and targeted partnerships to spread OEM messaging to groups that have historically hard to reach.	1	0	1	1	1	0	1	1	1	1	8
OEM	5.2.7	Update and expand the social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	1	0	1	1	1	0	1	1	1	1	8
OEM	5.3.1	Create a Multi-Hazard Preparedness Campaigns promoting mitigation efforts residents and businesses can take prior to hazard events, including print material and digital and social media content that focus on steps people can take to prepare for severe storms. This also includes development of new innovative messaging to promote in-person preparedness workshops to assist in preparing citizens for hurricane season and messaging to support the Community Outreach Team attracting participants to hurricane season at tabling events.	1	1	1	1	1	0	1	1	0	0	7
OEM	5.3.2	Provide public outreach throughout Philadelphia with READYHome, READYCommunity, and READYBusiness to increase community preparedness and mitigation.	1	1	1	1	1	0	1	1	0	0	7

Lead and Support Agencies	Initiative #	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
OEM	5.3.3	Promote post disaster mitigation strategies throughout SEPA region, targeting communities that are most vulnerable. VOAD partner agencies may implement mitigation strategies.	1	1	1	1	1	0	1	1	0	0	7
OEM	5.3.4	Update OEM's Ready programs, including READYBusiness to include additional risk mitigation strategies for small to medium-size businesses.	1	1	1	1	1	0	1	1	0	0	7
OEM GIS	5.3.5	Employ spatial data to inform OEM's community preparedness outreach to help OEM better understand where preparedness outreach is occurring and ultimately focus on areas most at risk.	1	1	1	1	1	1	1	1	0	0	8
OEM	5.3.6	Enhance readiness for climate-related severe weather events by expanding internal response playbooks and implementing additional readiness activities.	1	1	1	1	1	1	1	1	0	0	8
OEM	5.3.7	Continue and expand the centralized platform for community members to access emergency-related communications for all hazards, including alerts for extreme weather conditions, air quality concerns, and cyber terrorism. Continue to enhance initiatives to educate community members about the specific risks associated with hazard events and the vulnerabilities within the community that may amplify impacts. Prioritize language accessibility and localized messaging in outreach and communication efforts.	1	1	1	1	1	0	1	1	0	0	7
OEM	5.3.8	Establish and promote a two-way communication system for community members to report impacts and hazard-related concerns. The system should also be capable of providing information on the follow-up actions taken by the relevant City agencies.	1	1	1	1	1	0	1	1	0	0	7

Lead and Support Agencies	Initiative #	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
PDPH	5.3.9	Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	1	0	1	1	1	0	1	1	1	0	7
OEM	5.3.10	Further localize the STEP curriculum for schools and work to reestablish and develop a READYKids program in partnership with MDO Head Start & PFD Prevention Division.	1	0	1	1	0	0	1	1	0	1	6
OEM, PWD, L&I, PCPC, FRMTF	5.3.11	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement public education and awareness campaigns surrounding dam safety for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	1	1	1	1	1	0	1	1	0	0	7
OEM, Mayor's Office of Recovery and Grants	5.4.1	Develop and socialize guide and calendar of all available mitigation funding resources. Continue to develop and implement coordinated City approach to pursue mitigation funding.	1	1	1	1	1	0	1	1	0	0	7
OEM	5.4.2	Meet quarterly with VOAD partners to maintain preparedness, ensure situational awareness, identify resource capabilities, and build stakeholder relationships pre-disaster.	1	1	1	1	1	0	1	1	0	0	7
OEM	5.4.3	Revitalize the Philadelphia Emergency Management Council from a 6+ year hiatus. This local council will consist of key City leadership and will focus on strategic emergency management issues including long-term risk reduction and risk/hazard education at a senior level	1	1	1	1	1	0	1	1	0	0	7

Lead and Support Agencies	Initiative #	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
OEM	5.4.4	Continue to use the Regional Integration Center (RIC) and their products (situational awareness reports, pre-event briefings, weather reports, etc.) to bring partners to the table to coordinate pre-disaster meetings and information sharing as well as immediate post-disaster recovery work.	1	1	1	1	1	0	1	1	0	0	7
Healthcare Facility Owners and Operators	5.4.5	Develop and expedite a Cyber Readiness and Business Continuity program to address healthcare-related cyber incidents, improving resilience through collaboration with healthcare agencies and response partners.	1	1	1	1	1	0	1	1	0	0	7

6.5.3 Prioritization of Mitigation Actions

Actions that are deemed feasible (i.e., receive a positive evaluation score) were then compared and prioritized using another set of criteria (PEMA 2020):

- Effectiveness (20% of score) – The extent to which an action reduces the vulnerability of people and property.
- Efficiency (25% of score) – The extent to which time, effort, and cost is well used as a means of reducing vulnerability. This criterion assesses the benefits of an action versus the cost of the action's implementation.
- Multi-Hazard Mitigation (15% of score) – The action reduces vulnerability for more than one hazard.
- Addresses High-Risk Hazard (10% of score) – The action reduces vulnerability for people and property from a hazard(s) identified as high-risk.
- Addresses Critical Communications/Critical Infrastructure (15% of score) – The action pertains to the maintenance of critical functions and structures such as transportation, supply chain management, data circuits, etc.
- Equity (15% of score) – The action reduces risk to one or more populations more susceptible to the negative impacts of natural disaster due to environmental exposure, social vulnerability, or other factors.

Scores in each criterion range from 0 to 3. The action's priority is determined by using a formula based on the criteria values and weights. Priority values range from 0 to 3 as well. An action's priority is then determined using the following scale (PEMA 2020):

- Low priority = 0 – 1.8
- Medium priority = 1.9 – 2.4
- High priority = 2.5 – 3

Table 6-6 shows the prioritization scores for the identified, feasible mitigation actions. Municipal officials reviewed and updated the prioritization values based on local needs.

Table 6-6. Prioritization Scoring of Mitigation Actions

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
1.1.1	Continue to maintain and update the City's All-Hazard Mitigation Plan with a focus on plan integration and implementation.	3	2	3	3	2	3	2.6
1.1.2	Develop and implement a drought contingency plan. PWD will update the existing Drought Contingency Plan with pertinent policy and regulatory updates, improved science and technical tools, and with a greater understanding of how Delaware Watershed policies can impact Philadelphia's water supply during critical drought conditions such as reduced water super availability.	3	3	1	2	3	3	2.6
1.1.3	Invest resources to plan and staff initiatives to reduce hazard risks citywide. This includes development of and coordination for Cybersecurity Incident Response and Recovery Plan and Training; a Philadelphia Economic Recovery Plan; a Regional Disaster Housing Plan, and pandemic response planning.	3	2	3	3	3	3	2.75
1.1.4	PDPH Pandemic Planning and Implementation: Update and implement key plans including pandemic response, mass prophylaxis and immunization, and others to reflect best practices and lessons learned during COVID-19and other disease outbreak responses. This encompasses incorporating high-consequence pathogen planning and readiness, including biohazard considerations and healthcare coordination ; identifying sites to administer vaccine and/or dispense medical countermeasures during public health emergencies; coordinating with other human services partners to ensure inclusion of special populations such as children, persons experiencing homelessness, and persons with access and functional needs; identifying isolation and quarantine locations and potential wraparound services; ensuring a standardized process for public data dashboard development and discontinuation; and other preparations for outbreak related response activities.	3	3	1	3	3	3	2.7
1.1.5	Expand lab capacity to rapidly identify and subtype organisms.	3	2	1	3	3	3	2.45
1.1.6	Improve access to primary medical care citywide and improve the quality of primary care by expanding the scope of services and building facility capacity for City Health Centers.	3	3	2	3	3	3	2.85
1.1.7	Improve environmental conditions to foster a sense of safety in neighborhoods, connectedness among neighbors, and reduce the locations where illegal guns are stored and where illegal activity occurs. Projects include addressing blighted buildings, cleaning abandoned lots, improving lighting, and other initiatives to improve environmental conditions.	3	3	3	3	2	3	2.85

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
1.1.8	Implement Roadmap to Safer Communities programs including Group Violence Intervention, Community Crisis Intervention Program, and Operation Pinpoint.	3	3	1	3	2	3	2.55
1.1.9	Identify and implement short-term flood proofing tools for at-risk communities.	2	2	2	3	2	3	2.25
1.1.10	Climate Resilience Plan Update: Update the City's Climate Resilience Plan to include updated climate projections, a heat and flooding vulnerability analysis, new community-informed climate actions, and increased community engagement. Results of the updated climate resilience plan will be used to inform the Hazard Mitigation Plan.	3	3	3	3	2	3	2.85
1.1.11	Climate Resilience Place-based Program Expansion: Expand Office of Sustainability's climate resilience place-based program which will include identifying new communities with climate vulnerabilities and working closely with community based organizations to address those vulnerabilities and increase community resilience	3	3	3	3	2	3	2.85
1.1.12	Establish and maintain heating and cooling centers.	3	2	2	2	3	3	2.5
1.2.1	Conduct outreach and coordinate personnel to keep the Philadelphia unhoused population safe during extreme cold and extreme heat events.	2	2	2	3	1	3	2.1
1.2.2	Expand low barrier access to harm reduction resources in zip codes with high rates of unintentional fatal overdoses, particularly amongst communities of color.	3	3	2	3	1	3	2.55
1.2.3	Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	3	3	3	3	1	3	2.7
1.2.4	Protect and ensure continuous service of municipal spaces and facilities that serve vulnerable populations in Philadelphia, particularly during extreme heat and flooding events. Identify priority municipal sites that serve vulnerable populations, such as libraries, health centers, incarceration facilities, and recreation centers. Develop recommended mitigation and resilience actions based on the facility assessments.	3	3	3	3	2	3	2.85
2.1.1	Assess properties that may benefit from long-term flood resilience measures including elevation, acquisition, relocation, mitigation reconstruction, and additional adaptive/adaptation measures	3	3	2	3	3	3	2.85

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.1.2	Implement long-term flood resilience measures including elevate, acquire, relocate, retrofit, floodproof, complete mitigation reconstruction, and adapt properties that benefit from elevation, acquisition, relocation, completing mitigation reconstruction, or additional adaptive/adaptation measures.	3	3	2	3	3	3	2.85
2.1.3	Assess reuse of City properties that have assets that are prone to damage from flooding	3	3	2	3	3	3	2.85
2.1.4	Bartrams North and South Flood Mitigation: Examine and implement mitigation methods that protects buildings and access without providing any adverse impact to upstream or downstream properties along the western bank of the Schuylkill River.	3	3	2	3	2	2	2.55
2.1.5	Demolish Philadelphia owned 4910 Botanic site structures, remediate known environmental contamination, and convey the riverfront portion of the site to PPR/Schuylkill River Trail/Bartram's Garden to decrease flood risks, risk of criminal activity, and risk of building collapse.	3	3	3	3	3	2	2.85
2.1.6	Align reviews of City floodplain regulation with best practices and models from other peer city's and guidance with the International Code Council (ICC) tri-annual updates of the building codes. Follow and educate people in building profession on required and recommended strategies to mitigate hazards and increase resilience. (wordsmith further - ICC is the baseline, minimum).	3	3	2	3	2	3	2.7
2.1.7	Develop a software platform to share flooding event information across departments in real-time as well as historically.	2	2	2	3	1	3	2.1
2.1.8	Maintain enrollment in NFIP and CRS by implementing floodplain management initiatives, reducing the City's flood risk, and allowing residents to receive discounted flood insurance.	3	3	1	3	2	3	2.55
2.1.9	Implement interim flood mitigation to provide near-term relief to flooding in Eastwick while a community-driven long-term flood resilience strategy is being developed. The project will install a soil-filled flood barrier (for example, using HESCO Floodline) along the Cobbs Creek in Eastwick where riverine flooding typically overflows into the Eastwick community.	3	3	2	2	2	3	2.6

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.1.10	Retain consultant services for the Philadelphia Dept of License & Inspections in their Floodplain Administration duties to provide additional oversight and recommendations in the review of Hydrologic and Hydraulic (H&H) engineering analysis modeling submissions provided with applications that affect coastal floodplains, regulated floodways and riverine floodways without regulatory floodways. Over the span of this project, we intend for these services to help identify current gaps in the review processes of applications that require an H&H engineering analysis under International Building Code, Sections G103.4, G103.5, G103.6 & G103.7 and our local floodplain ordinance, and to develop/identify new engineering resources/tools to assist in more effective enforcement and administration of these floodplain provisions.	3	3	2	2	2	2	2.45
2.1.11	Conduct a detailed climate risk characterization and assessment of the PWD collection system to determine priority areas for infrastructure and operational improvements. The assessment will inform future operation, planning, and design adaptation efforts to ensure continued reliability and system resilience under a changing climate.	3	3	3	3	2	2	2.7
2.1.12	Ensure the flood resilience of PWD facilities by addressing risks associated with both coastal flooding (sea level rise and storm surge) and riverine flooding. This effort may include developing and implementing Adaptive Management Plans to proactively manage current and future flood-related impacts.	3	3	3	3	3	2	2.85
2.1.13	Development of a compound flood model to better understand flood risk today and in the future from all sources of flooding.	3	3	2	2	2	2	2.45
2.1.14	Evaluate a potential coastal levee in Eastwick that would mitigate future sea level rise and coastal storm surge events that are likely to impact the Eastwick neighborhood, the SEPTA tracks, the airport, and the Heinz Wildlife Refuge.	3	2	2	3	2	1	2.15
2.1.15	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement programs to inform surrounding private and commercial property owners of opportunities to elevate their structure and/or add flood protection measures, such as berms, floodwalls, or floodproofing, if the structure(s) are in a dam inundation zone for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	3	3	2	2	3	2	2.6
2.2.1	Continue bridge inspection training and conduct bridge inspections.	2	2	1	2	3	2	2
2.2.2	Continue to analyze the impact of natural and human-caused hazards and threats on critical infrastructure that supports supply chain systems through the update of the Freight (Truck) Network.	3	2	3	3	3	2	2.6

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.2.3	Develop a Trail Resiliency Plan and identify flood mitigation strategies for Philadelphia's extensive trail network. Trails often follow streams and rivers in Philadelphia. Recreation and travel can be a suitable use of the floodplain. However, trail infrastructure represents a significant investment from City, State and Federal partners. OTIS would like to examine how trail infrastructure can be built resiliently to protect the investment while also protecting the ability of the floodplain to absorb water. The study will consider vulnerable assets, best practices in materials and construction suitable to a floodplain, and overall trail network resiliency. Trails provide a travel mechanism that does not contribute to climate change and provides healthy recreational options for residents.	3	2	3	3	2	3	2.6
2.2.4	Create a hazard event database to capture description, severity, location, impact, and potential loss/damage estimate from an event. This data will be used to update the hazard analysis and mitigation actions for Philadelphia, as well as allow the City to be better prepared for future events.	2	2	3	3	1	3	2.25
2.2.5	Enhance THIRA process to identify gaps in mitigation capabilities, and to better align the THIRA with the HMP Planning Process.	2	2	3	3	3	2	2.4
2.2.6	Maintain Tier II Reporting and GIS program.	2	2	2	3	3	1	2.1
2.2.7	Update the Tier II emergency response plan process/template to provide more situational awareness on chemical inventories across the City for OEM/PFD and its partners.	2	2	2	3	2	2	2.1
2.2.8	Improve floodplain mapping to support vulnerability assessments for critical infrastructure and City initiated LOMCs, using updated inundation mapping	2	2	2	3	3	2	2.25
2.2.9	Use damage assessment data to conduct in depth GIS analysis of impacts from past flooding and storms events to better predict future impacts from similar storm events and inform severe weather preparedness planning, alert & warning messaging, and mitigation initiatives in those areas.	2	2	2	3	2	3	2.25
2.2.10	Utilize the results of the 2022 Hazus analysis to identify new mitigation projects.	2	2	2	3	2	3	2.25
2.2.11	Support the USACE production of inundation level mapping for the Schuylkill River alongside the remapping of the floodplain, to reflect the impact levels available for USGS gauge 01474500	2	3	2	2	2	2	2.25
2.2.12	Navy Yard Resilience Study: A comprehensive Resilience Study at the Navy Yard will be critical to inform the implementation of HMP projects. The study will analyze existing conditions; assess all potential risks & vulnerabilities; identify resiliency projects; and advance at least one early-action resiliency project.	3	3	3	2	3	2	2.75

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.2.13	Cobbs Creek Multiuse Trails: Due to the Cobbs Creek frequent floods, there are access and maintenance issues for the multiuse Cobbs Creek trail system. Resilient planning and design will be explored as part of the construction and future maintenance plan of the Cobbs Creek trail.	3	2	2	3	1	2	2.15
2.2.14	Initiating Delaware River Long-Term Flood Protection Feasibility Solutions Study to address tidal surge flooding. Depending on feasibility study results, DOA may select one or more phases to design and construct.	3	3	2	3	2	3	2.7
2.2.15	Design and implement improvements to 84th Street, a priority roadway in Eastwick, by combing traffic calming and flood resilience measures. Interventions may include increasing vegetation throughout the corrdior, elevating the bridge approaches out of the floodplain and improving bike and pedestrian facilities.	3	3	2	2	2	3	2.6
2.2.16	Develop and implement innovative, nature-based, and engineered flood resilience measures to protect flood-prone neighborhoods from pluvial flooding caused by extreme rainfall events. Opportunities include green infrastructure, stormwater management improvements, and comprehensive planning and technical analyses to design effective mitigation strategies.	3	3	2	3	2	3	2.7
2.3.1	Continue to enhance Citywide COOP-COG program to minimize disruptions and support continuation of essential City services during and following a disaster.	3	3	3	3	3	2	2.85
2.3.2	Maintain and utilize early warning system.	2	2	2	3	3	3	2.4
2.3.3	Procure and utilize long range drone(s) to assess areas of concern before and after hazardous events (and if possible, during events).	2	3	3	3	3	3	2.8
2.3.4	Purchase two VMS signs for deployment prior to and during emergencies and events to promote public safety and awareness.	2	2	3	3	2	2	2.25
2.3.5	Procure additional units of level B PPE for surge operators.	3	2	1	3	3	3	2.45
2.3.6	PWD Cybersecurity Upgrades: Replace and upgrade PWD software that stores critical infrastructure information that is vulnerable to cyber terrorism attacks.	3	2	2	3	3	1	2.3
2.3.7	Ensure DOA's compliance with EPA's Resource Conservation and Recovery Act (RCRA) by disposing of waste responsibly and inspecting systems proactively to mitigate the potential for a hazardous materials release.	3	2	1	2	2	2	2.05
2.3.8	Upgrade electrical feeds to prevent power loss due to reliance on a single feed line into various buildings (e.g., student housing, admin, and academic).	2	2	3	2	3	1	2.15

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.3.10	Utilize drug checking surveillance to identify changes in the illicit drug supply and mitigate the risks associated with emerging substances. Opportunities include detecting and analyzing emerging substances that alter the local drug landscape, addressing the rapid increase in fatal overdoes, preventing the overwhelming of medical providers, and ensuring the availability and effectiveness of harm reduction supplies.	3	2	1	2	1	3	2.05
2.4.1	Planning and Land Use Regulation and Incentive Alignment: Align the City's comprehensive plan, district plans, zoning regulations, development incentives, and other land use related programs with the City's efforts to reduce flood risk, based on up-to-date flood risk projections. This may include designation of local flood zones and related permitting requirements.	3	3	3	3	3	2	2.85
2.4.2	Resilient Design Guidelines: Collaborate with related City agencies on the creation of consistent, coordinated design guidelines documents to demonstrate possible strategies for resilience to current and future hazards for building design and the public realm. Build from existing base of guidelines created by various departments.	2	2	3	3	3	2	2.4
2.4.3	Include risk and resiliency considerations as comprehensive planning moves forward, including use of risk analysis by planning districts created for 2026 HMP update.	3	3	3	3	2	3	2.85
2.4.4	Philadelphia Creek Protection Study: Update the Wissahickon Watershed zoning overlay and steep slope protection areas, which promotes disaster resilient land use decisions in the area and apply these protections consistently throughout the City of Philadelphia.	3	3	2	2	2	3	2.6
2.4.5	PHL Climate Resilient Design Standards: Adopt Climate Resilient Design Standards at PHL airport to reduce the risk of flooding which will be exacerbated by climate change.	3	3	2	3	3	3	2.85
2.4.6	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, to develop land use ordinance(s) in the dam inundation zones for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin. The City will adopt and enforce the developed land use ordinance(s).	3	3	2	2	3	2	2.6
2.5.1	Design and improve Eastwick drainage and floodwater conveyance infrastructure.	3	3	2	3	3	3	2.85
2.5.2	Airport Drainage Infrastructure: Design additional and improve current PHL airport drainage infrastructure	3	3	2	3	3	2	2.7

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.6.1	Develop and implement the Climate Adaptation and Resiliency Plan (CARP). DOA is in the midst of evaluating its climate risks. Building on this baseline assessment, DOA will align findings with the Master Plan Update currently underway; identify and prioritize climate adaptation strategies; and implement the identified strategies and priority investments.	3	2	3	3	3	3	2.75
2.6.2	Assess, Design, Procure, and Construct Upgrades and Overhauls for Vent Wells, Emergency Exits, and Station Head Houses to protect and armor them against future flooding.	3	3	2	3	3	3	2.85
2.6.3	Conduct —and implement recommendations from—a Philadelphia International Airport Hydrologic and Hydraulic Resiliency Study to assess current and projected flood risk and identify resiliency strategies to address risks. Key steps include a review of existing conditions, coastal analysis, HEC-RAS analysis, development of preliminary adaptation study, determination of potential adaptation and mitigation measures, modeling of those potential measures, and a final technical report. DOA will then seek to implement recommended measures.	2	2	2	3	3	2	2.25
2.6.4	Invest in transmission main condition assessments to improve understanding of probability of failure in the transmission system and install and/or upgrade priority transmission, water, and discharge mains to improve system redundancy, improve water flows, improve water quality, enhance capacity, and address other system needs.	3	3	2	3	3	2	2.7
2.6.5	Design, procure, and install electric switch heaters for priority sites.	3	3	2	3	3	3	2.85
2.6.6	Plan and implement waterproofing for all Railroad and Transit Tunnels within City Limits — Broad Street, MFSE, Trolley Tunnel, Railroad.	3	2	3	3	3	3	2.75
2.6.7	Ensure adequate material and equipment is available to repair and replace street lights and traffic poles & signs.	2	2	1	3	3	2	2.1
2.6.8	Install battery back-up traffic signal controllers to at least 10% of signals in City.	2	2	3	3	3	2	2.4
2.6.9	Maintain portable generators for key traffic intersections.	2	2	3	3	3	2	2.4
2.6.10	Maintain safe roadways and bridges through roadway milling and paving capital projects.	2	2	2	2	3	2	2.15
2.6.11	Purchase and maintain hyper-local street level weather stations to assist in salting, flooding, and plowing operations.	2	2	1	3	2	2	1.95
2.6.12	Purchase and maintain drop-gates for known dangerous roads during emergency events, particularly along Cobbs Creek, for Bells Mill Road, and on Delaware Ave.	3	3	2	3	3	3	2.85
2.6.13	Redesign roadways and bridges to lesson occurrence/impact of flooding.	3	3	2	3	3	2	2.7

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.6.14	Strengthen the traffic signals beyond the national standards in reference to wind tolerance.	3	2	2	3	2	2	2.3
2.6.15	Upgrade equipment and resources necessary to respond to flooding, winter storms, and developing or unforeseen hazards.	2	3	3	3	3	2	2.65
2.6.16	Design and construct of a highway cap over the Vine Street Expressway between 13th and 10th Streets to reconnect the Chinatown and Chinatown North communities. The project represents a significant infrastructure investment that seeks to improve community access to green spaces, reduce noise and air pollution, manage stormwater, mitigate urban heat island effects, and improve traffic and pedestrian safety.	3	2	3	2	2	3	2.5
2.6.17	Removal and replacement of lead service lines	3	3	2	2	3	3	2.75
2.6.18	Bridge Sustainability in Northwest Philadelphia: Proximity to the Wissahickon Creek leaves the Bells Mill Road Bridge and Valley Green Road Bridge vulnerable to storm and flooding events and structural degradation. This project aims to repurpose and rehabilitate the two Wissahickon Creek bridges, promote recreational activity for residents and park visitors, and enable community members in disadvantaged Census tracts to access park amenities.	3	2	2	3	2	3	2.45
2.6.19	Maintain, replace, and upgrade existing electric grid infrastructure to reduce the probability of failure during severe weather events and extreme temperatures, improve system redundancy to reduce downtimes in severe weather events, enhance capacity, and address other system needs	3	3	2	3	2	3	2.7
2.6.20	Initiate design to replace the Fort Mifflin tide gate and install a new equalizer pipe to control high tides of the Delaware River to reduce area inundation and balance water surface elevations	2	3	2	3	2	2	2.35
2.6.21	Design and renovate buildings (City-owned facilities) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	3	2	1	2	2	1	1.9
2.6.22	Design and renovate buildings (other public facilities, such as Parks and Recreation and Free Library locations) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	3	2	1	2	1	1	1.75
2.6.23	Replace antiquated fire protection and potable water systems at the Navy Yard to ensure safety, reliability, and environmental protection.	3	3	2	2	2	1	2.3

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.6.24	Improve infrastructure to protect major intersections and roadways from increased street flooding due to severe storms and climate change. Problem areas include Kelly Drive and South Columbus Blvd and Eastwick at 84th Street and Hook Road.	3	3	2	3	2	2	2.55
2.6.25	Enhance the reliability and functionality of the communications system by upgrading outdated equipment that will no longer be supported by the vendor.	3	3	2	2	2	2	2.45
2.6.26	Continue to inspect and perform regular maintenance as needed on High-Hazard Potential Dams in the City to reduce the risk of dam failure.	3	3	1	1	3	1	
2.7.1	Develop and implement individual hazard management plans for City owned and operated historic structures and their surrounding landscapes. Plans should consider both natural hazards, climate change impacts, and human-caused hazards.; if necessary, consider moving the structure to a safer location. Build on Manayunk pilot for historic preservation.	2	2	3	3	2	2	2.25
2.7.2	Implement various mitigation and resiliency measures identified in the Fairmount Water Works Resiliency Plan to prevent future repetitive losses from flood events.	3	3	2	3	2	2	2.55
2.7.3	Re-conduct a citywide survey to identify and document all historic properties in the City (private and City-owned) in order to assess risk, vulnerability, and mitigation strategies for properties. Study should take into account all hazards, including building collapse, urban conflagration, and other human-caused and natural hazards.	3	2	3	3	3	2	2.6
2.7.4	Engage community members in identifying and protecting vulnerable community and City assets and valued cultural resources to reduce risk at the neighborhood level during hazard mitigation planning and recovery efforts. Include information about how to perform mitigation post-disaster to reduce future risk.	3	3	3	2	2	3	2.75
2.8.1	Integrate equity and social vulnerability indicators more prominently into OEM's planning and operational products to better predict, prioritize, and support community needs during disasters and emergencies to reduce risk. Form and compensate a community panel making up a diverse group of public representatives to review, provide feedback on, and participate in OEM's planning processes including the Hazard Mitigation Plan.	3	3	3	3	2	3	2.85

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.8.2	Public Health Vulnerability Data and Assessments: Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	3	2	3	3	3	3	2.75
2.8.3	Eastwick Place-Based Climate Risk, Adaption, and Resiliency Planning: Conduct community-based planning in one of the most vulnerable communities to climate change impacts, Eastwick. To support community resilience to flooding and other hazards, the planning efforts will focus on the identification of long-term mitigation efforts and development of mechanisms to implement them. This planning will build off the experience of a pilot community planning effort in Hunting Park, Beat the Heat, which addresses extreme heat. In Eastwick, the City will pilot a place-based flooding framework and seek funding to implement the planning process outcomes. The City also plans to expand the place-based extreme heat resiliency framework to other communities beyond Hunting Park.	3	2	2	3	3	3	2.6
2.8.4	Sustainable Corridors Project: Expand cool roadways pilot program and stormwater management projects in heat and flood vulnerable neighborhoods.	3	3	2	3	2	3	2.7
2.8.5	Lower South Infrastructure Resilience Roadmap and Implementation: A multi-departmental initiative focused on creating the strategic direction and tools needed to prepare the Lower Schuylkill area for present and future climate risks. The down-scaled understanding of specific climate risks and the potential solutions to address them will inform the master plans, building designs, and infrastructure plans currently underway or planned in this area, resulting in development that is more resilient to flooding and other risks.	3	3	2	3	3	3	2.85
2.8.6	Launch multiple, intersectional programs that provide support to communities living with the direct and indirect consequences of the Substance Use Overdose Crisis, including targeting and expanded community engagement, services to families impacted by substance use, and increased city services at critical “hot spot” locations.	3	3	1	3	3	3	2.7
2.8.7	Bartrams Safety : Build sidewalks, curb cuts, and pedestrian crossings, and install new lighting, gateway treatments, and (potentially) cameras to improve safety and reduce short dumping and crime along the Woodland Avenue / Grays Avenue / Lindbergh Blvd corridor in Kingsessing, Philadelphia.	3	3	1	3	2	3	2.55

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
2.8.8	Cohocksink Multi-hazard Mitigation Project: The final phase of a six-phase flood mitigation project proposes new sewer infrastructure and green stormwater infrastructure systems in the Northern Liberties and South Kensington commercial and residential neighborhoods.	3	3	2	3	3	3	2.85
2.8.9	Per the US Army Corps' Eastwick Flood Risk Management project, design and implement a levee along Cobbs Creek in collaboration with the community and stakeholders in neighboring Delaware County.	3	3	2	3	2	3	2.7
2.8.10	Continue the Philadelphia Fire Department's initiative to conduct education and outreach out fire prevention and provide and install free smoke alarms to Philadelphia home owners upon request. A number of adaptive alarms are made available to residents with hearing or vision loss.	3	3	2	3	2	3	2.7
2.8.11	Implement long-term flood mitigation measures as recommended in the Eastwick Flood Resilience Strategy.	2	3	2	3	2	3	2.5
3.1.1	Assess business risk to potential threats and hazards in Philadelphia and identify actionable solutions to support business response, recovery, and mitigation. This includes an analysis of past impacts to the business community and development of guidance on how businesses can leverage available mitigation funding and resources to be more prepared and resilient for the next disaster, including businesses that own or operate out of historic structures or historic districts.	3	3	2	3	2	2	2.55
3.1.2	Develop Regional Disaster Supply Chain Resilience Plan.	3	2	3	3	3	3	2.75
3.1.3	Establish and maintain open end contracts with construction companies for emergency bridge and road repairs.	2	2	3	3	3	2	2.4
3.1.4	Citywide Streets Vulnerability Assessment: Document institutional knowledge of flood prone roadways and road closures from severe weather events. Develop system for tracking future storm impacts to inform mitigation actions, planning, and response related activities.	3	2	2	3	3	3	2.6
3.1.5	Establish a smart detour plan for flooding of Wissahickon Creek, Schuylkill River, Cobbs Creek, and Delaware River (particularly along Delaware Avenue/Columbus Boulevard).	2	2	2	3	3	2	2.25
3.1.6	Develop Cyber Security Incident Response and Recovery Plan, including education and outreach to stakeholders and the public.	3	3	2	2	3	2	2.6
3.1.7	Conduct a climate vulnerability assessment for airport assets such as substations, mechanical rooms, baggage tunnels, and basement tunnels that are at risk to floods and other hazards.	3	3	2	3	3	2	2.7

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
3.1.8	Develop and implement long-term plans to safeguard the quality and quantity of Philadelphia's drinking water supply from the Schuylkill and Delaware rivers. Opportunities include implementing measures to prevent water quality degradation, developing strategies to ensure a sustainable water supply, and upgrading and protecting water infrastructure to support long-term water quality and quantity goals.	2	3	2	2	3	3	2.55
3.1.9	Install battery backup systems at all fiber network HUB locations to prevent communication loss during power outages, particularly for Intelligent Transportation System (ITS) devices.	2	2	2	2	3	2	2.15
3.2.1	Identify and implement a dedicated funding source for resiliency and energy projects. Funds could be used for resilient Infrastructure projects, coastal protection projects (where the risk does not belong to one department), operations and maintenance as needed, nature based solutions, energy efficiency upgrades, establishment of resilience hubs, community-level resilience actions and more. This fund would fill a funding gap for municipal capital projects to proactively implement best practice mitigation/adaptation measures for resilient infrastructure.	3	3	3	3	3	2	2.85
3.2.2	Resilience Hubs: Design and implement a resilience hub model specific to Philadelphia to support residents, before, during, and after disasters. This action includes identifying and implementing mitigation measures needed so that locations identified as hubs can remain operational during times of disaster. Structural measures may include but are not limited to backup generators/ emergency power supply, heating/cooling equipment, air filtration systems, etc.	3	2	3	3	2	3	2.6
3.2.3	Using the Eastwick Emergency Preparedness Capacity Building as a base, expand the work done in Eastwick to be more applicable to additional neighborhoods in the City that are at risk for various hazards.	2	2	2	3	3	2	2.25
3.2.4	Manayunk/East Falls Flood Preparedness & Mitigation Study: Community-led study to identify flood preparedness and mitigation strategies in these neighborhoods	3	2	3	3	2	3	2.6
3.2.5	Continue to foster relationships and partnerships across all levels of government, the private sector, community-based organizations, and faith-based organizations to enhance the City's emergency management program, encompassing preparedness, mitigation, response, and recovery efforts.	3	3	3	3	2	3	2.85
3.2.6	Enhance collaboration between health and human service providers, emergency management, law enforcement, and City administration to offer comprehensive support services for individuals who are unhoused. This includes securing government and law enforcement support for providing essential resources and information regarding shelter options.	3	3	3	3	2	3	2.85

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
3.2.7	Develop and implement a workshop to address scalable electricity disruptions and enhance response strategies in collaboration with partners. Conduct training sessions and simulation exercises during the workshop to test and improve capabilities. Key partners included utility providers, emergency management agencies, and community organizations.	3	3	3	3	2	2	2.7
3.2.8	Develop a Mid-Atlantic Regional Testbed to answer management questions around energy and water and to better understand Earth system changes and subsequent vulnerability and risk in Philadelphia	3	2	3	3	2	1	2.3
3.2.9	Establish a regional collaborative to coordinate actions and policies for sea level rise resilience	3	3	1	3	2	2	2.4
3.2.10	Establish working relationships with PA DEP's Dam Safety Program leaders and the public and private dam owners in City. Include these groups and individuals as stakeholders in the next HMP update.	3	3	1	1	0	0	1.3
3.3.1	Create a dedicated funding source to fund municipal climate resilience as well as community resilience and climate action. Funds would be used for projects to reduce vulnerability and increase resilience of Philadelphia's most vulnerable populations and community-led projects would draw upon their place-based knowledge of environmental hazards and community resilience.	3	3	2	3	2	3	2.7
3.3.2	Study of Climate Change / Hazard Vulnerability of Police and Fire facilities. Potentially expand the study to include other key civic priority facilitates. DPP will release an RFP and contract for a climate vulnerability assessment and report with maps and recommendations. This assessment will be updated on a regular basis.	2	2	3	3	1	3	2.25
3.3.3	Maintain relationships with universities and colleges within the Philadelphia region and beyond to support hazard mitigation, climate resilience, emergency planning, training, and exercises.	2	2	3	3	2	2	2.25
3.3.4	Risk & Resiliency Assessments: Characterize and evaluate current and future coastal flood risk for PWD's water and wastewater treatment facilities on the tidal Delaware River (4 total), taking into account sea level rise projections and storm surge impacts. Through the risk assessment process, identify potential flood risk mitigation alternatives, considering adaptive management strategies where feasible, engage with key local and regional stakeholders, and explore partnership building opportunities.	3	3	2	3	3	2	2.7

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
3.3.5	Build collaborative opportunities with university programs interested in hazard mitigation planning. Collaboration could take the form of sharing research, students completing analysis and mapping for HMP plan updates, City presentations to classes, identifying university led mitigation actions, and internships.	2	2	3	3	2	2	2.25
3.3.6	Develop a Climate Resilience Research Agenda to proactively work with Universities, ensuring research fills critical research gaps and needs within the city	3	2	3	3	1	2	2.3
4.1.1	Mapping Stormwater Flooding Risk: Better define urban flood risk in areas not covered by FEMA floodplain mapping through more comprehensive mapping of sewer system flood risk in other areas of the City. PWD has already studied flash flooding risk in Wingohocking Sewershed but hopes to expand these efforts. Share results as appropriate online for community-based planning.	2	2	2	3	3	2	2.25
4.1.2	Perform comprehensive study of the stormwater infrastructure of the Centennial District to identify necessary improvements in park infrastructure.	3	2	2	3	3	3	2.6
4.1.3	Complete stream restoration projects in West Fairmount Park whose impact is localized to discreet areas to eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	3	2	2	3	2	3	2.45
4.1.4	Advance the comprehensive planning, technical analyses, and stakeholder engagement in Germantown for a storm flood risk reduction and combined sewer overflow mitigation project within the Wingohocking and the Tookany/Tacony-Frankford (TTF) Watersheds.	3	3	2	3	3	3	2.85
4.1.5	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Cobbs Creek Reaches 1 to 3 and Cobbs Creek Reaches 6 to 8 in Phase 2.	3	2	2	3	2	3	2.45
4.1.6	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Tacony Creek.	3	2	2	3	2	3	2.45
4.1.7	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Valley Green Road and Spring Lane.	3	2	2	3	2	3	2.45
4.1.8	Identify additional stream and creek restoration projects to aid in eliminating historic flooding hazards through area studies. Consider appropriate nature-based solutions (natural infrastructure, elevated berm/park space, living shoreline, etc.) to assist in adapting to flooding impacts today and from SLR.	3	3	2	3	2	2	2.55
4.1.9	Restore tidal connections and increase flood storage capacity in the Lower Darby Creek area by restoring floodplain and wetlands in and around the John Heinz National Wildlife Refuge.	3	2	2	3	2	2	2.3

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4.2.1	Conduct hydraulic modeling.	2	2	2	3	2	2	2.1
4.2.2	Ongoing identification of larger infrastructure projects whose impact effects large areas of the city through PWD studies.	3	3	2	3	3	3	2.85
4.2.3	Examine the impacts of all dams that are considered HHPD both in Philadelphia and that have inundation areas impacting Philadelphia, including the assets and populations at risk of dam inundation. Plan appropriate mitigation efforts and apply for FEMA HHPD funding.	3	3	2	3	3	3	2.85
4.2.4	Implement PWD's Drinking Water Revitalization Plan (WRP) and related long-term Capital Improvement Plan, which focuses on PWD's Drinking Water Treatment Plants, Pumping Stations, and Conveyance Systems.	2	2	3	3	3	3	2.55
4.2.5	Conduct study to identify stream restoration projects in West Fairmount Park along with the goal to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	3	2	2	3	2	3	2.45
4.2.6	Complete wetland creation projects in FDR Park to eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas and connect park users to the water.	3	3	2	3	2	3	2.7
4.2.7	Perform Shedbrook Creek Stream Rehabilitation to aid in eliminating historic flooding hazards, improve safety of structure or surrounding areas, eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas.	3	2	2	3	2	3	2.45
4.2.8	Perform structural repairs to dams and fishway structure at Fairmount Dam to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	3	3	2	3	2	2	2.55
4.2.9	Complete smaller sewer and green infrastructure projects whose impact is localized to discreet areas. Over one hundred are currently in design stages.	2	3	2	3	3	3	2.65

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
4.2.10	Addition of effluent and outfall pumping station to Northeast Water Pollution Control Plant Outfall and Effluent Pumping Station to pump treated water to the river during extreme wet weather events and high tide. Benefits estimated 852,900 Phila residents, and an estimate 221,000 residents from 1) Abington Township; 2) Bensalem Township; 3) the Bucks County Water and Sewer Authority (including all or parts of the Townships of Bristol, Falls, Lower Wakefield, Middletown, Newtown, and Northampton and the Boroughs of Hulmeville, Langhorne, Langhorne Manor, Newtown, and Penndel); 4) Cheltenham Township, 5) Lower Moreland Township, and 6) Lower Southampton	3	3	2	3	3	3	2.85
4.2.11	Addition of wastewater and stormwater pumps and storage in various locations throughout the system and facilities to send more water to the water pollution control plants during wet weather events.	3	3	2	3	3	2	2.7
4.2.12	Build additional water mains to provide better system redundancy and resiliency.	3	3	2	3	3	2	2.7
4.2.13	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Historic District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	3	3	2	3	3	1	2.55
4.2.14	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Mustin District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	3	3	2	3	3	1	2.55
4.2.15	Install backup generators and switchgear at Queen Lane Raw Pump Station to ensure operations during power outages.	3	2	2	3	3	3	2.6
4.2.16	Rehabilitate Queen Lane Raw Water Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	3	3	2	3	3	3	2.85
4.2.17	Relocate Belmont Raw Water Pump Station Intake to ensure reliable source during droughts and winter storms.	3	3	2	3	3	3	2.85
4.2.18	Upgrade Lardner's Point Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	3	3	2	3	3	3	2.85
4.2.19	Upgrade Mingo Creek Pumping Station to handle increased flows from wet weather events.	3	3	2	3	3	3	2.85
4.2.20	Upgrade of various wastewater and stormwater pump stations to handle increased flows from wet weather events.	3	3	2	3	3	2	2.7
4.2.21	Upgrade P-796 at the Navy Yard Design to handle increased flows from wet weather events.	3	2	2	3	3	1	2.3

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4.2.22	Coordinate with Pennsylvania DEP and Franklin Mills Limited Partnership on future plan updates regarding HHPD standards and planning.	3	3	1	2	3	3	2.6
4.2.23	Replace 1,860 linear feet of 4'0" brick sewer with 72" reinforced concrete pipe sewer along a segment of 21st Street in the Germantown Neighborhood	3	3	2	3	2	3	2.7
4.2.24	Increase sedimentation tank Capacity and mitigate flood risks, provide community and economic resiliency, and improve water quality.	3	3	2	3	2	3	2.7
4.3.1	Establish a policy based on need and funding availability for a regular pruning cycle for City trees.	2	2	3	3	1	2	2.1
4.3.2	Complete sewer and green infrastructure projects whose impact is localized to discreet areas in West Fairmount Park.	3	3	2	3	3	3	2.85
4.3.3	Inspect trees within 100 ft. of walkways and roadways for signs of the emerald ash borer and treat affected trees every three years.	2	2	3	3	2	2	2.25
4.3.4	Monitor new tree watering contracts to ensure the trees have sufficient time to take root and establish themselves under warmer temperatures.	2	2	2	3	1	3	2.1
4.3.5	Pilot study the growth of Southern plant species with sustainable planting practices in preparation for increasing temperatures over the next century.	2	2	3	3	1	2	2.1
4.3.6	Decrease the backlog of 2,000+ tree maintenance and removal projects to reduce unpruned and dead trees falling on power lines during storm events.	2	2	3	3	2	2	2.25
4.3.7	Montgomery Creek infrastructure repair at approach to Black Road and I-76	3	2	2	3	2	2	2.3
4.3.8	City tree planting and maintenance: Planting and care of street and park trees throughout the City of Philadelphia to reduce the impacts of heat islands.	2	2	2	3	1	3	2.1
4.3.9	Develop and implement trail designs that ensure long-term viability in vulnerable areas, such as floodplains. Establish specific design standards for trails located in floodplains and other vulnerable areas to enhance resilience.	2	2	2	3	1	2	1.95
4.3.10	Explore the potential for vacant and underutilized properties in Eastwick to be converted to wetland and recreational space, including the former Pepper Middle School site.	3	2	2	3	1	2	2.15
4.4.1	Develop a continuously updated Climate Data tool for screening climate vulnerability and risk of capital investments and planning processes against the best available climate projections for the City and region.	3	2	2	3	3	3	2.6

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
4.4.2	Develop phased implementation strategy for optimizing use of biogas at NEWPCP and SWWPCP, including better utilization of biogas today and developing a plan for the future (including upgrading biogas to Renewable Natural Gas).	3	2	2	2	2	2	2.2
4.5.1	Examine mitigation opportunities that address flooding and rising water tables from increased precipitation and sea level rise inundating brownfields and releasing hazardous materials into local waterways.	2	2	2	3	2	3	2.25
4.5.2	Secure intake booming materials.	2	2	1	3	3	3	2.25
4.5.3	Remove oil storage facility (tank farm).	2	1	1	3	2	2	1.7
4.5.4	Remediation of lagoons at NEWPCP and SWWPCP	2	2	1	3	2	2	1.95
5.1.1	Conduct active shooter training for City staff.	2	2	1	2	1	1	1.55
5.1.2	Employ a READYEmployee process to alert City Employees of threats and hazards that could impact them and their work spaces.	3	3	3	3	3	2	2.85
5.1.3	Expand Multi-Assault, Counter Terrorism Action Capabilities (MACTAC) training program for patrol officers.	2	2	2	2	1	1	1.7
5.1.4	Expand and continue training for all PPD personnel including, but not limited to: SPOT Training, Prevention and Deterrence of Terrorism Training, Advanced Trauma Training, Mass Casualty Awareness Training, Customized Alarm Response Training, Site Protection by Observational Techniques Training, Protest Awareness Training, Customized Alarm Response Training, Tourniquet Training, Field Force Operations Training, Field Force Extraction Training, Field Force Command Planning Training.	2	2	2	2	1	1	1.7
5.1.5	Upkeep PFD Hazmat training and equipment.	2	2	2	3	1	1	1.8
5.1.6	Conduct regular training sessions and simulation exercises to test and enhance the effectiveness of cybersecurity response plans, such as SEPA region's plans.	2	2	2	3	2	1	1.95
5.1.7	Develop and deploy specialized messages for the over 7,000 City employees that work in the Center City Quadplex buildings (City Hall, MSB, OPB, SCCJ) to inform them of emergencies and quickly gather an accountability report.	3	3	3	3	3	1	2.7
5.2.1	Deploy and maintain targeted flood monitoring technology across the City to better inform mitigation, preparedness, and response efforts.	2	2	2	3	3	3	2.4

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
5.2.2	Inclusive and Equitable Public Health Notification, Engagement, Partnership and Awareness: Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	3	3	3	3	1	3	2.7
5.2.3	Revamp and update Philadelphia OEM's Alert and Warning Plan for the City, along with associated frameworks and deliverables.	3	3	3	3	2	3	2.85
5.2.4	Utilize the Eastwick Alerts system to notify residents of impending weather that could result in flooding, integrating advanced technology for automatic messaging and public information access (e.g., flood gauges, cameras). Integrate flood gauge information and camera footage on public-facing website.	3	3	3	3	2	3	2.85
5.2.5	Create a social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	3	2	3	3	3	3	2.75
5.2.6	Develop and implement an amplification strategy for Alert and Warning Messages using community groups and targeted partnerships to spread OEM messaging to groups that have historically hard to reach.	3	2	3	3	3	3	2.75
5.2.7	Update and expand the social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	3	2	3	3	3	3	2.75
5.3.1	Create a Multi-Hazard Preparedness Campaigns promoting mitigation efforts residents and businesses can take prior to hazard events, including print material and digital and social media content that focus on steps people can take to prepare for severe storms. This also includes development of new innovative messaging to promote in-person preparedness workshops to assist in preparing citizens for hurricane season and messaging to support the Community Outreach Team attracting participants to hurricane season at tabling events.	3	3	2	3	1	3	2.55
5.3.2	Provide public outreach throughout Philadelphia with READYHome, READYCommunity, and READYBusiness to increase community preparedness and mitigation.	3	3	3	3	3	3	3
5.3.3	Promote post disaster mitigation strategies throughout SEPA region, targeting communities that are most vulnerable. VOAD partner agencies may implement mitigation strategies.	3	2	3	3	2	3	2.6

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
5.3.4	Update OEM's Ready programs, including READYBusiness to include additional risk mitigation strategies for small to medium-size businesses.	3	2	3	3	3	3	2.75
5.3.5	Employ spatial data to inform OEM's community preparedness outreach to help OEM better understand where preparedness outreach is occurring and ultimately focus on areas most at risk.	2	2	3	3	2	2	2.25
5.3.6	Enhance readiness for climate-related severe weather events by expanding internal response playbooks and implementing additional readiness activities.	3	2	3	3	2	2	2.45
5.3.7	Continue and expand the centralized platform for community members to access emergency-related communications for all hazards, including alerts for extreme weather conditions, air quality concerns, and cyber terrorism. Continue to enhance initiatives to educate community members about the specific risks associated with hazard events and the vulnerabilities within the community that may amplify impacts. Prioritize language accessibility and localized messaging in outreach and communication efforts.	3	3	3	3	2	3	2.85
5.3.8	Establish and promote a two-way communication system for community members to report impacts and hazard-related concerns. The system should also be capable of providing information on the follow-up actions taken by the relevant City agencies.	2	2	3	3	2	3	2.4
5.3.9	Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	3	2	3	3	2	3	2.6
5.3.10	Further localize the STEP curriculum for schools and work to reestablish and develop a READYKids program in partnership with MDO Head Start & PFD Prevention Division.	3	2	3	3	2	3	2.6
5.3.11	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement public education and awareness campaigns surrounding dam safety for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	3	3	2	2	3	2	2.6
5.4.1	Develop and socialize guide and calendar of all available mitigation funding resources. Continue to develop and implement coordinated City approach to pursue mitigation funding.	3	3	3	3	2	2	2.7

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Equity	Priority
5.4.2	Meet quarterly with VOAD partners to maintain preparedness, ensure situational awareness, identify resource capabilities, and build stakeholder relationships pre-disaster.	2	2	3	3	1	3	2.25
5.4.3	Revitalize the Philadelphia Emergency Management Council from a 6+ year hiatus. This local council will consist of key City leadership and will focus on strategic emergency management issues including long-term risk reduction and risk/hazard education at a senior level	2	2	3	3	3	2	2.4
5.4.4	Continue to use the Regional Integration Center (RIC) and their products (situational awareness reports, pre-event briefings, weather reports, etc.) to bring partners to the table to coordinate pre-disaster meetings and information sharing as well as immediate post-disaster recovery work.	3	3	3	3	2	3	2.85
5.4.5	Develop and expedite a Cyber Readiness and Business Continuity program to address healthcare-related cyber incidents, improving resilience through collaboration with healthcare agencies and response partners.	3	3	2	2	2	2	2.45

The actions in Table 6-7 are listed in order of priority, with the high priority actions first. This list of actions is the result of the planning effort led by the Steering Committee and represents what the City consider most important. Any actions, including projects, to be implemented will have benefits outweighing their associated costs (i.e., the benefit-cost ratio would be greater than 1).

A blank Mitigation Action Worksheet template is included in Appendix E. The set of completed action worksheets and a table summarizing the worksheets by stakeholders are presented in Appendix J.

Table 6-7. Prioritized Mitigation Actions

Initiative #	Mitigation Action	Priority
High Priority		
5.3.2	Provide public outreach throughout Philadelphia with READYHome, READYCommunity, and READYBusiness to increase community preparedness and mitigation.	3
1.1.6	Improve access to primary medical care citywide and improve the quality of primary care by expanding the scope of services and building facility capacity for City Health Centers.	2.85
2.1.1	Assess properties that may benefit from long-term flood resilience measures including elevation, acquisition, relocation, mitigation reconstruction, and additional adaptive/adaptation measures	2.85
2.1.2	Implement long-term flood resilience measures including elevate, acquire, relocate, retrofit, floodproof, complete mitigation reconstruction, and adapt properties that benefit from elevation, acquisition, relocation, completing mitigation reconstruction, or additional adaptive/adaptation measures.	2.85
2.1.3	Assess reuse of City properties that have assets that are prone to damage from flooding	2.85
2.4.5	PHL Climate Resilient Design Standards: Adopt Climate Resilient Design Standards at PHL airport to reduce the risk of flooding which will be exacerbated by climate change.	2.85
2.5.1	Design and improve Eastwick drainage and floodwater conveyance infrastructure.	2.85
2.6.2	Assess, Design, Procure, and Construct Upgrades and Overhauls for Vent Wells, Emergency Exits, and Station Head Houses to protect and armor them against future flooding.	2.85
2.6.5	Design, procure, and install electric switch heaters for priority sites.	2.85
2.6.12	Purchase and maintain drop-gates for known dangerous roads during emergency events, particularly along Cobbs Creek, for Bells Mill Road, and on Delaware Ave.	2.85
2.8.5	Lower South Infrastructure Resilience Roadmap and Implementation: A multi-departmental initiative focused on creating the strategic direction and tools needed to prepare the Lower Schuylkill area for present and future climate risks. The down-scaled understanding of specific climate risks and the potential solutions to address them will inform the master plans, building designs, and infrastructure plans currently underway or planned in this area, resulting in development that is more resilient to flooding and other risks.	2.85
2.8.8	Cohocksink Multi-hazard Mitigation Project: The final phase of a six-phase flood mitigation project proposes new sewer infrastructure and green stormwater infrastructure systems in the Northern Liberties and South Kensington commercial and residential neighborhoods.	2.85
4.1.4	Advance the comprehensive planning, technical analyses, and stakeholder engagement in Germantown for a storm flood risk reduction and combined sewer overflow mitigation project within the Wingohocking and the Tookany/Tacony-Frankford (TTF) Watersheds.	2.85
4.2.2	Ongoing identification of larger infrastructure projects whose impact effects large areas of the city through PWD studies.	2.85
4.2.3	Examine the impacts of all dams that are considered HHPD both in Philadelphia and that have inundation areas impacting Philadelphia, including the assets and populations at risk of dam inundation. Plan appropriate mitigation efforts and apply for FEMA HHPD funding.	2.85

Initiative #	Mitigation Action	Priority
4.2.10	Addition of effluent and outfall pumping station to Northeast Water Pollution Control Plant Outfall and Effluent Pumping Station to pump treated water to the river during extreme wet weather events and high tide. Benefits estimated 852,900 Phila residents, and an estimate 221,000 residents from 1) Abington Township; 2) Bensalem Township; 3) the Bucks County Water and Sewer Authority (including all or parts of the Townships of Bristol, Falls, Lower Wakefield, Middletown, Newtown, and Northampton and the Boroughs of Hulmeville, Langhorne, Langhorne Manor, Newtown, and Penndel); 4) Cheltenham Township, 5) Lower Moreland Township, and 6) Lower Southampton	2.85
4.2.16	Rehabilitate Queen Lane Raw Water Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	2.85
4.2.17	Relocate Belmont Raw Water Pump Station Intake to ensure reliable source during droughts and winter storms.	2.85
4.2.18	Upgrade Lardner's Point Pumping Station to make the station more resilient in order to deliver water during extreme weather events.	2.85
4.2.19	Upgrade Mingo Creek Pumping Station to handle increased flows from wet weather events.	2.85
4.3.2	Complete sewer and green infrastructure projects whose impact is localized to discreet areas in West Fairmount Park.	2.85
1.1.7	Improve environmental conditions to foster a sense of safety in neighborhoods, connectedness among neighbors, and reduce the locations where illegal guns are stored and where illegal activity occurs. Projects include addressing blighted buildings, cleaning abandoned lots, improving lighting, and other initiatives to improve environmental conditions.	2.85
1.1.10	Climate Resilience Plan Update: Update the City's Climate Resilience Plan to include updated climate projections, a heat and flooding vulnerability analysis, new community-informed climate actions, and increased community engagement. Results of the updated climate resilience plan will be used to inform the Hazard Mitigation Plan.	2.85
1.1.11	Climate Resilience Place-based Program Expansion: Expand Office of Sustainability's climate resilience place-based program which will include identifying new communities with climate vulnerabilities and working closely with community based organizations to address those vulnerabilities and increase community resilience	2.85
1.2.4	Protect and ensure continuous service of municipal spaces and facilities that serve vulnerable populations in Philadelphia, particularly during extreme heat and flooding events. Identify priority municipal sites that serve vulnerable populations, such as libraries, health centers, incarceration facilities, and recreation centers. Develop recommended mitigation and resilience actions based on the facility assessments.	2.85
2.1.5	Demolish Philadelphia owned 4910 Botanic site structures, remediate known environmental contamination, and convey the riverfront portion of the site to PPR/Schuylkill River Trail/Bartram's Garden to decrease flood risks, risk of criminal activity, and risk of building collapse.	2.85
2.1.12	Ensure the flood resilience of PWD facilities by addressing risks associated with both coastal flooding (sea level rise and storm surge) and riverine flooding. This effort may include developing and implementing Adaptive Management Plans to proactively manage current and future flood-related impacts.	2.85
2.3.1	Continue to enhance Citywide COOP-COG program to minimize disruptions and support continuation of essential City services during and following a disaster.	2.85
2.4.1	Planning and Land Use Regulation and Incentive Alignment: Align the City's comprehensive plan, district plans, zoning regulations, development incentives, and other land use related programs with the City's efforts to reduce flood risk, based on up-to-date flood risk projections. This may include designation of local flood zones and related permitting requirements.	2.85
2.4.3	Include risk and resiliency considerations as comprehensive planning moves forward, including use of risk analysis by planning districts created for 2026 HMP update.	2.85

Initiative #	Mitigation Action	Priority
2.8.1	Integrate equity and social vulnerability indicators more prominently into OEM's planning and operational products to better predict, prioritize, and support community needs during disasters and emergencies to reduce risk. Form and compensate a community panel making up a diverse group of public representatives to review, provide feedback on, and participate in OEM's planning processes including the Hazard Mitigation Plan.	2.85
3.2.1	Identify and implement a dedicated funding source for resiliency and energy projects. Funds could be used for resilient Infrastructure projects, coastal protection projects (where the risk does not belong to one department), operations and maintenance as needed, nature based solutions, energy efficiency upgrades, establishment of resilience hubs, community-level resilience actions and more. This fund would fill a funding gap for municipal capital projects to proactively implement best practice mitigation/adaptation measures for resilient infrastructure.	2.85
3.2.5	Continue to foster relationships and partnerships across all levels of government, the private sector, community-based organizations, and faith-based organizations to enhance the City's emergency management program, encompassing preparedness, mitigation, response, and recovery efforts.	2.85
3.2.6	Enhance collaboration between health and human service providers, emergency management, law enforcement, and City administration to offer comprehensive support services for individuals who are unhoused. This includes securing government and law enforcement support for providing essential resources and information regarding shelter options.	2.85
5.1.2	Employ a READYEmployee process to alert City Employees of threats and hazards that could impact them and their work spaces.	2.85
5.2.3	Revamp and update Philadelphia OEM's Alert and Warning Plan for the City, along with associated frameworks and deliverables.	2.85
5.2.4	Utilize the Eastwick Alerts system to notify residents of impending weather that could result in flooding, integrating advanced technology for automatic messaging and public information access (e.g., flood gauges, cameras). Integrate flood gauge information and camera footage on public-facing website.	2.85
5.3.7	Continue and expand the centralized platform for community members to access emergency-related communications for all hazards, including alerts for extreme weather conditions, air quality concerns, and cyber terrorism. Continue to enhance initiatives to educate community members about the specific risks associated with hazard events and the vulnerabilities within the community that may amplify impacts. Prioritize language accessibility and localized messaging in outreach and communication efforts.	2.85
5.4.4	Continue to use the Regional Integration Center (RIC) and their products (situational awareness reports, pre-event briefings, weather reports, etc.) to bring partners to the table to coordinate pre-disaster meetings and information sharing as well as immediate post-disaster recoery work.	2.85
2.3.3	Procure and utilize long range drone(s) to assess areas of concern before and after hazardous events (and if possible, during events).	2.8
1.1.3	Invest resources to plan and staff initiatives to reduce hazard risks citywide. This includes development of and coordination for Cybersecurity Incident Response and Recovery Plan and Training; a Philadelphia Economic Recovery Plan; a Regional Disaster Housing Plan, and pandemic response planning.	2.75
2.2.12	Navy Yard Resilience Study: A comprehensive Resilience Study at the Navy Yard will be critical to inform the implementation of HMP projects. The study will analyze existing conditions; assess all potential risks & vulnerabilities; identify resiliency projects; and advance at least one early-action resiliency project.	2.75
2.6.1	Develop and implement the Climate Adaptation and Resiliency Plan (CARP). DOA is in the midst of evaluating its climate risks. Building on this baseline assessment, DOA will align findings with the Master Plan Update currently underway; identify and prioritize climate adaptation strategies; and implement the identified strategies and priority investments.	2.75

Initiative #	Mitigation Action	Priority
2.6.6	Plan and implement waterproofing for all Railroad and Transit Tunnels within City Limits — Broad Street, MFSE, Trolley Tunnel, Railroad.	2.75
2.6.17	Removal and replacement of lead service lines	2.75
2.7.4	Engage community members in identifying and protecting vulnerable community and City assets and valued cultural resources to reduce risk at the neighborhood level during hazard mitigation planning and recovery efforts. Include information about how to perform mitigation post-disaster to reduce future risk.	2.75
2.8.2	Public Health Vulnerability Data and Assessments: Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	2.75
3.1.2	Develop Regional Disaster Supply Chain Resilience Plan.	2.75
5.2.5	Create a social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	2.75
5.2.6	Develop and impliment an amplification strategy for Alert and Warning Messages using commnity groups and targeted partnerships to spread OEM messaging to groups that have historically hard to reach.	2.75
5.2.7	Update and expand the social, digital, and traditional media campaign focused on increasing the number of READYPhiladelphia subscribers including people with access and functional needs.	2.75
5.3.4	Update OEM's Ready programs, including READYBusiness to include additional risk mitigation strategies for small to medium-size businesses	2.75
1.1.4	PDPH Pandemic Planning and Implementation: Update and implement key plans including pandemic response, mass prophylaxis and immunization, and others to reflect best practices and lessons learned during COVID-19and other disease outbreak responses. This encompasses incorporating high-consequence pathogen planning and readiness, including biohazard considerations and healthcare coordination ; identifying sites to administer vaccine and/or dispense medical countermeasures during public health emergencies; coordinating with other human services partners to ensure inclusion of special populations such as children, persons experiencing homelessness, and persons with access and functional needs; identifying isolation and quarantine locations and potential wraparound services; ensuring a standardized process for public data dashboard development and discontinuation; and other preparations for outbreak related response activities.	2.7
1.2.3	Use data to identify populations at high risk of adverse outcomes during a public health emergency and allocate resources to address planning, communications, and service gaps as appropriate. This includes indices to identify communities that are at high risk of adverse health outcomes during heat, pandemic influenza, or other priority health hazards.	2.7
2.1.6	Align reviews of City floodplain regulation with best practices and models from other peer city's and guidance with the International Code Council (ICC) tri-annual updates of the building codes. Follow and educate people in building profession on required and recommended strategies to mitigate hazards and increase resilience. (wordsmith further - ICC is the baseline, minimum)	2.7
2.2.14	Initiating Delaware River Long-Term Flood Protection Feasibility Solutions Study to address tidal surge flooding. Depending on feasibility study results, DOA may select one or more phases to design and construct.	2.7
2.2.16	Develop and implement innovative, nature-based, and engineered flood resilience measures to protect flood-prone neighborhoods from pluvial flooding caused by extreme rainfall events. Opportunities include green infrastructure, stormwater management improvements, and comprehensive planning and technical analyses to design effective mitigation strategies.	2.7

Initiative #	Mitigation Action	Priority
2.5.2	Airport Drainage Infrastructure: Design additional and improve current PHL airport drainage infrastructure	2.7
2.6.4	Invest in transmission main condition assessments to improve understanding of probability of failure in the transmission system and install and/or upgrade priority transmission, water, and discharge mains to improve system redundancy, improve water flows, improve water quality, enhance capacity, and address other system needs.	2.7
2.6.13	Redesign roadways and bridges to lesson occurrence/impact of flooding.	2.7
2.6.19	Maintain, replace, and upgrade existing electric grid infrastructure to reduce the probability of failure during severe weather events and extreme temperatures, improve system redundancy to reduce downtimes in severe weather events, enhance capacity, and address other system needs	2.7
2.8.4	Sustainable Corridors Project: Expand cool roadways pilot program and stormwater management projects in heat and flood vulnerable neighborhoods.	2.7
2.8.6	Launch multiple, intersectional programs that provide support to communities living with the direct and indirect consequences of the Substance Use Overdose Crisis, including targeting and expanded community engagement, services to families impacted by substance use, and increased city services at critical “hot spot” locations.	2.7
2.8.9	Per the US Army Corps' Eastwick Flood Risk Management project, design and implement a levee along Cobbs Creek in collaboration with the community and stakeholders in neighboring Delaware County.	2.7
2.8.10	Continue the Philadelphia Fire Department’s initiative to conduct education and outreach out fire prevention and provide and install free smoke alarms to Philadelphia home owners upon request. A number of adaptive alarms are made available to residents with hearing or vision loss.	2.7
3.1.7	Conduct a climate vulnerability assessment for airport assets such as substations, mechanical rooms, baggage tunnels, and basement tunnels that are at risk to floods and other hazards.	2.7
3.3.1	Create a dedicated funding source to fund municipal climate resilience as well as community resilience and climate action. Funds would be used for projects to reduce vulnerability and increase resilience of Philadelphia's most vulnerable populations and community-led projects would draw upon their place-based knowledge of environmental hazards and community resilience.	2.7
3.3.4	Risk & Resiliency Assessments: Characterize and evaluate current and future coastal flood risk for PWD’s water and wastewater treatment facilities on the tidal Delaware River (4 total), taking into account sea level rise projections and storm surge impacts. Through the risk assessment process, identify potential flood risk mitigation alternatives, considering adaptive management strategies where feasible, engage with key local and regional stakeholders, and explore partnership building opportunities.	2.7
4.2.6	Complete wetland creation projects in FDR Park to eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas and connect park users to the water.	2.7
4.2.11	Addition of wastewater and stormwater pumps and storage in various locations throughout the system and facilities to send more water to the water pollution control plants during wet weather events.	2.7
4.2.12	Build additional water mains to provide better system redundancy and resiliency.	2.7
4.2.20	Upgrade of various wastewater and stormwater pump stations to handle increased flows from wet weather events.	2.7
4.2.23	Replace 1,860 linear feet of 4’0” brick sewer with 72” reinforced concrete pipe sewer along a segment of 21st Street in the Germantown Neighborhood	2.7
4.2.24	Increase sedimentation tank Capacity and mitigate flood risks, provide community and economic resiliency, and improve water quality.	2.7

Initiative #	Mitigation Action	Priority
5.2.2	Inclusive and Equitable Public Health Notification, Engagement, Partnership and Awareness: Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	2.7
2.1.11	Conduct a detailed climate risk characterization and assessment of the PWD collection system to determine priority areas for infrastructure and operational improvements. The assessment will inform future operation, planning, and design adaptation efforts to ensure continued reliability and system resilience under a changing climate.	2.7
3.2.7	Develop and implement a workshop to address scalable electricity disruptions and enhance response strategies in collaboration with partners. Conduct training sessions and simulation exercises during the workshop to test and improve capabilities. Key partners included utility providers, emergency management agencies, and community organizations.	2.7
5.1.7	Develop and deploy specialized messaged for the over 7,000 City employees that work in the Center City Quadplex buildings (City Hall, MSB, OPB, SCCJ) to inform them of emergencies and quickly gather an accountability report.	2.7
5.4.1	Develop and socialize guide and calendar of all available mitigation funding resources. Continue to develop and implement coordinated City approach to pursue mitigation funding.	2.7
4.2.9	Complete smaller sewer and green infrastructure projects whose impact is localized to discreet areas. Over one hundred are currently in design stages.	2.65
2.6.15	Upgrade equipment and resources necessary to respond to flooding, winter storms, and developing or unforeseen hazards.	2.65
2.8.3	Eastwick Place-Based Climate Risk, Adaption, and Resiliency Planning: Conduct community-based planning in one of the most vulnerable communities to climate change impacts, Eastwick. To support community resilience to flooding and other hazards, the planning efforts will focus on the identification of long-term mitigation efforts and development of mechanisms to implement them. This planning will build off the experience of a pilot community planning effort in Hunting Park, Beat the Heat, which addresses extreme heat. In Eastwick, the City will pilot a place-based flooding framework and seek funding to implement the planning process outcomes. The City also plans to expand the place-based extreme heat resiliency framework to other communities beyond Hunting Park.	2.6
3.1.4	Citywide Streets Vulnerability Assessment: Document institutional knowledge of flood prone roadways and road closures from severe weather events. Develop system for tracking future storm impacts to inform mitigation actions, planning, and response related activities.	2.6
4.1.2	Perform comprehensive study of the stormwater infrastructure of the Centennial District to identify necessary improvements in park infrastructure.	2.6
4.2.15	Install backup generators and switchgear at Queen Lane Raw Pump Station to ensure operations during power outages.	2.6
4.4.1	Develop a continuously updated Climate Data tool for screening climate vulnerability and risk of capital investments and planning processes against the best available climate projections for the City and region.	2.6
1.1.1	Continue to maintain and update the City's All-Hazard Mitigation Plan with a focus on plan integration and implementation.	2.6
1.1.2	Develop and implement a drought contingency plan. PWD will update the existing Drought Contingency Plan with pertinent policy and regulatory updates, improved science and technical tools, and with a greater understanding of how Delaware Watershed policies can impact Philadelphia's water supply during critical drought conditions such as reduced water super availability.	2.6

Initiative #	Mitigation Action	Priority
2.1.9	Implement interim flood mitigation to provide near-term relief to flooding in Eastwick while a community-driven long-term flood resilience strategy is being developed. The project will install a soil-filled flood barrier (for example, using HESCO Floodline) along the Cobbs Creek in Eastwick where riverine flooding typically overflows into the Eastwick community.	2.6
2.2.2	Continue to analyze the impact of natural and human-caused hazards and threats on critical infrastructure that supports supply chain systems through the update of the Freight (Truck) Network.	2.6
2.2.3	Develop a Trail Resiliency Plan and identify flood mitigation strategies for Philadelphia's extensive trail network. Trails often follow streams and rivers in Philadelphia. Recreation and travel can be a suitable use of the floodplain. However, trail infrastructure represents a significant investment from City, State and Federal partners. OTIS would like to examine how trail infrastructure can be built resiliently to protect the investment while also protecting the ability of the floodplain to absorb water. The study will consider vulnerable assets, best practices in materials and construction suitable to a floodplain, and overall trail network resiliency. Trails provide a travel mechanism that does not contribute to climate change and provides healthy recreational options for residents.	2.6
2.2.15	Design and implement improvements to 84th Street, a priority roadway in Eastwick, by combing traffic calming and flood resilience measures. Interventions may include increasing vegetation throughout the corrdior, elevating the bridge approaches out of the floodplain and improving bike and pedestrian facilities.	2.6
2.4.4	Philadelphia Creek Protection Study: Update the Wissahickon Watershed zoning overlay and steep slope protection areas, which promotes disaster resilient land use decisions in the area and apply these protections consistently throughout the City of Philadelphia.	2.6
2.7.3	Re-conduct a citywide survey to identify and document all historic properties in the City (private and City-owned) in order to assess risk, vulnerability, and mitigation strategies for properties. Study should take into account all hazards, including building collapse, urban conflagration, and other human-caused and natural hazards.	2.6
3.1.6	Develop Cyber Security Incident Response and Recovery Plan, including education and outreach to stakeholders and the public.	2.6
3.2.2	Resilience Hubs: Design and implement a resilience hub model specific to Philadelphia to support residents, before, during, and after disasters. This action includes identifying and implementing mitigation measures needed so that locations identified as hubs can remain operational during times of disaster. Structural measures may include but are not limited to backup generators/ emergency power supply, heating/cooling equipment, air filtration systems, etc.	2.6
3.2.4	Manayunk/East Falls Flood Preparedness & Mitigation Study: Community-led study to identify flood preparedness and mitigation strategies in these neighborhoods	2.6
4.2.22	Coordinate with Pennsylvania DEP and Franklin Mills Limited Partnership on future plan updates regarding HHPD standards and planning.	2.6
5.3.3	Promote post disaster mitigation strategies throughout SEPA region, targeting communities that are most vulnerable. VOAD partner agencies may implement mitigation strategies.	2.6
5.3.9	Review, update, expand, and/or implement public health related notifications, educational programs, and planning process informed through inclusive stakeholder engagement processes to increase the reach of PDPH communications and promote more equitable outcomes. These include an expanded set of public notification strategies and protocols for health-related emergencies; the Community Response Partner Network (CRPN); the Health Alert Network; resident education programs around public health hazards; and community-based health bulletins.	2.6
5.3.10	Further localize the STEP ciriculum for schools and work to restablish and develop a READYKids program in partnership with MDO Head Start & PFD Prevention Division.	2.6

Initiative #	Mitigation Action	Priority
2.1.15	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement programs to inform surrounding private and commercial property owners of opportunities to elevate their structure and/or add flood protection measures, such as berms, floodwalls, or floodproofing, if the structure(s) are in a dam inundation zone for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	2.6
2.4.6	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, to develop land use ordinance(s) in the dam inundation zones for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin. The City will adopt and enforce the developed land use ordinance(s).	2.6
5.3.11	Philadelphia OEM will lead initiatives in partnership with other applicable City offices, divisions, and departments, as well as dam owners, to implement public education and awareness campaigns surrounding dam safety for the high hazard potential dams in the City, including the Philadelphia Mills Dam, Belmont Raw Water Basin, and Queen Lane Raw Water Basin.	2.6
4.2.13	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Historic District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	2.55
4.2.14	Design and construction of integrated flood and stormwater management systems in the Navy Yard's Mustin District to protect critical energy infrastructure and public waterfront access, preserve historic structures, and minimize flood risks for employees, visitors, and residents.	2.55
1.1.8	Implement Roadmap to Safer Communities programs including Group Violence Intervention, Community Crisis Intervention Program, and Operation Pinpoint.	2.55
1.2.2	Expand low barrier access to harm reduction resources in zip codes with high rates of unintentional fatal overdoses, particularly amongst communities of color.	2.55
2.1.4	Bartrams North and South Flood Mitigation: Examine and implement mitigation methods that protects buildings and access without providing any adverse impact to upstream or downstream properties along the western bank of the Schuylkill River.	2.55
2.1.8	Maintain enrollment in NFIP and CRS by implementing floodplain management initiatives, reducing the City's flood risk, and allowing residents to receive discounted flood insurance.	2.55
2.6.24	Improve infrastructure to protect major intersections and roadways from increased street flooding due to severe storms and climate change. Problem areas include Kelly Drive and South Columbus Blvd and Eastwick at 84th Street and Hook Road.	2.55
2.7.2	Implement various mitigation and resiliency measures identified in the Fairmount Water Works Resiliency Plan to prevent future repetitive losses from flood events.	2.55
2.8.7	Bartrams Safety : Build sidewalks, curb cuts, and pedestrian crossings, and install new lighting, gateway treatments, and (potentially) cameras to improve safety and reduce short dumping and crime along the Woodland Avenue / Grays Avenue / Lindbergh Blvd corridor in Kingsessing, Philadelphia.	2.55
3.1.1	Assess business risk to potential threats and hazards in Philadelphia and identify actionable solutions to support business response, recovery, and mitigation. This includes an analysis of past impacts to the business community and development of guidance on how businesses can leverage available mitigation funding and resources to be more prepared and resilient for the next disaster, including businesses that own or operate out of historic structures or historic districts.	2.55
3.1.8	Develop and implement long-term plans to safeguard the quality and quantity of Philadelphia's drinking water supply from the Schuylkill and Delaware rivers. Opportunities include implementing measures to prevent water quality degradation, developing strategies to ensure a sustainable water supply, and upgrading and protecting water infrastructure to support long-term water quality and quantity goals.	2.55

Initiative #	Mitigation Action	Priority
4.1.8	Identify additional stream and creek restoration projects to aid in eliminating historic flooding hazards through area studies. Consider appropriate nature-based solutions (natural infrastructure, elevated berm/park space, living shoreline, etc.) to assist in adapting to flooding impacts today and from SLR.	2.55
4.2.4	Implement PWD's Drinking Water Revitalization Plan (WRP) and related long-term Capital Improvement Plan, which focuses on PWD's Drinking Water Treatment Plants, Pumping Stations, and Conveyance Systems.	2.55
4.2.8	Perform structural repairs to dams and fishway structure at Fairmount Dam to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	2.55
5.3.1	Create a Multi-Hazard Preparedness Campaigns promoting mitigation efforts residents and businesses can take prior to hazard events, including print material and digital and social media content that focus on steps people can take to prepare for severe storms. This also includes development of new innovative messaging to promote in-person preparedness workshops to assist in preparing citizens for hurricane season and messaging to support the Community Outreach Team attracting participants to hurricane season at tabling events.	2.55
1.1.12	Establish and maintain heating and cooling centers.	2.5
2.6.16	Design and construct of a highway cap over the Vine Street Expressway between 13th and 10th Streets to reconnect the Chinatown and Chinatown North communities. The project represents a significant infrastructure investment that seeks to improve community access to green spaces, reduce noise and air pollution, manage stormwater, mitigate urban heat island effects, and improve traffic and pedestrian safety.	2.5
2.8.11	Implement long-term flood mitigation measures as recommended in the Eastwick Flood Resilience Strategy	2.5
Medium Priority		
1.1.5	Expand lab capacity to rapidly identify and subtype organisms.	2.45
2.3.5	Procure additional units of level B PPE for surge operators.	2.45
2.6.18	Bridge Sustainability in Northwest Philadelphia: Proximity to the Wissahickon Creek leaves the Bells Mill Road Bridge and Valley Green Road Bridge vulnerable to storm and flooding events and structural degradation. This project aims to repurpose and rehabilitate the two Wissahickon Creek bridges, promote recreational activity for residents and park visitors, and enable community members in disadvantaged Census tracts to access park amenities.	2.45
4.1.3	Complete stream restoration projects in West Fairmount Park whose impact is localized to discreet areas to eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	2.45
4.1.5	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Cobbs Creek Reaches 1 to 3 and Cobbs Creek Reaches 6 to 8 in Phase 2.	2.45
4.1.6	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Tacony Creek.	2.45
4.1.7	Complete stream and creek restoration projects to reduce impact of historic flooding hazards along Valley Green Road and Spring Lane.	2.45
4.2.5	Conduct study to identify stream restoration projects in West Fairmount Park along with the goal to improve safety of structure or surrounding areas, eliminate or reduce erosion issues, help to regulate supply for drinking water intakes, reduce swimming hazards, and reduce flooding damage to surrounding areas.	2.45
4.2.7	Perform Shedbrook Creek Stream Rehabilitation to aid in eliminating historic flooding hazards, improve safety of structure or surrounding areas, eliminate or reduce erosion issues, reduce swimming hazards, and reduce flooding damage to surrounding areas.	2.45

Initiative #	Mitigation Action	Priority
2.1.10	Retain consultant services for the Philadelphia Dept of License & Inspections in their Floodplain Administration duties to provide additional oversight and recommendations in the review of Hydrologic and Hydraulic (H&H) engineering analysis modeling submissions provided with applications that affect coastal floodplains, regulated floodways and riverine floodways without regulatory floodways. Over the span of this project, we intend for these services to help identify current gaps in the review processes of applications that require an H&H engineering analysis under International Building Code, Sections G103.4, G103.5, G103.6 & G103.7 and our local floodplain ordinance, and to develop/identify new engineering resources/tools to assist in more effective enforcement and administration of these floodplain provisions.	2.45
2.1.13	Development of a compound flood model to better understand flood risk today and in the future from all sources of flooding.	2.45
2.6.25	Enhance the reliability and functionality of the communications system by upgrading outdated equipment that will no longer be supported by the vendor.	2.45
5.3.6	Enhance readiness for climate-related severe weather events by expanding internal response playbooks and implementing additional readiness activities.	2.45
5.4.5	Develop and expedite a Cyber Readiness and Business Continuity program to address healthcare-related cyber incidents, improving resilience through collaboration with healthcare agencies and response partners.	2.45
5.3.8	Establish and promote a two-way communication system for community members to report impacts and hazard-related concerns. The system should also be capable of providing information on the follow-up actions taken by the relevant City agencies.	2.4
2.2.5	Enhance THIRA process to identify gaps in mitigation capabilities, and to better align the THIRA with the HMP Planning Process.	2.4
2.3.2	Maintain and utilize early warning system.	2.4
2.4.2	Resilient Design Guidelines: Collaborate with related City agencies on the creation of consistent, coordinated design guidelines documents to demonstrate possible strategies for resilience to current and future hazards for building design and the public realm. Build from existing base of guidelines created by various departments.	2.4
2.6.8	Install battery back-up traffic signal controllers to at least 10% of signals in City.	2.4
2.6.9	Maintain portable generators for key traffic intersections.	2.4
3.1.3	Establish and maintain open end contracts with construction companies for emergency bridge and road repairs.	2.4
3.2.9	Establish a regional collaborative to coordinate actions and policies for sea level rise resilience	2.4
5.2.1	Deploy and maintain targeted flood monitoring technology across the City to better inform mitigation, preparedness, and response efforts.	2.4
5.4.3	Revitalize the Philadelphia Emergency Management Council from a 6+ year hiatus. This local council will consist of key City leadership and will focus on strategic emergency management issues including long-term risk reduction and risk/hazard education at a senior level	2.4
2.6.20	Initiate design to replace the Fort Mifflin tide gate and install a new equalizer pipe to control high tides of the Delaware River to reduce area inundation and balance water surface elevations	2.35
2.3.6	PWD Cybersecurity Upgrades: Replace and upgrade PWD software that stores critical infrastructure information that is vulnerable to cyber terrorism attacks.	2.3
4.2.21	Upgrade P-796 at the Navy Yard Design to handle increased flows from wet weather events.	2.3
2.6.14	Strengthen the traffic signals beyond the national standards in reference to wind tolerance.	2.3
2.6.23	Replace antiquated fire protection and potable water systems at the Navy Yard to ensure safety, reliability, and environmental protection.	2.3

Initiative #	Mitigation Action	Priority
3.2.8	Develop a Mid-Atlantic Regional Testbed to answer management questions around energy and water and to better understand Earth system changes and subsequent vulnerability and risk in Philadelphia	2.3
3.3.6	Develop a Climate Resilience Research Agenda to proactively work with Universities, ensuring research fills critical research gaps and needs within the city	2.3
4.1.9	Restore tidal connections and increase flood storage capacity in the Lower Darby Creek area by restoring floodplain and wetlands in and around the John Heinz National Wildlife Refuge.	2.3
4.3.7	Montgomery Creek infrastructure repair at approach to Black Road and I-76	2.3
1.1.9	Identify and implement short-term flood proofing tools for at-risk communities.	2.25
2.2.4	Create a hazard event database to capture description, severity, location, impact, and potential loss/damage estimate from an event. This data will be used to update the hazard analysis and mitigation actions for Philadelphia, as well as allow the City to be better prepared for future events.	2.25
2.2.8	Improve floodplain mapping to support vulnerability assessments for critical infrastructure and City initiated LOMCs, using updated inundation mapping	2.25
2.2.9	Use damage assessment data to conduct in depth GIS analysis of impacts from past flooding and storms events to better predict future impacts from similar storm events and inform severe weather preparedness planning, alert & warning messaging, and mitigation initiatives in those areas.	2.25
2.2.10	Utilize the results of the 2022 Hazus analysis to identify new mitigation projects.	2.25
2.2.11	Support the USACE production of inundation level mapping for the Schuylkill River alongside the remapping of the floodplain, to reflect the impact levels available for USGS gauge 01474500	2.25
2.3.4	Purchase two VMS signs for deployment prior to and during emergencies and events to promote public safety and awareness.	2.25
2.6.3	Conduct —and implement recommendations from—a Philadelphia International Airport Hydrologic and Hydraulic Resiliency Study to assess current and projected flood risk and identify resiliency strategies to address risks. Key steps include a review of existing conditions, coastal analysis, HEC-RAS analysis, development of preliminary adaptation study, determination of potential adaptation and mitigation measures, modeling of those potential measures, and a final technical report. DOA will then seek to implement recommended measures.	2.25
2.7.1	Develop and implement individual hazard management plans for City owned and operated historic structures and their surrounding landscapes. Plans should consider both natural hazards, climate change impacts, and human-caused hazards.; if necessary, consider moving the structure to a safer location. Build on Manayunk pilot for historic preservation.	2.25
3.1.5	Establish a smart detour plan for flooding of Wissahickon Creek, Schuylkill River, Cobbs Creek, and Delaware River (particularly along Delaware Avenue/Columbus Boulevard).	2.25
3.2.3	Using the Eastwick Emergency Preparedness Capacity Building as a base, expand the work done in Eastwick to be more applicable to additional neighborhoods in the City that are at risk for various hazards.	2.25
3.3.2	Study of Climate Change / Hazard Vulnerability of Police and Fire facilities. Potentially expand the study to include other key civic priority facilitates. DPP will release an RFP and contract for a climate vulnerability assessment and report with maps and recommendations. This assessment will be updated on a regular basis.	2.25
3.3.3	Maintain relationships with universities and colleges within the Philadelphia region and beyond to support hazard mitigation, climate resilience, emergency planning, training, and exercises.	2.25

Initiative #	Mitigation Action	Priority
3.3.5	Build collaborative opportunities with university programs interested in hazard mitigation planning. Collaboration could take the form of sharing research, students completing analysis and mapping for HMP plan updates, City presentations to classes, identifying university led mitigation actions, and internships.	2.25
4.1.1	Mapping Stormwater Flooding Risk: Better define urban flood risk in areas not covered by FEMA floodplain mapping through more comprehensive mapping of sewer system flood risk in other areas of the City. PWD has already studied flash flooding risk in Wingohocking Sewershed but hopes to expand these efforts. Share results as appropriate online for community-based planning.	2.25
4.3.3	Inspect trees within 100 ft. of walkways and roadways for signs of the emerald ash borer and treat affected trees every three years.	2.25
4.3.6	Decrease the backlog of 2,000+ tree maintenance and removal projects to reduce unpruned and dead trees falling on power lines during storm events.	2.25
4.5.1	Examine mitigation opportunities that address flooding and rising water tables from increased precipitation and sea level rise inundating brownfields and releasing hazardous materials into local waterways.	2.25
4.5.2	Secure intake booming materials.	2.25
5.3.5	Employ spatial data to inform OEM's community preparedness outreach to help OEM better understand where preparedness outreach is occurring and ultimately focus on areas most at risk.	2.25
5.4.2	Meet quarterly with VOAD partners to maintain preparedness, ensure situational awareness, identify resource capabilities, and build stakeholder relationships pre-disaster.	2.25
4.4.2	Develop phased implementation strategy for optimizing use of biogas at NEWPCP and SWWPCP, including better utilization of biogas today and developing a plan for the future (including upgrading biogas to Renewable Natural Gas).	2.2
2.1.14	Evaluate a potential coastal levee in Eastwick that would mitigate future sea level rise and coastal storm surge events that are likely to impact the Eastwick neighborhood, the SEPTA tracks, the airport, and the Heinz Wildlife Refuge.	2.15
2.2.13	Cobbs Creek Multiuse Trails: Due to the Cobbs Creek frequent floods, there are access and maintenance issues for the multiuse Cobbs Creek trail system. Resilient planning and design will be explored as part of the construction and future maintenance plan of the Cobbs Creek trail.	2.15
2.3.8	Upgrade electrical feeds to prevent power loss due to reliance on a single feed line into various buildings (e.g., student housing, admin, and academic).	2.15
2.6.10	Maintain safe roadways and bridges through roadway milling and paving capital projects.	2.15
3.1.9	Install battery backup systems at all fiber network HUB locations to prevent communication loss during power outages, particularly for Intelligent Transportation System (ITS) devices.	2.15
4.3.10	Explore the potential for vacant and underutilized properties in Eastwick to be converted to wetland and recreational space, including the former Pepper Middle School site.	2.15
2.2.6	Maintain Tier II Reporting and GIS program.	2.1
2.2.7	Update the Tier II emergency response plan process/template to provide more situational awareness on chemical inventories across the City for OEM/PFD and its partners.	2.1
2.6.7	Ensure adequate material and equipment is available to repair and replace street lights and traffic poles & signs.	2.1
4.2.1	Conduct hydraulic modeling.	2.1
4.3.1	Establish a policy based on need and funding availability for a regular pruning cycle for City trees.	2.1

Initiative #	Mitigation Action	Priority
4.3.5	Pilot study the growth of Southern plant species with sustainable planting practices in preparation for increasing temperatures over the next century.	2.1
1.2.1	Conduct outreach and coordinate personnel to keep the Philadelphia unhoused population safe during extreme cold and extreme heat events.	2.1
2.1.7	Develop a software platform to share flooding event information across departments in real-time as well as historically.	2.1
4.3.4	Monitor new tree watering contracts to ensure the trees have sufficient time to take root and establish themselves under warmer temperatures.	2.1
4.3.8	City tree planting and maintenance: Planting and care of street and park trees throughout the City of Philadelphia to reduce the impacts of heat islands.	2.1
2.3.7	Ensure DOA's compliance with EPA's Resource Conservation and Recovery Act (RCRA) by disposing of waste responsibly and inspecting systems proactively to mitigate the potential for a hazardous materials release.	2.05
2.3.10	Utilize drug checking surveillance to identify changes in the illicit drug supply and mitigate the risks associated with emerging substances. Opportunities include detecting and analyzing emerging substances that alter the local drug landscape, addressing the rapid increase in fatal overdoes, preventing the overwhelming of medical providers, and ensuring the availability and effectiveness of harm reduction supplies.	2.05
2.2.1	Continue bridge inspection training and conduct bridge inspections.	2
2.6.11	Purchase and maintain hyper-local street level weather stations to assist in salting, flooding, and plowing operations.	1.95
4.5.4	Remediation of lagoons at NEWPCP and SWWPCP	1.95
4.3.9	Develop and implement trail designs that ensure long-term viability in vulnerable areas, such as floodplains. Establish specific design standards for trails located in floodplains and other vulnerable areas to enhance resilience.	1.95
5.1.6	Conduct regular training sessions and simulation exercises to test and enhance the effectiveness of cybersecurity response plans, such as SEPA region's plans.	1.95
2.6.21	Design and renovate buildings (City-owned facilities) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	1.9
Low Priority		
5.1.5	Upkeep PFD Hazmat training and equipment.	1.8
2.6.22	Design and renovate buildings (other public facilities, such as Parks and Recreation and Free Library locations) to minimize energy consumption, enhance disaster resistance, and protect critical infrastructure. Opportunities include high-performance building envelopes to reduce heat gain and loss; efficient HVAC systems to optimize heating and cooling; and integrating renewable energy.	1.75
4.5.3	Remove oil storage facility (tank farm).	1.7
5.1.3	Expand Multi-Assault, Counter Terrorism Action Capabilities (MACTAC) training program for patrol officers.	1.7
5.1.4	Expand and continue training for all PPD personnel including, but not limited to: SPOT Training, Prevention and Deterrence of Terrorism Training, Advanced Trauma Training, Mass Casualty Awareness Training, Customized Alarm Response Training, Site Protection by Observational Techniques Training, Protest Awareness Training, Customized Alarm Response Training, Tourniquet Training, Field Force Operations Training, Field Force Extraction Training, Field Force Command Planning Training.	1.7
5.1.1	Conduct active shooter training for City staff.	1.55

Initiative #	Mitigation Action	Priority
3.2.10	Establish working relationships with PA DEP's Dam Safety Program leaders and the public and private dam owners in City. Include these groups and individuals as stakeholders in the next HMP update.	1.33

7. PLAN MAINTENANCE

7.1 UPDATE PROCESS SUMMARY

Following state and federal guidelines, the HMP features a plan maintenance process to ensure that it stays current and relevant. The process of monitoring, evaluating, and updating the HMP is critical to maintaining its value and supporting the success of the City's hazard mitigation efforts. Ensuring effective implementation of mitigation actions paves the way for continued momentum in the planning process and supports future resiliency.

This plan maintenance process details a method and schedule for monitoring, evaluating, and updating the plan, specifying how, when, and by whom these tasks will be completed over the next five-years. Additionally, this section explains how the City will integrate mitigation actions into existing planning mechanisms, such as comprehensive plans and ordinances, and outlines how the public will remain involved in between plan updates.

7.2 MONITORING, EVALUATING, AND UPDATING THE PLAN

7.2.1 Responsibilities

The City of Philadelphia's Office of Emergency Management (OEM)'s Hazard Mitigation Program Area will assume responsibility for monitoring, evaluating, and updating the plan and monitoring progress of mitigation actions. This will be accomplished through collaborative partnerships built throughout the planning process, including continuing to engage members of the Steering Committee.

The OEM Hazard Mitigation Program Manager and OEM Hazard Planning Coordinator will serve as the HMP Coordinators to lead efforts for future coordination with the Steering committee.

The HMP Coordinators are responsible for maintaining and updating the plan during its performance period. The HMP Coordinators will be the prime point of contact for questions regarding the plan and its implementation as well as to coordinate incorporation of additional information into the plan.

To assist with ensuring the plan remains a dynamic document that reflects the priorities, concerns, and impacts of the City, the Steering Committee will continue to be engaged and support the efforts of the HMP Coordinators. Each organization designated as a mitigation action agency lead is expected to retain a hazard mitigation representative to support the organization's input to monitor, evaluate, and update the responsibilities identified in this section. A list of mitigation action agency leads is provided below:

- Deputy Commerce Director, Department of Commerce
- Executive Director, Mayor's Commission on People
- First Deputy Director, Office of Emergency Management
- Hazard Mitigation Program Manager, Office of Emergency Management
- Hazard Planning Coordinator, Office of Emergency Management
- Director, Philadelphia Office of Sustainability
- Chief Inspector, Philadelphia Police Department Special Operations Bureau
- Planning Captain, Philadelphia Fire Department

- Environmental Planner, Philadelphia City Planning Commission
- Senior GIS Analyst, Department of Public Property
- Public Health Preparedness Program Manager, Philadelphia Department of Public Health
- CDBG-DR Director, Department of Finance
- Director of Federal Infrastructure Strategy, Office of Transportation and Infrastructure Systems
- Director of Planning, Preservation and Property Management, Philadelphia Parks and Recreation
- Strategic Planning Manager, Philadelphia Water Department
- Chief Code Official, Licenses and Inspections

The HMP Coordinator will strive to ensure the Steering Committee represents City agencies and stakeholders within the City.

7.2.2 Annual Plan Reviews and 5-year Updates

The City of Philadelphia will continue to update the plan on a 5-year cycle as dictated by current guidance. However, there will be a need for annual reviews to ensure that the plan remains up-to-date and relevant for stakeholders and the public. The annual plan review also serves as an opportunity to evaluate the effectiveness of the HMP. The evaluation of the HMP is an assessment of whether the planning process and actions have been effective, whether the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated regularly to determine the effectiveness of the programs and to reflect changes that could affect mitigation priorities or available funding.

This will be achieved by maintaining the ongoing quarterly meetings of the Hazard Mitigation Steering Committee, which was originally established for the 2022 plan, conducted annual reviews for the 2022 plan, and was the guiding body for the 2026 plan. OEM, guided by the HMP Coordinators, will remain as the coordinating entity for the Steering Committee and will lead the reviews of the plan on an annual basis. While there will be one annual review, the committee will meet with a quorum of members in attendance no less than quarterly to review the plan and provide updates and add or remove mitigation actions as needed. An approximate timeline for the quarterly meetings and annual review process is outlined in Table 7-1. This timeline is subject to change based on stakeholder availability and any major disaster responses that may impact this timeline.

All plan stakeholders, including those with mitigation actions identified in the 2026 plan and new stakeholders that wish to have a project added to the plan through a plan amendment, are encouraged to participate in the annual review process each February. At least eight weeks before the annual plan review meeting, the HMP Coordinator will advise the Steering Committee and stakeholders of the meeting date, agenda, and expectations of participants.

Table 7-1. HMP Performance Period Implementation Milestone Schedule Example

Period	Action
Year 1: HMP is approved, new 5-year performance period begins	
1st Quarter (October–December 2025)	OEM ensure that departments and agencies are aware that the 2026 HMP is now enforce and approved by PEMA and FEMA.
2nd Quarter (January–March 2026)	OEM convenes stakeholders to conduct a light annual plan review as the plan will still be very new. This annual review will focus on training partners on implementing hazard mitigation.
3rd Quarter (April–June 2026)	OEM implements revisions to the mitigation strategy and aid lead and supporting organizations in finding solutions for identified challenges.
4th Quarter (July–September 2026)	OEM works with stakeholders to identify projects for the BRIC/FMA cycle of potential funding opportunities to support the implementation of mitigation actions.
Year 2	
1st Quarter (October–December 2026)	OEM conducts outreach to start identifying projects that are currently underway and starts planning the annual review.
2nd Quarter (January–March 2027)	OEM convenes stakeholders to conduct an annual plan review and work to identify ways that the plan can be integrated into other plans.
3rd Quarter (April–June 2027)	OEM implements revisions to the mitigation strategy and aid lead and supporting organizations in finding solutions for identified challenges.
4th Quarter (July–September 2027)	OEM works with stakeholders to identify projects for the BRIC/FMA cycle of potential funding opportunities to support the implementation of mitigation actions.
Year 3	
1st Quarter (October–December 2027)	OEM conducts outreach to start identifying projects that are currently underway and starts planning the annual review. OEM begins to identify funding and technical support for the 2030 HMP update.
2nd Quarter (January–March 2028)	OEM convenes stakeholders to conduct an annual plan review and work to identify ways that the plan can be integrated into other plans. OEM will also brief partners on what is required for a full plan update.
	OEM implements revisions to the mitigation strategy and aid lead and supporting organizations in finding solutions for identified challenges.
4th Quarter (July–September 2028)	OEM kicks off 2030 HMP update process and meets regularly with the Stakeholder Steering Committee and All-Stakeholders Workgroup. OEM works with stakeholders to identify projects for the BRIC/FMA cycle of potential funding opportunities to support the implementation of mitigation actions.
Year 4	
1st Quarter (October–December 2028)	OEM conducts outreach to start identifying projects that are currently underway and starts planning the annual review. OEM continues to draft the 2030 HMP update and meet regularly with the Stakeholder Steering Committee and All-Stakeholders Workgroup.
2nd Quarter (January–March 2029)	OEM continues to draft the 2030 HMP update and meet regularly with the Stakeholder Steering Committee and All-Stakeholders Workgroup.
3rd Quarter (April–June 2029)	OEM continues to draft the 2030 HMP update and meet regularly with the Stakeholder Steering Committee and All-Stakeholders Workgroup. OEM implements revisions to the mitigation strategy and aid lead and supporting organizations in finding solutions for identified challenges.
4th Quarter (July–September 2029)	OEM continues to draft the 2030 HMP update the Stakeholder Steering Committee and the All-Stakeholders Workgroup. OEM works with stakeholders to identify projects for the BRIC/FMA cycle of potential funding opportunities to support the implementation of mitigation actions.
Year 5	

Period	Action
1st Quarter (October–December 2029)	OEM hosts a public comment period for the 2020 HMP update and meets regularly with the Stakeholder Steering Committee and All-Stakeholders Workgroup.
2nd Quarter (January-March 2030)	OEM submits 2030 HMP update to FEMA Region 3 for review and approval.
Begin new 5-year performance period	

Continuing the practice that was set up for the 2022 HMP, the following questions will be considered as part of the annual review:

- Which mitigation actions have been started, completed, or are no longer feasible?
- Are there any new mitigation actions that should be added to the plan?
- Which mitigation actions should the City pursue FEMA Hazard Mitigation Assistance (HMA) funding for?
- Are projects changing priority based on the shifting physical, economic, or political landscape of the City?
- What training, technical assistance, and resources are needed to implement remaining mitigation actions in the plan?

The annual review evaluation will also assess whether:

- Goals and objectives address current and expected conditions
- The nature or magnitude of the risks has changed
- Current resources are appropriate for implementing the plan
- Different or additional resources are now available
- Implementation problems are present, such as technical, political, legal, or coordination issues with other agencies,
- Outcomes have occurred as expected
- New agencies/departments/staff should be included, as defined under 44 CFR 201.6

Participants will review mitigation goals and actions using performance-based indicators, including the following:

- Project completion
- Achievement of the goals
- Resources
- Feasibility
- Timeframes
- Budgets
- Lead/support organization commitment

Participants will assess how other programs and policies have conflicted with or augmented planned or implemented measures and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions. Other programs and policies can include those that address the following:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

An annual report of findings from the review process will be sent to both PEMA and FEMA. Once this report has been submitted to PEMA and FEMA, OEM will also work to release a related blog post to keep the public better informed.

7.2.3 Hazard Mitigation Plan Integration and Implementation

Under the coordination of OEM, each organization designated as a mitigation action agency lead will be responsible for implementing their specific mitigation actions as outlined in this plan. This involves integrating these actions into other planning documents, such as comprehensive plans and zoning ordinances, when necessary.

These organizations are also tasked with seeking and securing funds from internal and external sources to carry out mitigation actions. For any FEMA Hazard Mitigation Assistance Funding (HMA), which includes BRIC, FMA, and HMGP programs, the Hazard Mitigation Plan Steering Committee will decide which projects advance through the State Application Process. OEM will continue to provide technical assistance to City agencies interested in applying for FEMA HMA funding and will also monitor additional mitigation funding sources beyond FEMA's HMA to support the implementation of projects listed in this plan. Ultimately, City departments/offices and organizations identified as agency leads are responsible for applications, grant management, required cost matches, and reporting procedures for grants.

Information on the current status of plan integration will occur throughout the year through meetings such as the IRA forum, OEM meetings with the Planning Commission, and the Environmental Justice and Climate Resilience Working Group, and others. These regular meetings will ensure that Hazard Mitigation is being considered during grant applications and plan creations. Additionally, information will be collected during the annual review process about the status of project implementation and plan integration. This information can include such items as documented plan chapters, aligned goals, and funding strategies and project prioritization documents.

7.2.4 Plan Amendment Process

As a part of the eligibility and process to apply for FEMA's HMA programs, mitigation projects must be included in the City's Hazard Mitigation Plan. This ensures that the proposed mitigation project aligns with citywide mitigation goals and objectives. Projects not already included in the Hazard Mitigation Plan can be added through an amendment process approved by the City's Hazard Mitigation Plan Steering Committee, PEMA, and FEMA.

The Hazard Mitigation Plan Steering Committee will meet on a semi-annual basis specifically to review any newly proposed projects that are not already included in the 2026 Hazard Mitigation Plan. Projects that align with citywide mitigation goals and objectives will be approved by the Steering Committee for inclusion in a Hazard Mitigation Plan during these semi-annual meetings. An amendment request is then sent to PEMA and FEMA for formal inclusion in the plan. Agencies and organizations interested in adding a mitigation action to the 2026 plan through the plan amendment process are strongly encouraged to participate in the annual review process each February. An additional opportunity for projects to be added will also occur in September of each year, based on the release of the FEMA HMA programs.

OEM and the Steering Committee will be responsible for monitoring progress, evaluating effectiveness, and documenting annual progress of the plan. Monitoring activities may include Steering Committee meetings to discuss progress on implementing the mitigation strategy and achieving the plan's goals and reports on the status of mitigation actions.

The December following the Plan Adoption, OEM will collect and process information from departments, agencies, and organizations identified as implementing the mitigation actions identified in the plan. OEM will contact agencies via email and request the following information (at minimum):

- Mitigation action number
- Timeframe
- Action purpose
- Goal addressed
- Action to be taken (per year for the five-year cycle)
- Current status
- Challenges
- Reviewer name, title, and agency
- Funding sources obtain or is the project waiting for funding

The annual review of mitigation actions will support the submittal of an increased number of project grant applications due to continuous engagement of implementers in the process. The annual review supports continued prioritization of projects based on current needs and resources.

7.2.5 Evaluations Following Disasters

Following any major disasters or emergencies, the plan will be evaluated to determine if the recommended actions remain relevant and appropriate. The risk assessment will be revisited to see if any changes are necessary based on the pattern of disaster damage or if new data is available to update the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.2.6 Future Updates

Potential areas for growth in future updates and annual reviews include:

- **Promoting regional-scale hazard mitigation initiatives:** Philadelphia will actively engage in regional-scale hazard mitigation initiatives, including other jurisdiction's HMPs, over the next five years and beyond. By collaborating with neighboring municipalities, state agencies, and regional organizations, the City will develop and implement strategies to reduce vulnerabilities and enhance resilience. This will involve sharing resources, expertise, and data, as well as participating in coordination meetings, joint training exercises, and information-sharing sessions. Future updates to the City's Hazard Mitigation Plan will incorporate the outcomes of these initiatives, ensuring a stronger and safer community.
- **Increase and enhance regular outreach to external partners:** By forging stronger connections with community organizations and private sector partners, OEM aims to foster a resilient and prepared community. This effort will include regular communication, collaborative planning, and joint training exercises to ensure stakeholders are engaged in mitigation efforts. By leveraging the strengths and resources of NGOs, OEM seeks to create a comprehensive approach to hazard mitigation that addresses the specific needs and vulnerabilities of different communities, ensuring equitable and effective efforts. Findings and insights from these partnerships will be integrated into future updates of the Hazard Mitigation Plan, keeping the plan relevant and effective.
- **Identify opportunities to integrate hazard mitigation into the City's operations framework:** OEM will collaborate with other City and external departments and agencies to identify opportunities for integrating mitigation strategies into routine processes, such as capital improvement planning, zoning regulation and comprehensive planning, and infrastructure maintenance. By ensuring that existing City framework focus on mitigation efforts, OEM aims to embed risk reduction as an integral part of decision-making across all

parts of the City and region. This approach will not only minimize the potential impacts of future disasters but foster a proactive culture of resilient throughout City and regional operations.

- **Expanded outreach to reach underrepresented populations:** Philadelphia, a vibrant and diverse city of 1.6 million people, faced challenges in achieving equitable and inclusive community engagement for the 2026 plan update due to limited staff, funding, and public outreach hurdles. Additional funding and the establishment of the Public Steering Committee for the 2026 helped overcome some of the hurdles that occurred during the 2022 Plan. However, the 2026 outreach strategy still fell a bit short of engaging a representative cross-section of the community. For the next plan update, Philadelphia aims to develop a more robust public outreach strategy and participatory planning process, focusing on populations underrepresented in the 2026 hazard mitigation planning process and those at greater risk due to marginalization and systemic racism. The public steering committee will be back to continue to guide and facilitate the plan update process, ensuring more inclusive and comprehensive engagement. To further enhance outreach efforts, the following additional solutions are proposed: Community Liaisons, Partnerships with Local Organizations, and Multilingual Outreach.
- **Integrating pre-disaster recovery planning:** One important benefit of a Hazard Mitigation Plan is that it provides a framework for both pre-disaster mitigation and post-disaster mitigation and recovery. In the Mitigation Strategy, Philadelphia would like to identify additional mitigation actions that the City can take in the immediate hours, days, and weeks after a disaster to ensure the community can build back better and emerge from a disaster stronger and more resilient than before.

7.3 CONTINUED PUBLIC INVOLVEMENT

Philadelphia is committed to continued public involvement in the hazard mitigation process. During all phases of plan maintenance, the public can view and provide feedback on the HMP via OEM's website, community engagement workshops, and by contacting OEM through email or phone. The full plan and its executive summary are accessible to the public at any time via the phila.gov website. Designed to be accessible to all, the executive summary will be updated over the next five years with additional information on the plan, hazard mitigation, and disaster preparedness. Hard copies of the plan can be viewed in person by request, and OEM will work to make copies available in public libraries across the city.

The HMP Coordinators will be responsible for receiving, tracking, and filing public comments on the HMP. OEM will compile all comments and present them to the Hazard Mitigation Plan Steering Committee during the annual review process. The Steering Committee will consider these comments for incorporation in future plan amendments and updates.

OEM will continue to attend public meetings with partner agencies and community organizations to promote awareness and solicit useful feedback on the mitigation plan. Additionally, OEM will be releasing the hazard mitigation newsletter to the public as it was previously a stakeholders-only publication. This will permit the public to get quarterly updates on Hazard Mitigation work across the City and keep them engaged between plan updates and annual reviews.

This chapter details the formal process that will ensure that the Hazard Mitigation Plan remains an active and relevant document and that the All-Stakeholder Work Group maintains its eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. In addition, this chapter describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation.

8. PLAN ADOPTION

The HMP serves as the City's hazard mitigation plan, as required under 44 CFR 201. This plan has been formally adopted by the City of Philadelphia, as required by 44 CFR 201.6(c)(5). Development of the HMP was a collaborative partnership with stakeholders from local, regional, state, and federal government agencies as well as nonprofit and private sector organizations and the community. It represents the shared goals, objectives, and actions identified through the planning process for Philadelphia to pursue to reduce risk and build community resilience.

Adoption of the HMP signifies the shared commitment of the City's agencies, partners, and communities to implement the mitigation strategy and utilize the plan to guide hazard mitigation and resilience efforts over the next five years. The adopted plan communicates the City's priorities and facilitates communication and collaboration among communities and stakeholders.

On month day, 2026, the City of Philadelphia adopted the HMP after receiving "Approvable Pending Adoption" status from FEMA on XXXX. The adoption resolution was submitted to FEMA, and FEMA provided full approval of the HMP on XXXX, making the plan effective as of XXXX. Copies of the adoption resolution and FEMA approval letter are included on the following pages, documenting the successful completion and adoption of the 2026 HMP.

The City of Philadelphia's resolution of adoption for this hazard mitigation plan will be inserted here when available.

APPENDIX A. REFERENCES

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APPENDIX B. ACRONYMS AND DEFINITIONS

ACRONYMS

%g	percent of gravitational acceleration
ACS	American Community Survey
ACIS	Applied Climate Information System
ADA	American with Disabilities Act
AFN	Access and Functional Needs
ALICE	Asset, Limited, Income, Constrained, Employed
AMD	Abandoned Mine Drainage
AMDATP	Abandoned Mind Drainage Abatement and Treatment Program
AOR	Area of Responsibility
ARC	American Red Cross
ATSDR	Agency for Toxic Substances and Disease Registry
BBPP	Basement Backup Protection Program
BCA	Benefit Cost Analysis
BCGES	Building Code Effectiveness Grading Schedule
BCO	Building Code Official
BEPP	Building Energy Performance Program
BFE	Base Flood Elevation
BIPOC	Black, Indigenous, and People of Color
BOSFP	Board of Safety and Fire Prevention
BRIC	Building Resilient Infrastructure and Communities
BWQDP	Baseline Water Quality Data Program
CAA	Community Action Agency
CAC	Community Assistance Contacts
CAP-SSSE	Compliance Assistance Program–State Support Services Element

CARP	Climate Adaption and Resiliency Plan
CAV	Community Assisted Visit
CCA	Complex Coordinated Attacks
CCP	Community College of Philadelphia
CCTA	Complex Coordinated Terror Attacks
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant Disaster Recovery
CDC	Centers for Disease Control
CDMS	Comprehensive Data Management System
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CERT	Community Emergency Response Team
CEO	Office of Community Empowerment and Opportunity
CFM	Certified Floodplain Manager
CFR	Code of Federal Regulations
CHA	Community Health Assessment
CHD	Coronary Heart Disease
CHIP	Community Health Improvement Plan
CHOP	Children's Hospital of Philadelphia
CJPS	Criminal Justice and Public Safety
COG	Continuity of Government
COOP	Continuity of Operations Plan
COPD	Chronic Obstructive Pulmonary Disease
COVID	Coronavirus
CPRG	Climate Pollution Reduction Grant

CPRN	Community Response Partner Network
CPT	Core Planning Team
CRCC	Commonwealth Response Coordination Center
CRS	Community Rating System
CSO	Combined Sewer Outflow
CTO	City Treasurer's Office
CTP	Cooperating Technical Partners Program
CVA	Climate Vulnerability Assessment
CWA	Clean Water Act
DBHIDS	Department of Behavioral Health and Intellectual Disability Services
DCED	Department of Community and Economic Development
DCNR	Department of Conservation and Natural Resources
DEA	Drug Enforcement Administration
DEI	Office of Diversity, Equity, and Inclusion
DEM	Digital Elevation Model
DEP	Department of Environmental Protection
DFIRM	Digital Flood Insurance Rate Map
DHCD	Division of Housing and Community Development
DHS	Department of Human Services
DLI	Department of Labor and Industry
DMA 2000	Disaster Mitigation Act of 2000
DMV	Department of Motor Vehicles
DOA	Division of Aviation
DOE	Department of Energy
DOH	Department of Health

DOT	Department of Transportation
DPD	Department of Planning and Development
DPP	Department of Public Property
DPW	Department of Public Works
DR	Major Disaster Declaration (Federal)
DRWC	Delaware River Waterfront Corporation
DVIC	Delaware Valley Intelligence Center
DVRPC	Delaware Valley Regional Planning Commission
EAP	Emergency Action Plan
EAP	Education and Awareness Program
EAS	Emergency Alert System
EF	Enhanced Fujita Scale
EHI	Environmental Health Indicators
EM	Emergency Declaration (Federal)
EMA	Emergency Management Agency
EMS	Emergency Medical Services
EMPG	Emergency Management Grant Program
EOC	Emergency Operation Center
EOP	Economic Opportunity Plan
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPF	Environmental Protection Fund
ER	Emergency Room
ERAP	Emergency Rental Assistance Program

ES	Executive Summary
ESF	Emergency Support Function
ESG	Emergency Solutions Grant
ESRI	Environmental Systems Research Institute
EWP	Emergency Watershed Protection
FBI	Federal Bureau of Investigation
FBIA	Faith-Based and Interfaith Affairs
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIA	Flood Insurance Administration
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FOW	Friends of Wissahickon
FRA	Federal Railroad Administration
FRMTF	Flood Risk Management Task Force
FTA	Federal Transit Administration
FTO	Foreign Terrorist Organization
FY	Fiscal Year
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System

GTRP	Greenways, Trails, and Recreation Program
GVI	Gun Violence Intervention
HAZMAT	Hazardous Materials
Hazus	Hazards U.S.
HCRI	Hazards and Vulnerability Research Institute
HELP	Homeowner's Emergency Loan Program
HHPD	High Hazard Potential Dams
HHS	Health and Human Services
HIFLD	Homeland Infrastructure Foundation-Level Data
HM	Hazard Mitigation
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMIS	Homeless Management Information System
HMP	Hazard Mitigation Plan
HOLC	Homeowners' Loan Corporation
HSGP	Homeland Security Grant Program
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
HVL	Highly Volatile Liquids
IA	Individual Assistance
ICC	International Code Council
ICS	National Incident Command System
IIJA	Infrastructure Investment and Jobs Act
IRA	Inflation Reduction Act
ITS	Intelligent Transportation System

KBDI	Keetch-Bryam Drought Index
KCP	Keystone Communities Program
LEED	Leadership in Energy and Environmental Design
LEP	Limited English Proficiency
LEPC	Local Emergency Planning Committee
LGBTQ+	Lesbian, Gay, Bisexual, Transgender, and Queer
LOP	Letter of Permission
LPR	Local Plans and Regulations
LSA	Local Share Account
LTCP	Long Term Control Plan
LWCF	Land and Water Conservation Fund
MACTAC	Multi-Assault, Counter Terrorism Action Capabilities
MDO	Managing Director's Office
MEMP	Municipal Energy Master Plans
MIRC	Mitigation Insurance and Resilient Communities
MMI	Modified Mercalli Intensity Scale
Mph	Miles per Hour
MRP	Mean Return Period
MSA	Metropolitan Statistical Areas
MSI	Mine Subsidence Insurance
MSL	Mean Sea Level
N/A	Not Applicable
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NCDC	National Climate Data Center

NCEI	National Centers for Environmental Information
NDMC	National Drought Mitigation Center
NDSP	National Dam Safety Program
NDVI	Normalized Difference Vegetation Index
NEHRP	National Earthquake Hazard Reductions Program
NEPA	National Environmental Policy Act
NEWPCP	Northeast Water Pollution Control Plant
NFIA	National Flood Insurance Act
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NFWF	National Fish and Wildlife Foundation
NHC	National Hurricane Center
NID	National Inventory of Dams
NIDIS	National Integrated Drought Information System
NIHHIS	National Integrated Heat Health Information System
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NPDP	National Performance of Dams Program
NPL	National Priorities List (EPA)
NRCC	Northeast Regional Climate Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	Naval Support Activity

NSP	Natural Systems Protection
NSSL	National Severe Storms Library
NWP	Nationwide Permit
NWS	National Weather Service
OACCE	Office of Arts, Culture, and the Creative Economy
OAWP	Orphan or Abandoned Well Plugging Program
OBME	Office of Black Male Engagement
OCF	Office of Children and Families
OCJ	Office of Criminal Justice
OEM	Office of Emergency Management
OEW	Office of Engagement for Women
OHR	Office of Human Resources
OHS	Office of Homeless Services
OIA	Office of Immigrant Affairs
OIT	Office of Innovation and Technology
OMB	Office of Management and Budget
OOS	Office of Sustainability
OPE	Office of Public Engagement
OPSG	Operation Stonegarden
ORP	Office of Reentry Partnerships
ORU	Opioid Response Unit
OSHA	Occupational Safety and Health Administration
OTF	Operations Transformation Grant
OTIS	Office of Transportation and Infrastructure Systems
OVA	Office of the Victim Advocate

OVP	Office of Violence Prevention
OYE	Office of Youth Engagement
PA	Pennsylvania
PA	Public Assistance
PA-SHARE	Pennsylvania State Historic and Archaeological Resource Exchange
PAID	Philadelphia Authority for Industrial Development
PASDA	Pennsylvania Spatial Data Access
PATCO	Port Authority Transit Corporation
PATTS	Pennsylvania Tier II System
PCAP	Priority Climate Action Plan
PCPC	Philadelphia City Planning Commission
PDM	Pre-Disaster Mitigation Program
PDPH	Philadelphia Department of Public Health
PDSI	Palmer Drought Severity Index
PECO	Philadelphia Electric Company
PEMA	Pennsylvania Emergency Management Agency
PennDOT	Pennsylvania Department of Transportation
PennTAP	Pennsylvania Technical Assistance Program
PFD	Philadelphia Fire Department
PFMC	Philadelphia Facilities Management Corporation
PGA	Peak Ground Acceleration
PGW	Philadelphia Gas Works
PHA	Peak Horizontal Acceleration
PHA	Philadelphia Housing Authority
PHDC	Philadelphia Housing Development Corporation

PHMC	Public Health Management Corporation
PHMSA	Pipeline and Hazardous Materials Safety Administration
PHL	Philadelphia International Airport
PIF	Pandemic Intervals Framework
PIDC	Philadelphia Industrial Development Corporation
PIT	Point in Time
PMBC	Philadelphia More Beautiful Committee
PNE	Philadelphia Northeast Airport
PNP	Private Nonprofit
PPD-8	Presidential Policy Directive 8
PPD	Philadelphia Police Department
PPE	Personal Protective Equipment
PPR	Philadelphia Parks and Recreation
PRA	Philadelphia Redevelopment Authority
PRHP	Philadelphia Register of Historic Places
PROEMS	Philadelphia Regional Office of Emergency Medical Services
PRPA	Philadelphia Regional Port Authority
PRT	Pennsylvania Recreation Trails
PSGCB	Pennsylvania State Geospatial Coordinating Board
PSIP	Philadelphia Streetlight Improvement Project
PTSD	Post-Traumatic Stress Disorder
PWD	Philadelphia Water Department
RACP	Redevelopment Assistance Capital Program
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
RC	Readiness Center

RCRA	Resource Conservation and Recovery Act
RCPGP	Regional Catastrophic Preparedness Grant Program
RCV	Replacement Cost Value
RF	Risk Factor
RFP	Request for Proposals
RIC	Regional Integration Center
Risk MAP	Risk Mapping, Assessment, and Planning
RL	Repetitive Loss
RLF	Revolving Loan Fund
ROW	Right-of-Way
RSI	Regional Snowfall Index
SA	Spectral Acceleration
SARA	Superfund Amendments and Reauthorization Act
SBA	Small Business Administration
SCC	State Conservation Commission
SD	Substantial Damage
SEPA	Southeast Pennsylvania
SEPTA	Southeastern Pennsylvania Transportation Authority
SFHA	Special Flood Hazard Area
SHMO	State Hazard Mitigation Officer
SHPO	State Historic Preservation Office
SHSP	State Homeland Security Program
SI	Substantial Improvement
SIP	Structure and Infrastructure Project
SJTPO	South Jersey Transportation Organization

SLR	Sea Level Rise
SLOSH	Sea, Lake, Overland Surges from Hurricanes
SMGM	Stormwater Management Guidance Manual
SOG	Standard Operating Guide
SPC	Storm Prediction Center
SRL	Severe Repetitive Loss
SSBG	Social Services Block Grant
SUPHR	Substance Use Prevention and Harm Reduction
SWEEP	Streets, Walkways, Educations, and Enforcement Program
SWRAC	Solid Waste and Recycling Advisory Committee
SWWPCP	Southwest Water Pollution Control Plant
TAP	Transportation Alternatives Program
TBD	To Be Determined
TCDI	Transportation and Community Development Initiative
TCIG	Targeted Community Investment Grant
THIRA	Threat Hazard Identification and Risk Assessment
TPL	Trust for Public Land
TRACEM	Thermal, Radiological, Asphyxiation, Chemical, Etiological, or Mechanical
TTF	Tookany/Tacony-Frankford
TWIP	Town Watch Integrated Services
U.S.	United States
UASI	Urban Areas Security Initiative
UCC	Uniform Construction Code
UHI	Urban Heat Island
UNFCC	United Nations Framework Convention on Climate Change

USACE	United States Army Corps of Engineers
USCG	United State Coast Guard
USDA	United States Department of Agriculture
USDHS	United States Department of Homeland Security
USDOT	United States Department of Transportation
USEDA	United States Economic Development Administration
USEIA	United States Energy Information Administration
USFA	United States Fire Administration
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV	Ultra-Violet
VMS	Variable Message Sign
VOAD	Volunteer Organization Active in Disasters
WCT	Wind Chill Temperature
WFO	Weather Forecast Office
WHO	World Health Organization
WILMAPCO	Wilmington Area Planning Council
WNV	West Nile Virus
WPPZ	West Philadelphia Promise Zone
WRP	Water Revitalization Plan
WRPP	Watershed Restoration and Protection Program
WUI	Wildland/Urban Interface
ZBA	Zoning Board of Adjustment

DEFINITIONS

- **Adaptive capacity—**the ability of a human or natural system to adjust to climate change by moderating potential damage, taking advantage of opportunities, or coping with the consequences (EPA 2023)
- **Asset—**anything that is important to the character and function of a community (e.g., people, structures, community lifelines, the economy, and natural, historic, and cultural resources) (FEMA 2023)
- **Capability assessment—**an evaluation of which authorities, policies, programs, funding and resources a participant has to accomplish hazard mitigation (FEMA 2023)
- **Cascading hazards—**a primary event, such as heavy rainfall, seismic activity, or rapid snowmelt, followed by a chain of consequences that may range from modest (lesser than the original event) to substantial (National Academies of Sciences, Engineering, and Medicine 2022)
- **Community lifelines—**the most fundamental services in a community that, when stabilized, enable all other aspects of society to function (FEMA 2023)
- **Extent—**the range of anticipated intensities of the identified hazards within a community, most commonly expressed using various scientific scales (FEMA 2022)
- **Hazard profile—**a description of a hazard's location, extent, previous occurrences and probability of future events within a community (FEMA 2023)
- **Hazard ranking—**the process of identifying the hazards that pose the greatest risk to a community, based on how likely the hazard is to occur, the potential consequences if the hazard does occur, and other relevant local factors
- **Impact—**the consequences or effects of a hazard on a community's assets identified in the vulnerability assessment. (FEMA 2023)
- **Integration—**the inclusion of hazard mitigation principles, vulnerability information and mitigation actions into other existing community planning to leverage activities that have co-benefits, reduce risk and increase resilience (FEMA 2022)
- **Mitigation action—**measures, projects, plans or activities proposed to reduce the current and future vulnerabilities identified in the risk assessment (FEMA 2023)
- **Mitigation strategy—** the long-term blueprint for reducing the potential hazard-related losses identified in the risk assessment; the strategy consists of mitigation goals, mitigation actions, and a plan for implementing the actions (FEMA 2023)
- **Natural hazard—**a source of harm or difficulty created by a meteorological, environmental or geological event (FEMA 2023)
- **Plan maintenance—**monitoring and updating a hazard mitigation plan as warranted by changing conditions, availability of new information, and progress on the proposed mitigation actions (FEMA 2023)
- **Planning process—**the procedures used to develop a hazard mitigation plan with broad acceptance across the community
- **Risk—**the potential for damage or loss when natural hazards interact with people or assets (FEMA 2023)
- **Risk assessment—**a data-driven analysis to find where a local jurisdiction is vulnerable to hazards (FEMA 2023)
- **Social vulnerability—**the potential for loss within an individual or social group, as affected by traits that influence an individual's or group's resilience, which is their ability to prepare, respond, cope or recover from an event (FEMA 2023)

- **Stakeholder—**individuals or groups that a mitigation action or policy affects, including businesses, private organizations and residents (FEMA 2023)
- **Vulnerability—**a description of which assets within locations identified to be hazard prone are at risk from the effects of the hazard (FEMA 2023)

APPENDIX C. MEETING DOCUMENTATION

Insert Appendix Content

APPENDIX D. LOCAL MITIGATION PLAN REVIEW TOOL

Table B-1 summarizes the 44 CFR 201 requirements and where each is addressed in this hazard mitigation plan.

Table B-1 FEMA Local Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Chapter 8
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Chapter 1
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Chapter 4
Profiling Hazards: §201.6(c)(2)(i)	Section 4.3
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Chapter 1
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Sections 2.4.4.1, 4.3
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 4.3
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Sections 2.4.4.2, 4.3
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Chapter 6
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Chapter 6
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Chapter 6
Mitigation Actions: §201.6(c)(3)(iv)	Chapter 6
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Chapter 7; Appendix F
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Chapter 7; Appendix F
Continued Public Involvement: §201.6(c)(4)(iii)	Chapter 7; Appendix F

APPENDIX E. PUBLIC AND STAKEHOLDER OUTREACH

Insert Appendix Content

APPENDIX F. PARTICIPATION MATRIX

Insert Appendix Content

APPENDIX G. ACTION WORKSHEET TEMPLATE

This appendix includes the instructions and template provided for the development of Mitigation Strategy Action Worksheets.

Stakeholder(s)	Action
Initiative Number:	
Location (address, latitude/longitude)	
Mitigation Technique Category	
Hazard(s) Addressed	
Priority (High, Medium, Low)	
Estimated Cost	
Potential Funding Streams	
Timeline	
Lead Agency/Department	
Support Agencies/ Departments	
Project Point of Contact	
Name	
Title	
Agency/Department	
Phone	
E-mail	

Mitigation Technique Category

Local Plans and Regulations (LPR) – These actions include government authorities, policies, or codes that influence the way land and buildings are being developed and built.

Structure and Infrastructure Project (SIP) – These actions involve (1) modifying existing structures and infrastructure to protect them from a hazard, or (2) removing them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also includes projects to construct manmade structures to reduce the impact of hazards.

Natural Systems Protection (NSP) – These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.

Education and Awareness Programs (EAP) – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities.

Costs:

If an estimated cost is known, please provide or use the following ranges:

Low = < $10,000 *Medium* = $10,000 to $100,000 *High* = > $100,000

If costs have not been estimated, please use the following categories:

Low	Possible to fund under existing budget. Project is part of, or can be part of, an existing on-going program.
Medium	Could budget for under existing work plan but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High	Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Timeline:

Short = 1 to 5 years Long-Term = 5 years or greater

OG = On-going program DOF = Depending on funding

APPENDIX H. PLAN MAINTENANCE TOOLS

This appendix includes tools and worksheets to facilitate plan maintenance and review by the City of Philadelphia.

The FEMA 386-4 guidance worksheets are available to assist with progress reporting. These worksheets are provided in this section for ease of access to maintain the 2025 HMP throughout its period of performance.

Worksheet #1 Progress Report step 2

Progress Report Period: _____ (date) to _____ (date)

Project Title: _____ Project ID#: _____

Responsible Agency: _____

Address: _____

City/County: _____

Contact Person: _____ Title: _____

Phone #(s): _____ email address: _____

List Supporting Agencies and Contacts:

_____

_____

_____

Total Project Cost: _____

Anticipated Cost Overrun/Underrun: _____

Date of Project Approval: _____ Start date of the project: _____

Anticipated completion date: _____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase): _____

_____

_____

Milestones	Complete	Projected Date of Completion

Plan Goal(s)/Objective(s) Addressed:

Goal: _____

Objective: _____

Indicator of Success (e.g., losses avoided as a result of the acquisition program):

In most cases, you will list losses avoided as the indicator. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

_____

_____

Status (Please check pertinent information and provide explanations for items with an asterisk. For completed or canceled projects, see Worksheet #2 — to complete a project evaluation):

Project Status

☐ Project on schedule

☐ Project completed

☐ Project delayed*

*explain: _____

_____

☐ Project canceled

Project Cost Status

☐ Cost unchanged

☐ Cost overrun*

*explain: _____

_____

☐ Cost underrun*

*explain: _____

_____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

_____

_____

_____

_____

B. What obstacles, problems, or delays did you encounter, if any?

_____

_____

_____

C. How was each problem resolved?

_____

_____

_____

Next Steps: What is/are the next step(s) to be accomplished over the next reporting period?

Other comments:

Worksheet #2 Evaluate Your Planning Team step 3

When gearing up for the plan evaluation, the planning team should reassess its composition and ask the following questions:	YES	NO
Have there been local staffing changes that would warrant inviting different members to the planning team?		
Comments/Proposed Action:		
Are there organizations that have been invaluable to the planning process or to project implementation that should be represented on the planning team?		
Comments/Proposed Action:		
Are there any representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the planning team?		
Comments/Proposed Action:		
Are there procedures (e.g., signing of MOAs, commenting on submitted progress reports, distributing meeting minutes, etc.) that can be done more efficiently?		
Comments/Proposed Action:		
Are there ways to gain more diverse and widespread cooperation?		
Comments/Proposed Action:		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?		
Comments/Proposed Action:		

If the planning team determines the answer to any of these questions is "yes," some changes may be necessary.

Worksheet #3 Evaluate Your Project Results step 3

Project Name and Number: _____

Project Budget: _____

Project Description: _____

Associated Goal and Objective(s): _____

Indicator of Success (e.g., losses avoided): _____

Insert location map.
Include before and after photos if appropriate.

Was the action implemented? ☐ YES ☐ NO

IF NO

Why not?	**YES**	**NO**
Was there political support for the action?	☐	☐
Were enough funds available?	☐	☐
Were workloads equitably or realistically distributed?	☐	☐
Was new information discovered about the risks or community that made implementation difficult or no longer sensible?	☐	☐
Was the estimated time of implementation reasonable?	☐	☐
Were sufficient resources (for example staff and technical assistance) available?	☐	☐

IF YES

What were the results of the implemented action? _____

	YES	NO
Were the outcomes as expected? If No, please explain:		
Did the results achieve the goal and objective(s)? Explain how:		
Was the action cost-effective? Explain how or how not:		
What were the losses avoided after having completed the project?		
If it was a structural project, how did it change the hazard profile?		
Additional comments or other outcomes:		

Date: _____

Prepared by: _____

Worksheet #4 Revisit Your Risk Assessment step 4

Risk Assessment Steps	Questions	YES	NO	COMMENTS
Identify hazards	Are there new hazards that can affect your community?			
Profile hazard events	Are new historical records available?			
	Are additional maps or new hazard studies available?			
	Have chances of future events (along with their magnitude, extent, etc.) changed?			
	Have recent and future development in the community been checked for their effect on hazard areas?			
Inventory assets	Have inventories of existing structures in hazard areas been updated?			
	Is future land development accounted for in the inventories?			
	Are there any new special high-risk populations?			
Estimate losses	Have loss estimates been updated to account for recent changes?			

If you answered "Yes" to any of the above questions, review your data and update your risk assessment information accordingly.

Worksheet #5 Revise the Plan step 4

Prepare to update the plan.

When preparing to update the plan:	*Check the box when addressed:*
1. Gather information, including project evaluation worksheets, progress reports, studies, related plans, etc.	
Comments:	
2. Reconvene the planning team, making changes to the team composition as necessary (see results from Worksheet #2).	
Comments:	

Consider the results of the evaluation and new strategies for the future.

When examining the community consider:	*Check the box when addressed:*
1. The results of the planning and outreach efforts.	
Comments:	
2. The results of the mitigation efforts.	
Comments:	

3. Shifts in development trends.	
Comments:	
4. Areas affected by recent disasters.	
Comments:	
5. The recent magnitude, location, and type of the most recent hazard or disaster.	
Comments:	
6. New studies or technologies.	
Comments:	
7. Changes in local, state, or federal laws, policies, plans, priorities, or funding.	
Comments:	

8. Changes in the socioeconomic fabric of the community.	
Comments:	
9. Other changing conditions.	
Comments:	

Incorporate your findings into the plan.

When examining the plan consider:	*Check the box when addressed:*
1. Revisit the risk assessment. *(See Worksheet #4)*	
Comments:	
2. Update your goals and strategies.	
Comments:	
3. Recalculate benefit-cost analyses of projects to prioritize action items.	
Comments:	

APPENDIX I. CRITICAL FACILITY INVENTORY- FOR OFFICIAL USE ONLY

Due to the sensitive nature of this information, details of critical facilities have been redacted for the public document. A full list of critical facilities identified for the vulnerability analysis is available at the City of Philadelphia Office of Emergency Management. Contact the Hazard Mitigation Program Manager, Noah Palau, to view the list.

APPENDIX J. MITIGATION ACTION WORKSHEETS AND SUPPLEMENTARY DATA

Worksheets

Supplementary Data

This appendix summarizes additional activities and resources provided to plan participants to support the update of the mitigation strategy.

2022 Goals and Objectives Review

The City of Philadelphia's planning documents and recent policies changes were reviewed and discussed with Steering Committee, who reviewed and approved the updated goals for the 2025 HMP. The 2025 City of Philadelphia HMP goals are in line with the State HMP mitigation goals, embody the overarching needs and concerns of the City and address both natural and non-natural hazard risk reduction.

The goals listed above were used to develop relevant objectives. The objectives address the results of the vulnerability assessment in more specific terms and reflect the possible effects that can be mitigated for the identified hazards, as well as existing limitations in available data and information. The objectives that were originally identified during the 2022 HMP update process were reviewed by the Steering Committee, All-Stakeholders Work Group, and Public Steering Committee and updated to reflect changes in City priorities and capabilities since the HMP was written in 2022. The 2025 goals and objectives can be seen below.

Goal 1: Protect all life and reduce risks that exacerbate inequities in health safety.

Objective 1.1 Develop and implement strategies to reduce Philadelphians' risk to natural and human-made hazards.

Objective 1.2 Prioritize mitigation actions that affect populations most at-risk11 and that prioritize equity and accessibility.

Goal 2: Build the resilience of community assets, including property, infrastructure, and cultural resources.

Objective 2.1 Implement projects and programs that protect property against flooding.

Objective 2.2 Assess vulnerability of infrastructure to identify where to prioritize mitigation actions.

Objective 2.3 Develop and implement mitigation programs and strategies that protect critical facilities and services.

Objective 2.4 Integrate hazard and risk information into land use planning decisions.

Objective 2.5 Promote post-disaster mitigation as part of restoration, recovery, and resilience building.

Objective 2.6 Repair, restore, and maintain existing infrastructure.

Objective 2.7 Identify, plan for, and protect historic properties and cultural resources.

Objective 2.8 Address historic drivers of vulnerability and invest in community assets.

Goal 3: Foster an economy that promotes mitigation and reduces impacts from hazards.

Objective 3.1 Prioritize mitigation strategies that support the continuation of critical business operations during and following a disaster.

Objective 3.2 Sustain, promote, and enhance partnerships with external public and private entities to identify and share resources.

Objective 3.3 Form partnerships to leverage and share resources to address hazard risks today and projected from climate change.

Goal 4: Restore and enhance the natural ecology.

Objective 4.1 Promote nature-based solutions to manage stormwater and reduce the impacts of flooding and SLR.

Objective 4.2 Support projects that address water holistically including water quality, stormwater management, dam safety, and flood mitigation.

Objective 4.3 Restore and enhance green spaces and prioritize communities overburdened by environmental hazards.

Objective 4.4 Support the transition away from fossil fuels and other greenhouse gases that impact health and safety and exacerbate climate change.

Objective 4.5 Improve air, water, and soil quality across the City starting with environmental justice communities.

Goal 5: Create awareness and demand for mitigation and adaptation as a standard of practice.

Objective 5.1 Tailor mitigation training to public officials, businesses, organizations, and the public emphasizing equity and inclusion.

Objective 5.2 Improve existing and put in place necessary warning systems.

Objective 5.3 Increase public's awareness of hazards, mitigation, and other protective measures, including those related to the projected impacts of climate change.

Objective 5.4 Continue and expand coordination efforts to plan for cross-agency mitigation efforts.

Mitigation Strategy Workshops and Meetings

Existing mitigation goals and objectives, and the 2022 HMP mitigation actions were first examined at the Steering Committee Goals, Objectives, and 2022 Mitigation Strategy Review Meeting and revisited during the All-Stakeholder Workgroup: Mitigation Strategy Workshop and the Public Steering Committee: Mitigation Strategy Workshops. The Steering Committee thoroughly reviewed and updated the mitigation goals and objectives utilizing the latest information gathered through the hazard profiles, vulnerability assessments, and the risk assessment; the mitigation goals and objectives were also compared to the State HMP goals and objectives. The updated goals and objectives were then presented at the Mitigation Strategy Workshops for final review and approval. Plan participants continued to review and provide progress on the 2022 mitigation actions throughout the planning process.

1. FEMA Local Mitigation Handbook
2. Public Survey Results
3. FEMA Mitigation Action Types (Table J-1)
4. FEMA Mitigation Ideas
5. FEMA Project Useful Life Factsheet
6. Mitigation Funding Sources at the Federal, State, and Local levels (Table J-2)
7. FEMA Ecosystem Services
8. Mitigation Catalog

Types of Mitigation Actions

A mitigation action is a specific action, project, activity, or process taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan's mission and goals. The actions to reduce vulnerability to threats and hazards form the core of the plan and are a key outcome of the planning process.

The primary types of mitigation actions to reduce long-term vulnerability are:

- Local Plans and Regulations (LPR)
- Structure and Infrastructure Projects (SIP)
- Natural Systems Protection (NSP)
- Education and Awareness Programs (EAP)

Table J-1. FEMA Mitigation Action Types

Mitigation Type	Description	Examples
Local Plans and Regulations	These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.	1. Comprehensive plans 2. Land use ordinances 3. Subdivision regulations 4. Development review 5. Building codes and enforcement 6. NFIP Community Rating System 7. Capital improvement programs 8. Open space preservation 9. Stormwater management regulations and master plans
Structure and Infrastructure Projects	These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards. Many of these types of actions are projects eligible for funding through the FEMA Hazard Mitigation Assistance program.	1. Acquisitions and elevations of structures in flood prone areas 2. Utility undergrounding 3. Structural retrofits 4. Floodwalls and retaining walls 5. Detention and retention structures 6. Culverts 7. Safe rooms

Mitigation Type	Description	Examples
Natural Systems Protection	These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.	1. Sediment and erosion control 2. Stream corridor restoration 3. Forest management 4. Conservation easements 5. Wetland restoration and preservation
Education and Awareness Programs	These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady or Firewise Communities. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important foundation. A greater understanding and awareness of hazards and risk among local officials, stakeholders, and the public is more likely to lead to direct actions.	1. Radio or television spots 2. Websites with maps and information 3. Real estate disclosure 4. Presentations to school groups or neighborhood organizations 5. Mailings to residents in hazard-prone areas 6. StormReady 7. Firewise Communities

Potential Mitigation Funding Sources

While it is important to recognize the mitigation strategies for the City of Philadelphia to help achieve the mitigation goals and objectives of the HMP, it is also important to provide sources for funding to implement these strategies. Table J-2 provides a list of federal programs, descriptions, and links for those seeking funding sources. Please note that this table is not intended to be a comprehensive list, but rather a starting point to help identify potential sources of funding for the identified mitigation strategies.

Table J-2. Mitigation Funding Sources

Program	Description	Lead Agency	Website
Hazard Mitigation Assistance (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages – includes FMA, HMGP, PDM	FEMA	https://www.fema.gov/hazard-mitigation-assistance
Flood Mitigation Assistance (FMA)	Program Grants to States and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program	FEMA	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program (HMGP)	Grants to States and communities for planning and projects providing long-term hazard mitigation measures following a major disaster declaration	FEMA	https://www.fema.gov/hazard-mitigation-grant-program
Public Assistance: Hazard Mitigation Funding Under Section 406	Hazard mitigation discretionary funding available under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a Presidentially declared disaster	FEMA	https://www.fema.gov/press-release/20220328/fema-hazard-mitigation-grants-404-and-406

Program	Description	Lead Agency	Website
Assistance to Firefighters Grant Program	The primary goal of the Assistance to Firefighters Grants is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated Emergency Medical Services organizations, and State Fire Training Academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program
High Hazard Potential Dams (HHPD) Rehabilitation Grant	The Rehabilitation of High Hazard Potential Dams Grant Program (HHPD provides technical, planning, design, and construction assistance in the form of grants to non-Federal governmental organizations or nonprofit organizations for rehabilitation of eligible high hazard potential dams.	FEMA	https://www.grants.gov/web/grants/view-opportunity.html?oppId=316238
Fire Management Assistance Grant Program	Assistance for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands that threaten such destruction as would constitute a major disaster. Provides a 75% Federal cost share and the State pay the remaining 25% for actual cost.	FEMA	https://www.fema.gov/fire-management-assistance-grant-program
Disaster Housing Program	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage, and rental assistance	HUD	https://www.hud.gov/program_offices/public_indian_housing/publications/dhap
HOME Investment Partnerships Program	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low-income persons)	HUD	https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/
HUD Disaster Recovery Assistance	Grants to fund gaps in available recovery assistance after disasters (including mitigation)	HUD	https://www.hud.gov/info/disasterresources
Section 108 Loan Guarantee	Enables states and local governments participating in the Community Development Block Grant (CDBG) program to obtain federally guaranteed loans for disaster-distressed areas	HUD	https://www.hudexchange.info/programs/section-108/
Smart Growth Implementation Assistance program	The Smart Growth Implementation Assistance program focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under 4 categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design or medical and social service facilities siting.	EPA	https://www.epa.gov/smartgrowth
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats	U.S. Fish and Wildlife Service	https://www.fws.gov/partners/

Program	Description	Lead Agency	Website
FHWA Emergency Relief Program	Fund for the repair or reconstruction of Federal-aid highways that have suffered serious damage as a result of (1) natural disasters or (2) catastrophic failures from an external cause	U.S. Department of Transportation (DOT)	https://www.fhwa.dot.gov/programadmin/erelief.cfm
Transportation Investment Generating Economic Recovery (TIGER)	Investing in critical road, rail, transit, and port projects across the nation	U.S. DOT	https://www.transportation.gov/tags/tiger-grants
Community Facilities Direct Loan & Grant Program	This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.	USDA	https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program
Emergency Loan Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters, or quarantine	USDA	https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index
Emergency Watershed Protection (EWP) Program	Provide assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Emergency Management Performance Grants (EMPG) Program	Assist local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities	FEMA, U.S. DHS	https://www.fema.gov/emergency-management-performance-grant-program
Reimbursement for Firefighting on Federal Property	Provides reimbursement only for direct costs and losses over and above normal operating costs.	U.S. DHS	https://www.usfa.fema.gov/grants/firefighting_federal_property.html
Department of Homeland Security Grant Program (HSGP)	HSGP is composed of three interconnected grant programs including the State Homeland Security Program, Urban Areas Security Initiative (UASI), and Operation Stonegarden. Together, these competitive grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration.	U.S. DHS	https://www.dhs.gov/homeland-security-grant-program-hsgp

Program	Description	Lead Agency	Website
Land & Water Conservation Fund	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies)	National Park Service	https://www.nps.gov/subjects/lwcf/index.htm
Land and Water Conservation Fund	Funding to states, local and conservation organizations for outdoor recreational development, renovation, land acquisition, and planning.	U.S. Department of the Interior	https://www.doi.gov/lwcf
U.S. Small Business Administration	Small Business Administration (SBA) provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.	SBA	https://www.sba.gov/funding-programs/disaster-assistance

Mitigation Catalog

Table J-3 provides a list of potential personal, corporate, and government scale mitigation actions for each of the identified natural hazards in the City of Philadelphia All-Hazard Mitigation Plan. Please note that this table is not intended to be a comprehensive list, but rather a starting point to help identify potential actions for participating stakeholders.

Table J-3. City of Philadelphia Mitigation Catalog

DROUGHT		
Personal Scale	Corporate Scale	Government Scale
• Manipulate the Hazard: • None • Reduce exposure to the hazard: • Consider stored water/captured water techniques during dry seasons. • Establishing an irrigation time/scheduling program or process so that all agricultural land gets the required amount of water. Through incremental timing, each area is irrigated at different times so that all water is not consumed at the same time. Spacing usage may also help with recharge of groundwater. • Reduce vulnerability to the hazard: • Drought resistant landscapes. • Reduce water system losses. • Regularly check for leaks to minimize water supply losses. • Install low-flow water saving showerheads and toilets. • Turn water flow off while brushing teeth or during other cleaning activities. • Adjust sprinklers to water the lawn and not the sidewalk or street. • Run the dishwasher and washing machine only when they are full. • Check for leaks in plumping or dripping faucets. • Install rain-capturing devices for irrigation. • Install graywater systems in homes to encourage water reuse. • Rotate crops by growing a series of different types of crops on the same fields every season to reduce soil erosion. • Planting “cover crops,” such as oats, wheat, and buckwheat, to prevent soil erosion. • Increase Capability: • Practice active water conservation techniques. • Seek ways to operate wells in such a way to enhance their functional longevity and supply capability.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • Consider stored water/captured water techniques during dry seasons. • Reduce vulnerability to the hazard: • Drought resistant landscapes. • Reduce private water system losses. • Identify alternate water supply sources. • Install low-flow water saving showerheads and toilets. • Adjust sprinklers to water the lawn and not the sidewalk or street. • Increase Capability: • Practice active water conservation. • Develop a COOP. • Create a water conservation plan.	• Manipulate the Hazard: • Ground Water Recharge through stormwater management. • Implement cloud seeding techniques during dry seasons. • Reduce exposure to the hazard: • Identify and create ground water back up sources. • Create /identify new impounded water supply points. • Developing new or upgrading existing water delivery systems to eliminate breaks and leaks. • Reduce vulnerability to the hazard: • Water use conflict regulations. • Reduce water system losses. • Distribute water saving kits. • Identify sites ideally suited for ground water recharge. • Implement stormwater retention in regions ideally suited for groundwater recharges. • Utilize drought resistant landscapes on community owned facilities. • Encourage citizens to take water-saving measures. • Increase Capability: • Public education on drought resistance. • Identify alternative water supplies for time of drought. Mutual aid agreements with alternative suppliers. • Develop a drought contingency plan. • Develop criteria-”triggers” for drought related actions. • Improve accuracy of water supply forecasts. • Provide incentives to influence active water conservation techniques such as water user rate reductions. • Consider providing incentives to property owners that utilize drought resistant landscapes in the design of their homes. • Use of water buffalo tankers. • Promote well usage techniques that strive to enhance functional longevity and supply capability of private water supply wells. • Develop an ordinance to restrict the use of public water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc.

EARTHQUAKE		
Personal Scale	Corporate Scale	Government Scale
• Manipulate the Hazard: • None • Reduce exposure to the hazard: • Locate outside of hazard area (off soft soils). • Reduce vulnerability to the hazard: • Retrofit structure (anchor house structure to foundation). • Secure household items that can cause injury or damage such as water heaters, bookcases, and other appliances. • Build to higher design standards. • Increase Capability: • Practice “drop, cover and hold” • Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72 hr. self-sufficiency during an event. • Increase capability by having cash reserves for reconstruction. • Become informed on the hazard and risk reduction alternatives available. • Develop a post-disaster action plan for your household.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • Locate/relocate mission critical functions outside hazard area where possible. • Reduce vulnerability to the hazard: • Build redundancy for critical functions/facilities. • Retrofit critical buildings/areas housing mission critical functions. • Increase Capability: • Adopt higher standard for new construction -- Consider “performance-based design’ when building new structures. • Increase capability by having cash reserves for reconstruction. • Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility. • Develop a Continuity of Operations Plan (COOP).	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • Locate critical facilities or functions outside of hazard area where possible. • Reduce vulnerability to the hazard: • Harden infrastructure. • Provide redundancy for critical functions. • Adopt higher regulatory standards for structures. • Conduct “rapid screening” programs for critical facilities to identify facilities that may be particularly prone to EQ damage, then develop investigation/action plans to address such structures. • Increase Capability: • Provide better hazard maps. • Provide technical information and guidance. • Enact tools to help manage development in hazard areas: tax incentives, information. • Include retrofitting/replacement of critical system elements in CIP. • Develop strategy to take advantage of post disaster opportunities. • Warehouse critical infrastructure components such as pipe, power line, and road repair material. • Develop and adopt a Continuity of Operations / Continuity of Government Plan (COOP/COG). • Initiate triggers guiding improvements such as: (< 50% substantial damage/improvements). • Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities. • Develop a post disaster action plan that includes a grant funding and debris removal components. • Utilize warning systems. • Educate builders and developers on seismic construction standards.

EXTREME TEMPERATURE		
Personal Scale	Corporate Scale	Government Scale
• Manipulate the Hazard: • Increase tree plantings • Installation of green roofs to provide shade and remove heat • Use cool roofing products that reflect sunlight and heat away from a building • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Retrofit pipes including locating water pipes on the inside of building insulation or keeping them out of vulnerable spaces to extreme cold • Increase Capability: • None	• Manipulate the Hazard: • Increase tree plantings • Installation of green roofs to provide shade and remove heat • Use cool roofing products that reflect sunlight and heat away from a building • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Retrofit pipes including locating water pipes on the inside of building insulation or keeping them out of vulnerable spaces to extreme cold • Increase Capability: • Set rules restricting outdoor work during extreme temperature events	• Manipulate the Hazard: • Increase tree plantings • Encourage installation of green roofs to provide shade and remove heat • Encourage the use of cool roofing products that reflect sunlight and heat away from a building • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Require minimum temperatures in housing/landlord codes • Increase Capability: • Educate citizens regarding the dangers of extreme heat and cold and the steps they can take to protect themselves when extreme temperatures occur • Establish warming and cooling centers • Establish extreme temperature planning in emergency operation plans • Create a database to track those individuals at high risk of death such as older adults, individuals who are unhoused, etc.

FLOOD, FLASH FLOOD, ICE JAM		
Personal Scale	Corporate Scale	Government Scale
• Manipulate the Hazard: • Clear stormwater drains and culverts • Reduce exposure to the hazard: • Locate or re-locate outside of hazard area • Institute low impact development techniques on property • Reduce vulnerability to the hazard: • Retrofit existing structures and utilities above Base Flood Elevation (BFE) • Floodproof existing structures (wet- or dry floodproofing). • Store hazardous materials above BFE or outside of floodprone areas • Increase Capability: • Develop household mitigation plan, such as retrofit savings, communication capability with outside, 72-hr. self-sufficiency during and after an event • Buy flood insurance	• Manipulate the Hazard: • Clear stormwater drains and culverts • Reduce exposure to the hazard: • Locate business critical facilities or functions outside hazard area • Institute low impact development techniques on property • Reduce vulnerability to the hazard: • Build redundancy for critical functions/ retrofit critical buildings. • Provide flood-proofing measures when new critical infrastructure must be located in floodplains. • Harden structures and infrastructure (wet and dry-floodproofing) • Store hazardous materials above BFE or outside of floodprone areas • Increase Capability: • Increase capability by having cash reserves for reconstruction • Develop and adopt a Continuity of Operations Plan (COOP) • Solicit ‘cost-sharing” through partnerships with private sector stakeholders on projects with multiple benefits. • Dam owner/operators should continue to	• Manipulate the Hazard: • Clear stormwater drains and culverts • Dredging, levee construction, providing retention areas. • Structural flood control: levee’s, dams, channelization, revetments. • Construct regional stormwater control facilities • Lead and develop a City-wide stream clearing strategy including the development of thresholds for response/action. • Reduce exposure to the hazard: • Locate/re-locate critical facilities outside of hazard area • Acquire or relocate identified repetitive loss properties. • Promote open space uses in identified high hazard areas via techniques such as: PUD’s, easements, setbacks, greenways, sensitive area tracks. • Adopt land development criteria such as PUD’s, Density transfers, clustering • Institute low impact development techniques on property • Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff • Pass an ordinance to incorporate additional zoning classifications into flood zones within each municipality. • Increase floodplain standards within municipal ordinances and include provisions for enforcing best practice standards • Consider increasing minimum freeboard beyond 1’ freeboard state requirement • Continue development application reviews by City Planning Board to reduce risky development practices. • Reduce vulnerability to the hazard: • Harden structures and infrastructure (wet and dry-floodproofing) • Provide redundancy for critical functions and infrastructure • Adopt appropriate regulatory standards such as cumulative substantial improvement/damage, freeboard, lower substantial damage threshold, compensatory storage. • Stormwater management regulations and master planning. • Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on down-stream communities. • Participate in the Community Rating System (CRS) • Implement as-built regulatory requirements • Implement site review ordinances/requirements • Establish stream maintenance programs with stakeholders (e.g., Soil and Water Conservation District) - support City leads of such efforts • Incorporate retrofitting/replacement of critical facilities and infrastructure in Capital Improvement Plans (CIPs)

FLOOD, FLASH FLOOD, ICE JAM		
Personal Scale	Corporate Scale	Government Scale
	be aware of and understand dam inspection and reporting requirements. • Ensure that all dam EAP's are kept in compliance with State Regulations.	• Promote the use of vegetation/plants as green erosion control measures to reduce localized flooding. • Work with environmental groups to address removal of debris, log jams, etc. in flood vulnerable stream sections • Increase Capability: • Produce better hazard maps, and improve access to flood hazard mapping • Capture/survey "high-water" marks during flood events. • Provide technical information and guidance on appropriate mitigation options available to businesses and homeowners • Enact tools to help manage development in hazard areas (stronger controls, tax incentives, information) • Establish an additional layer of zoning within flood hazard areas • Develop strategy to take advantage of post disaster opportunities • Improve compliance with and enforcement of the NFIP • Develop mitigation partnerships with regional stakeholders • Join Community Rating System (CRS) program, or improve level of participation in CRS • Develop and implement a public information strategy for flood hazard awareness, flood insurance (NFIP) and mitigation • Maintain existing data as well as gather new data needed to define risks and vulnerability. • Create a building and elevation inventory of structures in the floodplain • Identify flood prone areas that may be in need of new flood studies • Establish a program to identify and educate owners of flood-prone properties of potential mitigation options (e.g., elevations, relocations) • Charge a hazard mitigation fee on all new permits to create a hazard mitigation funding source for initiatives or grant cost share requirements. • Integrate floodplain management policies into other planning mechanisms within the planning area. • Establish a Stormwater Utility to deal with urban drainage/flooding issues • Establish incentives to promote flood hazard mitigation of private property (e.g., permit fee waivers). • Adopt ordinances/standards for cumulative damages and/or improvements • Upgrade NFIP Floodplain ordinance, as well as other ordinances to current or above current state and federal standards. • Develop and adopt a COOP • Join "Storm Ready" Program • Participate in City and regional training programs

FLOOD, FLASH FLOOD, ICE JAM		
Personal Scale	Corporate Scale	Government Scale
		• Provide additional training/certification to NFIP floodplain administrators and code officials. • Implement annual training to account for turnover of municipal officials. • Maintain and enhance flood forecasting ability, including the establishment and maintenance of critical stream gages • Explore grant funding opportunities and potential partnerships to help maintain existing gages and install additional gages to improve forecasting and flood warning ability. • Promote awareness and participation in alert systems • Support and participate in regional flood management efforts • Support and implement hazard disclosure for the sale/re-sale of property in identified risk zones. • Provide continued and enhanced training for emergency responders • Establish a revolving “bank” or budget line item to fund grant application support • Continue to review updated Flood Insurance Rate Maps to ensure accuracy as well as maintaining lines of communication with homeowners to make them aware of potential changes related to their property status. • Provide trainings for floodplain administrators on the NFIP/Floodplain Best Practices and also pursue CFM accreditation for municipal floodplain administrators. • Build and maintain relationships to develop regional watershed/floodplain mitigation solutions. • Pursue grant funding opportunities to fund repairs of catchments and infrastructure on a proactive basis. • Explore grant funding opportunities related to climate change to fund mitigation projects.

HURRICANE, TROPICAL STORM, NOR'EASTER		
Personal Scale	Corporate Scale	Government Scale
• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Retrofit structures (improved roofing, glazing, insulation, etc.). • Provide for redundant heat and power. • Contact municipality or utilities to trim or remove trees that could affect power lines. • Plant appropriate trees near home and power lines ("Right tree, right place" National Arbor Day Foundation Program. • Increase Capability: • Improve awareness of impending severe weather (e.g., obtain a NOAA weather radio). • Promote 72-hour self-sufficiency. • Provide for redundant heat and power.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Relocate critical infrastructure, such as power lines, underground • Reinforce or relocate critical infrastructure such as powerlines so that it meets performance expectations. • Increase Capability: • Contact municipality or utilities to trim or remove trees that could affect power lines. • Create redundancy (e.g., backup generators). • Improve awareness of impending severe weather (e.g., obtain a NOAA weather radio). • Develop a Continuity of Operations Plan (COOP). • Monitor impending storm events so that you can release employees in such a manner as to not negatively impact emergency response personnel/services.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Harden infrastructure such as locating utilities underground. • Trimming trees back from power lines. • Designate and strengthen critical road sections and bridges. • Adopt ordinances that regulate the type and quantity of trees planted near utility lines. • Relocate critical infrastructure, such as power lines, underground. • Require minimum temperatures in housing/landlord codes. • Increase Capability: • Support programs such as "Tree Watch" that proactively manage problem areas by use of selective removal of hazardous trees, tree replacement, etc. • Enforce building codes. • Increase communication alternatives. • Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines. • Promote awareness and participation in alert systems. • Provide NOAA weather radios to the public. • Create/Enhance "mutual aid" agreements for response to all emergencies. • Create/identify evacuation routes to be utilized during severe storm events. • Develop debris management plans. • Join "Storm-Ready" program. • Provide early warning of impending hurricane events to identified critical or essential facilities. This would include facilities such as large employments centers, schools, hospitals. • Promote emergency power supplies to private property. • Improve, expand, or harden communications facilities and services. • Recruit additional emergency personnel or use mutual aid agreements. • Increase sheltering capabilities. • Increase capability to respond to power outages and downed power lines. • Establish partnerships with utility providers through pro-active planning.

TORNADO, WINDSTORM		
Personal Scale	Corporate Scale	Government Scale
• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Contact municipality or utilities to trim or remove trees that could affect power lines. • Plant appropriate trees near home and power lines (“Right tree, right place” National Arbor Day Foundation Program. • Increase Capability: • Improve awareness of impending severe weather (e.g., obtain a NOAA weather radio). • Promote 72-hour self-sufficiency. • Provide for redundant heat and power.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Relocate critical infrastructure, such as power lines, underground. • Reinforce or relocate critical infrastructure such as powerlines so that it meets performance expectations. • Retrofit pipes including locating water pipes on the inside of building insulation or keeping them out of vulnerable spaces to extreme cold. • Increase Capability: • Contact municipality or utilities to trim or remove trees that could affect power lines. • Create redundancy (e.g., backup generators). • Improve awareness of impending severe weather (e.g., obtain a NOAA weather radio). • Develop a Continuity of Operations Plan (COOP). • Monitor impending storm events so that you can release employees in such a manner as to not negatively impact emergency response personnel/services.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Harden infrastructure such as locating utilities underground. • Trimming trees back from power lines. • Designate and strengthen critical road sections and bridges. • Adopt ordinances that regulate the type and quantity of trees planted near utility lines. • Relocate critical infrastructure, such as power lines, underground. • Increase Capability: • Support programs such as “Tree Watch” that proactively manage problem areas by use of selective removal of hazardous trees, tree replacement, etc. • Enforce building codes. • Increase communication alternatives. • Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines. • Promote awareness and participation in alert systems. • Provide NOAA weather radios to the public. • Create/Enhance “mutual aid” agreements for response to all emergencies. • Create/identify evacuation routes to be utilized during severe storm events. • Develop debris management plans. • Join “Storm-Ready” program. • Provide early warning of impending severe storm events to identified critical or essential facilities. This would include facilities such as large employments centers, schools, hospitals. • Promote emergency power supplies to private property. • Improve, expand, or harden communications facilities and services. • Recruit additional emergency personnel or use mutual aid agreements. • Increase sheltering capabilities. • Increase capability to respond to power outages and downed power lines. Establish partnerships with utility providers through pro-active planning.

WINTER STORM		
Personal Scale	Corporate Scale	Government Scale
• Manipulate the Hazard: • None • Reduce exposure to the hazard: • Plant appropriate trees near home and power lines (“Right tree, right place” National Arbor Day Foundation). • Reduce vulnerability to the hazard: • Insulate House to provide greater thermal efficiency and reduce heat loss. • Provide redundant heat and power. • Insulate Structure. • Ensure natural gas input/release valves do not get covered in snow. • Increase Capability: • Trim or remove trees that could affect power lines. • Prepare emergency food and supplies to be self-sufficient for at least 72 hours in the event of a severe winter storm. • Be aware of inclement weather conditions and move your vehicles off the street as severe weather systems approach. • Retrofit structures.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Relocate critical infrastructure, such as power lines, underground. • Reinforce or relocate critical infrastructure such as powerlines so that it meets performance expectations. • Install tree wire. • Increase Capability: • Trim or remove trees that could affect power lines. • Create redundancy in utilities and communications. • Develop a Continuity of Operations Plan (COOP) to address operations before, during and after coastal storm events. • Utilize weather radios at the work place to keep your employees aware of severe weather conditions.	• Manipulate the Hazard: • None • Reduce exposure to the hazard: • None • Reduce vulnerability to the hazard: • Harden infrastructure such as locating utilities underground where appropriate. • Trimming trees back from power lines. • Designate snow routes and strengthen critical road sections and bridges. • Adopt codes and regulations that address the issues of parking of vehicles along roadways during severe weather events. • Develop or enhance the capacity/capability of stormwater conveyance systems. • Provide backup power sources at vital critical facilities. • Increase Capability: • Support programs that proactively manage problem areas by use of selective removal of hazardous trees, tree replacement, etc. • Establish and enforce building codes that require all roofs to withstand snow loads--Develop/Improve/Enforce building Codes in Hazard Areas. • Increase communication alternatives. • Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines. • Provide weather radios to vulnerable populations. • Enhance public awareness campaigns to address those issues of alert and warning and actions to take during severe weather events. • Utilize the best available technology to enhance the warning systems for all severe weather events (i.e.: tornado warning systems). • Coordinate severe weather warning capabilities and the dissemination of warning amongst those agencies within the planning are with the highest degree of capability. • Encourage local ordinances for planting tree near lines and join Tree City USA. • Increase tree management programs. • Join the Community Rating System. • Join “Storm-Ready.” • Retrofit critical structures and promote hazard resistant construction. • Keep open communications and education of hazards for mobile home communities. • Retrofit above-ground utilities to underground facilities if appropriate.

WINTER STORM		
Personal Scale	Corporate Scale	Government Scale
		• Create a salt reserve or research alternates to stretch salt reserve. • Ensure accessibility to hospitals. • Provide better debris logistics and removal. • Provide better communication systems and back-up communication systems to inform public of hazards and to communicate during the hazard event.

APPENDIX K. PEMA PLANNING STANDARDS

This appendix includes the 2020 PEMA planning standards and guidelines for hazard mitigation planning.

APPENDIX L. DAM FAILURE PROFILE- FOR OFFICIAL USE ONLY

Due to the sensitive nature of this information, the Dam Failure Profile has been redacted for the public document. The full Dam Failure Profile is available at the City of Philadelphia Office of Emergency Management. Contact the Hazard Mitigation Program Manager, Noah Palau, to view the list.