

# **NYRCR** **City of** **Middletown**

NY Rising Community  
Reconstruction Plan

**DECEMBER 2014**

**NY RISING  
COMMUNITY  
RECONSTRUCTION  
PROGRAM**



# City of Middletown NYRCR Planning Committee

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*Cover photo is courtesy of Eric Thayer.*

# Foreword

## Introduction

In the span of approximately one year, beginning in August 2011, the State of New York experienced three extreme weather events. Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy wreaked havoc on the lives of New Yorkers and their communities. These tragic disasters signaled that New Yorkers are living in a new reality defined by rising sea levels and extreme weather events that will occur with increased frequency and power. They also signaled that we need to rebuild our communities in a way that will mitigate against future risks and build increased resilience.

To meet these pressing needs, Governor Andrew M. Cuomo led the charge to develop an innovative, community-driven planning program on a scale unprecedented and with resources unparalleled. The NY Rising Community Reconstruction (NYRCR) Program, within the Governor's Office of Storm Recovery (GOSR), empowers the State's most impacted communities with the technical expertise and funding resources needed to develop thorough and implementable reconstruction plans to build physically, socially, and economically resilient and sustainable communities.

## Program Overview

The NYRCR Program, announced by Governor Cuomo in April of 2013, is a more than \$700 million planning and implementation program established to provide rebuilding and resiliency assistance to communities severely damaged by Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy. Drawing on lessons learned from past recovery efforts, the NYRCR Program is a unique combination of bottom-up community participation and State-provided technical expertise. This powerful combination recognizes not only that

community members are best positioned to assess the needs and opportunities of the places where they live and work, but also that decisions are best made when they are grounded in rigorous analysis and informed by the latest innovative solutions.

Launched in the summer of 2013 and completed in March 2014, Round I of the NYRCR planning process included 50 NYRCR Planning Areas, comprising 102 storm-impacted localities. In January 2014, Governor Cuomo announced a second round of the planning process, serving an additional 22 storm-impacted localities. Four of these localities were absorbed into existing Round I NYRCR Planning Areas, bringing the number of localities participating in Round I up to 106; the other 18 localities formed 16 new Round II NYRCR Planning Areas. Between Rounds I and II, there are 66 NYRCR Planning Areas, comprising 124 localities. The program serves over 2.7 million New Yorkers and covers nearly 6,500 square miles, which is equivalent to 14% of the overall State population and 12% of the State's overall geography.

In Rounds I and II, the State allotted between \$3 million and \$25 million to each participating locality for the implementation of eligible projects identified in the NYRCR Plan. The funding for these projects is provided through the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant – Disaster Recovery (CDBG-DR) program.

Each NYRCR Planning Area is represented by a NYRCR Planning Committee composed of local residents, business owners, and civic leaders. Members of the Planning Committees were identified in consultation with established local leaders, community organizations and, in some cases, municipalities. The NYRCR Program sets a new standard for community participation in recovery and resiliency planning, with community members leading the planning process. Across the



State, more than 650 New Yorkers have represented their communities by serving on Planning Committees. Nearly 650 Planning Committee Meetings have been held, during which Planning Committee members worked with the State's team to develop community reconstruction plans, which identify opportunities to make their communities more resilient. All meetings were open to the public. An additional 250+ Public Engagement Events attracted thousands of community members, who provided feedback on the planning process and resulting proposals. The NYRCR Program's outreach has included communities that are traditionally underrepresented, such as immigrant populations and students. All planning materials are posted on the program's website ([www.stormrecovery.ny.gov/nyrcr](http://www.stormrecovery.ny.gov/nyrcr)), providing several ways for community members and the public to submit feedback on the program and materials in progress.

Throughout the planning process, Planning Committees were supported by staff from GOSR, planners from New York State (NYS) Department of State and NYS Department of Transportation, and consultants from world-class planning firms that specialize in engineering, flood mitigation solutions, green infrastructure, and more.

The NYRCR Program does not end with this NYRCR Plan. Governor Cuomo has allotted over \$700 million for planning as well as implementing eligible projects identified in NYRCR Plans. NYRCR Planning Areas are also eligible for additional funds through the NY Rising to the Top Competition, which evaluates applications from Round II NYRCR Planning Committees across three categories—Regional Approach, Inclusion of Vulnerable Populations, and Use of Green Infrastructure. The winner of each category will be allotted a share of the competition's \$3.5 million to fund additional eligible projects.

In April 2014, Governor Cuomo announced that projects identified in NYRCR Plans would receive priority consideration through the State's Consolidated Funding Application (CFA) process and charged the Regional Economic Development Councils (REDCs), which play an advisory role in the CFA process, to support

NYRCR projects. In December 2014, Governor Cuomo announced that 24 NYRCR projects received nearly \$12 million in CFA funding. This announcement is an example of the Governor honoring his commitment to leverage the work of the NYRCR Planning Committees to incorporate resilience into other State programs and to find additional sources of funding for NYRCR projects. The NYRCR Program is also working with both private and public institutions to identify existing funding sources and to create funding opportunities where none existed before.

The NYRCR Program has successfully coordinated with State and Federal agencies to help guide the development of feasible projects. The program has leveraged the REDC State Agency Review Teams (SARTs), composed of representatives from dozens of State agencies and authorities, for feedback on projects proposed by NYRCR Planning Committees. The SARTs review projects with an eye toward regulatory and permitting needs, policy objectives, and preexisting agency funding sources. The NYRCR Program is continuing to work with the SARTs to streamline the permitting process and ensure shovels are in the ground as quickly as possible.

On the pages that follow, you will see the results of months of thoughtful, diligent work by the City of Middletown NYRCR Planning Committee, which is passionately committed to realizing a brighter, more resilient future for its community.

## The NYRCR Plan

This NYRCR Plan is an important step toward rebuilding a more resilient community. Each NYRCR Planning Committee began the planning process by defining the scope of its planning area, assessing storm damage, and identifying critical issues. Next, the Planning Committee inventoried critical assets in the community and assessed the assets' exposure to risk. On the basis of this work, the Planning Committee described recovery and resiliency needs and identified opportunities. The Planning Committee then developed a series of comprehensive reconstruction and resiliency strategies,



and identified projects and implementation actions to help fulfill those strategies.

The projects and actions set forth in this NYRCR Plan are divided into three categories. The order in which the projects and actions are listed in this NYRCR Plan does not necessarily indicate the Planning Committee's prioritization of these projects and actions. Proposed Projects are projects proposed for funding through an NYRCR Planning Area's allotment of CDBG-DR funding. Featured Projects are projects and actions that the Planning Committee has identified as important resiliency recommendations and has analyzed in depth, but has not proposed for funding through the NYRCR Program. Additional Resiliency Recommendations are projects and actions that the Planning Committee would like to highlight and that are not categorized as Proposed Projects or Featured Projects. The Proposed Projects and Featured Projects found in this NYRCR Plan were voted for inclusion by voting members of the Planning Committee. Those voting members with conflicts of interest recused themselves from voting on any affected projects, as required by the NYRCR Ethics Handbook and Code of Conduct.

As part of Round II of the NYRCR Program, the City of Middletown NYRCR Planning Area has been allotted up to \$3 million in CDBG-DR funds for the implementation of eligible projects identified in this plan.

While developing projects for inclusion in NYRCR Plans, Planning Committees took into account cost estimates, cost-benefit analyses, the effectiveness of each project in reducing risk to populations and critical assets, feasibility, and community support. Planning Committees also considered the potential likelihood that a project or action would be eligible for CDBG-DR funding. Projects and actions implemented with this source of Federal funding must satisfy a Federally-designated eligible activity category, fulfill a national

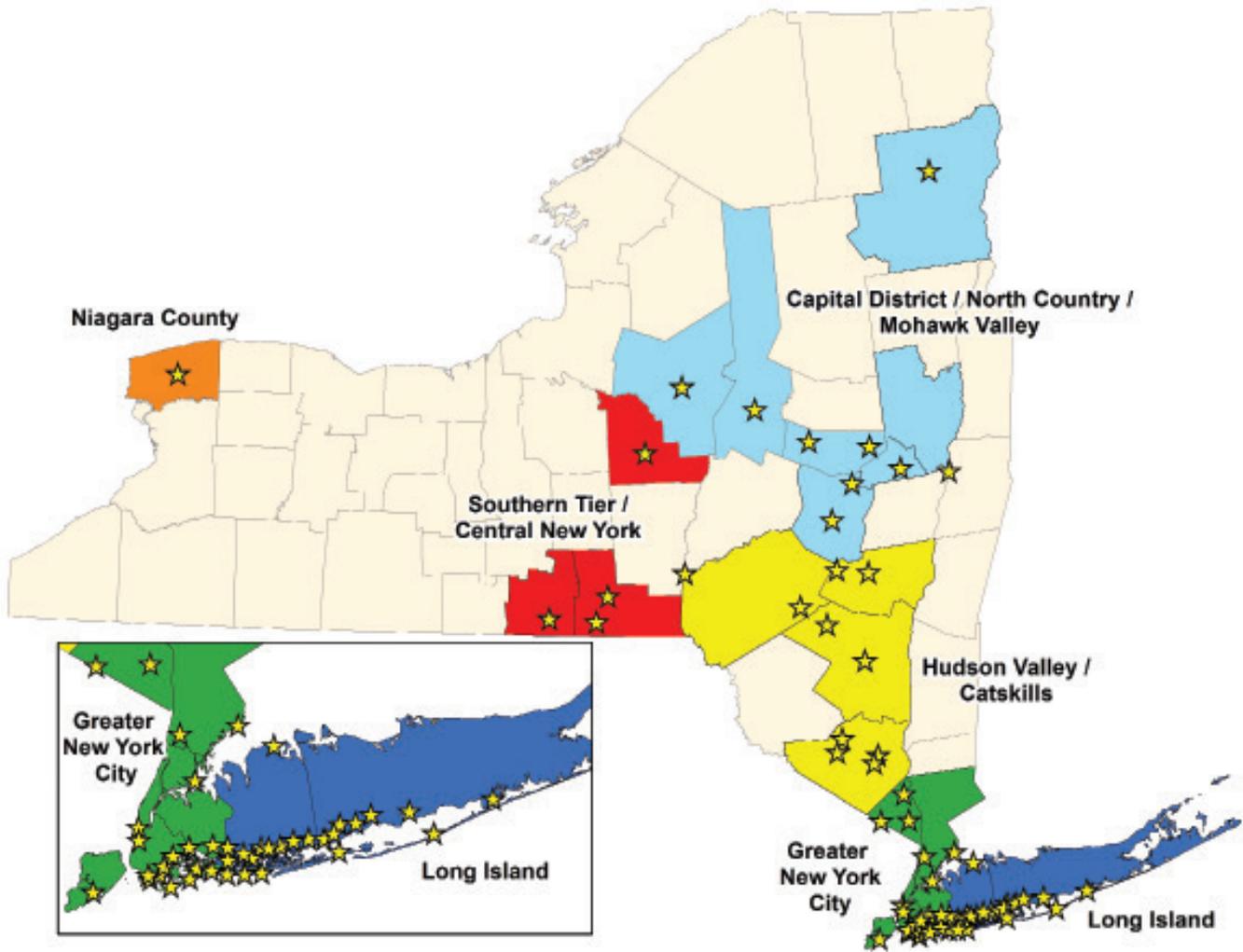
objective (i.e., meeting an urgent need, removing slums and blight, or benefiting low- to moderate-income individuals), and have a tie to the natural disaster to which the funding is linked. These are among the factors that GOSR will consider, in consultation with local municipalities and nonprofit organizations, when determining which projects and actions are best positioned for implementation.

The total cost of Proposed Projects in this NYRCR Plan exceeds the NYRCR Planning Area's CDBG-DR allotment to allow for flexibility if some Proposed Projects cannot be implemented due to environmental review, HUD eligibility, technical feasibility, or other factors. Implementation of the projects and actions found in this NYRCR Plan are subject to applicable Federal, State, and local laws and regulations, including the Americans with Disabilities Act. Inclusion of a project or action in this NYRCR Plan does not guarantee that a particular project or action will be eligible for CDBG-DR funding or that it will be implemented. Projects will be implemented on a staggered timeline, and the NYRCR Program will choose an appropriate State or local partner to implement each project. GOSR will actively seek to match projects with additional funding sources, when possible.

In the months and years to follow, many of the projects and actions outlined in this NYRCR Plan will become a reality, helping New York not only to rebuild, but also to build back better.



# NYRCR Communities



*Note: Map displays the 66 NYRCR Planning Areas from Rounds I and II. (Five of the Round I Planning Areas—Niagara, Herkimer, Oneida, Madison, and Montgomery Counties—are not funded through the CDBG-DR program.)*



# Contents

**Executive Summary ..... viii**

**Section 1: Community Overview.....1**

**A Collaborative, Innovative Approach .....2**

    Recovery Support Functions.....2

**City of Middletown NYRCR Plan Geographic Scope.....2**

**Description of Storm Damage .....6**

    Hurricane Irene and Tropical Storm Lee.....6

    Damages along Monhagen Brook .....8

    Damages along Draper Brook.....9

    Superstorm Sandy ..... 11

**National Flood Insurance Program in the City of Middletown..... 14**

**Flood Hazard Areas ..... 15**

**Community Character, Critical Issues..... 18**

    Geographic Overview..... 18

    Key City Components ..... 18

**The People of Middletown .....19**

    Social Vulnerability ..... 22

    Transportation and Local Facilities ..... 24

**Diversity of Housing Options .....26**

**High Cost of Repetitive Flooding .....27**

**Economic Character, Concerns, and Potential .....27**

    Land Use Planning and Development ..... 28

**Critical Issues ..... 32**

**Community Vision..... 32**

    City of Middletown NYRCR Planning Goals ..... 32

**Relationship to Regional Plans ..... 33**

    Review of Existing Plans ..... 33



**Section 2: Assessment of Risk and Needs.....39**

**Description of Community Assets and Assessment of Risk .....39**

    Introduction and Overview ..... 39

    Inventory Process ..... 39

    Description of Community Assets ..... 41

    Assessment of Risk to Assets and Systems ..... 54

**Assessment of Needs and Opportunities.....65**

    Community Planning and Capacity Building ..... 65

    Economic Development..... 65

    Health and Social Services ..... 66

    Housing..... 66

    Infrastructure..... 67

    Natural and Cultural Resources ..... 68

**Strategy 3: Reconstruction and Resiliency Strategies.....71**

**Strategy 1. ....72**

**Strategy 2. ....75**

**Strategy 3 .....78**

**Strategy 4 .....80**

**Strategy 5 .....82**

**Strategy 6 .....84**

**Section 4: Proposed and Featured Project Profiles .....91**

**Proposed Projects .....93**

    Monhagen Brook Culvert and Dredging Project..... 93

    Dorothea Dix Drive Flood Retention / Wetland Construction / Restoration  
    Project (Phase I) ..... 98

    West Main Street Streambank Mitigation ..... 105

    Culvert Improvements at West Main Street and Monhagen Avenue ..... 112

    Maple Hill Park Improvements ..... 117



<b>Featured Projects .....</b>	<b>124</b>
Bridge Upgrade to Middletown New Jersey Railroad Bridge .....	124
Sterling Street/Genung Street/West Main Street Buy-out/Elevation Program.....	130
SUNY Orange County Community College Public Safety/Emergency Operations Center/Fire/Emergency Medical Services/Shelter .....	135
<b>Section 5: Additional Materials.....</b>	<b>141</b>
Additional Resiliency Recommendations .....	141
Master Project Table .....	143
Risk Assessment Methodology .....	154
Glossary .....	186
End Notes .....	188



# Executive Summary

## Overview

**N**estled between the Shawangunk Mountains and the Wallkill River, the City of Middletown (City) is located in the heart of the Hudson Valley. The City primarily consists of a residential community with commercial and industrial properties scattered throughout. Commercial businesses can be found along the City's major arterial roads – East Main Street, West Main Street, Route 211, and Route 17M.

The City's Central Business District is made up of residential, commercial, industrial, and mixed-use properties and is considered the lifeblood of Middletown. The Monhagen Brook also bisects this area of the City. The Brook and its tributaries serve as the main source of drinking water for the City; however, it is also the City's main source of flooding. Hurricane Irene caused major flooding along Monhagen Brook, which inundated and severely damaged or destroyed homes and businesses in the center of Middletown. Flooding incapacitated the City's emergency services and its ability to reach its population of 28,086 people.

To address the impacts of regular flooding and to bolster resiliency against future storms, the City of Middletown formed a planning area under the guidance and funding of New York Governor Andrew M. Cuomo's NY Rising Community Reconstruction (NYRCR) Program. The City of Middletown NYRCR Plan aims to address the most critical needs and impacts from major storm events while identifying projects and strategies to encourage future resiliency, increase safety and quality of life, and inject incentives for economic growth. The Committee's highest priorities in the City of Middletown NYRCR Plan are synthesized into projects that could become realities with an NYRCR Program allotment of up to \$3 million.

The NYRCR Plan, an eight-month exercise of intense community collaboration, public engagement and input, and scientific observation and analysis, reflects the Community's can-do spirit through achievable projects and implementation strategies to rebuild with resiliency and to guard against future natural disasters.

## Critical Issues

During the initial City of Middletown NYRCR Planning Committee Meetings (Committee Meetings), the City of Middletown NYRCR Committee (Committee) identified several key challenges to creating resiliency, developing economic growth, and enhancing the quality of life in the City. These critical issues include:

- Aging, undersized, and damaged stormwater infrastructure;
- Deterioration and prevalence of lingering damages to roadways from increasingly intense storm events;
- Lack of appropriate emergency response access to the southern side of the City during intense storm events;
- Uncoordinated development in the upstream Monhagen and Draper Brook watersheds;
- Lack of strategically located open space and green/infiltration areas within the densely developed City;
- Lack of interconnected green infrastructure and open space;
- Socially vulnerable populations located in flood hazard areas;
- Local business interruptions and economic loss due to flooding damages, power loss, and flooded access routes during storm events;



- Extreme flood events that adversely affect performance of the City's wastewater treatment plant and its available capacity due to inflow/infiltration systems;
- Underutilization of vacant properties and lack of strategic investment; and
- Disinvestment of commercial and retail within the Central Business District due to the high density shopping and retail center in the Town of Wallkill.

*In the wake of the devastation caused by recent significant storm events, the City of Middletown will embark on a comprehensive planning process focused on building more resilient infrastructure, economy, and open space. Developing a coordinated plan to attract economic and housing reinvestment will enrich the quality of living for the City's residents.*

## A Community-Driven Process

Meeting this planning challenge with the same collaborative spirit that drove response and recovery efforts, the Committee reviewed existing plans and studies, engaged in scientific and cost-benefit analyses and risk assessments, and conducted extensive, multimedia public outreach and engagement.

Public input underscored every phase of the planning process and was essential to project identification and strategy development. A comprehensive communications strategy deliberately incorporated multiple means and measures to reach residents and homeowners; non-resident property owners; business owners; and educational, community, faith-based, and social service organizations across the public and private sectors.

Specific venues for public involvement and engagement included open weekly or bi-weekly NYRCR Committee Meetings, online and hard copy surveys, door-to-door visits, interviews of community, first response, and social service agencies, televised community-wide public meetings.

## Vision Statement

Through collaborative discussions, stakeholder engagement, reviews of existing plans and studies, and a focused intention towards holistic community recovery, the Committee adopted the following vision to guide the recovery and resiliency effort for the City of Middletown NYRCR Plan.

## A Blueprint for Implementation

The storms of 2011 and 2012, although extreme events, were just the latest in a series of natural disasters that have devastated the City of Middletown. The Committee and the public relied on a multi-generational body of knowledge and experience, augmented by anecdotal evidence and scientific analysis, including hydraulic modeling, to identify Middletown's primary needs, risks, and critical issues, all of which provided a blueprint for project and strategy realization.

The City of Middletown NYRCR Plan aims to bolster the resiliency of existing critical assets and any proposed post-storm new construction projects to future storm events. The Committee first identified and analyzed the City's economic, healthcare and social services, housing, infrastructure, and natural and cultural resources to assess prospective risk if these assets were lost or impaired due to flooding. The Committee then evaluated overall risk to these assets, with a particular eye toward flooding by the Monhagen and Draper Brooks and their tributaries that wind through the City.

Next, the Committee developed a number of strategies to address the most critical health, safety, resiliency, and quality of life needs identified by the Community and the Committee. Analysis, ongoing discussions during Committee Meetings, and public feedback served as the basis for these strategies. These strategies reflect the community's values, issues, needs, and opportunities. They are the foundation for identifying and prioritizing projects that will work towards the comprehensive recovery and resiliency of the City. The strategies became the foundation for projects and actions proposed in this Plan for available Community



Development Block Grant – Disaster Recovery (CDBG-DR) funding.

After months of analysis, Public Engagement Events, and strategizing at Committee Meetings, the Committee developed a finalized project list for inclusion in the Middletown NYRCR Plan. The projects were classified in three categories. The three-tiered methodology was designed to identify and consider the full range of potential actions and outcomes, while providing a clear direction toward project implementation.

**Proposed Projects** are those recommended for funding through the City’s allotment of CDBG-DR funding.

**Featured Projects** are projects and actions that the Planning Committee has identified as important resiliency recommendations and has analyzed in depth, but has not proposed for funding through the NYRCR Program.

**Additional Resiliency Recommendations** are projects and actions the Committee has highlighted, but which are not categorized as Proposed or Featured Projects.

## From Strategies to Implementable Projects

The City of Middletown NYRCR Plan is grounded in six strategies that capture critical needs expressed by the Community and analyzed during the planning process. Strategies yielded proposed and featured projects, and additional resiliency recommendations to collectively remediate, mitigate, rebuild, and incentivize a renewed City of Middletown.

### Strategies

**Strategy 1:** Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.

**Strategy 2:** Enhance and repair existing stormwater infrastructure, culverts, and drainage ways to ensure the

City can safely grow the economy, improve safety, and reduce future losses.

**Strategy 3:** Develop planning capacity and zoning capabilities to help promote integrated and functional relationships with Community partners.

**Strategy 4:** Provide and promote services that sustain human health and well-being throughout the life cycle of a disaster.

**Strategy 5:** Ensure housing opportunities are both flood-resilient and affordable for current and future residents, of all needs and ages, through local ordinances and mitigation initiatives.

**Strategy 6:** Preserve, protect, restore, and where possible, enhance or develop the natural, recreational, and cultural assets of the City.

## Projects

### MONHAGEN BROOK CULVERT AND DREDGING PROJECT

This project includes the following:

- Dredging and removal of sediment in and along the culvert;
- Removal of piers at the confluence of the Monhagen and Draper Brooks, and the replacement of this section and other damaged sections of culverts; and
- Re-channelization of the section of Monhagen Brook directly downstream of Genung Street. **(Proposed Project)**

### DOROTHEA DIX DRIVE FLOOD RETENTION/WETLAND CONSTRUCTION/RESTORATION PROJECT

The first phase of the project will include the acquisition of the 8.2-acre property and the demolition and removal of the existing parking lot area. It will include the engineering, construction, and re-channelization of the Monhagen Brook; the development of the first



phase of wetland mitigation areas; and the construction of the first phase of recreational features that include some sections of the proposed trail system and interpretive signage.

The second phase will include the renovation of the existing vacant building to be used as a community recreation center, which could also function as an Emergency Operation Center (EOC) and shelter. This phase would also include (1) the acquisition and preparation of a portion of the 63-acre property adjacent to the Phase I potential project site to create additional areas of mitigated wetlands, and (2) the development of the second phase of boardwalk and trail construction, along with other recreation features. Phase II is not proposed as part of this funding round. **(Proposed Project – Phase I)**

### CULVERT IMPROVEMENTS AT WEST MAIN STREET AND MONHAGEN AVENUE

The project will include the removal of the existing twin culverts and the upgrade of that section of culvert to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project will also include streambank mitigation of the day-lighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert. **(Proposed Project)**

### WEST MAIN STREET STREAMBANK MITIGATION

This project includes the restoration of streambanks and surrounding riparian area by West Main Street to improve flow conditions, reduce erosion, and provide additional flood attenuation, if possible. Consideration for regenerative design techniques could be used. **(Proposed Project)**

### MAPLE HILL PARK IMPROVEMENTS

This project will improve the existing berm/dam to create additional floodwater retention while enhancing the facility as a recreational amenity. This can work in concert with the other upstream wetland construction

and stormwater retention projects to alleviate or reduce flooding downstream along West Main Street, Monhagen Avenue, Fulton Avenue, Sterling Street, and Dolson Avenue. **(Proposed Project)**

### BRIDGE UPGRADE TO MIDDLETOWN NEW JERSEY RAILROAD BRIDGE

The Middletown New Jersey Railroad Bridge is identified as a pinch point as it crosses the Monhagen Brook. The proposed project would upgrade the bridge, which would include widening the culvert and bridge. This project will improve flow capacity and convey floodwaters. Reducing the threat of damage to the railroad line allows commerce to continue during and after a storm event. **(Featured Project)**

### STERLING/GENUNG/WEST MAIN BUY-OUT/ELEVATION PROGRAM

The goal of this project is to create a fund establishing a buy-out or elevation program for those properties repetitively flooded in the Sterling Street, Genung Street, and West Main Street neighborhoods. The buy-out/elevation program will enhance recreational opportunities for citizens within the newly formed open space while also helping to mitigate flooding. **(Featured Project)**

### EMERGENCY EVACUATION EQUIPMENT

This project seeks to expand the capability of the local response community through existing equipment donations programs to provide evacuation support in times where the local community is impacted by flooding. Participation in military surplus donation programs will allow the jurisdiction, with little to no cost, to secure high water capable vehicles that would aid them in times of disaster and provide valuable resources to the general public. **(Featured Project)**

Note: Proposed and Featured Projects are captured according to their associated strategy in the table that follows.



## CITY OF MIDDLETOWN NYRCR PLAN

City of Middletown NYRCR Projects	Proposed Project	Featured Project	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6
Monhagen Brook Culvert and Dredging Project	<b>X</b>		<b>X</b>	<b>X</b>			<b>X</b>	<b>X</b>
Dorothea Dix Drive Flood Retention/Wetland Construction/Restoration Project	<b>X</b>		<b>X</b>	<b>X</b>			<b>X</b>	<b>X</b>
West Main Street Stream Bank Mitigation	<b>X</b>		<b>X</b>	<b>X</b>			<b>X</b>	<b>X</b>
Culvert Improvements at West Main Street and Monhagen Ave	<b>X</b>		<b>X</b>	<b>X</b>				
Maple Hill Park Improvements		<b>X</b>	<b>X</b>	<b>X</b>			<b>X</b>	<b>X</b>
Bridge Upgrade to Middletown New Jersey Railroad Bridge		<b>X</b>	<b>X</b>	<b>X</b>				
Emergency Evacuation Equipment		<b>X</b>				<b>X</b>		
Sterling/Genung/West Main Buy-out/Elevation Program		<b>X</b>			<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>



*Photo is courtesy of Eric Thayer.*

# Section 1

Community Overview



*Photo is courtesy of Eric Thayer.*



# Section 1: Community Overview

## Flooding in the Heart of a City

*On a typical day in the City of Middletown, people can be seen driving, walking, and cycling along Fulton Street, emblematic of the hustle and bustle that characterizes this vibrant and active community. However, most residents are acutely aware of the unseen potential danger beneath the roadway.*

*On August 28, 2011, as Hurricane Irene made landfall, residents of the Southeastern Towers on Fulton Street looked out across a raging river that flowed down the thoroughfare toward Sterling Street. Floodwaters surged at a blistering pace, completely inundating a supermarket and cutting off emergency response access to an eldercare facility that stranded seniors.*

*The City's emergency response team and other City employees resorted to using large backhoes and front-end loaders to safely evacuate stranded residents at a home near the intersection of Academy Avenue and Fulton Street. Less than two weeks later, Tropical Storm Lee unleashed a second round of punishing rains and flooding that resulted in even more devastation to the City of Middletown.*

In late August and early September 2011, back-to-back storms Hurricane Irene and Tropical Storm Lee became the most recent severe flood events in a long history of floods in the City of Middletown (City), New York. The devastating impacts and issues caused by these storms and the subsequent flooding impacted the lives of residents and businesses across the City. Even though emergency personnel, local volunteers, community groups, and service agencies worked diligently to respond to and recover from the damage inflicted by the flooding, much work remains even several years after the incidents.



*Floodwaters from Monhagen Brook raged down Fulton Street in the City of Middletown during Hurricane Irene. This cell phone-captured image is courtesy of the City of Middletown Department of Public Works.*



*Stormwater systems were swallowed by the deluge of water from the back-to-back storms that rocked the City of Middletown in late summer 2011. Photo is courtesy of the City of Middletown Department of Public Works.*

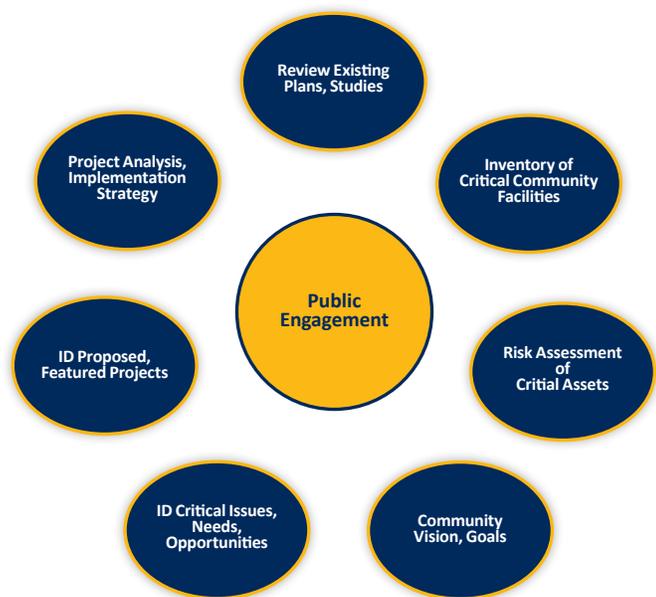
The Monhagen Brook runs directly beneath the center of Fulton Street and is one of the main sources of floodwater that routinely impacts the City. Ironically, while Monhagen Brook is the main source of drinking water for the City, it was also a significant source of flooding that damaged homes, destroyed public infrastructure, impeded emergency responder access, and isolated socially vulnerable populations. Because the City and the Monhagen Brook are inexorably linked, it is imperative to develop comprehensive strategies to address this unique relationship.



## A Collaborative, Innovative Approach

A collaborative, innovative approach, bolstered by comprehensive scientific analysis, underscored all elements of this City of Middletown NY Rising Community Reconstruction (NYRCR) Plan. The NYRCR Plan laid out recovery and resiliency strategies that strive to mitigate hardship and unpredictability in ways that enhance and protect lives, property, and infrastructure, while revitalizing economic prosperity and recreational amenities. See Figure 1.1 for a depiction of the planning process.

**FIGURE 1.1  
THE PLANNING PROCESS**



Source: Tetra Tech, Inc.

## Recovery Support Functions

The City of Middletown NYRCR Plan components, supporting analysis, and subsequent recommendations focus on the six Recovery Support Functions (RSFs) identified by the Federal Emergency Management Agency’s (FEMA) National Disaster Recovery Framework (NDRF). The NDRF is the coordinating structure for key areas of Federal emergency assistance. See Figure 1.2 for a depiction of the RSFs.

**FIGURE 1.2  
RECOVERY SUPPORT FUNCTIONS**



## City of Middletown NYRCR Plan Geographic Scope

The City of Middletown is located in the western part of the Hudson Valley, between the Shawangunk Mountains and the Wallkill River, about a 1.5-hour drive northwest of New York City. The City of Middletown is bordered by the Town of Wallkill to the north, west, and east, and by the Town of Wawayanda to the south.

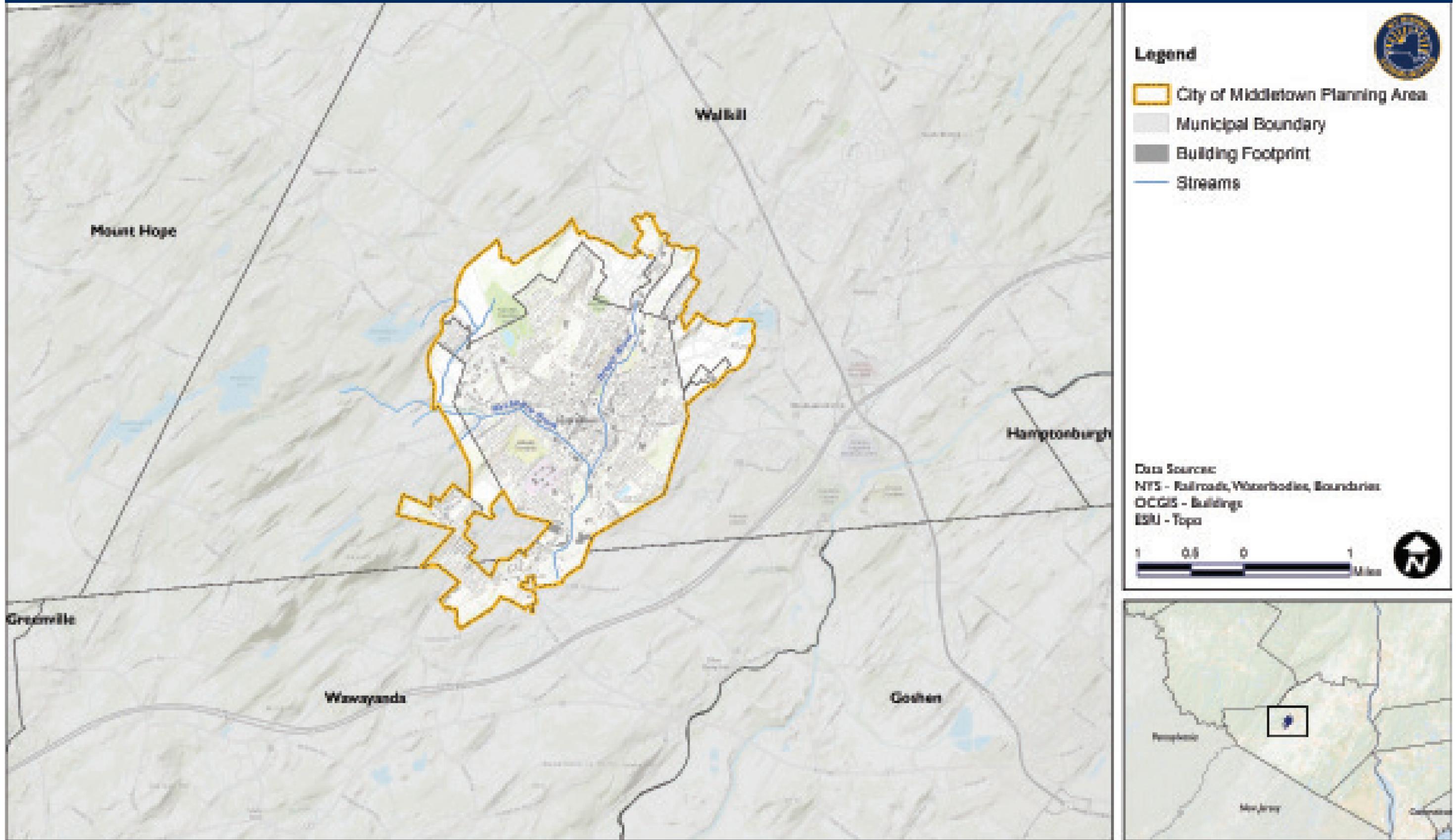
The Monhagen Brook and the Draper Brook systems are the main watercourses in the City; however, the majority of the Monhagen Brook and Draper Brook watersheds are located in the Town of Wallkill. Therefore, the City’s watercourses depend on the activities and management of these Brooks in the adjacent towns.

The Committee and the Consultant Team expanded the geographic scope of the City of Middletown NYRCR Plan Area (Plan Area) to include key sections of the upstream watersheds in the Town of Wallkill. This expansion was based on hydrologic connectivity with parts of the Town of Wallkill, a review of past storm events, the sources of historical flooding, and the location of vulnerable critical City facilities.

The Committee acknowledged the regional benefits of collaboration in developing, analyzing, and implementing projects that would mutually benefit both the City of Middletown and the Town of Wallkill. A map of the City of Middletown NYRCR Plan Area is depicted in Figure 1.3.



*As pictured above, autumn’s fallen leaves color the landscape and waterways in the City. Photo is courtesy of Eric Thayer.*





Hurricane Irene and Tropical Storm Lee inflicted significant damage to the City of Middletown Department of Public Works facilities along Monhagen Avenue. This cell phone image of a washed away road is indicative of the devastation and danger severe flooding poses. Image is courtesy of the City of Middletown DPW.

## Description of Storm Damage

The description of storm damage was developed through community outreach, interviews and research.

## Hurricane Irene and Tropical Storm Lee

### AUGUST TO SEPTEMBER 2011

Hurricane Irene moved across southeast New York State on August 28, 2011, bringing extended periods of heavy rainfall (over 8.5 inches of rain in a 12-hour period), resulting in widespread flooding across the area. High winds and flooding from the storm created debris depositions, and caused major damage to infrastructure throughout the region. These two storms had a major impact on the City, which was completely inundated with floodwaters along major thoroughfares

and was exacerbated by damaged stormwater and roadway infrastructure.

The deluge caused by Hurricane Irene propelled a huge volume of water through channelized sections of the Monhagen Brook, resulting in severe damage at Monhagen Avenue and Fulton Avenue. The City of Middletown Department of Public Works (DPW) facilities and properties along Monhagen Avenue were severely damaged. The City’s DPW facility had about four feet of water in the building.

**Power outages, impassable roadways, and compromised communications capabilities were among the storm damages.**

Meanwhile, although City Hall lost power, it had a back-up generator. The entire Central Business District (CBD) of the City of Middletown was without power for nearly a week. Several arterial roadways that provide access into and out of the City were completely cut off.



A DPW team member points out the height of floodwaters in the DPW garage along Monhagen Avenue during Hurricane Irene. Photo is courtesy of Tetra Tech, Inc.



Emergency response services, including those from the Central Firehouse pictured above, were cut off from reaching many locations throughout the City of Middletown, as floodwaters swallowed major thoroughfares. Photo is courtesy of Tetra Tech, Inc.

State Highway Route 211, which serves as the main access way east of the City and for Interstate 84, was completely inundated with several feet of floodwaters.

Academy Avenue, which provides access from the south, was completely flooded and impassable from the intersection of Dolson Avenue to Fulton Avenue. Monhagen Avenue and West Main Street were also flooded, thus impeding access to and from the City from the west. Access on the north side of the City was impacted by severe flooding along Wisner Avenue, southeast of the intersection with North Avenue.

Flooding essentially cut off major access points on all sides of the City. This isolated residents who tried to evacuate, and it prohibited access to neighboring emergency service personnel and equipment that could not get into the City. Flooding along Monhagen Avenue and Fulton Avenue also bisected the City in two sections, from east to west. Emergency service personnel and equipment, primarily located on the north side of the City, were unable to access the people and areas on the southern side of the City.

**The City was paralyzed in the wake of Hurricane Irene, as the storm eliminated access to, from, and within the City.**

The Pocatello Lake Outlet, located at the Aspen Townhouses on County Route 78, flooded during Hurricane Irene. Floodwaters destroyed the flood diversion wall and caused damage to townhouse property roads, city streets, and drainage channels along County Route 78 and North Aspen Drive.

Draper Brook also overflowed its banks and flooded areas of Wisner Avenue, Smith Street, Route 211, Grove Street, and Grant Street. These areas continue to be problematic since Hurricane Irene and Tropical Storm Lee because of lingering damages to the area's infrastructure.

During Hurricane Irene, widespread flooding completely inundated residences along Sterling Street and Genung Street. Flooding near the intersection of East Main Street and Academy Avenue was particularly problematic, as it prevented emergency personnel and vehicles stationed at the Central Firehouse from accessing the southern side and other areas in the City.

The City also suffered infrastructure damage to several culverts and roadways over the top of culverts. On Fulton Avenue, the force of the floodwaters caused the culvert to rupture, causing entire sections of the roadway to uplift and create huge craters in the roadway once floodwaters subsided.



Roads sunk and were washed away, as pictured above at left, as a result of raging floodwaters that turned streets into rivers, such as the image pictured above at right. Damages from Hurricane Irene and Tropical Storm Lee exceeded \$7 million. Photos are courtesy of the City of Middletown Department of Public Works.

### THE ONE-TWO PUNCH

Less than two weeks after Hurricane Irene blew through the City, Tropical Storm Lee brought heavy rains (five inches of rain over the course of the storm) and additional flooding across parts of central and southeastern New York State. The already devastated City was once again struck by high winds, heavy rains, and flooding.

The chaos caused by these two storms in the City of Middletown was not only engraved in the memories of residents, it was captured by photojournalists and videographers. Many of these were posted on public media outlets and documented the degree of destruction the City experienced.

After the two storms, the City developed a list of major and minor damages. Major damages totaled \$6,874,031, and minor damages were \$260,769, with a total damages cost of \$7,134,800. These costs were attributable to damage to roadways, culverts, the City of Middletown DPW garage, and the removal of a pier. Table 1.1 describes the location and costs of damages sustained in the City.

From August 28, 2011, through May 18, 2012, the City of Middletown met with FEMA, the New York State Office of Emergency Management (NYS OEM), and the Orange County Office of Emergency Management (Orange County OEM) to discuss recovery efforts and eligibility requirements for various grant programs.

The following discussion on damages to the Monhagen and Draper Brook drainageways is based on information documented in the Town of Wallkill and City of Middletown Natural Hazards Mitigation Plan (2014).

### Damages along Monhagen Brook

The Monhagen Brook drainageway represents one of the most significant problem areas for flooding in the City of Middletown. This is due, in part, to the large watershed that collects water and channels it directly downstream into and through the City of Middletown. Undersized culverts and debris sometimes compound this problem by frequently clogging the channel during significant storm events. In turn, this prevents outflow from continuing downstream and out of the City, to the Wallkill River, and beyond. This area contains several vulnerable assets, such as multiple residential structures and numerous critical facilities. These include water extraction/treatment buildings, an electrical substation, a fire house, a pre-school, retirement homes, and a state-run home. Noted problem areas include:

### Damages along Monhagen Brook

- Pilgrim Estates neighborhood – Flooding occurred in Brewster Drive and along other streets and properties;
- County Road 78 near Monhagen Middle School, Egerton Road – Flooding prevented access to the middle school and adjacent Maple Avenue elementary school;



### Damages along Monhagen Brook (cont'd)

- Rear portion of properties along West Main Street – Channel of drainageway was damaged by significant storm events, and concrete sidewalks collapsed;
- Boyce Excavating property, east side of Monhagen Avenue – The culvert entrance is undersized, and the Boyce property and downstream City properties were flooded;
- City Water Department/City Street Department Garages, Monhagen Avenue – Buildings sustained flood damage;
- City Salt Storage Facility, Monhagen Avenue – Flooding destroyed a 12 x 8-foot concrete box culvert and the staging-loading area at the Salt Storage facility;
- Mill Street to Genung Street – Flooding along the open channel, upstream from Mill Street, resulted in debris that clogged the enclosed drainageway section downstream;
- Fulton Street and areas downstream to Genung Street – Flooding occurred along Monhagen Avenue; and
- Dolson Avenue – The entrance to the City wastewater treatment plant was blocked by floodwaters.

### Damages along Draper Brook

- Along Railroad, from Baker Development property to Wisner Avenue – Flooding damaged the railroad bed, the City DPW garage, and the parking lot at the end of Midland Avenue;
- Low Avenue, Smith Street, and Wickham Avenue – Streets and sidewalks flooded along portions of Low Avenue, Smith Street, and Wickham Avenue;
- Thrall Park – The Park was inundated by flooding;
- Railroad Avenue – Streets and sidewalks flooded along Railroad Avenue, from Grove Street to Cottage Street;
- Cottage Street – Streets and sidewalks flooded on Cottage Street, from Railroad Avenue to Roberts Street;
- Roberts Street – Flooding along Roberts Street,

across from East Main Street, blocked access to Central Firehouse; and

- Streets and sidewalks, private properties – Flooding along the lower portion of Draper Brook, from Grant Street to Genung Street, prevented access by emergency vehicles.

Since Hurricane Irene and Tropical Storm Lee, the City has experienced repeated flooding problems, particularly from the north, as floodwaters have fed into the Draper Brook drainageway. This caused repeated flooding along Wisner Avenue, Smith Street, Route 211, Grove Street, and Grant Street. An investigation into the cause of this increased flooding may be necessary.

The City's infrastructure damage estimates are listed in Table 1.1. The major damage points and road closures affecting the City during and after Hurricane Irene and Tropical Storm Lee are visualized in Figure 1.4.



**TABLE 1.1 - HURRICANE IRENE AND TROPICAL STORM LEE DAMAGES TO PUBLIC INFRASTRUCTURE IN THE CITY OF MIDDLETOWN**

Location	Amount (\$)	Major/Minor Damage
Academy to Republic Plaza Site	\$285,535	Major
East Avenue and Fulton Street Site	\$236,430	Major
Southwinds Corrugated Culvert Roof	\$681,501	Major
Mill Street to Salt Shed Site	\$1,647,000	Major
Salt Shed Site to City Street Department Garage	\$702,390	Major
City Street Department Garage to City Water Department Garage	\$835,633	Major
West Main Street Drainageway Site	\$649,951	Major
City Water Department Garage to Monhagen Avenue	\$1,345,507	Major
North Aspen and County Road 78 Jersey Barrier Site	\$179,831	Major
Pier Removal Academy Avenue-Genung Street	\$310,254	Major
Genung Street Culvert Crossing	\$8,915	Minor
86 Academy Site	\$3,395	Minor
South Street and Fulton Street Site	\$61,317	Minor
West Main Street Site	\$5,161	Minor
Little Avenue Site	\$26,895	Minor
Grant Street Site	\$44,362	Minor
Between Grant Street and Benton Avenue Site	\$24,560	Minor
Between Benton Avenue and East Main Street Site	\$31,198	Minor
Cottage Street Site	\$12,322	Minor
Wawayanda Avenue from Grandview to Fulton Street Site	\$12,891	Minor
Wawayanda Avenue Downstream from East Conkling Avenue Site	\$10,456	Minor
Waywayanda Avenue and Wawayanda Place Site	\$6,566	Minor
Lake Avenue Sidewalk Site	\$12,730	Minor
<b>TOTAL</b>	<b>\$7,134,800</b>	

Source: City of Middletown DPW, 2011.

Note: All determinations of minor vs. major damage were made by the City's engineer.

## Superstorm Sandy

### OCTOBER 2012

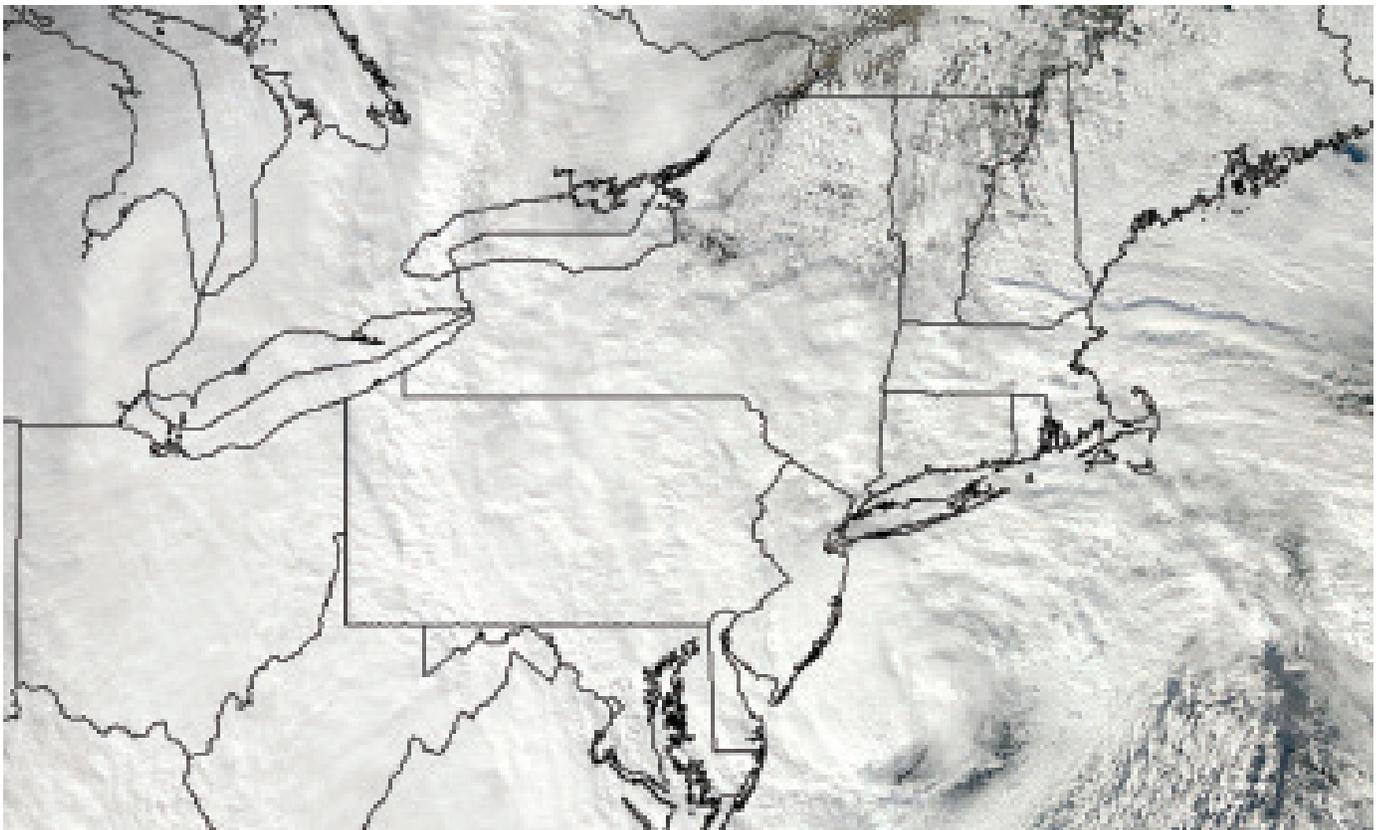
Superstorm Sandy made landfall on October 29, 2012, impacting the southeastern region of New York State with storm surge, high waves, and wind. Water levels rose along the entire East Coast, with the highest storm surges and greatest inundation levels occurring in New Jersey, New York, and Connecticut. This storm greatly affected the New York metropolitan area. As a result of this storm, 60 New Yorkers lost their lives; millions of residents in the region were impacted by flooded streets, water systems, and subways; over two million homes lost power; thousands of housing units were damaged; and hundreds of homes were destroyed (NYS HMP, 2014).

Although the City of Middletown was spared significant damage from Superstorm Sandy, the City was impacted by power outages due to high winds. Peak wind gusts in

close proximity to Middletown ranged from 58 mph in Montgomery to 61 mph at Orange Lake. In the City of Middletown, wind speeds were as high as 38 mph, and wind gusts ranged from 16-56 mph, according to the National Weather Service.

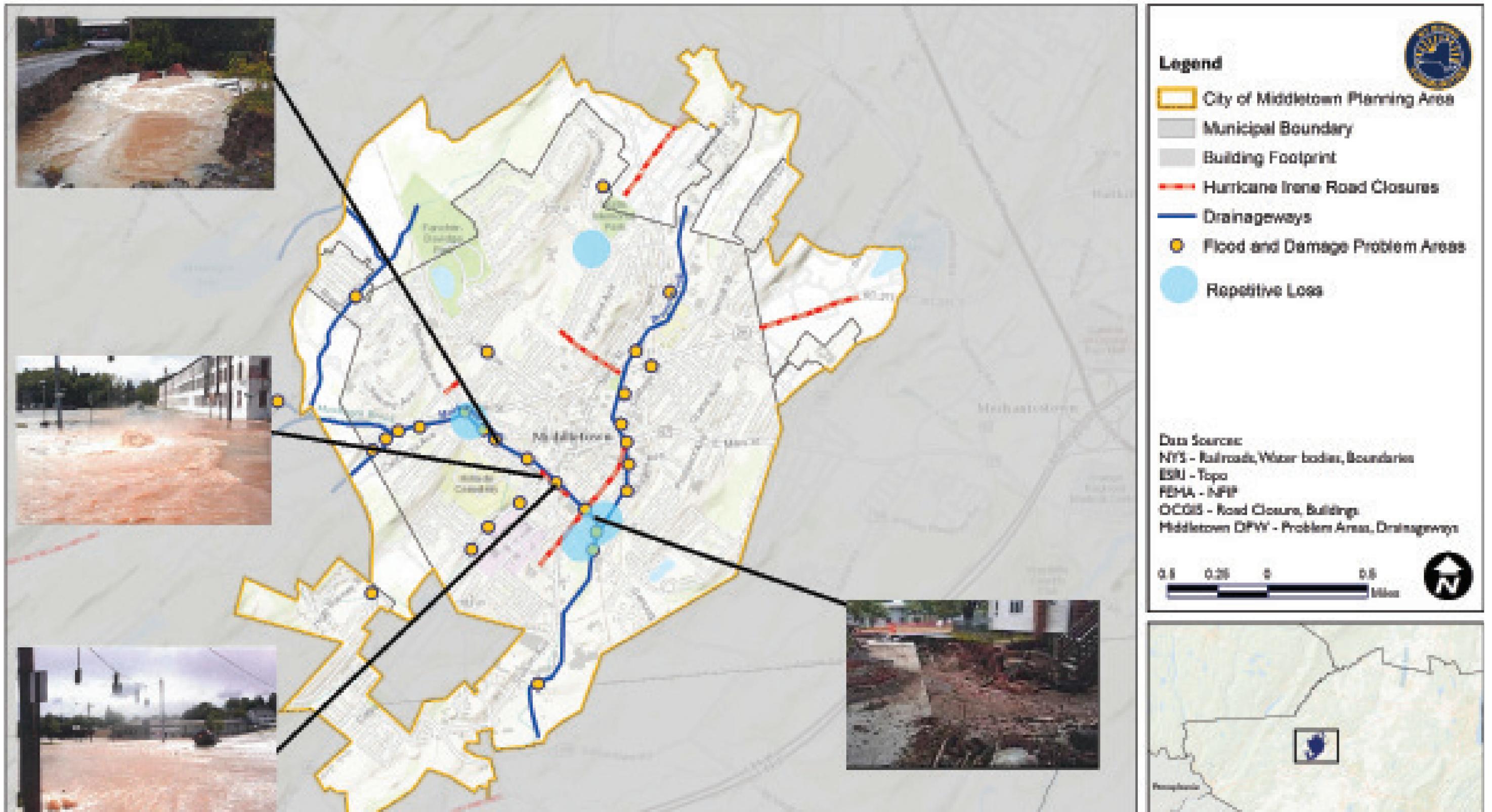
Orange County opened a shelter on Seward Avenue in Middletown to accommodate residents who were displaced due to power outages. Additionally, traffic lights were inoperable because of widespread power outages. Numerous roads were closed because of downed wires and trees in the City, including on Kennedy Terrace, Prospect Avenue, East Main Street, and Highland Avenue.

Winds blew off the roof of a home on Mount Hope Road, while a home's roof on North Street caught on fire because of downed electrical wires. The City declared a state of emergency. Schools closed for several days.



Satellite imagery of Superstorm Sandy landfall. Image is courtesy of NOAA.

**NYRCR: City of Middletown, Orange County**  
**FIGURE 1.4 - DAMAGES MAP**



Multiple images shown with the map on this page depict the location and extent of flooded streets and structures, along with associated damage at various locations throughout the City. Photos are courtesy of the City of Middletown DPW.



# National Flood Insurance Program in the City of Middletown

As of April 4, 2013, FEMA awarded more than \$102 million in individual assistance and \$459 million in public assistance grants to affected counties in the State of New York for disaster recovery.

National Flood Insurance Program (NFIP) information for flood-insured properties in the City of Middletown indicates that there are 125 NFIP policies in the City of Middletown, accounting for 58 claims and totaling \$545,362 in damages from Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy. Within City limits, it is estimated that a total of 250 structures valued at over

\$33 million reside in the 100-year floodplain. These structures fall under the following categories:

## BUILDINGS IN THE 100-YEAR FLOODPLAIN

- 179 residential structures;
- 47 commercial buildings;
- 3 industrial buildings;
- 7 garages/barns/sheds;
- 1 utility building (water);
- 1 apartment building;
- 1 retirement home;
- 1 state-run home;
- 1 electrical substation; and
- 9 equipment storage lots.

**TABLE 1.2  
REPETITIVE LOSS STRUCTURES IN THE CITY OF MIDDLETOWN  
BY OCCUPANCY CLASS**

Municipality	Repetitive Loss Properties					
	2 to 4 Family	Assumed Condo	Non Residential	Other Residential	Single Family	Total
City of Middletown	0	0	2	0	4	6

Source: FEMA, 2014

Notes:

1. Policies, claims, repetitive loss, and severe repetitive loss statistics provided by FEMA Region 2, and are current as of May 31, 2014.
2. The statistics were summarized using the Community Name provided by FEMA Region 2.

**TABLE 1.3  
NFIP POLICIES, CLAIMS, AND REPETITIVE LOSS STATISTICS**

Municipality	# Policies	# Claims (Losses)	Total Loss Payments	# Rep. Loss Prop.	# Severe Rep. Loss Prop.	# Policies in the 1% Flood Boundary
City of Middletown	126	58	\$545,362	6	0	68

Source: FEMA Region 2, 2014

1. Policies, claims, repetitive loss, and severe repetitive loss statistics provided by FEMA Region 2, and are current as of May 31, 2014. Please note the total number of repetitive loss properties includes the severe repetitive loss properties. The number of claims represents claims closed by 5/31/14.
2. Total building and content losses from the claims file provided by FEMA Region 2.
3. The policies inside and outside of the flood zones are based on the latitude and longitude provided by FEMA Region 2 in the policy file.
4. FEMA noted that where there is more than one entry for a property, there may be more than one policy in force or more than one GIS possibility. A zero percentage denotes less than 1/100th percentage and not zero damages or vulnerability as may be the case.



The City of Middletown has six repetitive loss (RL) properties. Tables 1.2 and 1.3 summarize the NFIP policies, claims, and RL statistics for the City of Middletown. According to FEMA, the majority of the RL occupancy class is single-family residences (66.7%). The City of Middletown does not have any severe repetitive loss (SRL) properties, according to FEMA.

The NFIP statistics contribute important information to the analysis of the City's vulnerability levels. The RL and SRL properties help indicate areas of the municipality that undergo frequent flood events. Just over half of the policies (68) in the City are located within the 100-year flood boundary; this could result in potentially high losses during an extreme storm event. Since 1979, over \$500,000 in loss payments have been made to property owners, with the number of claims having increased over the past decade.

The locations of the RL properties and claims can be looked at as potential areas for investment and project implementation to enhance the long-term resiliency of the City of Middletown.



*Pictured above is an historic image of the old Middletown train station. The majority of the City's housing and infrastructure was developed in the late 1800s and early 1900s, due to the industrialization in the City and the advent of two railroads – the Erie Railroad, and the New York, Ontario, and Western Railroad. Much of the City's stormwater infrastructure was developed during that same time period, contributing to current flooding issues. Photo is courtesy of the Library of Congress.*

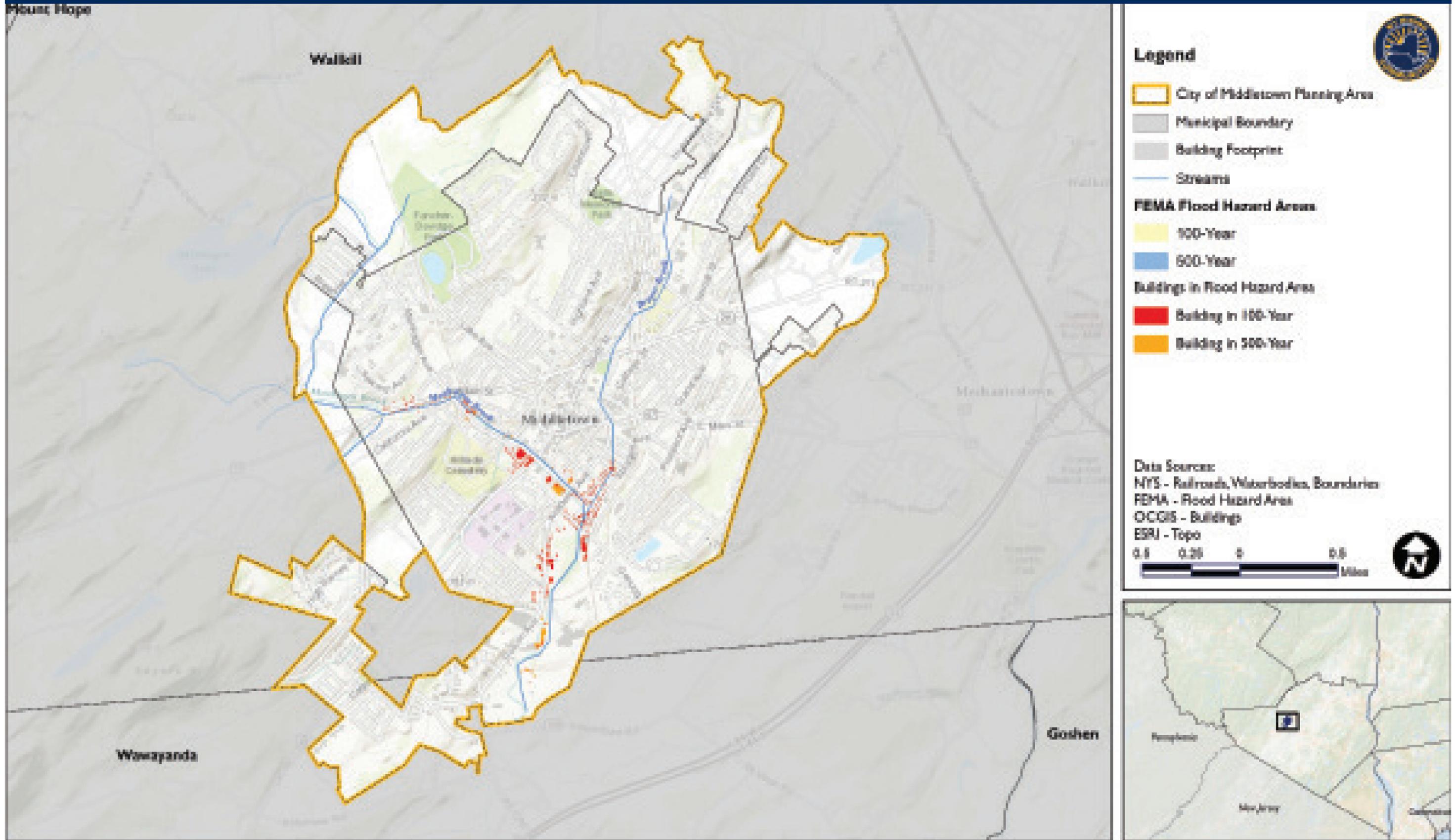
## Flood Hazard Areas

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. The floodplain most frequently referred to is the 100-year floodplain. A 100-year floodplain is not a flood that will occur once every 100 years; rather, it is a flood that has a 1% chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Due to this misleading term, FEMA has properly defined this term as the 1% annual chance flood. Most Federal and state agencies, as well as the NFIP, now utilize the 1% annual chance flood as the standard term.

The City of Middletown consists of about 3,286 acres. Approximately 5%, or 151 acres of the City, are located in the 100-year Flood Hazard Area (FHA). In contrast, 1%, i.e., 21 acres of the City, resides in the 500-year FHA (or the 0.2% annual chance flood).

FEMA FHA boundaries and the NFIP RL and SRL properties are displayed in Figure 1.5.

NYRCR: City of Middletown, Orange County  
FIGURE 1.5 - FEMA FLOOD HAZARD AREA MAP





## Community Character, Critical Issues

Several critical community issues were identified following an extensive planning process that included a review of existing plans, technical analysis, public input, interagency coordination, and Committee guidance and discussion. Understanding that additional issues and needs likely will be uncovered through further analysis and the implementation of this NYRCR Plan, this section is not intended to represent a comprehensive or final inventory of real or potential issues and needs related to resiliency and community development. Issues discussed here, as well as the needs and opportunities identified in Section 2, reflect an evaluation of available data, along with significant due diligence, technical analysis, stakeholder input, and Committee discussion.

**The planning process led to a greater understanding of local issues, needs, and opportunities that exist in the City of Middletown.**

Understanding the dynamics of a community is an important step in the NYRCR planning process. A community’s character should help to define what projects and strategies best address needs and should capitalize on opportunities in the Community. The City of Middletown is a unique and diverse city, with many distinctive characteristics. This NYRCR Plan offers projects and strategies to address identified critical issues.



*Pictured here is the City of Middletown’s Central Business District. Photo is courtesy of Tetra Tech, Inc.*

## Geographic Overview

The City of Middletown is located in the heart of western Hudson Valley, just north of the Black Dirt region of Orange County. This location made it an important distribution point for the region’s agricultural goods. Tucked away in the foothills of the Shawangunk Mountains and spurred into action by the construction of the Erie Railroad and the New York, Ontario, and Western Railway, the City of Middletown evolved into a stronghold for industry. Its location also made the City one of the main terminals for tourists, because it provided quick access to the Catskill Mountains.

After rail lines were eliminated in the City, there was an economic downturn in the 1970s and 1980s. Recently, however, the City’s downtown has become invigorated. A Business Improvement District (BID) was formed to help promote the downtown, improve streetscapes, and regulate architectural standards. This, in conjunction with a recent population influx, has facilitated a resurgence of the City’s vitality.

## Key City Components

The City’s Central Business District consists of residential, commercial, industrial, and mixed-use properties, and it is bisected by Monhagen Brook. This District is the lifeblood of the City. The Paramount Theater is one of the key features of this area and complements the businesses and restaurants that attract patrons.



*Pictured here is the regal Paramount Theatre. Photo is courtesy of Eric Thayer.*



The south side of the City is home to the State University of New York (SUNY) Orange County Community College. The college encompasses approximately 29 acres, making it one of the largest land holders in the City. It is second in size only to the City itself. The Community College enrolls approximately 7,000 students annually; the City of Middletown's campus supports about 3,500 of those students. The City and Community College have worked in concert to facilitate growth of the College. The City of Middletown NYRCR planning process included the Community College as a stakeholder to ensure projects and strategies positively affect this valuable community asset.



*Pictured here is an historic map of the City of Middletown. Photo is courtesy of the City of Middletown.*

The Monhagen Brook is the dividing line between the southern and northern parts of the City. The brook and its upstream tributaries serve as the primary drinking water source for the City. A series of dams, including the Monhagen Lake Dam, capture the water in a series of reservoirs. This main source of drinking water is also the City's main source of flooding.

As discussed previously, a large section of the City's center is in the 100-year FHA, and a large stretch of Fulton Avenue and Monhagen Avenue is in the Monhagen Brook floodway. This area flooded with up to six feet of water during Hurricane Irene and severely damaged the City's DPW facilities along Monhagen



*Pictured here is one of the beautiful buildings on the campus of SUNY Orange County Community College. Photo is courtesy of Eric Thayer.*

Avenue, destroying numerous homes and businesses. Flooding also incapacitated the City's emergency services ability to reach populations City-wide.

The planning process spanned the divide between these two key sections of the City, while protecting and enhancing Monhagen Brook.

## The People of Middletown

As reported by the 2010 U.S. Census, the City of Middletown has a population of 28,086 people who reside in 10,866 housing units. This represents a population increase of 10.6% since the 2000 U.S. Census. Significant City revitalization and urban renewal efforts spurred this significant population increase in only one decade.

Tables 1.4 and 1.5 summarize recent population trends in the City.



**TABLE 1.4 – CITY OF MIDDLETOWN POPULATION, 2000 TO 2010**

Municipality	2010 Population	2000 Population	2000 Population Over 65	2010 Population Over 65	2000 Individuals with Poverty Status	2012 Individuals with Poverty Status <sup>1</sup>
City of Middletown	28,086	25,388	3,036	2,976	4,379	4,906

Source: American Community Survey, 2012; U.S. Census 2010; U.S. Census 2000.

\* This number is based on the 2008-2012 American Community Survey 5-year estimate for the City of Middletown.

**TABLE 1.5 – CITY OF MIDDLETOWN POPULATION TRENDS, 1960 TO 2010**

Year	Population	Change in Population	Percent (%) Population Change
1960	23,475	889	3.9%
1970	22,607	-868	-3.7%
1980	21,454	-1,153	-5.1%
1990	24,160	2,706	12.6%
2000	25,388	1,228	5.1%
2010	28,068	2,680	10.6%

Source: U.S. Census Bureau, 1960 – 2010.

The City has a slightly younger population, with a median age of 33.7 years. For comparison, the Orange County median age is 36.6 years, and the State of New York median age is 38.0 years. City of Middletown residents aged 65 years and older comprise 10.6% of the population, which is comparable to the Orange County average of 11% for the same age range. The City has a relatively high population of 20-34 year olds (21.8%) and 35-49 year olds (21.2%), which provides an essential workforce for the community and region (see Figure 1.6).

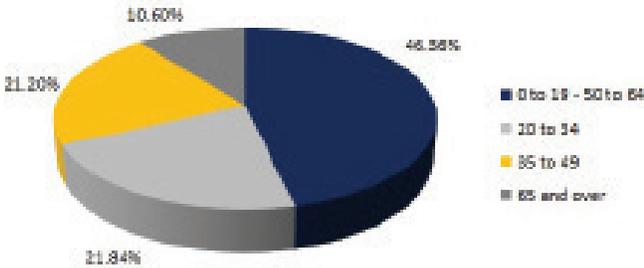
According to the 2010 U.S. Census, 37.1% of City residents are White, 39.8% are Hispanic or Latino, 18.1% are Black/African American, 1.8% are Asian, and 3.3% are another ethnicity, including American Indian and Alaskan Native (see Figure 1.8). It is important to note that according to the U.S. Census, Hispanics and Latinos are not considered a race but an ethnicity; therefore, they may be of any race.

The 2010 U.S. Census also indicates that 75.6% of City residents graduated from high school, compared to a national average of 85.7%, and 17.2% of City residents have earned a bachelor’s degree or higher, compared to a national average of 28.5%.

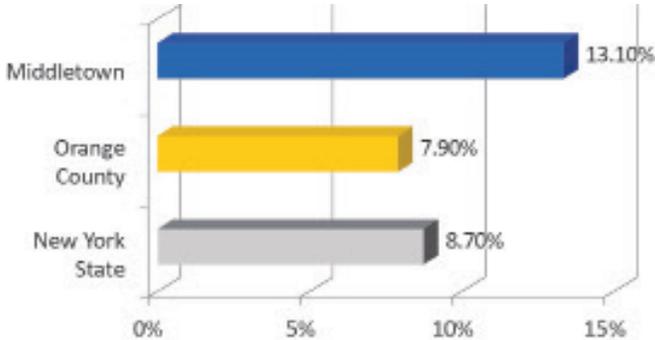


Pictured above is an example of an advertisement in Spanish for a Public Engagement Event. Recognizing that diversity is one of the City’s greatest assets, and to encourage maximum attendance at Public Engagement Events, the Committee advertised in Spanish, the second-most commonly spoken language in the City.

**FIGURE 1.6 - CITY OF MIDDLETOWN MEDIAN AGE**

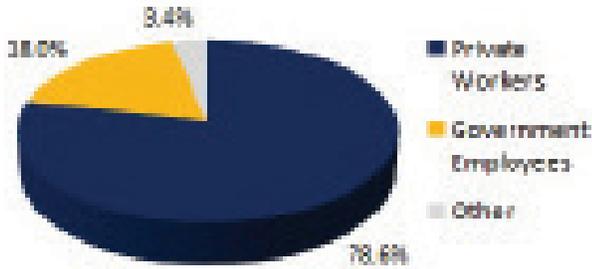


**FIGURE 1.9 - CITY OF MIDDLETOWN UNEMPLOYMENT COMPARISON**



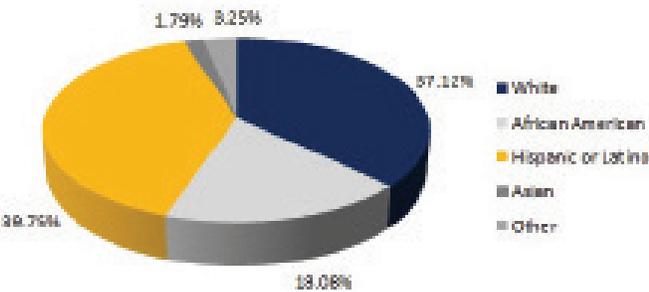
Source for Figures 1.6 – 1.9: U.S. Census.

**FIGURE 1.7 - CITY OF MIDDLETOWN EMPLOYMENT**



According to the 2010 U.S. Census, at 13.1%, unemployment in the City is higher than average, compared against both Orange County (7.9%) and New York State (8.7%). In addition, 17.9% of City residents were under the poverty level, as opposed to 11.7% in Orange County and 14.9% in the State of New York. While these statistics are not necessarily representative of a thriving economy, they point out opportunities to enhance economic drivers.

**FIGURE 1.8 - CITY OF MIDDLETOWN POPULATION DISTRIBUTION BY ETHNICITY**



The City of Middletown has attracted a diverse array of people in recent years. The City's location, on the fringe of the New York metropolitan area, has kept cost of living down. Access to major employment hubs has increased population growth in the City of Middletown.



## Social Vulnerability

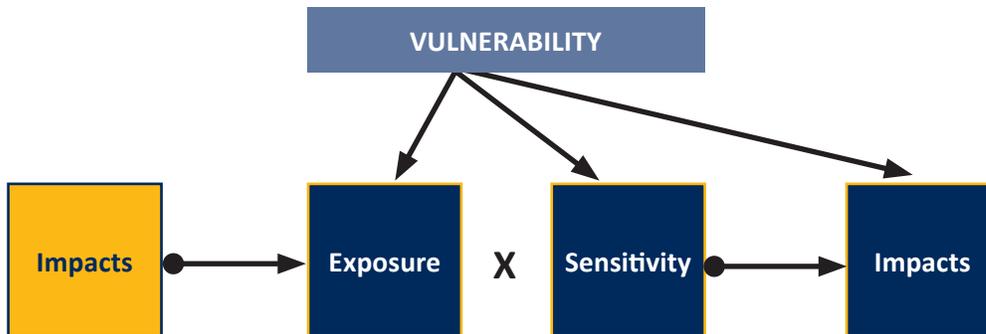
To understand resiliency and recovery issues, this City of Middletown NYRCR Plan has factored in the vulnerability of the City’s residents to natural hazards, such as flooding. Developed through a partnership with the University of South Carolina (USC) and the National Oceanic and Atmospheric Administration (NOAA), the Social Vulnerability Index (SOVI) measures the social vulnerability of populations to environmental hazards.

SOVI is a comparative metric that helps users examine differences in social vulnerability among population groups at the Census block group level. SOVI graphically illustrates the geographic variation in social vulnerability.

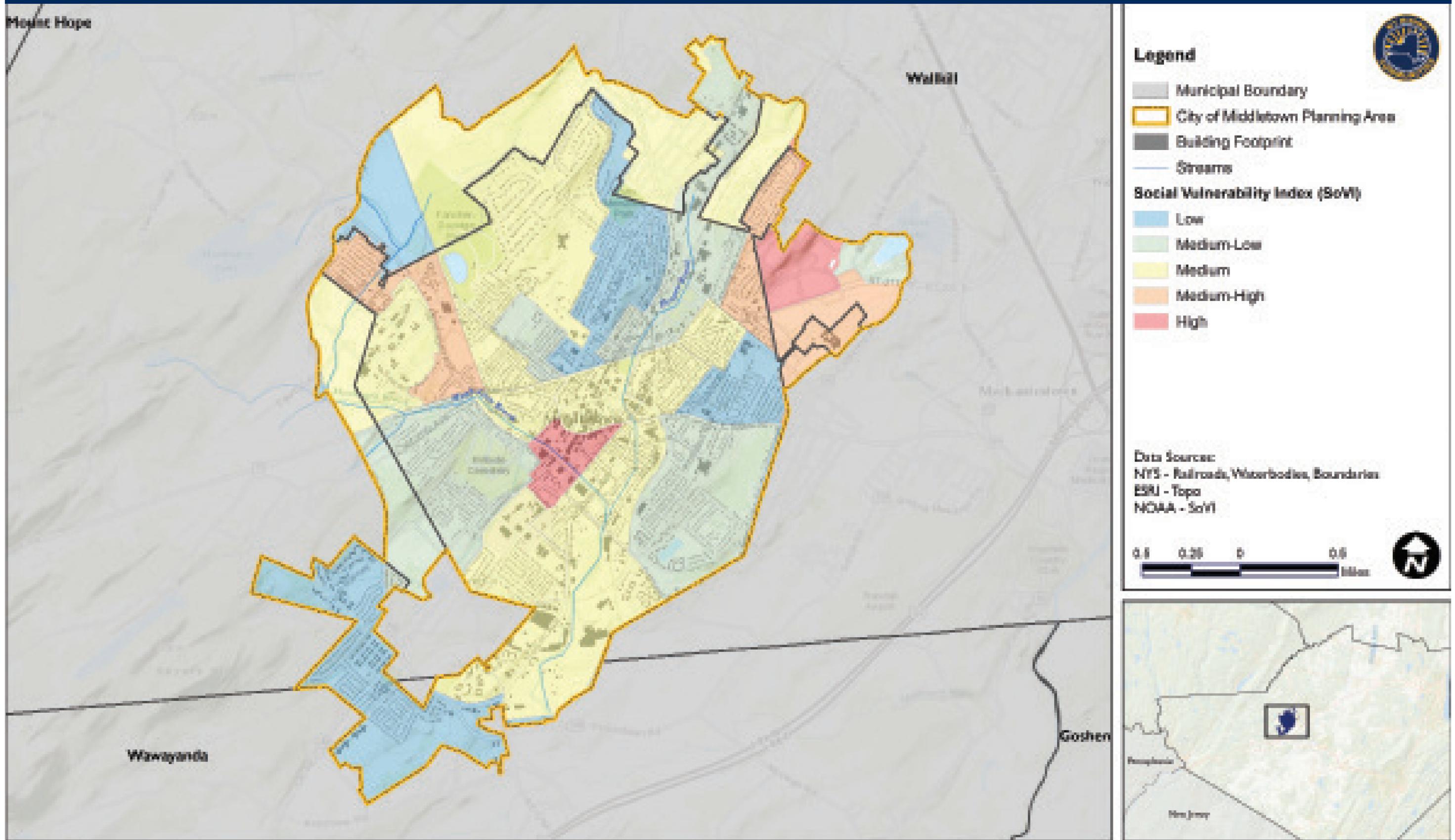
It shows differences in capacity for preparedness and response, as well as areas where resource use would be most effective to reduce vulnerability. SOVI is also useful as an indicator to determine the level of recovery from disasters.

The City of Middletown has several areas of high social vulnerability, according to the SOVI analysis, most notably, the portion of the City between Mill Street and Academy Avenue that is in close proximity to Fulton Avenue. The Pilgrim Estates section of the City also has a high social vulnerability to natural hazards.

**FIGURE 1.10 - SOCIAL VULNERABILITY**



NYRCR: City of Middletown, Orange County  
FIGURE 1.11 - SOCIAL VULNERABILITY





## Transportation and Local Facilities

### TRANSPORTATION

Major roads in the City of Middletown include State Route 211 and State Route 17M. These corridors provide primary access into and out of the City. Their repeated flooding has created significant evacuation and safety issues. The City also contains a number of local collector streets that provide access to individual homes, businesses, and other local assets.

Middletown Transit Corporation (Middletown Transit) has provided local bus service (fixed route) in the City since 1935. Middletown Transit operates four routes, which connect at a central hub downtown, off Railroad Avenue. Service now extends beyond the City limits, east into the Town of Wallkill to the shopping and retail areas along Route 211. However, service still relies on a section of Route 211 near the boundary of the two localities that frequently floods.

The Interstate 84 and U.S. Route 6 interchange is located only a few miles east of the City of Middletown, and provides easy access to New York City and Pennsylvania. Access to this interchange was also limited during Hurricane Irene and Tropical Storm Lee because of flooding.

While regional transportation systems may be less vulnerable to the impacts of local flooding, many local residents rely on accessing them to maintain their livelihoods. The Metropolitan Transit Authority (MTA) provides commuter rail service that links Orange County to New York City via the Port Jervis Line of Metro-North Commuter Railroad. The Middletown-Town of Wallkill station is located just north of the Galleria at Crystal Run Mall. Both of these rail stops were rendered useless for days after Hurricane Irene, as the entire Metro North line was suspended because of widespread flooding and debris. Additional commuter service to New York City is offered by Coach USA, a commuter bus line with numerous stations in or close to the City.



*Pictured here is a navigational sign at the heavily used Middletown-Town of Wallkill Metro North Station. Photo is courtesy of Tetra Tech, Inc.*

### LOCAL FACILITIES

The City of Middletown is served by a local police department and fire department. Additional local facilities and service providers for the City of Middletown are summarized in Table 1.6.

**TABLE 1.6 - CITY OF MIDDLETOWN SERVICE PROVIDERS**

NAME	ADDRESS	MUNICIPALITY
<b>EDUCATION</b>		
Monhagen Middle School	555 County Rt 78	Middletown (C)
Middletown High School	24 Gardner Avenue Extension	Middletown (C)
Middletown Christian School	70 Highland Avenue	Middletown (C)
Maple Hill Elementary School	491 County Rt 78	Middletown (C)
William A. Carter Elementary School	435 E Main Street	Middletown (C)
Twin Towers Middle School	112 Grand Avenue	Middletown (C)
New Beginnings Montessori	33 Albert Street	Middletown (C)
St. Joseph's School	113 Cottage Street	Middletown (C)
Orange County Community College	115 South Street	Middletown (C)
Truman Moon Elementary School	53 Bedford Avenue	Middletown (C)
Presidential Park Elementary School	50 Roosevelt Avenue	Middletown (C)
AHRC	11 Canterbury Circle	Middletown (C)
Medical College	60 Prospect Ave	Middletown (C)
Orange County Employment and Training	18 Seward Ave	Middletown (C)
<b>WATER SERVICES</b>		
Middletown Water Plant		Middletown (C)
Middletown Sewer Treatment Plant		Middletown (C)
Middletown Water Tower		Middletown (C)
Middletown Water Tower		Middletown (C)
Middletown Water Tower		Middletown (C)
<b>ENERGY SERVICE</b>		
Orange and Rockland		Wallkill (T)
<b>COMMUNICATIONS SERVICE</b>		
Frontier Communications		Middletown (C)
<b>MEDICAL SERVICES</b>		
Middletown Medical	111 Maltese Drive	Middletown (C)
Orange Regional Medical Center	707 E Main Street	Middletown (C)
Orange Regional Medical Pavilion	75 Crystal Run Road	Middletown (C)
Crystal Run Healthcare	155 Crystal Run Road	Middletown (C)
<b>EMERGENCY SHELTERS</b>		
Middletown High School	24 Gardner Avenue Extension	Middletown (C)
Monhagen Middle School	555 County Route 78	Middletown (C)
Red Cross	135 Crotty Road	Middletown (C)
Medical College	60 Prospect Ave	Middletown (C)
Homeless Shelter	18 Seward Ave	Middletown (C)

Source: Wallkill and Middletown Natural Hazard Plan, 2014.

Note: (C) = City (T) = Town



## Diversity of Housing Options

According to the 2010 U.S. Census American Community Survey, there are 10,866 housing units in the City. Almost half of the housing units (48.4%) are single-family residential structures (attached and detached), with the remaining 51.5% as multi-family units. The percentage of owner-occupied units (48.9%) is approximately equal to renter-occupied units (51.1%). The owner-occupied percentage is lower than both Orange County (69.7%) and the State of New York (54.5%). The City has a vacancy rate of 12.2%, compared to 8.7% in Orange County and 10.8% in New York State.

The housing stock in the City is generally older than in many other areas of the State, with 52.6% built before 1939. The median home value in the City is \$217,400, which is significantly lower than Orange County (\$288,800) and the State (\$295,300).

The high proportion of housing units built prior to 1939 and the higher rate of vacancy may indicate opportunities to improve the City’s housing stock.

**Increasing costs and reduced affordability of housing are growing issues throughout the State of New York and in Orange County. The severity of these issues is more pronounced in the City of Middletown, which will be exacerbated by the future escalation of costs for flood insurance.**

Median costs for owners and renters in the City are:

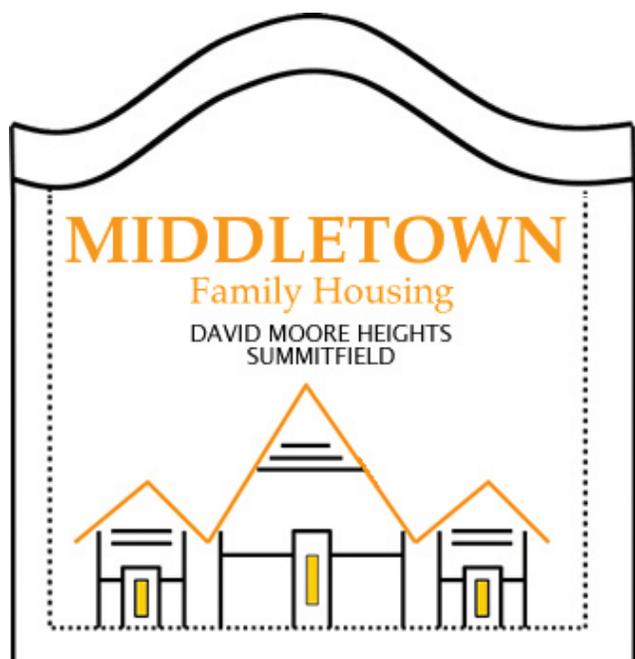
- **Owner-Occupied (with a mortgage)**  
Median monthly costs: \$2,113 (compared to Orange County – \$2,320, and State of New York – \$2,040)
- **Renter-Occupied**  
Median gross rent: \$1,116 (compared to Orange County – \$1,123, and State of New York – \$1,061)

Based on the various issues affecting housing affordability, 43.3% of owners with a mortgage and 51.9% of renters pay more than 30% of their household income for housing costs. According to the U.S. Department of Housing and Urban Development (HUD), paying more than 30% of household income for housing costs qualifies a resident as being “cost-burdened” and indicates residents are likely to have difficulty affording essential costs of life, including savings or expendable cash to cover relocation or repair costs in the face of a disaster.

**Nearly half of homeowners and more than half of renters in the City of Middletown pay such a large percentage of their income for housing that they are officially considered “cost-burdened,” meaning that the essential costs of life may be difficult to afford.**

Decreased housing affordability affects community development by limiting the attraction of a younger workforce, young families, and first-time homebuyers. Cumulatively, these factors restrict local spending and future economic growth.

The City created the Middletown Housing Authority to facilitate the development and creation of higher-quality housing options.



## High Cost of Repetitive Flooding

Approximately 204 residents in the City of Middletown live in the 1% annual chance FHA. The methodology used to determine this number widely underestimates the population at risk to flooding. For example, this estimate does not account for multiple residences on the same parcel, such as multiple mobile homes on a property.

Of the total parcels within the City, approximately 131 (8.2%) properties are located in the 1% annual chance flood area. An estimated \$49,511,000 (6.6%) of the City’s replacement cost for the general building stock (structure and contents) is located in the 1% annual chance flood area. There are 126 NFIP policies in the City of Middletown community, 68 of which are located in the 1% annual chance flood area. FEMA has identified six RL properties.

The Wallkill and Middletown Natural Hazards Mitigation Plan (2014) estimates that for a 1% annual chance flood, \$44,361,000 (5.9%) of the City’s replacement cost for the general building stock (structure and contents) will be damaged; 530 households may be displaced; 370 people may seek short-term sheltering; and an estimated 6,040 tons of debris could be generated.

## Economic Character, Concerns, and Potential

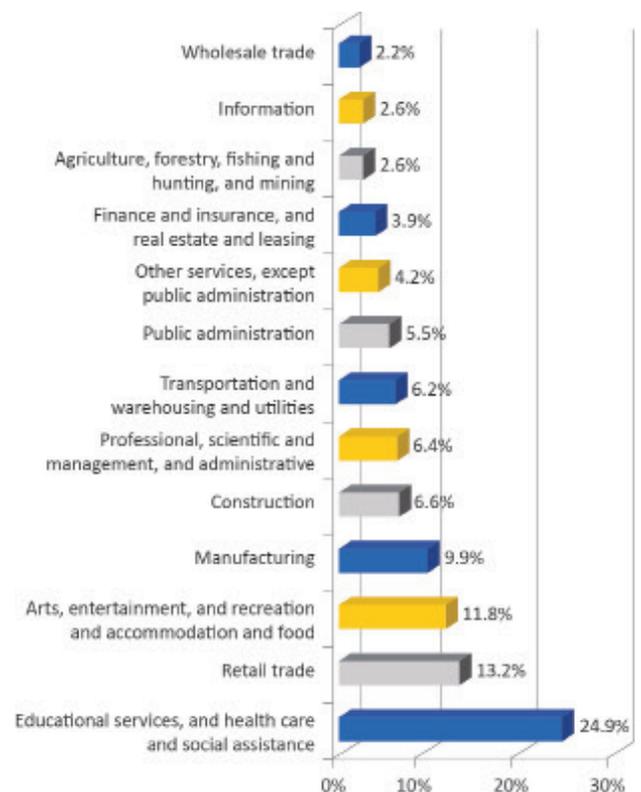
The City has numerous commercial enterprises, restaurants, retail stores (including several smaller malls with local and chain retailers), and provides cultural and commercial offerings for residents and visitors, alike. Of all workers in the City, 18.0% are employed by the government and 78.6% work for private businesses.

The City has additional features that support local businesses and can be leveraged for future economic growth, including:

- Quality of life, local character, and charm;
- Historic architecture;
- Performing arts and entertainment;
- Access to open space and outdoor recreation;
- Proximity to a large market for jobs; and
- Active community members and organizations.

Figure 1.12 shows breakdown of employment by sector and indicates some of the key drivers for the local economy.

**FIGURE 1.12 – CITY OF MIDDLETOWN EMPLOYMENT SECTORS**



Source: U.S. Census



While many indicators, such as unemployment status and median income, suggest a healthy economy in the City of Middletown, several issues currently deter the local business environment from reaching its full potential.

A thriving economy in the City is significantly restrained by the real and perceived threat of severe flood damage. The City's BID has made significant strides to enhance the economic strength, quality of life, and character of the City. The BID is funded through a special tax assessed by business owners in the Central Business District. Since the inception of the BID in 1992, the City has worked to enhance the Central Business District and provide a framework for success. The BID focuses

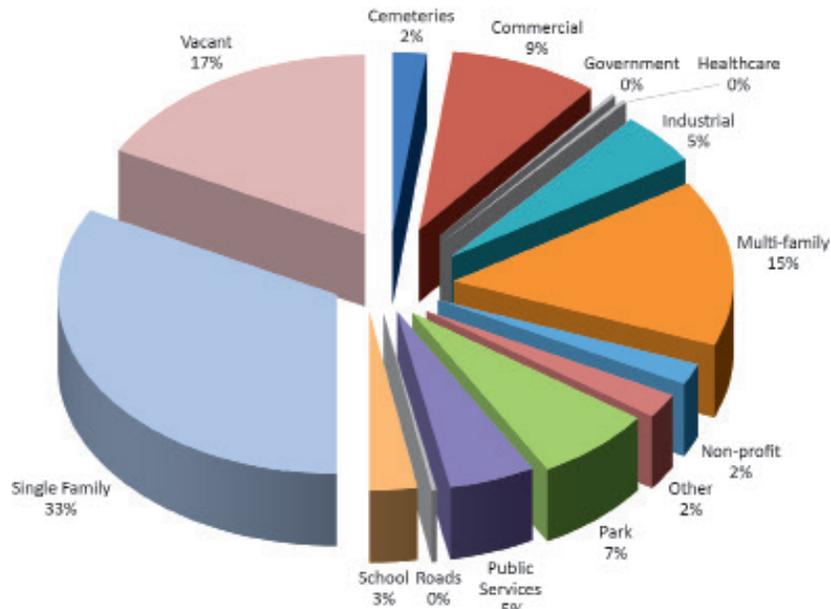


*The majority of properties in the City of Middletown are single-family residences. Pictured here are homes along West Main Street. Photo is courtesy of Tetra Tech, Inc.*

on the following:

- **Beautification**
  - Floral displays tastefully placed throughout the Central Business District and by BID Maintenance Coordinator
  - Decorative street signs throughout the Central Business District

**FIGURE 1.13 - CITY OF MIDDLETOWN LAND USES**



Source: Orange County Planning Data

• **Safety**

- Traffic control and parking coordination at downtown events

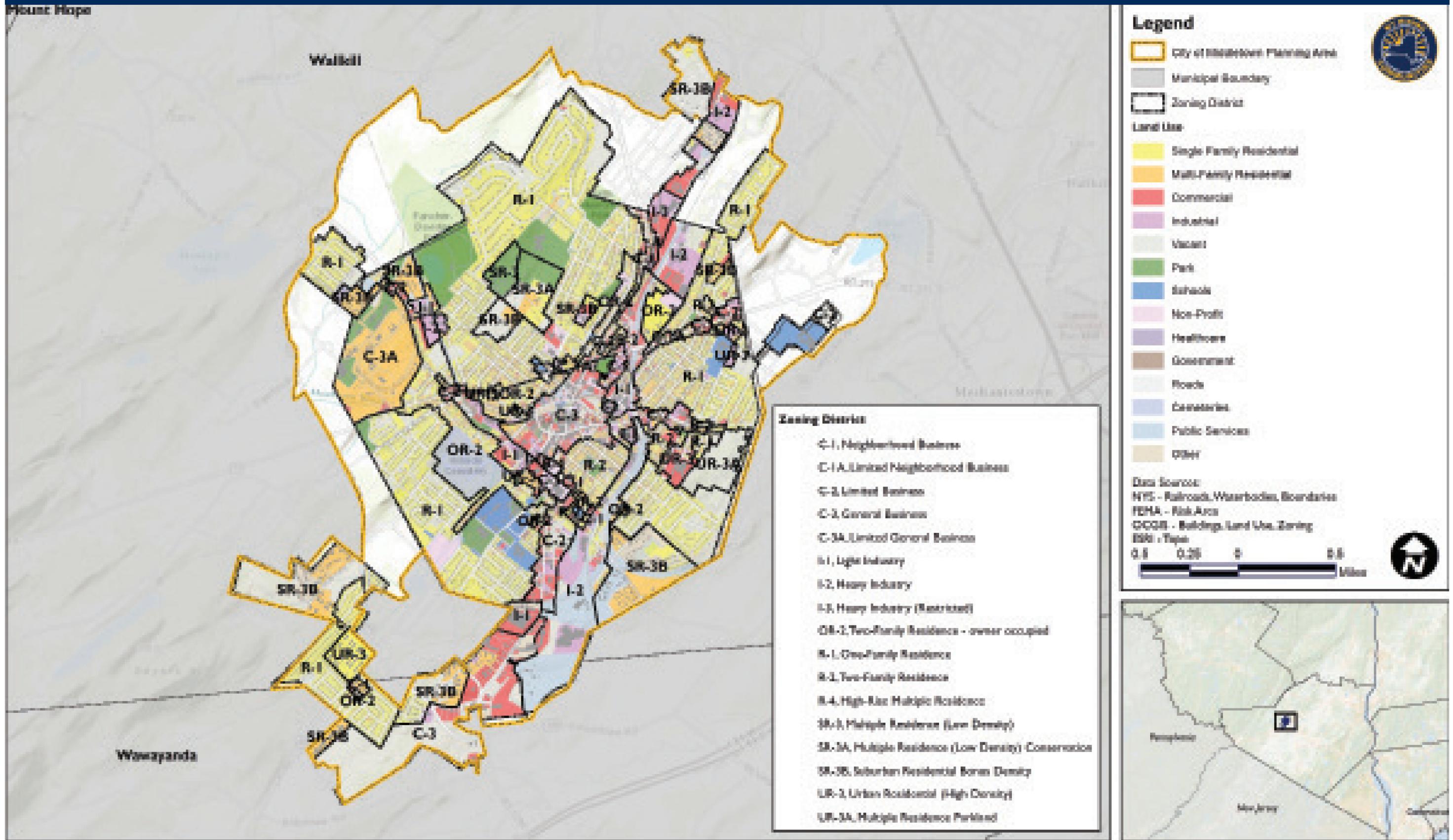
• **Sanitation**

- Maintenance and coordination of a six-day per week litter control program



Historic Map of the City of Middletown. Image is courtesy of the City of Middletown.

**NYRCR: City of Middletown, Orange County**  
**FIGURE 1.14 - LAND USE / ZONING MAP**





- Weed control and general maintenance of



Morrison Hall – 1906 Mansion of SUNY Orange County. Image is courtesy of the City of Middletown.

downtown trees and bushes

- **Promotional Events and Activities**
  - Weekly Farmers Market
  - Weekly summer concerts
  - Bi-weekly summer car shows
  - Holiday tree lighting, parade, and ceremony the day after Thanksgiving

## Land Use Planning and Development

Like many communities, the City of Middletown encompasses a range of land uses, including residential, commercial, industrial, public space, agriculture, and community services.



Pictured here is the vacant O&W Station. Photo is courtesy of Eric Thayer.

There are 7,474 properties in the City, the majority of which are single-family residential properties. A large percentage of the City includes commercial and multi-family land uses. Figure 1.13 provides the breakdown of land uses in the City. Figure 1.14 shows the geographic distribution of land uses and the zoning in the City.

*In the wake of the devastation caused by recent significant storm events, the City of Middletown will embark on a comprehensive planning process focused on building more resilient infrastructure, economy, and open space. Developing a coordinated plan to attract economic and housing reinvestment will enrich the quality of living for the City’s residents.*



*Mt Carmel, 1930.  
Image is courtesy of the  
City of Middletown.*

The City utilizes a variety of regulatory tools to guide land use and development, including, but not limited to building codes, zoning ordinances, subdivision ordinances, NFIP Flood Damage Prevention Ordinance, and the Floodplain Management Plan.

## Critical Issues

During the initial City of Middletown NYRCR Plan Planning Committee Meetings, the Committee identified several key challenges to creating resiliency, developing economic growth, and enhancing the quality of life in the City. These critical issues included:

- Aging, undersized, and damaged stormwater infrastructure;
- Deterioration and prevalence of lingering damage to roadways from increasingly intense storm events;
- Lack of appropriate emergency response access to the southern side of the City during intense storm events;
- Uncoordinated development in the upstream Monhagen and Draper Brook watersheds;
- Lack of strategically located open space and green/infiltration areas in the densely developed City;
- Lack of interconnected green infrastructure and open space;

- Socially vulnerable populations located in FHAs;
- Local business interruptions and economic loss due to flooding damages, power loss, and flooded access routes during storm events;
- Extreme flood events that adversely affect performance of the City wastewater treatment plant and its available capacity due to inflow/infiltration;
- Underutilization of vacant properties and lack of strategic investment; and
- Disinvestment of commercial and retail within the Central Business District due to the high density shopping and retail center in the Town of Wallkill.
- The City no longer has direct transit rail access.

## Community Vision

Through collaborative discussions, stakeholder engagement, reviews of existing plans and studies, and a focused intention toward holistic community recovery, the Committee adopted the following vision to guide the recovery and resiliency effort for the City of Middletown NYRCR Plan.



## City of Middletown NYRCR Planning Committee Goals

- Address flooding issues within the City.
- Build new resilient infrastructure and leverage existing infrastructure investments to maximize economic development potential, improve public safety, and enhance emergency access.
- Attract reinvestment to revitalize the local economy and to create opportunities for growth.
- Develop a sense of place and build economic resilience by capitalizing on the vibrancy of both the SUNY Orange County Community College and the Central Business District to forge an interconnected social, economic, and functional bond.
- Enhance parks, cultural assets, and greenway infrastructure, so they serve multiple purposes – recreation, resilience, and protection.
- Plan for and promote a variety of housing types that are resilient in design and location, as well as supporting residents.
- Address repetitively flooded properties.
- Plan for proper emergency access and response to all residents and areas in the City.
- Ensure that appropriate health and social services are accessible to all residents on a daily basis and in emergency scenarios.



*Pictured above is an old warehouse at the corner of Fulton Street and Wawayanda Avenue. Photo is courtesy of Eric Thayer.*



**TABLE 1.7 - REVIEW OF EXISTING PLANS AND STUDIES**

Resource	Relevance	Key Components for City of Middletown NYRCR Planning Process
Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan (2014)	<ul style="list-style-type: none"> <li>• Provides local strategies and recommended actions for mitigating all potential hazards to the City of Middletown and the Town of Wallkill.</li> <li>• Provides detailed information on past and current flood issues, stream and hydrological conditions, past and current flood initiatives, vulnerabilities to natural resources, emergency services, prevention and planning, property protection, and recommendations for additional mitigation actions to address future disaster events.</li> </ul>	<ul style="list-style-type: none"> <li>• Detailed past flood information;</li> <li>• Local facility information;</li> <li>• Hazard vulnerabilities and flood-related issues;</li> <li>• Assessed values and potential losses;</li> <li>• Past and ongoing mitigation projects;</li> <li>• Regional collaborations and initiatives; and</li> <li>• Proposed mitigation initiatives.</li> </ul>
City of Middletown City Code (2014)	<ul style="list-style-type: none"> <li>• Provides administrative regulations, such as local land use regulations for allowable uses and development standards, within the City.</li> </ul>	<ul style="list-style-type: none"> <li>• Establishes the context for reconstruction projects related to local development and public works projects.</li> </ul>
City of Middletown Selected Financial Operations and Information Technology Report of Examination (Period Covered: January 1, 2011 to July 9, 2012)	<ul style="list-style-type: none"> <li>• Establishes a vision for the future growth, development, and protection of the City.</li> <li>• Provides overarching goals and recommended implementation actions for areas of the community related to technological preservation and disaster management.</li> </ul>	<ul style="list-style-type: none"> <li>• Community vision;</li> <li>• Detailed community, demographic, and economic data; and</li> <li>• Goals and recommendations for technological areas of community.</li> </ul>
Orange County Water Master Plan (2010)	<ul style="list-style-type: none"> <li>• Addresses water usage, risks, and influence throughout the County.</li> </ul>	<ul style="list-style-type: none"> <li>• Detailed past flood information;</li> <li>• Local facility information;</li> <li>• Hazard vulnerabilities and flood-related issues;</li> <li>• Assessed values and potential losses;</li> <li>• Past and ongoing mitigation projects;</li> <li>• Regional collaborations and initiatives; and</li> <li>• Proposed mitigation initiatives.</li> </ul>
Orange County Comprehensive Plan (2010)	<ul style="list-style-type: none"> <li>• Establishes a vision for the long-term maintenance, growth, and development of the County.</li> <li>• Provides overarching goals and recommended implementation actions for all areas of the County, including but not limited to, infrastructure, community facilities, housing, economic development, and natural and cultural resources.</li> </ul>	<ul style="list-style-type: none"> <li>• County vision;</li> <li>• Detailed community, demographic, and economic data; and</li> <li>• Goals and recommendations for all areas of community and economic development.</li> </ul>
Orange County Transportation Council Long-Range Transportation Plan (December 2011)	<ul style="list-style-type: none"> <li>• Evaluating the County’s ability to provide safe, balanced, and efficient transportation throughout the County.</li> </ul>	<ul style="list-style-type: none"> <li>• County vision;</li> <li>• Critical issues; and</li> <li>• Past, current, and recommended projects/initiatives.</li> </ul>
Orange County Comprehensive Plan Strategies for Communities (2010)	<ul style="list-style-type: none"> <li>• Establishes a vision for the long-term maintenance, growth, and development of the County.</li> <li>• Provides overarching goals and recommended implementation actions for all areas of the County, including but not limited to, infrastructure, community facilities, housing, economic development, and natural and cultural resources.</li> </ul>	<ul style="list-style-type: none"> <li>• County vision;</li> <li>• Detailed community, demographic, and economic data; and</li> <li>• Goals and recommendations for all areas of community and economic development.</li> </ul>



**TABLE 1.7 - REVIEW OF EXISTING PLANS AND STUDIES (CONT'D)**

Resource	Relevance	Key Components for City of Middletown NYRCR Planning Process
<p>City of Middletown Comprehensive Plan (2007) Task 1 Existing Conditions and Technical Memorandum</p>	<ul style="list-style-type: none"> <li>• Establishes a vision for the future growth, development and protection of the City.</li> <li>• Provides overarching goals and recommended implementation actions for all areas of the community, including, but not limited to, infrastructure, community facilities, housing, economic development, and natural and cultural resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Community vision;</li> <li>• Detailed community, demographic, and economic data;</li> <li>• Goals and recommendations for all areas of community and economic development;</li> <li>• Critical issues; and</li> <li>• Past, current and recommended projects/initiatives.</li> </ul>
<p>City of Middletown Community Development Agency Urban Renewal Plan (2014)</p>	<ul style="list-style-type: none"> <li>• Provides an economic development plan for the City of Middletown. Outlines strategies for economic growth as well as issues within the City regarding affordable housing and business opportunities.</li> <li>• Three categories of mortgage funding have been identified.</li> </ul>	<p>Inventory of existing conditions and key trends; City vision; identified goals; and priority projects for economic development.</p>
<p>NY Office of Economic and Community Development 2014 Program Year Action Plan Year 5 - City of Middletown (2014)</p>	<ul style="list-style-type: none"> <li>• Provides a plan focusing on the issues of affordable housing, economic and community development, planning and administration, single and multi-family home rehabilitation, code enforcement, and direct homebuyer assistance.</li> </ul>	<ul style="list-style-type: none"> <li>• Inventory of existing conditions and key trends; City vision, identified goals; and</li> <li>• Priority projects for economic development.</li> </ul>
<p>Orange County Single Jurisdiction Hazard Mitigation Plan (February 2011)</p>	<ul style="list-style-type: none"> <li>• Provides County and local strategies and recommended actions for mitigating all potential hazards to the County.</li> <li>• Provides detailed information on past and current flood issues, stream and hydrological conditions, past and current flood initiatives, vulnerabilities to natural resources, emergency services, prevention and planning, property protection, and recommendations for additional mitigation actions to address future disaster events.</li> </ul>	<ul style="list-style-type: none"> <li>• Detailed past flood information;</li> <li>• Local facility information;</li> <li>• Hazard vulnerabilities and flood-related issues;</li> <li>• Assessed values and potential losses;</li> <li>• Past and ongoing mitigation projects;</li> <li>• Regional collaborations and initiatives; and</li> <li>• Proposed mitigation initiatives.</li> </ul>
<p>Orange County, NY Agriculture Economic Development Strategy (2004)</p>	<ul style="list-style-type: none"> <li>• Provides County overview of agriculture economics, business development, and farm-friendly land use policies and programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Inventory of existing conditions and key trends;</li> <li>• City vision;</li> <li>• Identified goals; and</li> <li>• Priority projects for agriculture development.</li> </ul>
<p>Master Plan City of Middletown, New York (January 2000)</p>	<ul style="list-style-type: none"> <li>• Establishes a vision for the long-term maintenance, growth, and development of the City.</li> <li>• Provides overarching goals and recommended implementation actions for all areas of the community including, but not limited to, infrastructure, community facilities, housing, economic development, and natural and cultural resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Community vision;</li> <li>• Detailed community, demographic, and economic data; and</li> <li>• Goals and recommendations for all areas of community and economic development.</li> </ul>

## Relationship to Regional Plans

The Committee recognizes the importance of identifying issues and challenges that transcend municipal boundaries, along with the need to work collaboratively with neighboring communities to gain greater regional resiliency and prosperity. To that end, the Planning Committee harnessed opportunities for regional collaboration throughout this process, including leveraging existing regional plans and studies; encouraging stakeholder input from neighboring communities; identifying projects with regional benefits; exploring opportunities to leverage multiple funding sources; protecting assets with regional significance; and fostering inter-agency cooperation to address any potential hurdles to implementing proposed projects.

The Committee reviewed and incorporated existing documents into the planning process to build on relevant data, methodologies, stakeholder engagement, and consensus to inform the development of this NYRCR Plan.

**As the planning process proceeded, key gaps in analysis and information were identified and potential solutions were formulated as part of prioritizing projects and initiatives for implementation through the NYRCR Program.**

The content and recommendations of this document are intended to help to serve as the basis for additional local planning efforts in the future.

### REVIEW OF EXISTING PLANS

The City of Middletown contributed to several regional studies and plans in recent years that foster collaborative initiatives to enhance quality of life and all aspects of economic, community, and environmental health. This NYRCR Plan's development included a review of these and other prior regional planning efforts to identify common goals, emerging issues, and opportunities for collaboration. This review also helped to identify regional key economic drivers, housing stock

characteristics, and demographic trends that would influence regional community development.

The Committee drew on these prior planning efforts to identify potential projects of regional significance, benefiting the City of Middletown and the region.

Table 1.7 provides a review of those existing plans and studies reviewed and incorporated into this planning process, along with an indication of the key components that will help drive implementation of the City of Middletown NYRCR Plan.

# Section 2

Assessment of Risk  
and Needs



*Photo is courtesy of Eric Thayer.*

## Section 2: Assessment of Risk and Needs

### Description of Community Assets and Assessment of Risk

#### Introduction and Overview

A primary goal of the City of Middletown NY Rising Community Reconstruction (NYRCR) Plan is to ensure that both reconstructed assets and any proposed post-storm, new construction projects are more resilient and effective during future storm events. To comprehensively understand risks to the City of Middletown NYRCR Community (Community), the City of Middletown NYRCR Planning Committee (Committee), with support from the Consultant Team, identified and analyzed economic, health and social services, housing, infrastructure, and natural and cultural resources in the City of Middletown.



Shown above are a series of maps that depict the flood zones throughout the City. These maps were used at well-publicized Public Engagement Events held at City Hall. Photo is courtesy of Tetra Tech, Inc.

To meet this goal, the Committee developed a comprehensive inventory of assets within and beyond the City of Middletown Plan Area (Plan Area). By gathering this information, the Committee compiled sufficient and accurate information to assess risk to the assets on the existing and future planning horizon. The Committee was actively engaged throughout the inventory and risk assessment process, and collectively approved the results.

### Inventory Process

#### DATA COLLECTION

The Committee, with support from the Consultant Team, prepared a preliminary inventory of assets through stakeholder outreach, Committee deliberations, and a review of datasets. The New York State Department of State (NYS DOS) Risk Assessment Work Group provided a comprehensive list of datasets that were shared with the Committee. NYS DOS provided databases that included datasets from numerous public and private sources.

In addition to the data provided by NYS DOS, the Committee compiled local-level data from Orange County Geographic Information Systems (GIS) and the Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan (HMP) (2014). Data was also gathered from Committee Members during scheduled meetings, at a workshop following a Public Engagement Event, and via a community map portal.



Pictured here is one of the well-attended Public Engagement Events. Photo is courtesy of Tetra Tech, Inc.



### A COLLABORATIVE APPROACH TO DEVELOPING GEOGRAPHIC INFORMATION

Accurate geographic information is paramount to any planning process; however, GIS data is not always readily available in digital format. The Committee held a public workshop with a mapping and data collection exercise to help capture the wealth of community knowledge in geographic format. The information was then digitized and incorporated into an online GIS web-mapping portal for the Committee to use throughout the planning process.

**This unique, online tool enabled the Committee to identify and detail community assets and critical facilities.**

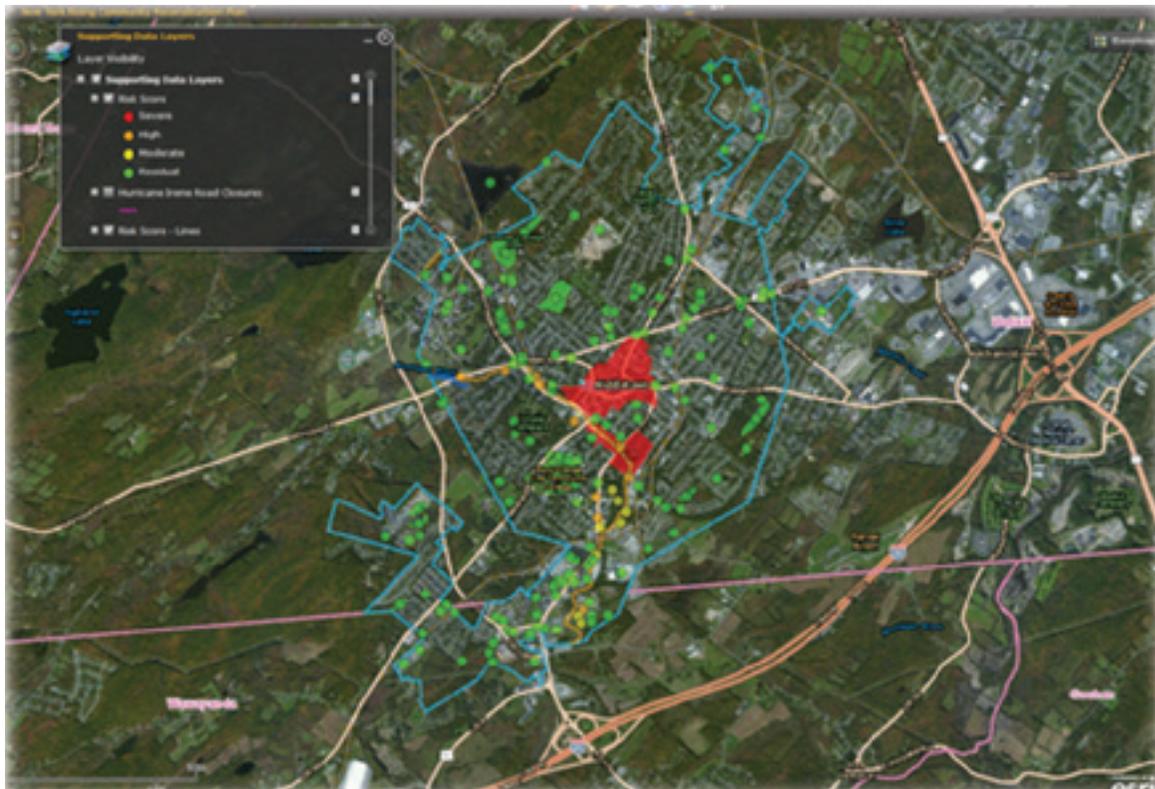
This online portal, shown in Figure 2.1, allowed Committee Members to visualize, interact with, edit,

and add community assets. The portal also allowed for the capture and use of local knowledge to populate and refine the asset inventory information. A special workshop trained Committee Members on the use of the portal to compile and fine-tune assets and other geographic information gathered from the data collection exercises. This tool empowered the Committee to visualize detailed community information, thus facilitating informed decision-making.

### ASSET CLASSIFICATION

The Committee and Consultant Team reviewed and classified the identified assets into six categories of Recovery Support Functions (RSFs) in accordance with the Federal Emergency Management Agency’s (FEMA) National Disaster Recovery Framework. These six categories, along with examples, are described in Table 2.1.

**FIGURE 2.1 - INTERACTIVE GIS WEB-MAPPING PORTAL**



Source: City of Middletown NYRCR Committee, 2014.

**TABLE 2.1 – ASSET CATEGORIES**

Asset Class	Examples
Community Planning and Capacity Building*	This RSF comprises plans, management functions, and recovery activities, not physical assets.
Economic	Office buildings, business and industrial parks, manufacturing, warehouses, storage facilities, groceries, restaurants, banks, lodging, storefronts, downtown center, and seasonal/tourism destinations.
Health and Social Services	Schools, healthcare, daycare, eldercare, emergency operations, government and administrative services, media and communications, police, fire, and rescue.
Housing	Single-family and multi-family dwellings, supportive housing/group homes, senior housing, and affordable housing.
Infrastructure Systems	Pedestrian, bicycle and vehicular ways, transit, bridges, airports, rail, ports, ferries, gas stations, water supply, stormwater, wastewater, solid waste, recycling, and power generation facilities.
Natural and Cultural Resources	Natural habitats, wetlands and marshes, recreation facilities, parks, public access, open spaces, agricultural areas, religious establishments, libraries, museums, historic landmarks, and performing arts venues.

*\*Because this RSF does not comprise physical assets, the Community-identified assets for the NYRCR Plan were not assessed according to this category. However, needs and opportunities for this RSF were still considered, due to the importance of this function. Source: NYS DOS, 2013*

Assets were also classified as either “critical” or “non-critical” facilities. Critical facilities included buildings and structures that, if severely damaged, would reduce the availability of essential community services necessary to cope with an emergency. Facility assets were categorized as “Yes, FEMA” for all assets that meet FEMA definitions of critical facilities.

Such facilities include, but are not limited to, hospitals, police stations, fire stations, emergency communication centers, and similar emergency facilities. Other facility assets identified by the Committee or other agencies as locally significant to the community were categorized as “No, Locally Significant,” and could include schools, key infrastructure, and important cultural facilities. Details on the City of Middletown NYRCR Plan asset inventory and risk assessment are included in Section 5: Additional Materials.

**AREAS OF FLOOD RISK**

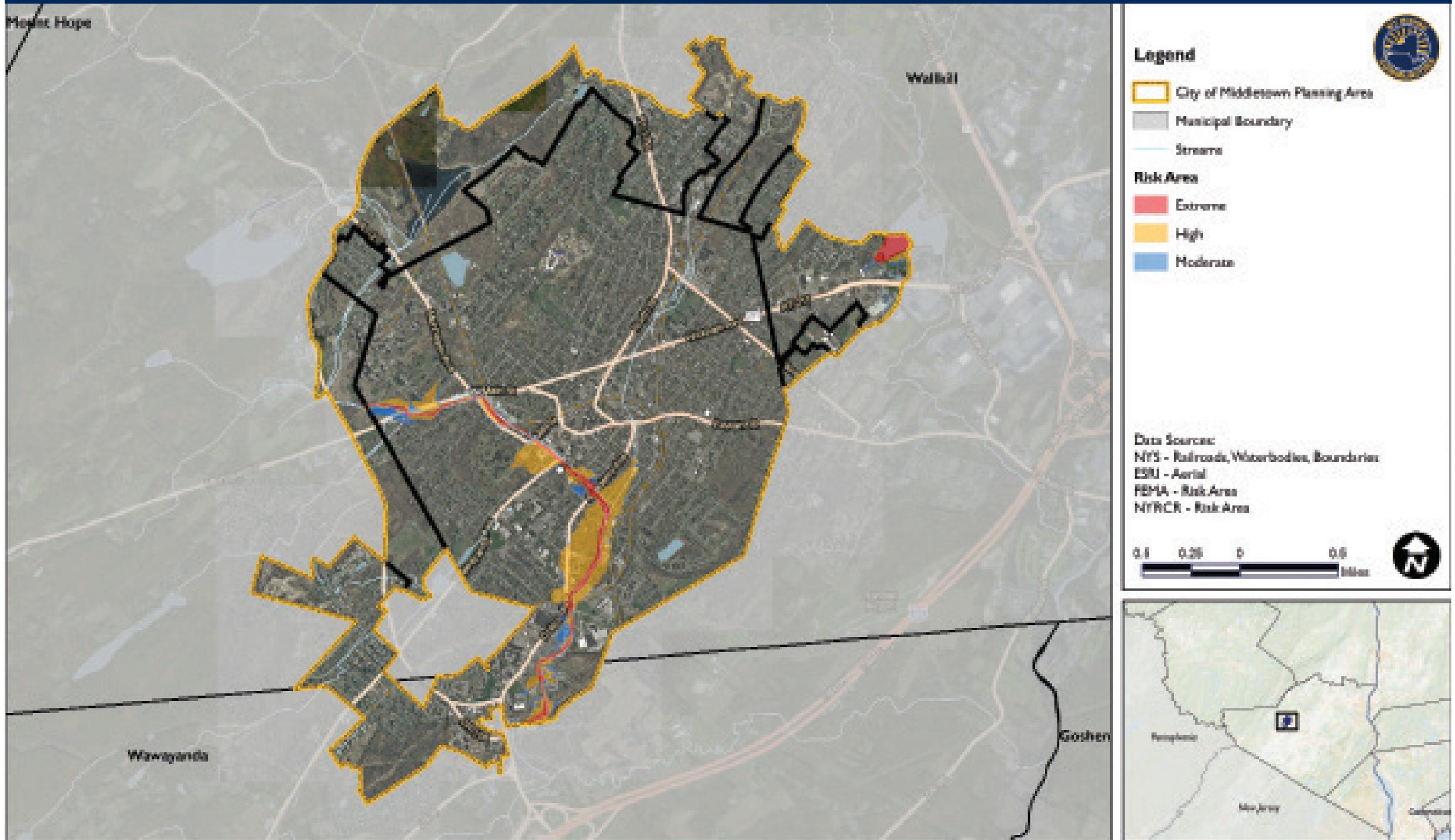
After the completion of asset identification and classification, the next vital step of asset evaluation included an assessment of risk for each asset. This risk was based on the assets’ geographic locations, and the proclivity for flooding in and around those locations.

This geographic assessment centered on the risk areas for riverine communities. The three risk areas for riverine communities are based on the current FEMA Flood Hazard Area (FHA) and additional moderate risk areas, based on a spatial analysis that used community-identified damage points outside of the FHA. Details of the additional analyses are included in Section 5: Additional Materials. The risk areas reflect the frequency and likelihood of flood inundation and are classified as either “extreme,” “high,” or “moderate” in descending order of risk magnitude. Figure 2.2 shows the risk areas in the City of Middletown NYRCR Plan Area.

**Description of Community Assets**

The following section describes the City of Middletown’s identified assets by RSF and provides additional information for each asset group. Figures 2.3 through 2.7 illustrate asset locations by RSF in the City of Middletown NYRCR Plan Area and the extent of the defined risk area.

NYRCR: City of Middletown, Orange County  
FIGURE 2.2 - RISK AREA MAP





## Economic Assets

The Committee recognized the importance of maintaining a focus on economic development while simultaneously incorporating resilience measures that strengthen the local community’s ability to succeed and thrive in future years.

Hurricane Irene and Tropical Storm Lee impacted many economic assets in the City’s vital downtown area, its central hub of economic activity. Several of the identified downtown assets, including the Associated Supermarket, were damaged during these events because of flooding along Fulton Avenue. Additionally, Dolson Avenue, a main arterial in the City, experienced heavy flooding.

As a direct result of these two major storm events, several downtown businesses were damaged or made inaccessible to City residents. This negatively impacted local wages and associated taxes, business-generated revenues, and suppliers and other businesses that support the local economy.

The Committee identified 67 facilities in the community asset category including restaurants, gas stations, banks, pharmacies, and grocery stores. A majority of these assets are located along Monhagen Avenue and Dolson Avenue. These assets support City residents in disaster situations by providing supplies, food, and services. Middletown’s downtown as a whole was identified as the key economic asset and included a large number of key commercial properties. Figure 2.3 illustrates the location of the economic assets in the City of Middletown NYRCR Plan Area.

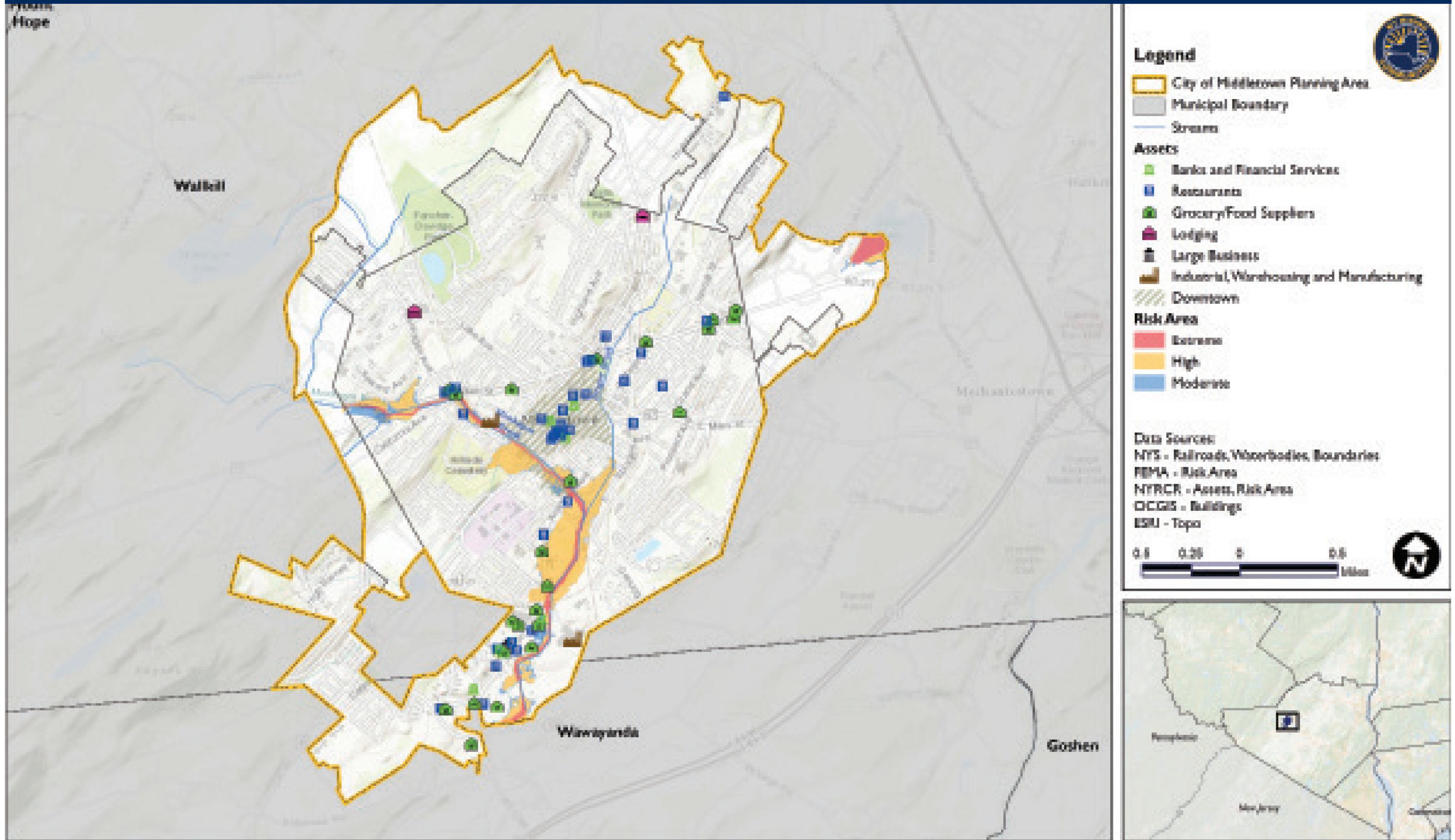
Recent Business Improvement District (BID) streetscape improvements have led to a safer and more attractive pedestrian environment. These urban design improvements should be explored elsewhere in the City.



The two images featured here depict downtown City buildings and businesses. The protection and enhancement of the City of Middletown’s downtown area, which is its central hub of economic activity, is key to the City’s sustained and enhanced growth in the future. Photo above is courtesy of Tetra Tech; photo at bottom is courtesy of Eric Thayer.



NYRCR: City of Middletown, Orange County  
**FIGURE 2.3 - ECONOMIC ASSETS**





Pictured here is the City of Middletown Fire Department, one of the critical community assets. Photo is courtesy of Tetra Tech, Inc.



Thrall Library, pictured above, is a valuable community asset that provides social, culture, and quality-of-life value to residents. Photo is courtesy of Eric Thayer.



The SUNY Orange Center for Science and Engineering, pictured above, is a community asset that is vital to maintaining and attracting a young, educated workforce. Photo is courtesy of Eric Thayer.

## Health and Social Service Assets

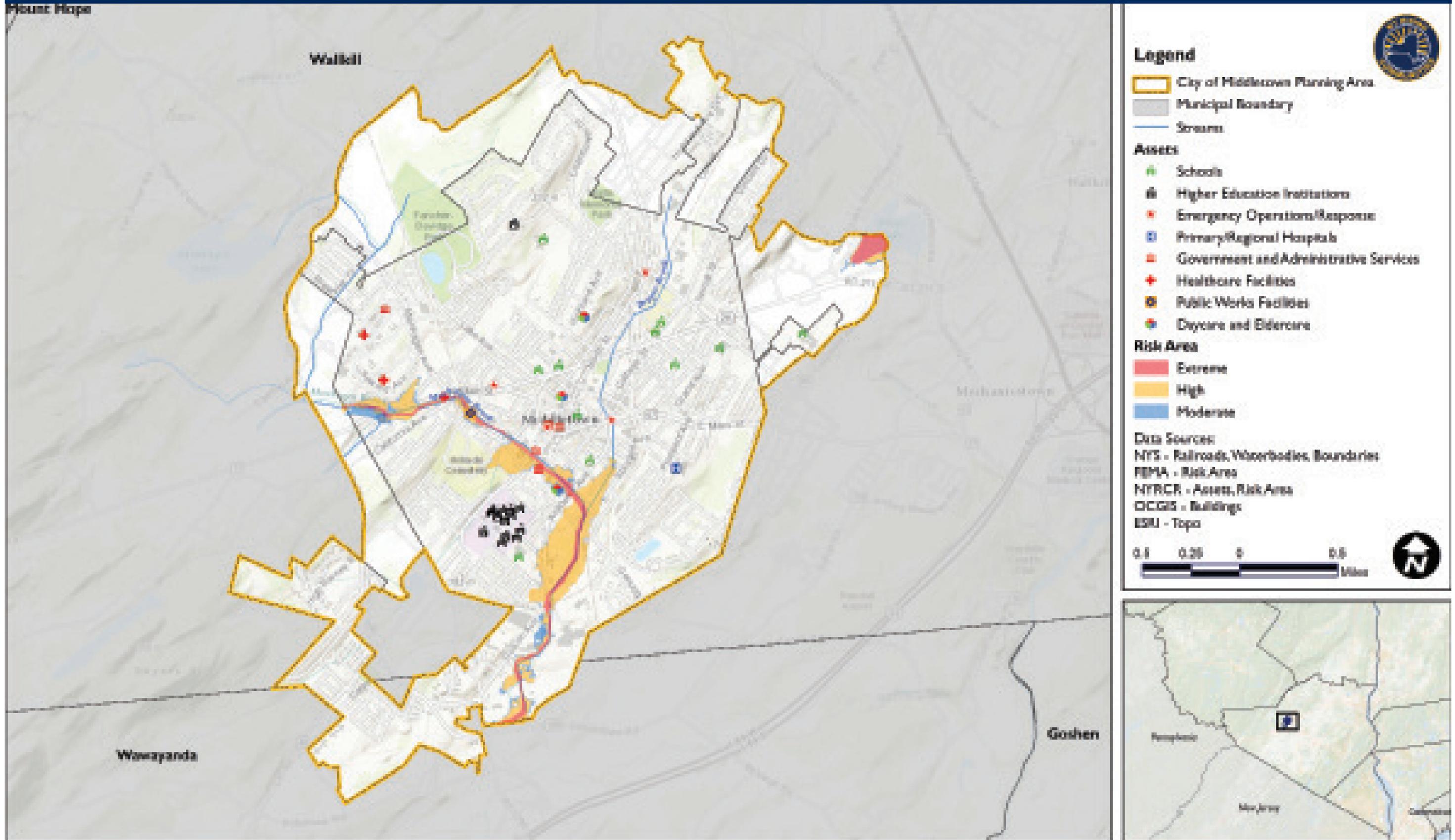
The health and social service asset category includes a variety of public functions, from health treatment facilities to general-purpose shelters in public schools, and from post offices to town halls. During a flood event, these facilities potentially serve as critical disaster response and recovery centers. Their identification, therefore, is essential to future disaster management and preparedness.

This category also includes many critical assets, including fire protection, police services, hospitals,

and emergency operations facilities. Storms severely damaged parts of the City of Middletown and hindered residents’ ability to access health and social services because of impassable and damaged roads and bridges.

The Committee identified 51 facilities in this category, including Horton Hospital, Middletown Fire Department, and Orange County Community College. Several of these structures are located near Monhagen Brook and are considered at-risk for future flood damage. Figure 2.4 identifies the location of the health and social service assets in the Plan Area.

**NYRCR: City of Middletown, Orange County**  
**FIGURE 2.4 - HEALTH AND SOCIAL SERVICE ASSETS**





## Infrastructure Assets

Infrastructure assets include resources such as pedestrian, bicycle, and vehicular ways; transit; roadways and bridges; airports; rail tracks, bridges, and stations; electric, telephone, and natural gas facilities; gas stations; water supply; stormwater, wastewater, and solid waste management facilities; and recycling centers. Major roads in the City of Middletown include State Routes 211 and 17M. These corridors provide primary access into and out of the City.

During severe weather events that result in flooding, Routes 211 and 17M are typically inundated with water and create significant evacuation and safety issues. The Interstate 84 and U.S. Route 6 interchanges are located a few miles east of the City, and provide easy access to New York City and Pennsylvania. The Metropolitan Transit Authority (MTA) provides commuter rail service that links Orange County to New York City via the Port Jervis Line of the Metro-North Commuter Railroad. While these regional transportation assets may be less vulnerable to impacts from flooding, local residents depend on these modes of transportation to get to workplaces. The Middletown-Town of Wallkill rail station is located north of the Galleria at Crystal Run Mall. Hurricane Irene caused widespread flooding and debris deposition, which rendered these rail stops useless for days after the storm.



*Stormwater infrastructure, such as the drainage channel shown in the image above, is essential to direct floodwaters away from critical facilities. Photo is courtesy of Eric Thayer.*

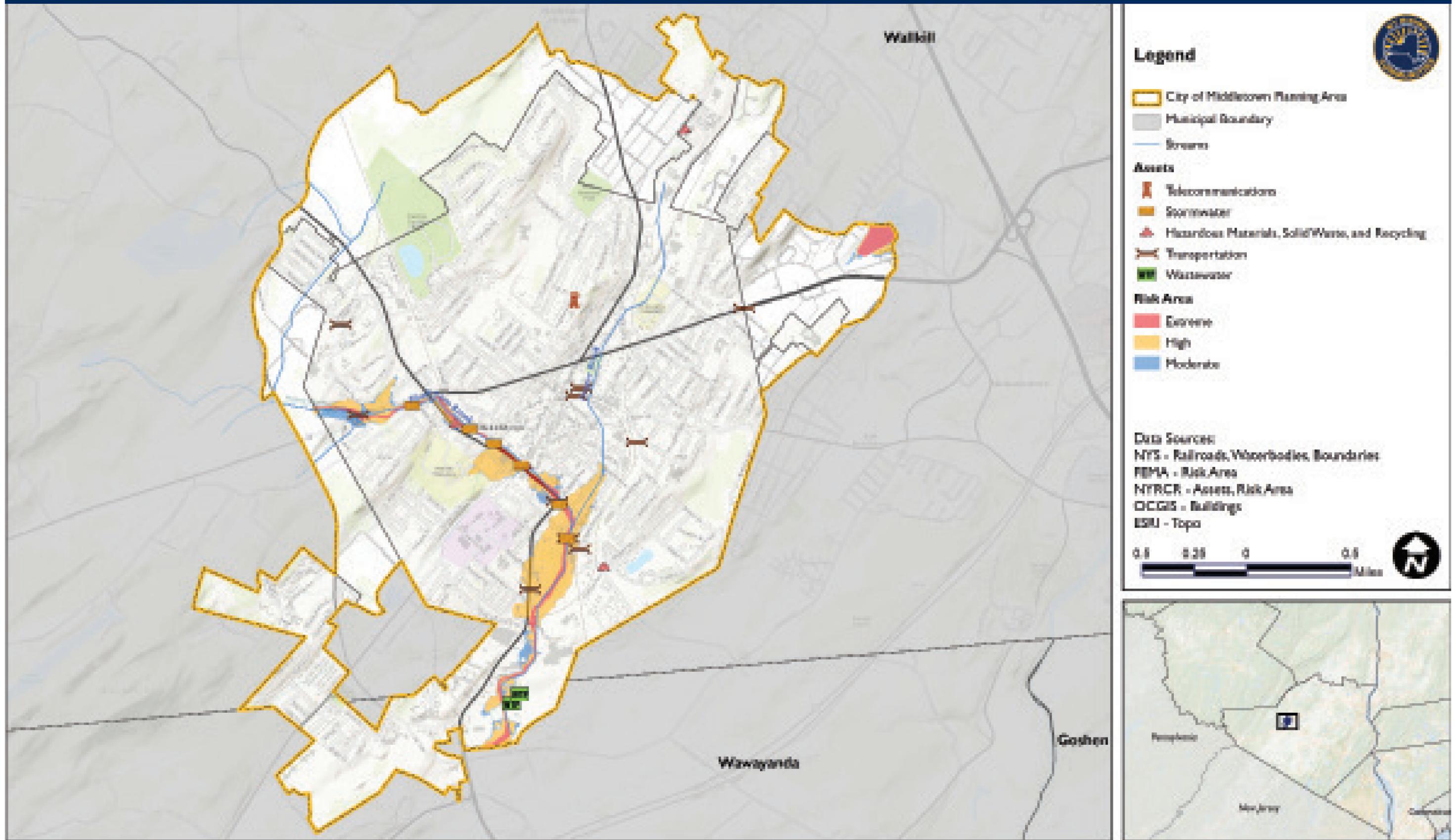
Sewer capacity issues also exist in the City of Middletown. A sanitary sewer bottleneck occurs at the intersection of Sterling Street and Sprague Avenue. When this area floods, raw sewage spills into the street because of the lack of treatment plant capacity.

The City owns over 1,200 acres of watershed in the Towns of Wallkill and Mount Hope. The land consists of surface water supplies comprised of three reservoirs (i.e., Monhagen Reservoir #1, Highland Reservoir #1, and Shawangunk Reservoir #3), Mill Pond, and a small impoundment on Shawangunk Kill.

During a storm event, infrastructure assets may provide access to critical disaster response and recovery personnel; they may also allow for the maintenance of sanitary conditions during a disaster event. The Committee and Consultant Team identified 25 infrastructure assets in the Plan Area, including stormwater culverts, the sewer treatment plant, and numerous transportation facilities. Figure 2.5 identifies their locations.

**Transportation and stormwater-related facilities were among the assets in this category most often identified by the Committee as being critical to community resilience. Safe access to and from the City during storm events was a clear priority, based on public comment and Committee feedback.**

NYRCR: City of Middletown, Orange County  
**FIGURE 2.5 - INFRASTRUCTURE ASSETS**





## Natural and Cultural Resource Assets

Natural and cultural resources are important to the quality of life in the City of Middletown. They provide scenic, recreational, and environmental benefits, and they provide protection for other community assets from potential flood impacts. Identifying these assets is important to:

- (1) Understand ways to protect historic and cultural resources; and
- (2) Determine where natural resources, such as wetlands or floodplains, could be enhanced to help protect the City’s infrastructure and other assets during storm events.



*Pictured here is Maple Hill Park, one of the City of Middletown’s natural and cultural assets. Photo is courtesy of Eric Thayer.*

Buildings and structures constructed in the floodplain have the potential to sustain flood damage. These structures can also change the pattern of water flow and increase flooding and flood-related damage on adjacent properties. The City of Middletown (approximately 3,286 acres in size) has about 151 acres (5%) of its land located in the 100-year FHA and about 21 acres (1%) of its land located in the 500-year FHA. These floodplains are associated with the Monhagen Brook, which is located in the south-southwestern portion of the City. Numerous buildings and structures are located in both the 100-year and 500-year floodplains.

Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt,

groundwater, and floodwaters. Trees, root mats, and other wetland vegetation also slow the speed of floodwaters, distributing them more slowly over floodplains. Wetlands within and downstream of urban areas are valuable, because they decrease the rate and volume of surface water runoff from impervious surfaces and buildings. A one-acre wetland can typically store approximately one million gallons of water.

Overall, wetlands help protect adjacent and downstream properties from flood damage. The City of Middletown contains areas of freshwater wetlands in the northern and southeastern portions of the City.

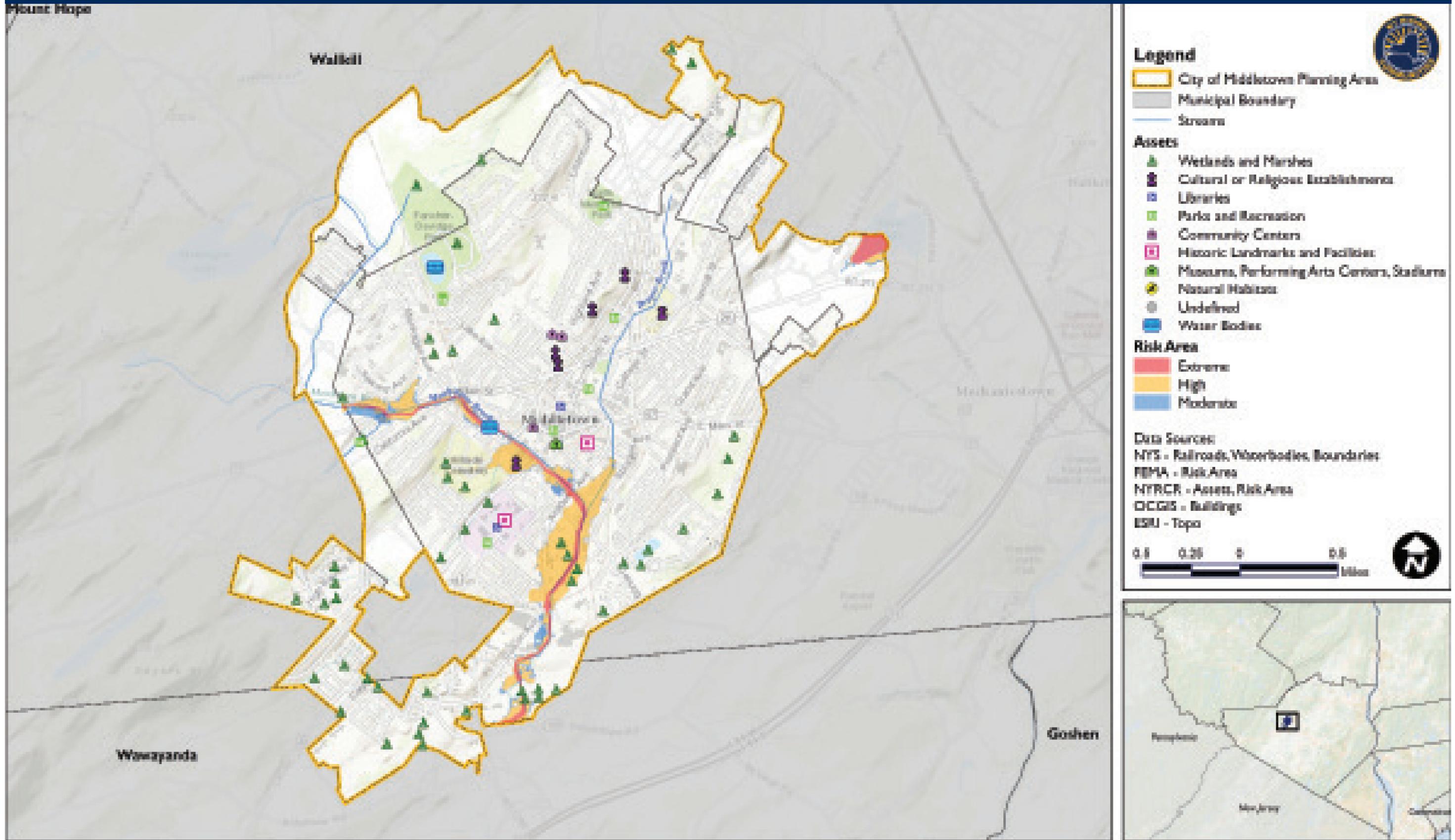
In addition to natural areas, Middletown contains 13 parks that provide a wide range of recreational opportunities for residents. These facilities enhance quality of life and can accommodate an array of activities, including group sports, bicycling, ice-skating, jogging, swimming, walking, fishing, cooking, picnics, playground activities, outdoor concerts, and a place to relax.

The Committee, with assistance from the Consultant Team, identified 77 facilities in this category, including the Paramount Theater, Thrall Library, Hillside Cemetery, the YMCA, City Square Park, and numerous wetlands and marshes. Many of these assets were identified as having high community value. Figure 2.6 illustrates the location of the cultural and natural resource assets throughout the City.



*The Paramount Theatre is located in the City’s Central Business District. It is one of the key features in downtown Middletown. The Theatre is one of the area’s finest examples of community-supported restoration of a downtown landmark. It is a notable cornerstone of the City’s growing downtown district. Photo is courtesy of Eric Thayer.*

**NYRCR: City of Middletown, Orange County**  
**FIGURE 2.6 - CULTURAL AND NATURAL RESOURCE ASSETS**





## Housing Assets

A number of residential neighborhoods in the City are routinely impacted by flooding. The West Main Street and Sterling Street residential neighborhoods were significantly impacted by floodwaters from Hurricane Irene and Tropical Storm Lee.

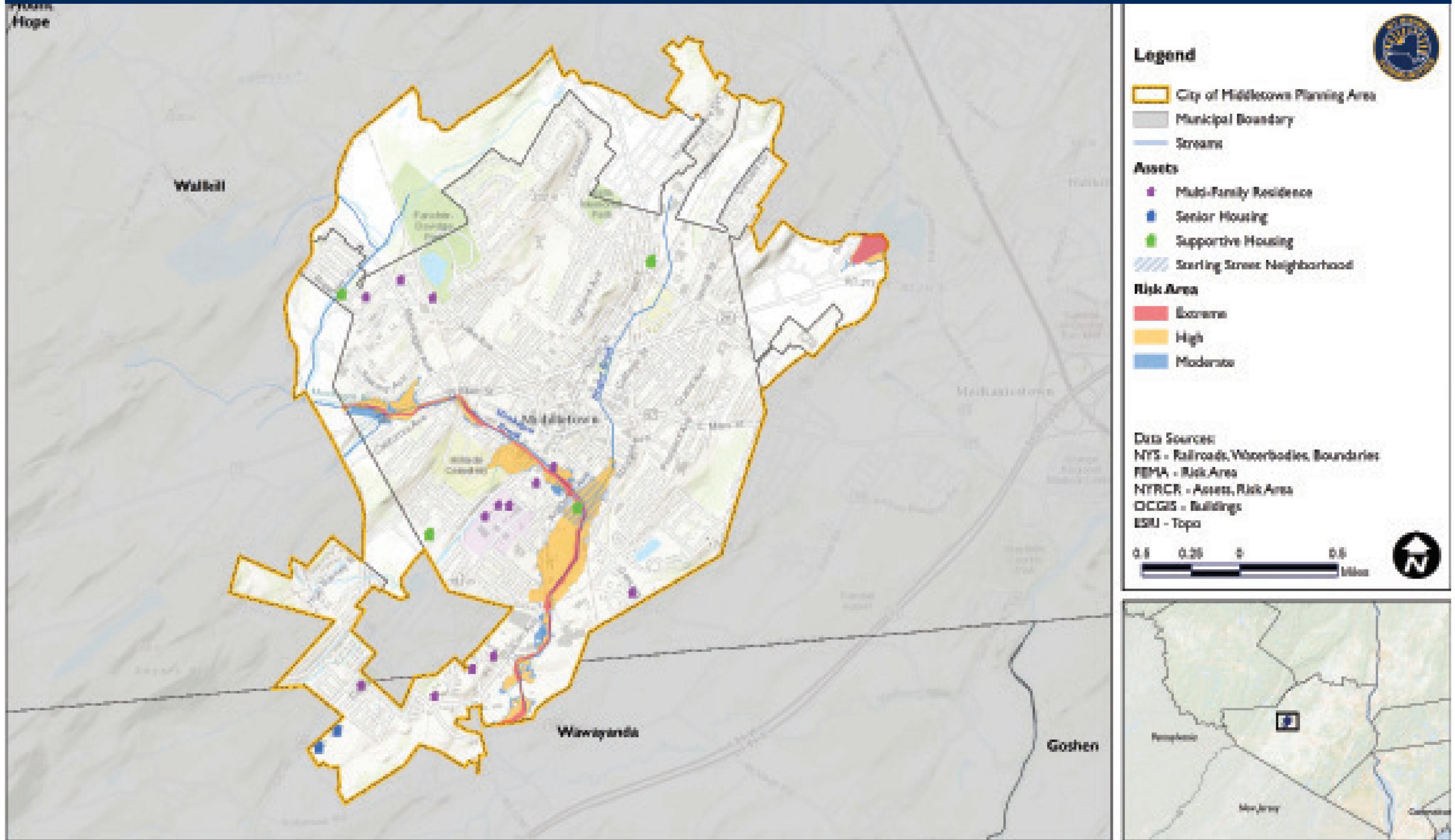
The Sterling Street neighborhood is located along the Monhagen Brook, just upstream of the point of confluence with Draper Brook. This neighborhood was identified as a housing asset that is routinely impacted by flooding events. The Southeastern Towers complex is another housing asset where access is cut off by flooding events that overtop Fulton Avenue.

The Committee and Consultant Team identified a total of 20 facilities in this category. This asset category includes, but is not limited to, multi-family dwellings, supportive housing/group homes, and senior housing. A majority of the housing assets, i.e., 13 of the 20 facilities, are located in the southern half of the City. Three of the facilities are associated with the State University of New York (SUNY) Orange County Community College. The remaining assets are located in the western and northeastern portions of the City. Figure 2.7 identifies the location of the housing assets in the City of Middletown.



*Pictured here is the Sterling Street neighborhood. Photo is courtesy of Eric Thayer.*

NYRCR: City of Middletown, Orange County  
FIGURE 2.7 - HOUSING ASSETS





# Assessment of Risk to Assets and Systems

## DESCRIPTION OF METHODOLOGY

Based on Community and Committee feedback and in conjunction with information captured by the asset inventory, risks for the City of Middletown’s assets were assessed using the NYS DOS-provided Risk Assessment Tool. The Risk Assessment Tool is designed to assess and quantify the risk to individual community assets through built-in formulas that calculate an overall risk score category. The risk score category is based on three factors – hazard, exposure, and vulnerability. The tool calculates a score for each of these factors and combines them to represent the relative risk of each asset in the community to one another.

The Risk Assessment Tool calculation combines scores for the three factors using the formula:

$$\begin{array}{l}
 \text{HAZARD} \\
 \times \text{EXPOSURE} \\
 \times \text{VULNERABILITY} \\
 \hline
 = \text{RISK}
 \end{array}$$

Each factor in this equation is calculated automatically, based on appropriate inputs and are assigned as follows:

- **HAZARD SCORE:** Assigned for each asset based on a 100-year storm event occurring within the next 100 years.
- **EXPOSURE SCORE:** Determined by the risk area where the asset is located, and local landscape attributes that influence the potential for storm impacts. This score reflects how landscape features can moderate damage to individual assets.
- **VULNERABILITY SCORE:** Reflects the level of impairment or consequences that assets may experience from a hazard event, and reflects the ability of the asset to resist damage from the hazard.

Details on this NYRCR Plan’s risk assessment are included in Section 5: Additional Materials.

## INTERPRETATION OF RISK

Risk scores help to identify assets with an elevated potential for storm damage. Some factors that should be considered for each asset in developing a community risk management strategy include:

- Contribution Risk scores help to identify assets with an elevated potential for storm damage. Some factors that should be considered for each asset in developing a community risk management strategy include Capacity of the asset to adapt.

The Consultant Team evaluated risk for a 100-year (1% annual chance) and a 500-year event (0.2% annual chance), the latter of which represents a higher-intensity storm event. Risk was calculated for each asset, resulting in categorization in one of several categories.

### FLOODPLAIN VS. FLOODWAY

*A **floodplain** is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. Most often floodplains are referred to as 100-year floodplains. A 100-year floodplain is not the flood that will occur once every 100 years, rather it is the flood that has a 1% chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time (Delaware County Hazard Mitigation Plan Update 2013).*

*A **regulatory floodway** means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations (FEMA 2014).*

### Severe Category

Both exposure and vulnerability should be reduced for assets in this category, if possible. Relocation of these assets should be considered as a priority option.

### High Category

Risk scores in this high category indicate conditions that could lead to significant negative outcomes from a storm.

Actions should be taken to reduce vulnerability, such as elevating or flood-proofing the asset to help avoid a long-term loss of function.

### Moderate Category

Risk scores in this category pose moderate-to-serious consequences. Adaptation may be a lower priority, based on exposure or because vulnerability remains relatively low. A combination of measures should be considered to reduce exposure or vulnerability.

### Residual Category

Risk scores in the residual category occur when the asset is located outside of an identified risk area, and exposure and vulnerability are relatively low. This situation suggests floods would pose minor or infrequent consequences. Note that risk is never completely eliminated. Some residual risk still remains, even after management measures have been implemented. It is recommended to monitor conditions and adapt, as necessary.

## ASSESSMENT RESULTS

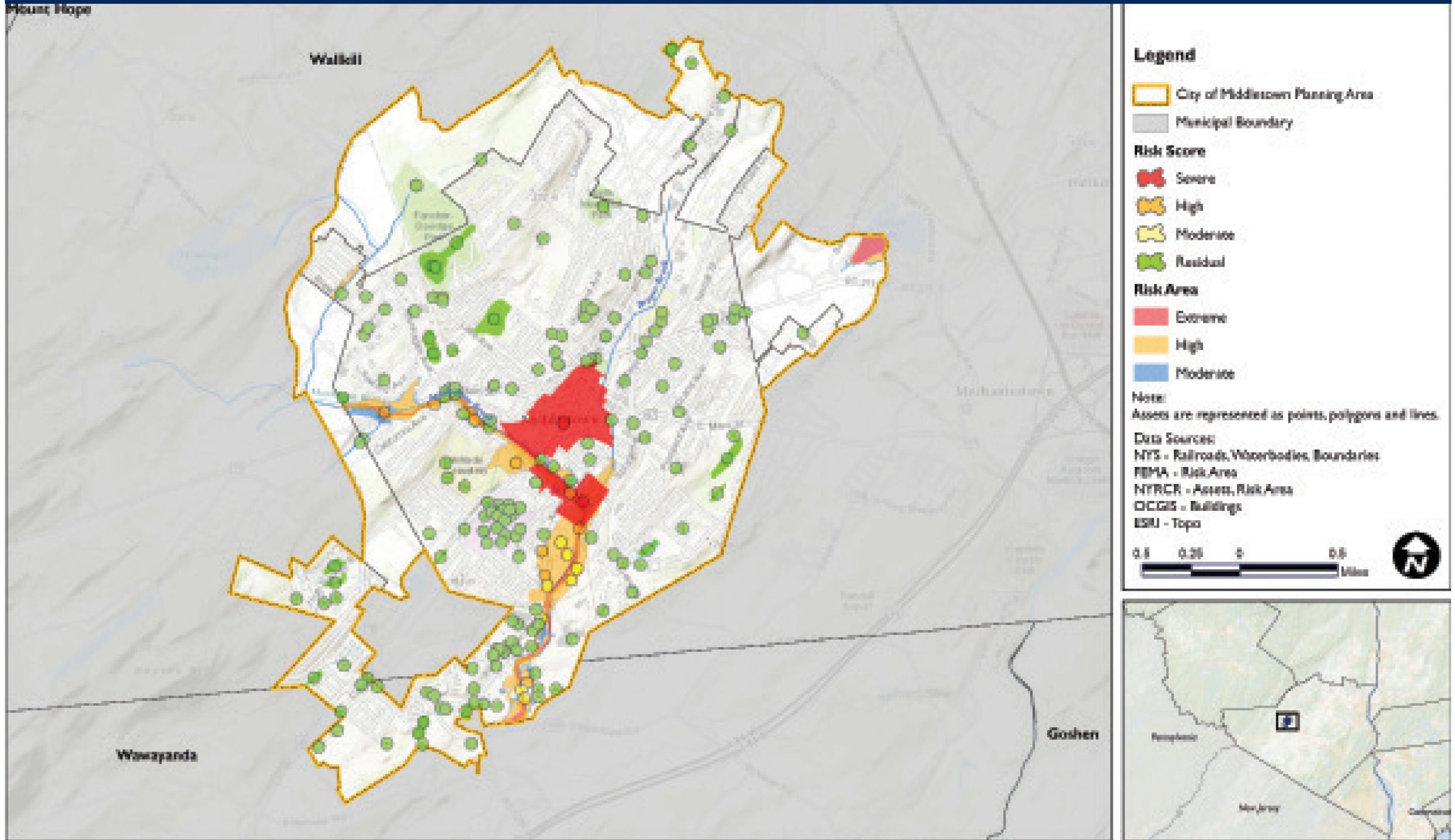
Many assets identified in the City are within or proximate to downtown Middletown. Most development in the downtown is either on or near the floodplain, and many sections of the City are in the floodway. Flooding from the Monhagen Brook and the Draper Brook poses the greatest risk to the City and many of its key assets.

Numerous buildings in the City are located in the 100-year floodplain. Approximately 5% of the total area of the City is located in the 100-year floodplain, and 1% is located in the 500-year floodplain. Stronger and more frequent storms have rendered the City of Middletown more susceptible to devastating effects of flooding. Clearly, many assets within the City are exposed and extremely vulnerable to storm events. The risk score results indicate this vulnerability.



*Many residential areas are at-risk throughout the City during severe flood events, including streets that experience storm drain “geysers,” such as the one depicted in the image above. Photo is courtesy of the City of Middletown.*

NYRCR: City of Middletown, Orange County  
**FIGURE 2.8 - RISK SCORE MAP**





As shown in Figure 2.8, many assets with severe and high risk scores during a 100-year event are along or near Fulton and Dolson Avenues, in close proximity to Monhagen Brook. The assets with the highest risk scores include the following:

- Downtown Middletown (extreme);
- Monhagen Brook (severe);
- Sterling Street neighborhood (severe);
- Academy Avenue at Fulton Avenue (severe);
- West Main Street (high);
- Several culverts (high);
- Middletown Department of Public Works (DPW) facility (high);
- Hillside cemetery (high);
- Middletown recycling drop-off (high);
- Middletown sewer treatment plant (high); and
- Shell gas station (high).

## ECONOMIC

The risk scores identified at Table 2.2 indicate that a number of the City's economic assets are located in severe or high risk areas from flooding. Three assets (i.e., Rite-Aid, Key Bank, and Jiffy Lube) were identified at moderate risk; one asset (i.e., Shell gas station on Dolson Avenue) was identified at high risk; and one asset (i.e., the Middletown downtown area) was identified at extreme risk from flooding during a 100-year event. Key Bank and Jiffy Lube are located along Dolson Avenue, and Rite-Aid is located on Fulton Street.

All five assets are located in close vicinity to Monhagen Brook. The Shell gas station and Jiffy Lube are both located in the 1% annual chance floodplain. Key Bank and Rite-Aid are located in the 0.2% annual chance floodplain. Downtown Middletown includes areas along Fulton Avenue and was identified as being extremely impacted during storm events. Due to the location of these assets and their close proximity to the Monhagen Brook, these facilities are susceptible to flooding events.

This risk reflects information provided by the Community and Committee. A number of the businesses and facilities in the City were routinely affected by flood events, especially the flood events associated with Hurricane Irene and the remnants of Tropical Storm Lee. Table 2.2 lists the risk scores for economic assets in the City of Middletown.

The buildings identified as moderate and high risk in Table 2.2 are the most vulnerable and exposed to flooding within the City and could be considered for flood mitigation actions, including possible relocation. Other buildings could be prioritized for flood-proofing or other mitigation measures. Most of the development in the center of the City, near Fulton Avenue and Dolson Avenue, occurs either on or near the floodplain, and many of the key assets are at risk from flooding.

**TABLE 2.2 - ECONOMIC ASSETS**

Asset/Asset Type	Asset Subcategory	100-Year Risk Score	500-Year Risk Score
Downtown Area		Extreme	Extreme
Shell Gas Station	Grocery/Food Suppliers	High	High
Key Bank	Banks and Financial Services	Moderate	Moderate
Jiffy Lube	Grocery/Food Suppliers	Moderate	Moderate
Rite-Aid Drugstore	Grocery/Food Suppliers	Moderate	Moderate
5 Banks/Financial Services	Banks and Financial Services	Residual	Residual
20 Grocery/Food Suppliers	Grocery/Food Suppliers	Residual	Residual
EA Morse and Co, Inc.	Industrial, Warehousing and Manufacturing	Residual	Residual
Genpak	Industrial, Warehousing and Manufacturing	Residual	Residual
AutoZone	Large Business	Residual	Residual
Ginos Motel	Lodging	Residual	Residual
Globe Hotel	Lodging	Residual	Residual
33 Restaurants	Restaurants	Residual	Residual

Source: NYRCR Program, NYS DOS

## HEALTH AND SOCIAL SERVICE ASSETS

Two of the City's health and social service facilities are located in a risk area. One can be found in the extreme risk area (i.e., Middletown DPW facility), and one is in the moderate risk area (i.e., the Promenade). The City's health and social services assets have incurred flood damages in the past, and some are at high risk from flooding in the future.

One asset, the Middletown DPW complex, was identified as high risk from flooding during a 100-year flooding event. This facility is located in the 1% annual chance floodplain, with the Monhagen Brook located less than 100 feet northeast of the property. This location and the damage experienced by the DPW place this asset at high risk from flooding during a 100-year event.

Hurricane Irene severely damaged the DPW facility and associated property. The DPW facility had approximately four feet of water running through the building.

The remaining assets (i.e., 50 facilities) are at residual risk from flooding during a 100-year flooding event.

This data reflects information provided by the Community and Committee. A number of services and facilities in the City have frequently been affected by flood events and are especially associated with Hurricane Irene and Tropical Storm Lee. Table 2.3 lists the risk scores for health and social service assets in the City of Middletown.

To reduce future flood damages and losses to these assets, substantial mitigation actions could be considered to reduce both vulnerability and exposure. Some buildings and facilities most vulnerable to flooding could be considered for relocation. Most development in the main area of the City is either on or near the floodplain. Many key assets in the City, including the City's DPW facility, are at risk from flooding. Facilities that cannot be relocated could be prioritized for flood-proofing or other mitigation measures.

See Table 2.3 for risk scores for health and social service assets.



**TABLE 2.3 - HEALTH AND SOCIAL SERVICE ASSETS**

Asset/Asset Type	Asset Subcategory	100-Year Risk Score	500-Year Risk Score
Middletown DPW Facility	Public Works Facilities	High	High
The Promenade	Daycare and Eldercare	Moderate	Moderate
2 daycare/eldercare facilities	Daycare and Eldercare	Residual	Residual
4 emergency operations/ response facilities	Emergency Operations/ Response	Residual	Residual
14 government and administrative facilities	Government and Administrative Services	Residual	Residual
3 healthcare facilities	Healthcare Facilities	Residual	Residual
14 higher education facilities	Higher Education Institutions	Residual	Residual
Horton Hospital	Primary/Regional Hospitals	Residual	Residual
11 schools	Schools	Residual	Residual

Source: NYS DOS, NYRCR Program

### INFRASTRUCTURE ASSETS

Based on information provided by the Community and Committee, eight infrastructure assets are located in an extreme risk area; three assets are in a high risk area; and one is in a moderate risk area. One infrastructure asset, the Monhagen Brook Culvert at Genung Street, was identified as being at severe risk from flooding during a 100-year flood event. Ten assets were identified at high risk from flooding during a 100-year event. One asset, the Fulton Street Culvert, was identified at moderate risk, while the other 13 assets were identified to have residual risk.

**Monhagen Brook Culvert at Genung Street was identified as a property with severe risk from flooding. The Monhagen Brook is the main source of flooding in the City.**

Dolson Avenue was identified as a high-risk asset in the City. Dolson Avenue is a major thoroughfare that provides access to and from the City from the south. This street consistently floods during severe weather events. It has high community value and is located in a high-risk area. Dolson Avenue is also located in the 1% annual chance floodplain, with numerous assets and other development located along the street and within the floodplain.

West Main Street was also identified as a high-risk asset in the City, and like Dolson Avenue, it serves as one of the major access points in and out of the City. This area of the City routinely floods during severe weather.

The Academy Avenue/Fulton Avenue intersection is a major intersection in the City and floods during storm events, inhibiting access to the area. During Hurricane Irene, flooding in this area prevented emergency personnel and vehicles stationed at the Central Firehouse from accessing the south side and other areas of the City.

During Hurricane Irene, culverts in the City suffered damage. On Fulton Avenue, the force of the floodwaters ruptured a culvert, and entire sections of the roadway uplifted. This created large craters in the roadway, once the flooding subsided.

Flood events impacted numerous infrastructure assets, especially those associated with Hurricane Irene and Tropical Storm Lee. Table 2.4 lists the risk scores for infrastructure assets in the City of Middletown.



**TABLE 2.4 - INFRASTRUCTURE ASSETS**

Asset/Asset Type	Asset Subcategory	100-Year Risk Score	500-Year Risk Score
Monhagen Brook Culvert At Genung Street	Transportation	Severe	Severe
Middletown Recycling Drop-off	Hazardous Materials, Solid Waste, and Recycling	High	High
4 culverts	Stormwater	High	High
Fulton Avenue Culvert	Stormwater	High	High
Academy Avenue at Fulton Avenue	Transportation	High	High
Dolson Avenue	Transportation	High	High
West Main Street	Transportation	High	High
Sewer Treatment Plant	Wastewater	High	High
Fulton Street Culvert	Stormwater	Moderate	Moderate
Highland Avenue-Walkkill (General Switch)	Hazardous Materials, Solid Waste, and Recycling	Residual	Residual
Or - Fulton Avenue - Middletown Mgp	Hazardous Materials, Solid Waste, and Recycling	Residual	Residual
Or - Genung Street - Middletown Mgp	Hazardous Materials, Solid Waste, and Recycling	Residual	Residual
Digital Radio Broadcasting, Inc. - 94.9 Mhz-W235bi	Telecommunications	Residual	Residual
Digital Radio Broadcasting, Inc. - 95.7 Mhz-W239ac	Telecommunications	Residual	Residual
Wamc - 106.3 Mhz-W292dx	Telecommunications	Residual	Residual
Genung Street	Transportation	Residual	Residual
Power Dr. Inside	Transportation	Residual	Residual
Route 211 East Side Of the City	Transportation	Residual	Residual
Shortline Bus Depot	Transportation	Residual	Residual
Shortline Bus Terminal	Transportation	Residual	Residual
Sprague Avenue	Transportation	Residual	Residual
Middletown Sewer Treatment Plant	Wastewater	Residual	Residual

Source: NYRCR Program, NYS DOS

Based on the developed information, substantial mitigation actions should be considered to reduce both vulnerability and exposure to these infrastructure assets. Culverts and facilities most vulnerable and exposed to flooding in the City could be considered for substantial upgrades.

Most development in the main area of the City is either on or near the floodplain, and many key assets in the City are at risk from flooding. Therefore, mitigation actions, such as flood-proofing and upgrades, should be explored.



## NATURAL AND CULTURAL RESOURCE ASSETS

Based on information provided by the Community and Committee, one asset (i.e. Hillside Cemetery) was identified as high risk, six assets (all wetlands) were identified as moderate risk, and 70 assets were identified as residual risk from a 100-year flooding event.

Hillside Cemetery, located at 50 Mulberry Street, is the only natural and cultural resource asset with a high risk for a 100-year event. A small portion of the Hillside Cemetery is located in the 1% annual chance floodplain, approximately 600 feet south of Monhagen Brook.

Many natural and cultural resource assets are routinely affected by flood events. Table 2.5 lists the risk scores for natural and cultural assets in the City of Middletown.

Those buildings and facilities listed in the previous table that were identified as the most vulnerable and exposed to flooding in the City should be considered for flood-proofing mitigation measures and possible relocation. However, these considerations should also include facilities not located in the regulatory floodplain (and therefore, not associated with a risk score). Mitigation should be implemented where historical flood damages suggest future vulnerability.



*Pictured above is a walking path through a wooded area that is the location of the future Heritage Trail. Photo is courtesy of Eric Thayer.*

**TABLE 2.5 - NATURAL AND CULTURAL RESOURCE ASSETS**

Asset/Asset Type	Asset Subcategory	100-Year Risk Score	500-Year Risk Score
Hillside Cemetery	Cultural or Religious Establishments	High	High
Six wetland areas	Wetlands and Marshes	Moderate	Moderate
Middletown Elks Lodge 1097	Community Centers	Residual	Residual
Mulberry House Senior Center	Community Centers	Residual	Residual
YMCA	Community Centers	Residual	Residual
Applebee McPhillips Funeral Home	Cultural or Religious Establishments	Residual	Residual
Mount Carmel Church	Cultural or Religious Establishments	Residual	Residual
Seventh Day Adventist Church	Cultural or Religious Establishments	Residual	Residual
St. Joseph's Cemetery	Cultural or Religious Establishments	Residual	Residual
Temple Sinai	Cultural or Religious Establishments	Residual	Residual
Edwin Welling Van Duzer Memorial House	Historic Landmarks and Facilities	Residual	Residual
Morrison Hall	Historic Landmarks and Facilities	Residual	Residual
Learning Resource Center Library	Libraries	Residual	Residual
Thrall Library	Libraries	Residual	Residual
Paramount Theater	Museums, Performing Arts Centers, Stadiums	Residual	Residual
City Square Park	Parks and Recreation	Residual	Residual
Davidge Park	Parks and Recreation	Residual	Residual
Fancher Davidge Park	Parks and Recreation	Residual	Residual
Linden Avenue Park	Parks and Recreation	Residual	Residual
Middletown Lanes	Parks and Recreation	Residual	Residual
Mount Hope Park	Parks and Recreation	Residual	Residual
Tennis Courts	Parks and Recreation	Residual	Residual
Watts Memorial Park	Parks and Recreation	Residual	Residual
Monhagen Brook	Water Bodies	Residual	Residual
Waterbody	Water Bodies	Residual	Residual
45 wetland areas	Wetlands and Marshes	Residual	Residual
Monhagen Upstream Swamp	Wetlands and Marshes	Residual	Residual
Wetland Behind Fancher-Davidge Park	Wetlands and Marshes	Residual	Residual

Source: NYRCR Program, NYS DOS



## HOUSING ASSETS

One housing asset, the Middletown Hostel #46, was identified as high risk from flooding during a 100-year flooding event, consistent with information provided by the Community and the Committee. The Middletown Hostel #46 is located in the 1% annual chance floodplain and is situated less than 200 feet south of Monhagen Brook. This section of the City has other assets identified as high- and severe-risk properties. The hostel is also

located in the Sterling Street neighborhood, an area that routinely floods during storm events.

Table 2.6 lists the risk scores for housing assets in the City of Middletown. Most housing assets in the City are outside the areas at risk from flooding; however, the facilities listed in Table 2.6 should be prioritized for flood-proofing or other mitigation measures to reduce both vulnerability and exposure.

**TABLE 2.6 - HOUSING ASSETS**

Asset/Asset Type	Asset Subcategory	100-Year Risk Score	500-Year Risk Score
Middletown Hostel #46	Supportive Housing	High	High
Birch Court Apartments	Multi-Family Residence	Residual	Residual
Brewery Apartments	Multi-Family Residence	Residual	Residual
College Hill Apartments	Multi-Family Residence	Residual	Residual
David Moore Heights	Multi-Family Residence	Residual	Residual
Harriman Hall	Multi-Family Residence	Residual	Residual
Horton Hall	Multi-Family Residence	Residual	Residual
Orange Hall	Multi-Family Residence	Residual	Residual
Overlook Apartments	Multi-Family Residence	Residual	Residual
Southeast Towers	Multi-Family Residence	Residual	Residual
Summitfield Apartments	Multi-Family Residence	Residual	Residual
Sutton Hill Apartments	Multi-Family Residence	Residual	Residual
Tall Oaks Apartments	Multi-Family Residence	Residual	Residual
Middlecrest Crossing Senior Apartments	Senior Housing	Residual	Residual
Margaretville Hostel #2107	Supportive Housing	Residual	Residual
Middletown Hostel #10368	Supportive Housing	Residual	Residual
Middletown Hostel #1804	Supportive Housing	Residual	Residual

Source: NYRCR Program, NYS DOS

## Assessment of Needs and Opportunities

The Committee identified needs and opportunities, categorized by each of the six RSFs.

### Community Planning and Capacity Building

The Community Planning and Capacity Building RSF addresses the community’s ability to implement storm recovery activities and to plan how to mitigate the effects of future storms. Experience from recent major storms highlights the City’s overall limited capacity to support and permit appropriate reconstruction and redevelopment to build back better, using flood-resilient and flood-proofing measures and best practices that are consistent with long-term goals.

In recent years, the City of Middletown has spearheaded plans that guide the growth and development of all aspects of the City. This has included urban renewal plans to advance facility redevelopment and a Startup New York zone to promote economic development. These numerous plans and studies provide a significant advantage to the City of Middletown NYRCR planning

### COMMUNITY PLANNING AND CAPACITY BUILDING NEEDS AND OPPORTUNITIES

- Need:** A current City Comprehensive Plan.
- Need:** Higher-quality housing.
- Need:** Increase public safety awareness.
- Need:** Increased public education and outreach for residents, especially those most vulnerable to natural disasters. Outreach topics could include disaster preparedness, hazard mitigation, and stream management for stream-side landowners.
- Need:** Increase the code enforcement staff.
- Opportunity:** Recommend the development of a City Comprehensive Plan.
- Opportunity:** Develop a City-wide emergency plan as a result of the NYRCR planning process.

process, insofar as it can focus on particular areas of need, such as flood-specific and acute economic and housing challenges.

### Economic Development

The primary economic concern after a disaster is a community’s ability to return economic and business activities to normal operations. Recovery periods present unique opportunities for developing new economic strengths that result in a more sustainable and economically robust community. Communities that strategically design an economic development strategy and support these elements in their planning process are more likely to capitalize on opportunities for economic improvement, such as those presented through the NYRCR Program.

### ECONOMIC DEVELOPMENT NEEDS AND OPPORTUNITIES

- Need:** Retain critical commercial assets in the City.
- Opportunity:** Flood-proof or relocate critical facilities and assets.
- Need:** Enhance the college connection with downtown Middletown.
- Need:** Retain families and children in the City.
- Need:** Inject investment for commercial and retail establishments in the Central Business District to fill a niche market, such as healthcare and education.
- Opportunity:** Attract reinvestment to revitalize the local economy and create opportunities for growth.
- Opportunity:** Develop a sense of place and build economic resilience that capitalizes on the vibrancy of both the SUNY Orange County Community College and the Central Business District to forge an interlaced social, economic, and functional connection.



## Health and Social Services

After a disaster, one of the immediate considerations is for the swift restoration of public health, healthcare facilities, and essential social service needs. To help develop appropriate strategies and management measures, the Committee reviewed the existing City assets that support vulnerable populations, and identified key needs critical to protecting the health and well-being of all residents in a post-disaster environment. Transportation infrastructure failures and corridor access interruptions are the main hindrances to providing basic care at a level equal to that during “blue sky” periods.

Past flood events in the City of Middletown, including those associated with Hurricane Irene and Tropical Storm Lee, led to widespread structural damage of private properties and critical facilities, including the City’s DPW facility. The significant vulnerability posed by these interruptions to critical public health and safety services underlies a number of the needs and opportunities the Committee identified.

### HEALTH AND SOCIAL SERVICES NEEDS AND OPPORTUNITIES

- Need:** Protect socially vulnerable populations during flood events.
- Need:** Ensure appropriate health and social services are accessible to all residents on a daily basis and in emergency scenarios.
- Need:** Ensure uninterrupted emergency and medical services during floods and other disasters.
- Need:** Protect educational facilities, including the numerous public and private schools, along with the SUNY Orange County Community College.
- Opportunity:** Identify improvements to local service facilities, including the Middletown Fire Department.
- Need:** Provide additional outreach and education on key issues related to disaster preparedness, evacuations, sheltering in place, and stream maintenance.
- Opportunity:** Create a City-wide sheltering plan
- Need:** Provide an emergency shelter/community resource center for staff and residents of the City to use during severe weather events.
- Need:** Identify potential shelters at State University of New York (SUNY) Orange and Touro College.

## Housing

Local housing goals emphasize the need to increase affordable options outside the flood zone. Resiliency alternatives are directed toward the types and locations of housing assets with the greatest needs, the provision of sufficient housing alternatives for owners and renters, and the implementation of incentive programs for homeowners to undertake home elevations or other mitigation retrofits.

The housing stock in the City of Middletown is generally older than in many other areas of New York State; 56.2% of the homes in the City were built before 1939. The disproportionate number of older housing units and the higher rate of vacancy may indicate opportunities for improvements to the City’s housing stock.

Increased costs and reduced affordability are significant issues in the City of Middletown. Nearly half of homeowners and more than half of renters in the City pay more than 30% of their income for housing and therefore, are officially considered “burdened” by the U.S. Department of Housing and Urban Development (HUD). This jarring fact means that the essential costs of life, including clothing, food, and medical care, may be difficult for people to afford. Decreased housing affordability tends to negatively affect community development potential, because it deters the younger workforce, young families, and first-time homebuyers. Ultimately, this restricts local spending and future economic growth.

**In addition to affordability challenges, an estimated 204 residents in the City of Middletown live in the 1% annual chance floodplain. The methodology used to determine the number of residents in the 1% annual chance floodplain, however, widely underestimates the population at risk to flooding.**

For example, this estimate does not account for multiple residences on the same parcel (such as multiple mobile homes on a property). Working from an intimate knowledge of these factors, the Committee

identified housing-related needs and opportunities to further evaluate in the City of Middletown NYRCR planning process.

## HOUSING NEEDS AND OPPORTUNITIES

**Need:** Protect existing housing stock from repetitive flooding and further losses.

**Opportunity:** Explore the potential for flood-proofing or elevation of flood-prone properties to protect structures from future damage, with repetitive loss properties as a priority.

**Opportunity:** Explore the potential to acquire flood-prone properties and repurpose them as public open spaces and additional recreational and water access.

**Opportunity:** Create a housing strategy that protects existing building stock; identify land for new residential development; reduce flood insurance rates; and provide affordable housing to the workforce, existing residents, and new residents.

**Need:** Address cost-burdened residents and provide housing to accommodate a strong workforce, young families, and first-time home buyers.

**Need:** Plan for and promote a variety of housing types that are resilient in design, location, and which support residents.

## Infrastructure

Flooding caused by Hurricane Irene and Tropical Storm Lee incapacitated much of the critical infrastructure in the City of Middletown. Transportation interruptions, break-downs in communication networks, stormwater system overflows, and damages to emergency response equipment incurred during these storms and highlight the need for investment in this area. Rebuilding infrastructure with increased resilience is critical to improve the City’s capacity to respond to future disasters.

Residents and Committee Members noted deficiencies in disaster-time communications systems, along with a lack of safe access by emergency personnel and equipment in the southern section of the City during severe flooding events.

The City of Middletown has a history of incurring transportation and other infrastructure damages from severe storms, especially those leading to floods. Major corridors in the City include State Route 211 and State

Route 17M, which provide primary access into and out of the City, and have experienced repetitive flooding.

During Hurricane Irene, the stormwater infrastructure could not handle the large volume of water careening through channelized sections of the Monhagen Brook; this resulted in severe damage at Monhagen and Fulton Avenues in the City. Properties along Monhagen Avenue, including the City’s DPW facility, were severely damaged. Flooding of major roadways to and from the City forced closure of these major access points. Meanwhile, power outages were widespread throughout the City.

During Hurricane Irene, several arterial roadways that provide access to and from the City were completely cut off. State Route 211, which serves as the main access way east of the City and to Interstate 84, was inundated with several feet of water at the eastern boundary of the City. Academy Avenue, which provides access from the south, was completely flooded and impassable from the intersection of Dolson Avenue to Fulton Avenue. These are a few examples of the flooding and subsequent impacts the City has experienced during large storm events. Flooding of these locations prohibited access from emergency service personnel and equipment coming from outside the City.

## INFRASTRUCTURE NEEDS AND OPPORTUNITIES

**Need:** Upgrade the aging communication and power service infrastructure in the downtown.

**Opportunity:** Provide reliable power for communication supply when development applications are approved by BID.

**Need:** Address the aging, undersized, and damaged stormwater infrastructure.

**Opportunity:** Build new resilient infrastructure and leverage existing infrastructure investments to maximize economic development potential, improve public safety, and enhance emergency access.

**Need:** Improve telecommunications infrastructure to help ensure emergency communications capability and to attract young families, entrepreneurs, and tourists to the City.

**Opportunity:** Explore the potential for stormwater, wastewater, and drainage improvements in the City.

**Opportunity:** Plan for proper emergency access and response to all residents and areas of the City.



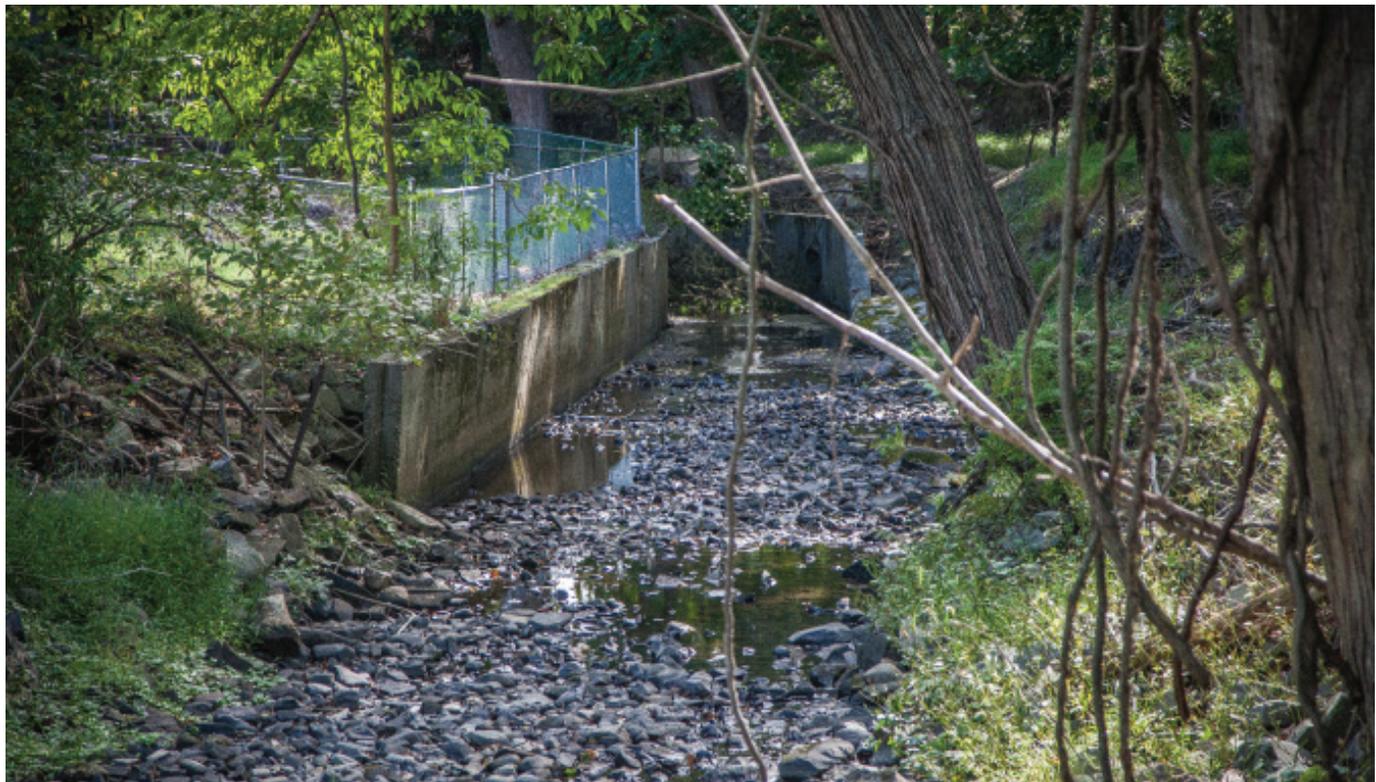
## Natural and Cultural Resources

Hazard and climate planners and managers increasingly recognize and promote natural infrastructure as low impact and sustainable means to mitigate losses from natural hazards.

**Monhagen Brook is one of the City's greatest assets and at the same time, one of its greatest threats.**

The substantial flood risk in the City is primarily caused by its proximity to Monhagen Brook, the waterway's ongoing streambank erosion, and its undersized channelization. This proximity, combined with numerous obstructions in the floodplain, results in reduced stream capacity in this reach and serves as the primary causes of substantial flood risk.

The Committee identified a number of needs and opportunities to enhance the marketing of local historic resources and to make environmental and ecosystem protection improvements through flood reduction.



*Pictured here is the Monhagen Brook behind West Main Street in the City. Photo is courtesy of the City of Middletown.*

## NATURAL AND CULTURAL RESOURCES NEEDS AND OPPORTUNITIES

**Need:** Address lack of strategically located open space and green/infiltration areas in the densely developed City.

**Need:** Address the lack of interconnected green infrastructure and open space.

**Opportunity:** Enhance parks, cultural assets, and greenway infrastructure so they serve multiple purposes, including recreation, resilience, and protection from flooding.

**Need:** Address stream conditions that cause repeat floods, including gravel deposits, streambank erosion, and remaining debris. Where appropriate, implement select debris removal, gravel harvesting, or alternative efforts to address problematic areas.

**Need:** Increase the natural strength of the streambanks to be more resilient against future floods.

**Need:** Provide safe pedestrian access.



*Photo is courtesy of Tetra Tech, Inc.*

# Section 3

Reconstruction and  
Resiliency Strategies



*Photo is courtesy of Eric Thayer.*

## Section 3: Reconstruction and Resiliency Strategies

**A** number of strategies were developed to address the most critical health, safety, resiliency, and quality of life needs identified by the City of Middletown NY Rising Community Reconstruction (NYRCR) Community (Community) and City of Middletown NYRCR Planning Committee (Committee). Analysis, ongoing discussions during Planning Committee Meetings, and public feedback served as the basis for these strategies.

This section provides details on each of the Committee’s reconstruction and resiliency strategies.

These strategies reflect the Community’s values, issues, needs, and opportunities. They are the foundation for identifying projects that will work towards the comprehensive recovery and resilience of the Community.

Many of the needs identified by the Committee and presented in Section 2 are included in the following discussion to help draw the connection between those needs and the related strategies. Some needs and opportunities appear explicitly in one or more strategies, either by reference in a strategy title or



*Pictured above is an image of a floodwater-submerged Route 78 near the Middle School. Photo is courtesy of Middletown DPW.*



in the description of that strategy. Other needs and opportunities are presented as actions in the associated tables beneath each strategy description.

While most of the initially identified needs and opportunities are directly translated here into short- or long-term strategies and actions, others are not. The Committee decided to promote the most immediate needs to serve the greatest community benefit.

The Committee developed these strategies with input from the public. A full description of Proposed Projects and Featured Projects is located in Section 4: Proposed and Featured Project Profiles. A full list of Proposed Projects, Featured Projects, and Additional Resiliency Recommendations can be found in Section 5: Additional Materials.



*Pictured above are roadway infrastructure improvements made after severe flooding at the corner of Wawayanda Avenue and Fulton Street. Photo is courtesy of Eric Thayer.*

## Strategy 1

### **Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.**

This strategy addresses a range of needs and opportunities across the six Recovery Support Functions (RSFs) and is most central in responding to the identified infrastructure challenges in the City. Investments in appropriate infrastructure systems are critical to ensure personal safety, property protection, and mobility.

Needs addressed by this strategy may include transportation infrastructure upgrades, protection of assets incurring repetitive flood damage, and ensuring the continuity of critical government and emergency response capabilities. Proposed actions will address existing conditions that contribute to repetitive flooding in the City. This strategy directs efforts and investment toward fulfilling several of the needs identified by the Committee, as listed below:

- Address infrastructure and flood mitigation deficiencies causing or contributing to repetitive flooding in the City.
- Improve conditions and infrastructure along Monhagen Brook and Draper Brook, including existing culverts, detention dams, and stream conditions.
- Repair, replace, and enhance bridges and culverts to address repetitive flooding and ensure mobility and access to and throughout the City during a flood.
- Restore streambanks and surrounding riparian areas to improve stream flow, reduce erosion, and provide additional flood attenuation.
- Improve the existing berm/dam in the Maple Hill Park area to create additional floodwater retention and enhance the Park as a recreation amenity.
- Retain critical commercial assets within the City by flood-proofing or relocating critical facilities and assets.
- Enhance parks, cultural assets, and greenway infrastructure so they serve multiple purposes – recreation, resilience, and protection from flooding events.

In light of these needs, the strategy to reduce the impacts of flooding allows for investment in a range of resiliency projects. Projects associated with this strategy will minimize flood impacts by reducing the City’s overall vulnerability to floods. Targeted infrastructure investments will address current damage and deficiencies while building more resilient systems to increase flood protection for community assets, systems, homes, and businesses. Table 3.1 identifies those projects developed by the Committee to accomplish Strategy 1.

Strategy 1 can be supported by opportunities for flood-proofing or relocating critical facilities and assets; acquiring flood-prone properties; constructing resilient infrastructure; improving stormwater, wastewater, and drainage in the City; and enhancing natural resources to serve multiple purposes.



Pictured above are the beginnings of roadway infrastructure improvements after severe stormwaters at the corner of Wawayanda Avenue and Fulton Street. Photo is courtesy of Tetra Tech, Inc.

### TABLE 3.1 - STRATEGY 1

**Strategy 1: Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
Monhagen Brook Culvert and Dredging Project	This project includes: <ul style="list-style-type: none"> <li>Dredging and removal of sediment within and along the culvert;</li> <li>* Removal of piers at the confluence of the Monhagen and Draper Brooks, and the replacement of this section and other damaged sections of culverts; and</li> <li>Re-channelization of the section of Monhagen Brook directly downstream of Genung Street.</li> </ul>	\$1.5 - \$2 million \$100,000 for property acquisition	Proposed	N
Dorothea Dix Drive Flood Retention/Wetland Construction/Restoration Project	The first phase of the project will include the acquisition of the 8.2-acre property, and the demolition and removal of the existing parking lot area. It will include the engineering, construction, and re-channelization of the Monhagen Brook; the development of the first phase of wetland mitigation areas; and the construction of the first phase of recreational features that include some sections of the proposed trail system and interpretive signage.	\$1.5 million	Proposed	Y



**TABLE 3.1 - STRATEGY 1 (CONT'D)**

**Strategy 1: Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
Culvert Improvements at West Main Street and Monhagen Avenue	The project will include the removal of the existing twin culverts and the upgrade of that section of culvert to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project will also include streambank mitigation of the day-lighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert.	\$2 million	Proposed	N
Culvert Improvements at West Main Street and Monhagen Avenue	The project will include the removal of the existing twin culverts and the upgrade of that section of culvert to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project will also include streambank mitigation of the day-lighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert.	\$2 million	Proposed	N
West Main Street Streambank Mitigation	Restoration of the streambanks and surrounding riparian area to improve flow conditions, reduce erosion, and provide additional flood attenuation, if possible. Consideration for regenerative design techniques could be used.	\$1.5 million - \$2 million	Proposed	N
Maple Hill Park Improvements	This project will improve the existing berm/dam to create additional floodwater retention while enhancing the facility as a recreational amenity. This can work in concert with the other upstream wetland construction and stormwater retention projects to alleviate or reduce flooding downstream along West Main Street, Monhagen Avenue, Fulton Avenue, Sterling Street, and Dolson Avenue.	\$500,000 - \$2 million	Proposed	Y
Bridge Upgrade to Middletown New Jersey Railroad Bridge	The Middletown New Jersey Railroad Bridge is identified as a pinch point as it crosses the Monhagen Brook. The proposed project would upgrade the bridge, which includes widening the culvert and bridge. This project will improve flow capacity and convey floodwaters. Reducing the threat of damage to the railroad line allows commerce to continue during and after a storm event.	\$1+ million	Featured	N
Sterling/Genung/ West Main Buy-out/ Elevation Program	The goal of this project is to create a fund establishing a buy-out or elevation program for those properties repetitively flooded in the Sterling Street, Genung Street, and West Main Street neighborhoods. The buy-out/elevation program will enhance recreational opportunities for citizens within the newly formed open space while also helping to mitigate flooding.	\$1 million	Featured	N



## Strategy 2

**Enhance and repair existing stormwater infrastructure, culverts, and drainageways to ensure the City can safely grow the economy, improve safety, and reduce future losses.**

During Hurricane Irene and Tropical Storm Lee, the restricted roadways into and out of the City limited access to health and social services. Emergency personnel could not access certain areas of the City due to flooded and closed roadways. Undersized and damaged stormwater infrastructure led to the buildup of debris and created a damming effect that both exacerbated flooding in the City and damaged public and private property in proximity to the Monhagen Brook.

**This strategy focused on improving the stormwater infrastructure and creating resiliency in the system to provide adequate flow during storm events.**

Reliable transportation and mobility during storms and floods depends on building a resilient stormwater and transportation network and addressing individual route segments with a history of flood vulnerability.

To achieve this strategy, some projects will focus on reducing flooding to enhance transportation access as well as reducing repetitive losses to both public and private properties. Others will look at upgrading bridges and culverts to allow for additional flow during flooding events.



*Pictured above is severe damage to roadways following Hurricane Irene. Photo is courtesy of Middletown DPW.*

**These proposed actions will work towards reducing flooding and lowering the cost of maintenance to the stormwater infrastructure. Additionally, these actions may reduce the impacts and costs of debris build-up, which intensifies flooding and damage in the system and to adjacent property and infrastructure.**

For example, elevating, upgrading, and providing additional flow under an aging bridge will ensure safe transportation access and will provide increased floodplain capacity to reduce roadway overtopping. Such initiatives could potentially reduce water surface elevations (WSE) of smaller, more frequent flooding events as well as during a 100-year event.

Other opportunities that could be pursued under this strategy include providing streambank mitigation and additional storage upstream to help reduce property loss due to erosion and to help slow and capture stormwater drainage before entering the City's stormwater system. Improvements to critical facilities and flood-prone properties, such as constructing new resilient infrastructure and leveraging existing infrastructure investments, could also be considered.

Overall, this strategy addresses needs and opportunities across six RSFs, proposing investments in infrastructure, health and social services, natural and cultural resources, community planning and capacity building, economic development, and housing. It capitalizes on opportunities to improve sheltering capabilities, healthcare access, and emergency response capabilities. Table 3.2 identifies those projects developed by the Committee to accomplish Strategy 2.



*During major flooding events, backyard drainage swales, such as the one shown in the image above, can become quickly inundated. Photo is courtesy of Middletown DPW.*



### TABLE 3.2 - STRATEGY 2

**Strategy 2: Enhance and repair existing stormwater infrastructure, culverts, and drainageways to ensure the City can safely grow the economy, improve safety, and reduce future losses.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
Monhagen Brook Culvert and Dredging Project	<p>This project includes:</p> <ul style="list-style-type: none"> <li>• Dredging and removal of sediment within and along the culvert;</li> <li>• Removal of piers at the confluence of the Monhagen and Draper Brooks, and the replacement of this section and other damaged sections of culverts; and</li> <li>• Re-channelization of the section of Monhagen Brook directly downstream of Genung Street.</li> </ul>	\$1.5 - \$2 million	Proposed	N
Dorothea Dix Drive Flood Retention/Wetland Construction/Restoration Project	<p>The first phase of the project will include the acquisition of the 8.2-acre property and the demolition and removal of the existing parking lot area. It will include the engineering, construction, and re-channelization of the Monhagen Brook; the development of the first phase of wetland mitigation areas; and the construction of the first phase of recreational features that include some sections of the proposed trail system and interpretive signage.</p>	\$1.5 million	Proposed	N



*Pictured above is an example of extreme road destruction caused by raging floodwaters during Hurricane Irene and Tropical Storm Lee. Enhancing and repairing stormwater infrastructure is vital to reducing the City's risk to flood damage. Photo is courtesy of the City of Middletown.*



**TABLE 3.2 - STRATEGY 2 (CONT'D)**

**Strategy 2: Enhance and repair existing stormwater infrastructure, culverts, and drainageways to ensure the City can safely grow the economy, improve safety, and reduce future losses.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
Culvert Improvements at West Main Street and Monhagen Avenue	The project will include the removal of the existing twin culverts and the upgrade of that section of culvert to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project would also include streambank mitigation of the day-lighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert.	\$2 million	Proposed	N
West Main Street Streambank Mitigation	This project would restore streambanks and surrounding riparian area to improve flow conditions, reduce erosion, and provide additional flood attenuation if possible. Consideration for regenerative design techniques could be used.	\$1.5 - \$2 million	Proposed	N
Maple Hill Park Improvements	This project would improve the existing berm/dam to create additional floodwater retention while enhancing the facility as a recreational amenity. This could work in concert with the other upstream wetland construction and stormwater retention projects to alleviate or reduce flooding downstream along West Main Street, Monhagen Avenue, Fulton Avenue, Sterling Street, and Dolson Avenue.	\$500,000 - \$2 million	Proposed	Y
Bridge Upgrade to Middletown New Jersey Railroad Bridge	The Middletown New Jersey Railroad Bridge is identified as a pinch point where it crosses the Monhagen Brook. The proposed project would upgrade the bridge, which would include widening the culvert and bridge. This project would improve flow capacity and convey floodwaters. Reducing the threat of damage to the railroad line allows commerce to continue during and after a storm event.	\$1+ million	Featured	N



### Strategy 3

**Develop planning capacity and zoning capabilities to help promote integrated and functional relationships with Community partners.**



Touro College is shown above. Photo is courtesy of Tetra Tech, Inc.

This strategy focuses on taking proactive measures to plan for disaster events while providing the City of Middletown with the capacity to respond. In this case, the Committee proposed specific actions that better prepare citizens and emergency response agencies to “weather the storm,” including providing adequate flood warning systems and conducting a wide-reaching education campaign to teach residents how to best prepare to shelter in place.

During previous storms, the flood-restricted roadways limited access for evacuation, and many residents were stranded or isolated during the Hurricane Irene and Tropical Storm Lee floods. Businesses and residents were without power for days.

**While existing agreements for sheltering are in place, the unique flooding issues in the City during disaster events make access to shelter by all residents throughout the City difficult.**

Addressing the resilience of these facilities where critical disaster-time functions are housed will ensure reliable communications systems during future storms.



SUNY Orange County Community College campus is shown above. Photo is courtesy of Tetra Tech, Inc.

The provision of reliable mobility and accessibility during storms and floods relies on building a resilient transportation network, and addressing individual route segments that have a history of flood vulnerability. Ensuring sufficient emergency sheltering and response relies on operational and structural capacity and locating the EOC in an area that is accessible and not at risk to flooding.

An upgraded public notification system would allow City officials to alert residents to potential threats in their portion of the City. The multi-faceted delivery method of phone and text correspondence allows vulnerable populations to receive incoming information in a manner that is understandable to all despite potential physical, educational, or other limitations.

**There is an opportunity to enhance emergency response and communication through partnerships with the colleges in the City.**

Planning can also ensure a continuity of expedited emergency medical, fire, and police services in and around the City. Mutual aid agreements could be considered with surrounding jurisdictions. Table 3.3 identifies those projects developed by the Committee to accomplish Strategy 3.



**TABLE 3.3 - STRATEGY 3**

**Strategy 3: Develop planning capacity and zoning capabilities to help promote integrated and functional relationships with community partners.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
SUNY Orange County Public Safety (PS)/ EOC/Fire/ Emergency Medical Services (EMS)/Shelter	Identify a site and work with SUNY Orange County Community College to acquire a site for the creation of a PS/EOC/Fire/EMS/Shelter station on the southern side of the City to more effectively serve the needs of the expanding campus as well as the needs of the City's residents during storm events.	\$300,000	Featured	Y



## Strategy 4

**Provide and promote services that sustain human health and well-being throughout the life cycle of a disaster.**

The citizens of the City of Middletown suffered significant health and social challenges due to repetitive flooding. Health and social service assets in the City support vulnerable populations and are critical for protecting the health and well-being of all residents in a post-disaster environment. Transportation infrastructure failure and access interruption significantly increases health and safety risks during disasters.

**Hurricane Irene and Tropical Storm Lee inundated arterial roadways that provide access into and out of Middletown. Flooding of these roadways cut off major access points to the City, which isolated residents and prohibited access from emergency service personnel and equipment.**

Maintaining sufficient sheltering capability relies on the operational capacity of a shelter in terms of the structure size and of the availability of provisions. In addition, shelter locations should be out of the flood risk area and should be accessible from other parts of the City. Sufficient healthcare access, mobility, sheltering capacity, and access to other essential goods and services are standards that are critical to the City's future resiliency.

## STRATEGY TARGETS

The Committee established the following strategy targets for Strategy 4:

- Ensure the protection of vulnerable populations during future floods.
- Address flooding of local transportation routes to provide access for emergency service providers during a disaster.
- Ensure the accessibility of appropriate health and social services to all residents on a daily basis and in emergency situations.
- Protect educational facilities, including public and private schools and the SUNY Orange County Community College.
- Increase the availability and distribution of information and training on sheltering, disaster preparedness, and evacuation procedures.
- Provide an emergency shelter/community center for staff and residents of the City to use during severe weather events.

This strategy looks to implement actions under five RSFs, including community planning and capacity building, housing, economic development, health and social services, and natural and cultural resources.

Table 3.4 identifies those projects developed by the Committee to accomplish Strategy 4.



**TABLE 3.4 - STRATEGY 4**

**Strategy 4: Provide and promote services that sustain human health and well-being throughout the life cycle of a disaster.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
Sterling/Genung/ West Main Buy-out/ Elevation Program	The goal of this project is to create a fund establishing a buy-out or elevation program for those properties repetitively flooded in the Sterling Street, Genung Street, and West Main Street neighborhoods. The buy-out/elevation program will enhance recreational opportunities for citizens in the newly formed open space while also helping to mitigate flooding.	\$1+ million	Featured	N
SUNY Orange County Campus PS/EOC/Fire/ EMS/ Shelter	Identify and work with SUNY Orange County Community College to acquire a site for the creation of PS/EOC/Fire/EMS/Shelter station on the southern side of the City to more effectively serve the needs of the expanding campus as well as the City’s residents during storm events.	\$300,000	Featured	Y



## Strategy 5

**Ensure housing opportunities are both flood-resilient and affordable for current and future residents, of all needs and ages, through local ordinances and mitigation initiatives.**

The flooding associated with Hurricane Irene and Tropical Storm Lee in 2011 crippled the City's economy and further impaired the housing stock.

**Strategy 5 addresses the need for mitigation and additional local planning efforts to guide future growth and development, and the need to protect existing housing stock from repetitive flooding.**

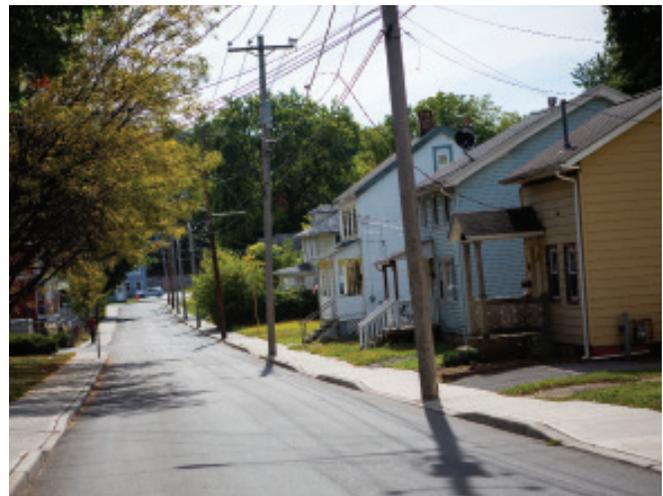
Actions that focus on the residential tax base would reap large benefits for the current and future residential population of the City. These may include providing higher-quality housing; retaining critical commercial assets in the City; connecting the downtown with local colleges; investing in commercial and retail assets in the Central Business District; and protecting existing housing stock from repetitive flooding.

Local housing goals emphasize increasing affordable options outside of the flood zone. Increasing costs and reduced affordability are significant issues in the City of Middletown. Nearly half of the homeowners and more than half of renters pay over 30% of their income for housing, rendering them officially cost-burdened by U.S. Department of Housing and Urban Development (HUD) guidelines. Decreasing housing affordability affects community development by limiting the attraction of a younger workforce, young families, and first-time homebuyers and by restricting local spending and future economic growth.

## STRATEGY TARGETS

The Committee established the following strategy targets for Strategy 5:

- Protect existing housing stock from repetitive flooding and further losses.
- Address cost-burdened residents and provide housing to accommodate a healthy workforce, young families, and first-time homebuyers.
- Plan for and promote a variety of housing types that are resilient in design and location and that support residents.
- Build resiliency in housing, economic development, and health and social services.
- Provide housing opportunities to help boost the economy of the commercial downtown by promoting and attracting live-work investment use types.



*Shown above is a peaceful depiction of Sterling Street neighborhood. Photo is courtesy of Eric Thayer.*



**TABLE 3.5 - STRATEGY 5**

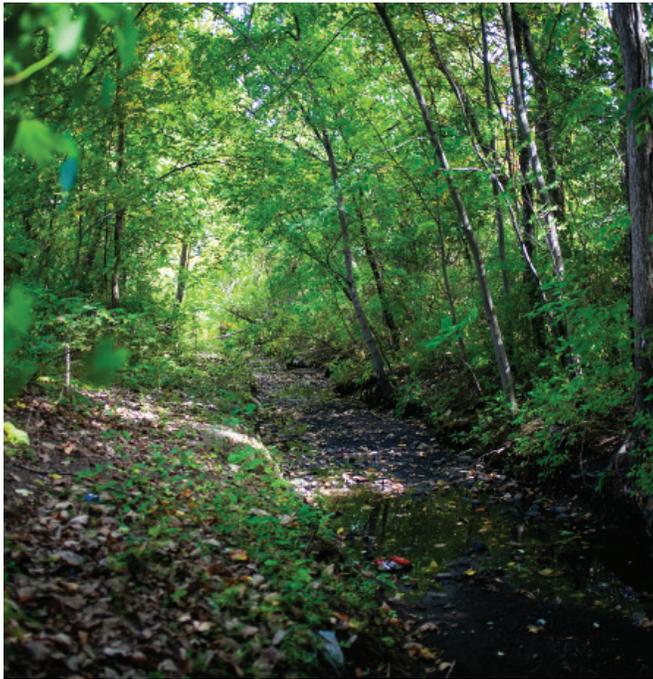
**Strategy 5: Ensure housing opportunities are both flood-resilient and affordable for current and future residents, of all needs and ages, through local ordinances and mitigation initiatives.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
Monhagen Brook Culvert and Dredging Project	<ul style="list-style-type: none"> <li>Dredging and removal of sediment within and along the culvert;</li> <li>Removal of piers at the confluence of the Monhagen and Draper Brooks, and the replacement of this section and other damaged sections of culverts; and</li> <li>Re-channelization of the section of Monhagen Brook directly downstream of Genung Street.</li> </ul>	\$1.5 - \$2 million; [\$100,000 for property acquisition]	Proposed and Featured	N
Dorothea Dix Drive Flood Retention/Wetland Construction/Restoration Project	The first phase of the project will include the acquisition of the 8.2-acre property and the demolition and removal of the existing parking lot area. It will include the engineering, construction, and re-channelization of the Monhagen Brook; the development of the first phase of wetland mitigation areas; and the construction of the first phase of recreational features that include some sections of the proposed trail system and interpretive signage.	\$1.5 million	Proposed	Y
Culvert Improvements at West Main Street and Monhagen Avenue	The project will include the removal of the existing twin culverts and the upgrade of that section of culvert to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project will also include streambank mitigation of the day-lighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert.	\$2 million	Proposed	N
West Main Street Streambank Mitigation	Restoration of the streambanks and surrounding riparian area to improve flow conditions, reduce erosion, and provide additional flood attenuation, if possible. Consideration for regenerative design techniques could be used.	\$1.5 million - \$2 million	Proposed	N
Maple Hill Park Improvements	This project will improve the existing berm/dam to create additional floodwater retention while enhancing the facility as a recreational amenity. This can work in concert with the other upstream wetland construction and stormwater retention projects to alleviate or reduce flooding downstream along West Main Street, Monhagen Avenue, Fulton Avenue, Sterling Street, and Dolson Avenue.	\$500,000 - \$2 million	Proposed	Y
Bridge Upgrade to Middletown New Jersey Railroad Bridge	The Middletown New Jersey Railroad Bridge is identified as a pinch point where it crosses the Monhagen Brook. The proposed project would upgrade the bridge, which includes widening the culvert and bridge. This project will improve flow capacity and convey floodwaters. Reducing the threat of damage to the railroad line allows commerce to continue during and after a storm event.	\$1+ million	Featured	N



## Strategy 6

**Preserve, protect, restore, and where possible, enhance or develop the natural, recreational, and cultural assets of the City.**



*Pictured above is a heavily wooded pathway that will be the future Heritage Trail. Photo is courtesy of Tetra Tech, Inc.*

The City of Middletown’s sense of place and identity is defined by its natural, cultural, and historic resources.

Enhancing parks, cultural assets, and greenway infrastructure will allow these features to serve multiple purposes in the City, including recreation, resilience, and protection from flooding.

This strategy addresses a number of needs and opportunities across five RSFs, with identified actions that address needs in community planning and capacity building, housing, economic development, infrastructure, health and social services, and natural and cultural resources.

## STRATEGY TARGETS

The Committee established the following strategy targets for Strategy 6:

- Address lack of strategically located open space and green/infiltration areas within the City.
- Address lack of interconnected green infrastructure and open space.
- Address stream conditions that cause repeat flooding.
- Increase the natural strength of the streambanks to be more resilient.
- Provide safe pedestrian access.
- Reuse of buildings and properties for parks and water access.
- Acquire repetitively flooded properties and create additional greenway areas.
- Improve existing berms/dams to create additional floodwater retention while enhancing areas as a recreation amenity.

The City’s natural, cultural, and historic assets are critical components of the City’s recovery and future economic development goals, and as such, their protection and enhancement are a priority in the City of Middletown NYRCR planning effort.

Accordingly, investments could be made in projects that respect a multitude of cultural and natural resources and are mindful not to enhance one at the expense of another. Table 3.6. identifies those projects developed by the Committee to accomplish Strategy 6.



*Pictured above is Maple Hill Park Lake. Photo is courtesy of Eric Thayer.*



**TABLE 3.6 - STRATEGY 6**

**Strategy 6: Preserve, protect, restore, and where possible, enhance or develop the natural, recreational, and cultural assets of the City.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
Monhagen Brook Culvert and Dredging Project	<ul style="list-style-type: none"> <li>Dredging and removal of sediment within and along the culvert;</li> <li>Removal of piers at the confluence of the Monhagen and Draper Brooks, and the replacement of this section and other damaged sections of culverts; and</li> <li>Re-channelization of the section of Monhagen Brook directly downstream of Genung Street.</li> </ul>	\$1.5 - \$2 million [\$100,000 for property acquisition]	Proposed and Featured	N
Dorothea Dix Drive Flood Retention/Wetland Construction/Restoration Project	The first phase of the project will include the acquisition of the 8.2-acre property and the demolition and removal of the existing parking lot area. It will include the engineering, construction, and re-channelization of the Monhagen Brook; the development of the first phase of wetland mitigation areas; and the construction of the first phase of recreational features that include some sections of the proposed trail system and interpretive signage.	\$1.5 million	Proposed	Y
Culvert Improvements at West Main Street and Monhagen Avenue	The project will include the removal of the existing twin culverts and the upgrade of that section of culvert to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project will also include streambank mitigation of the day-lighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert.	\$2 million	Proposed	N



**TABLE 3.6 - STRATEGY 6 (CONT'D)**

**Strategy 6: Preserve, protect, restore, and where possible, enhance or develop the natural, recreational, and cultural assets of the City.**

Project Name	Short Project Description	Estimated Cost	Proposed or Featured Project	Regional Project (Y/N)
West Main Street Streambank Mitigation	Restoration of the streambanks and surrounding riparian area to improve flow conditions, reduce erosion, and provide additional flood attenuation, if possible. Consideration for regenerative design techniques could be used.	\$1.5 million - \$2 million	Proposed	N
Maple Hill Park Improvements	This project would improve the existing berm/dam to create additional floodwater retention while enhancing the facility as a recreational amenity. This could work in concert with the other upstream wetlands construction and stormwater retention projects to alleviate or reduce flooding downstream along West Main Street, Monhagen Avenue, Fulton Avenue, Sterling Street, and Dolson Avenue.	\$500,000 - \$2 million	Featured	Y
Bridge Upgrade to Middletown New Jersey Railroad Bridge	The Middletown New Jersey Railroad Bridge is identified as a pinch point where it crosses the Monhagen Brook. The proposed project would upgrade the bridge, which includes widening the culvert and bridge. This project would improve flow capacity and convey floodwaters. Reducing the threat of damage to the railroad line allows commerce to continue during and after a storm event.	\$1+ million	Featured	N
Sterling/Genung/ West Main Buy-out/ Elevation Program	The goal of this project is to create a fund establishing a buy-out or elevation program for those properties repetitively flooded in the Sterling Street, Genung Street, and West Main Street neighborhoods. The buy-out/elevation program will enhance recreational opportunities for citizens within the newly formed open space while also helping to mitigate flooding.	\$1+ million	Featured	N

## Additional Community Resiliency

With the understanding that achieving resiliency in the City takes long-range planning and big thinking, a series

of additional resiliency projects were developed to support a number of the strategies previously outlined.

**TABLE 3.7 - ADDITIONAL COMMUNITY RESILIENCY PROJECTS**

Project Name	Short Project Description	Estimated Cost	Strategy	Regional Project (Y/N)
Middletown Comprehensive Plan Update and Greenway/Green Infrastructure Plan Element	This project would be part of either a new Comprehensive Master Plan or a Comprehensive Plan Amendment. This project would develop goals, guide and coordinate funding, identify connections (trail, bike, pedestrian), and cultivate zoning/design standards to enhance the quality of living and design of the City. This project would be coordinated with the development of the Heritage Trail Extension segments 2 and 3, which are currently funded and pending approval by the New York State Department of Transportation (NYS DOT).	\$110,000	3, 4, and 6	Y
Business Improvement District (BID) College expansion	This project would consist of a BID expansion and cooperative project with the SUNY Orange County Community College and Touro College to work on improvements and connections with downtown Middletown. During the project, the City would work to build on compensatory sidewalk and streetscape improvements being completed by SUNY Orange County Community College along Wawayana Avenue. The project would also expand the BID district to include both Colleges and Wawayanda Avenue to coordinate streetscape improvements and to create a coordinated design and investment effort.	\$50,000	3, 4, 5, and 6	Y
O&W Station Green Stormwater Design	Design standards to help facilitate private investment in green infrastructure, beautification, and enhancements of sense of place. A potential exists to make a specific green infrastructure/stormwater management recommendation for the redevelopment/adaptive reuse of the O&W station. This project would help leverage tax credits and economic development funding for the development of this site and would facilitate additional investment by the Middletown Community Health Center in the City. The project could result in the creation of additional health and social services on the north side of the City.	\$30,000	1, 2, 3, and 4	N



**TABLE 3.7 – ADDITIONAL COMMUNITY RESILIENCY (CONT'D)**

Project Name	Short Project Description	Estimated Cost	Strategy	Regional Project (Y/N)
Emergency Communication Upgrade	Install technology capable of providing the Public Safety Answering Point (PSAP) or EOC with the ability to send voice and text notification to phones throughout the Community to provide information. This process should be customizable during times of emergency to target the smallest block range in the jurisdiction through the entire City. This technology should also allow various types of messages to be developed in times of need and to should allow different messages to be transmitted to different people, depending on their needs and location.	\$500,000	4	Y
Monhagen Outfall Upgrade	The potential exists to upgrade the existing outfall to the east of Route 211, upstream of Pilgrim Estates, to provide additional storage capacity in the existing basin.	\$300,000	1	N
Thomas Jefferson Place Stormwater Retention/Detention	This project would explore the potential of constructing a detention pond upstream of Watts Park, starting at the dead end of Thomas Jefferson Place. This project coordinates with the project recommendation in the recently adopted Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan and therefore, has the potential to leverage Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) funding.	\$750,000 - \$1 million	1	N
Channel Daylighting and Riparian Improvements between 280 State Route 211 East and Lloyds Lane/ Shoprite Plaza	This project would implement channel daylighting and riparian improvements to address flooding behind the Pizza Hut south of State Route 211, southwest of Shoprite (behind the store’s loading bay), and behind Wallkill Plaza on Dunning Road, where stormwater flow from surrounding areas is channelized and sent underground as it drains to Silver Lake.	\$1 million - \$1.5 million	1	Y

# Section 4

Proposed and  
Featured Project  
Profiles



*Photo is courtesy of Tetra Tech, Inc.*

# Section 4: Proposed and Featured Project Profiles

**A**fter months of analysis, Public Engagement Events, and strategizing at Planning Committee Meetings, the City of Middletown NY Rising Community Reconstruction (NYRCR) Planning Committee (Committee) developed a list of projects for inclusion in the NYRCR Plan. The projects and actions set forth in this NYRCR Plan are divided into three categories. The order in which the projects and actions are listed in this NYRCR Plan does not necessarily indicate the Planning Committee’s prioritization of these projects and actions.

Program. Additional Resiliency Recommendations are projects and actions that the Planning Committee would like to highlight and that are not categorized as Proposed Projects or Featured Projects.

Several qualitative and quantitative analyses informed the Committee on potential project impacts on the City of Middletown. A Cost-Benefit Analysis (CBA) was conducted to weigh the potential benefits and the costs associated with each project. A Risk Reduction Analysis (RRA) was completed to identify the ways in which flood reduction projects would actually reduce flooding risks for the City of Middletown.

**FIGURE 4.1 - PROJECT LOCATION MAP**



Figure is courtesy of Scape, Inc.

Proposed Projects are projects proposed for funding through an NYRCR Planning Area’s allotment of CDBG-DR funding. Featured Projects are projects and actions that the Planning Committee has identified as important resiliency recommendations and has analyzed in depth, but has not proposed for funding through the NYRCR



Pictured here are infrastructure improvements in the City of Middletown. Photo is courtesy of Tetra Tech, Inc.



## Proposed Projects

### Monhagen Brook Culvert and Dredging Project

#### Project Background

Lingering damages and issues associated with the age and size of the stormwater management infrastructure in the City exacerbated problem areas already routinely impacted by flooding. The Sterling Street neighborhood is one of the areas highly prone to flooding due to its location in the floodplain and adjacency to the stormwater infrastructure. The proposed project’s location is between Sterling Street and Genung Street, near the confluence of the Monhagen and Draper Brooks. This area of the City of Middletown has been identified as a severe risk area due to the frequency and likelihood of flooding in this section of the City.

This section of culvert, located in an extreme risk area, has a series of piers providing support that cause debris to build up and impede the flow of water through the culvert. The culvert is also severely sedimented, with up to 2.5 feet of sediment restricting flow and inhibiting the functionality of the culvert. There is currently a project partially funded to address the necessary dredging and culvert upgrades at the confluence of the Monhagen and Draper Brooks. Reducing flooding in the Sterling Street neighborhood is an important goal of this NYRCR Plan, because flooding frequently impacts the area, resulting in thousands of dollars in damage. This project will address some of the flooding issues in the neighborhood.

#### CONNECTION TO THE DISASTER

During Hurricane Irene, widespread flooding completely inundated homes along Sterling and Genung Streets. The sedimented condition of the culvert increased the severity of flooding in this area of the City. The culvert was overtopped, causing damage to the infrastructure, adjacent properties, and the nearby roadways. Damage is still visible as the tops of the culvert were destroyed or removed.

#### DESCRIPTION OF PROJECT

The project corresponds with a recommendation from the recently adopted Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan (HMP) (2013) and has the potential to leverage Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) funding. This culvert project will consist of the following activities:

- Dredging and removal of sediment in and along the culvert;
- Removal of piers at the confluence of the Monhagen and Draper Brooks, and the replacement of this section and other damaged sections of culverts; and
- Re-channelization of the section of Monhagen Brook directly downstream of Genung Street.

A second phase of the project could include the acquisition of adjacent properties and adaptive reuse of a sub-station building for park and water access.

FIGURE 4.2 - PROJECT LOCATION



Image is courtesy of Scape, Inc.

### COST ESTIMATE AND ADDITIONAL FUNDING

The total project cost is estimated at \$1.5 million to \$2.0 million. This project would bridge the funding gap of an existing funded project for the dredging and culvert upgrades near the point of confluence of the Monhagen and Draper Brooks. Implementing this project would leverage approximately \$150,000 of existing funding.

### Project Benefits

This stormwater infrastructure upgrade and flood mitigation project provides multiple benefits to the City of Middletown, including risk and damage reduction, along with economic and social benefits. Based on the Hydrologic Engineering Center – River Analysis System (HEC-RAS) analysis there would be significant improvement and function within the culvert during more frequent storm events, such as a two-year storm event. The removal of the piers provides the most significant benefit as it alleviates the damming effect and the potential for debris build-up at the confluence of the two brooks. In turn, this would enhance flow during all storm events, lessening the amount of overland flow. The improvements would have a beneficial impact on the adjacent properties along Sterling Street, Genung Street, Academy Avenue, and Sprague Avenue. In addition, the Sterling Street neighborhood consists of low-to-moderate income residents, and this project would protect the properties and enhance safety to those most at-risk during disaster events.

### FLOODING PROTECTION AND EMERGENCY RESPONSE

This project has the potential to substantially reduce flood risk and to improve mobility and safety in the City of Middletown. Reduced flooding of Academy Avenue and other transportation routes could create considerable improvements in public safety, property protection, and access to health and social services during a disaster event. Creating greater mobility for emergency responders will enhance their effectiveness.

The existing hydraulic model does not simulate the culvert in this area, and the Draper Brook is not included within the model, making full assessment of the hydraulic benefits difficult without more detailed modeling. However, sediment removal and channel improvements downstream of the culvert do show some improvement of flood flows, particularly at lower storm events (minimal improvement at 100-year event). Since the culvert was not modeled explicitly, it is not possible to directly evaluate the impact of removal of the piers.

As an alternative assessment, the Consultant Team compared the impact on the floodplain if the capacity of the culvert were to be increased (reducing the amount of overland flow). It would take a 75% increase in the culvert capacity to achieve any real impact to the 100-year water surface elevation (WSE), and this would only be about 0.2 foot. Considering the amount of overland flow included within the model, it appears that this culvert is significantly undersized.

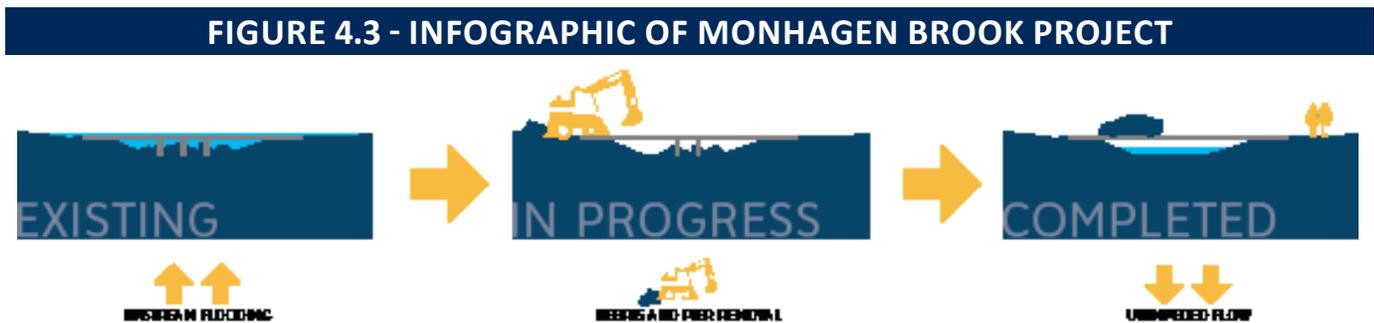


Image is courtesy of Scape, Inc.



### ANTICIPATED REDUCTION OF RISK

The improvements proposed in this project would reduce the risk and increase the resiliency of key infrastructure, health and social services, and economic assets adjacent to and downstream of the project site by enhancing flow during storm events and lessening the amount of overland flow.

The improvements would have beneficial impact on the adjacent properties along Sterling Street, Genung Street, Academy Avenue, and Sprague Avenue. This project has the potential to secure one asset (Jiffy Lube) and to eliminate the risks associated with flooding to this asset. The project also has the potential to reduce the risk for seven assets, including the Sterling Street neighborhood and the Promenade. The project could also reduce the risk to several upstream assets (i.e., culverts and storage buildings) and downstream assets (i.e., one building, culvert and wetland).

The reduction in risk to the upstream and downstream assets would be attributable to both reductions in water surface elevation (WSE) and/or a change in risk area from “Extreme” to “High” or “High” to “Not applicable (N/A),” based on the change in inundation extents. The original inundation extents are based on Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) data.

### ECONOMIC

This project is expected to create local, permanent jobs in the City of Middletown. In addition to economic growth spurred by construction, improvements aimed at building a more resilient City would also create greater confidence for private investors. As the City implements infrastructure projects that address lingering flood safety and accessibility issues, these ventures illustrate a commitment to the future and encourage individuals and private businesses to invest in the City of Middletown. By creating safer and more reliable access from the residential neighborhoods to the downtown, this project would benefit business growth in the City and would bolster the City’s role as a regional, commercial, and cultural hub.

This project would create approximately 10.73-14.3 construction jobs, potentially creating employment for local and regional contractors, in addition to 12.6-16.8 new support jobs from increased materials and equipment sales for suppliers and support industries. Injected funding into the regional construction supply line encourages economic growth through additional induced spending. Induced spending occurs as employees and businesses benefiting from the construction work in turn spend money on other goods and services. The potential induced benefit includes additional permanent jobs, increased taxes, and increased expendable income that may be spent on additional local goods and services.

This investment would also encourage Middletown’s younger population to stay in the City to start their families rather than move away. With a median age of 33.7 and with 43% of the population being between the ages of 20.0 and 49.0, there is a large workforce already in place for the City.

While this project would certainly create economic opportunity, there are limited direct economic benefits anticipated (e.g., permanent jobs, direct additional spending, and direct additional taxes).

### ENVIRONMENTAL

The environmental benefits of the project were analyzed using available project data and assumptions, as well as associated HEC-RAS models for an assessment of the potential impacts on the following:

- Type and quantity of environmental assets secured by the action.
- Type and quantity of clean-up accomplished by the action.
- Open space created by the action.
- Importance of the action for high-priority habitats, threatened and endangered species, migration, or habitat connectivity.

Table 4.1 outlines the type and quantity of the environmental benefits and impacts of the project. Although no environmental assets were identified as

**TABLE 4.1 - TYPE AND QUANTITY OF THE ENVIRONMENTAL BENEFITS AND IMPACTS**

	Type	Quantity
Environmental Assets Secured	Dredging and culvert upgrades at the confluence of the Monhagen and Draper Brooks.	Approximately 400 linear feet of dredging along the Monhagen Brook between Sterling Street and Genung Street.
Clean-up Accomplished	Clean up accumulated debris and remove sediments along Monhagen Brook upstream and downstream of the confluence with Draper Brook to improve stream flow.	Approximately 400 linear feet of debris and sediment removal along the Monhagen Brook between Sterling Street and Genung Street.
Open Space Created	No additional open space created.	
Importance for Habitat	The dredging and culvert improvements would improve flow conditions in the Monhagen and Draper Brooks during low flow events. This would create a more reliable flow source to support aquatic life and water quality in the Monhagen. The culvert and dredging project would improve conditions for the 100-year and 500-year events with decreases in WSE.	

completely secured, there are several environmental benefits associated with this project. An environmental benefit of the project includes an increase in conveyance capacity and reduction of upstream WSE.

The Consultant Team also conducted an analysis of the project location and impact extent using the following New York State Department of Environmental Conservation (NYS DEC) datasets:

- Rare Plants and Animals;
- Significant Natural Communities;
- Natural Communities Vicinity;
- State Regulated Wetlands;
- Classified Water Bodies;
- Surface Source Intake Zones;
- Bird Conservation Areas;
- Forest Matrix Blocks; and
- Forest Linkage Zones.

The results showed that the location of the proposed project is not near any threatened or endangered species. As indicated above, the expected result of the project will improve conditions in and along the Monhagen and Draper Brooks.

Although no areas of wetlands were identified within the project impact area, the reduction in WSE during smaller interval storm events could lead to the revitalization of wetland areas that may exist in the affected area. The Monhagen Brooks is identified as a Class C waterway, which indicates that its water supports fisheries and is suitable for non-contact activities. The Draper Brook is identified as Class D water, which indicates that its water supports fisheries and is suitable for non-contact activities but the waters will not support fish propagation. Tables 4.2 and 4.3 summarize the classified streams and rare plant and animals that could be affected by this project.

**SOCIAL**

Continuing to support the reduction of flooding in the Sterling Street neighborhood and increasing the overall well-being of the downstream area of the Monhagen Brook would have infinite health and social benefits. Reducing the debris in the brook would diminish the likelihood that vulnerable populations would become inaccessible following a flood event. Maintaining the flow of the brook would reduce localized flooding and allow the culvert to function as planned. Visitors and residents alike would benefit as safer homes and businesses would be the result of this project.



**TABLE 4.2 - CLASSIFIED STREAMS**

Regulation	Standard	Classification
855.5-182	C	C
855.5-187	D	D

Source: NYS DEC, 2014

**TABLE 4.3 - RARE PLANTS AND RARE ANIMALS**

**This location is in the vicinity of one or more:**

None

Source: NYS DEC, 2014

Ensuring adequate water supply and flow through Monhagen Brook also supports the local drinking water supply. The Monhagen Brook is a main source of drinking water for the City.

### SOCIALLY VULNERABLE POPULATIONS

During storm events, socially vulnerable populations are more at risk. Vulnerability to hazard events is influenced by age or income, strength of social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These populations are less likely to recover from an event and more likely to be severely impacted. The area of this project has a medium social vulnerability index of populations to environmental hazards.

### ADDITIONAL BENEFITS

In addition to the benefits described above, this project stands to also positively impact land use in the City. This project would have a positive impact on neighboring properties and uses by providing reduced flood risk, which would help protect assets and potentially increase property values.

Additionally, completion of this project would support a number of the City’s NYRCR strategies, including:

- **Strategy 1:** Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.
- **Strategy 2:** Enhance and repair existing stormwater infrastructure, culverts, and drainageways; to ensure the City can safely grow the economy, improve safety, and reduce future losses.
- **Strategy 5:** Ensure housing opportunities are both flood-resilient and affordable for current and future residents, of all needs and ages, through local ordinances and mitigation initiatives.
- **Strategy 6:** Preserve, protect, restore, and where possible enhance or develop the natural, recreational, and cultural assets of the City.

### Project Cost-Benefit Analysis

The re-channelization, dredging, and removal of piers would benefit overall community resilience toward future storms, ensuring the protection of the City’s assets and the safety of its residents. In addition, these improvements and enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit Community safety and health, as well as mobility, access, and other community needs. The Summary articulates the benefits.

### IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents and review of responses, and the completion of planning work is expected to occur over a 15-month period.

## REGULATORY REQUIREMENTS

This project may require approvals from NYS DEC (for example, an Article 15 permit may be required) and the City of Middletown.

## JURISDICTION

Jurisdiction for this project would be within the City of Middletown.

## SUMMARY

### Monhagen Brook Culvert and Dredging Project

- Investment: \$1.5 million to \$2 million
- Flood level reduction: Immediate: ~0 for downstream channel improvements; ~-0.2 for a 75% increase in the culvert capacity; Long-term: properties upstream and downstream from the project location, including the Sterling Street neighborhood
- Assets protected: Immediate: 1; Long-term: 7
- Repetitive flood properties removed: Immediate: 0; Long-term: 2
- Potential future loss prevented: Immediate: \$0; Long-term: Alleviate damages associated with debris and have the potential to protect properties that suffered previous damages over \$7 million
- Jobs created: Immediate: 10.73-14.3 Full-time Equivalent (FTE); Long-term: \*
- Strategies addressed: Immediate: 3; Long-term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the U.S. Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending.*



PROPOSED PROJECTS

# Dorothea Dix Drive Flood Retention/Wetland Construction/Restoration Project (Phase I) (Proposed)

## Project Background

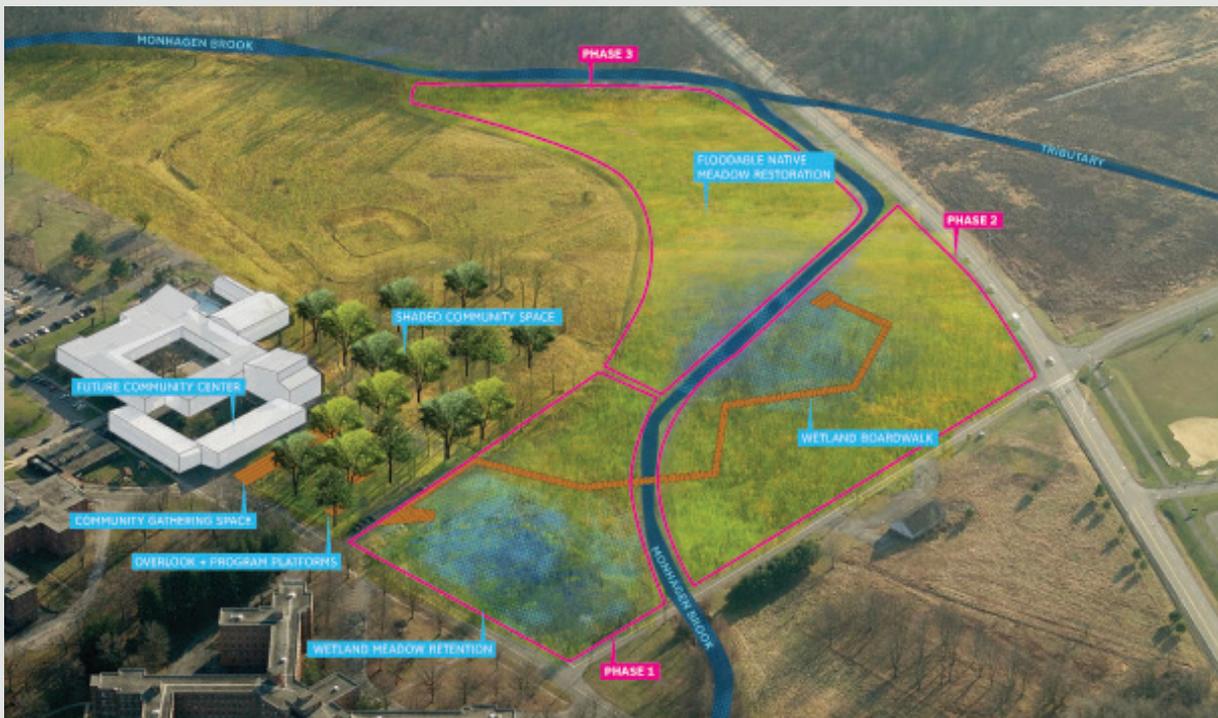
The City of Middletown has numerous areas that are routinely plagued by flooding during and after rainstorms. The Committee recognizes that attention to stormwater issues is important in reducing the flood vulnerability and impacts on the Community. One of most important hazard mitigation projects for the City of Middletown and the Town of Wallkill, as identified in the recently completed Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan (2014), is a stormwater retention project to provide stormwater retention areas upstream of areas routinely damaged by flooding.

The site is located at the intersection of Dorothea Dix Drive and Egerton Avenue. The official tax identification for the site is 69-1-64.62. Approximately 2.5 acres of the 8.2-acre site consists of unused parking space that could provide approximately 3.5 acres of flood retention and wetland construction directly adjacent to the Monhagen Brook. The City is also exploring an adjacent property for use as a community recreation center to serve residents of the both City of Middletown and the Town of Wallkill and to provide other regional benefits. The site is located adjacent to several large areas of contiguous wetlands, and it is adjacent to the now vacant Tuckerman Hall. Figure 4.4 shows an illustrative plan of Phase I of this proposed project, and Figure 4.5 presents a conceptual design of potential site enhancements.

## CONNECTION TO THE DISASTER

While no historic losses are noted in the project area, this project would have a direct effect on downstream properties and infrastructure in the City. Retention areas upstream of the more severely impacted areas of the City are one of the only viable options for capturing and

**FIGURE 4.4 - CONCEPTUAL DESIGN**



Pictured above is a conceptual design of the Dorothea Dix Drive Flood Retention/Wetland Construction/Restoration Project. Image is courtesy of Scope, Inc.

**FIGURE 4.5 - CONCEPTUAL DESIGN OF POTENTIAL SITE ENHANCEMENTS**



*Pictured above is a conceptual design of potential site enhancements at the Dorothea Dix Drive Restoration Project. These include a walking bridge, educational signage, and wetland plant life. Image is courtesy of Scape, Inc.*

slowing flows into the City during storm events. During Hurricane Irene, flooding caused numerous damages to properties and structures downstream of the proposed retention area. This site is also directly upstream of the West Main Street neighborhood, which has several repetitively flooded properties and would benefit from potential flood mitigation.

**DESCRIPTION OF PROJECT**

This project would be a regionally coordinated multi-phased project serving both Middletown and Wallkill residents. Collectively with other projects proposed for the area, this project has the potential to reduce the flooding impacts in the City of Middletown while offering the opportunity to create a large contiguous swath of wetlands.

This project could offer education and recreation opportunities as well, with the creation of a trail with interpretive signage that connects the proposed recreation and community center to the school properties across County Route 78. This center would also be eligible for use as an emergency operations center (EOC) and shelter.

The project would also enhance the area as a wetland habitat for indigenous species by slowing water accumulation during flood events and reducing the amount of debris and siltation through area stabilization. This project would serve residents on the western side of the City of Middletown and in the Town of Wallkill on a daily basis as a community recreational resource. It would simultaneously serve this same population as an emergency facility during disaster events.



The first phase of the project would include the acquisition of the 8.2-acre property, as well as the demolition and removal of the existing parking lot area. It would include the engineering, construction, and re-channelization of the Monhagen Brook; the development of the first phase of wetland mitigation areas; and the construction of the first phase of recreational features that include some sections of the proposed trail system and interpretive signage. Figure 4.7 shows a rendering of some of the anticipated improvements planned for Phase I of the project.

The second phase would include the renovation of the existing vacant building to be used as a community recreation center, which could also function as an EOC and shelter. This phase would include (1) the acquisition and preparation of a portion of the 63-acre property adjacent to the Phase I potential project site, and (2) the boardwalk and trail construction, along with other recreation features.

Figure 4.6 shows some of the Phase I improvements that connect the community center (part of Phase II) to the enhanced wetland area (part of Phase I).

### REGIONAL COORDINATION

This project was the result of several regionally coordinated meetings between the Town of Wallkill and City of Middletown NYRCR Co-chairs, NYRCR Planners, Governor’s Office of Storm Recovery (GOSR) Regional Lead, and the Community Managers. The proposed project area spans the boundary of the City of Middletown and the Town of Wallkill, and it would mutually benefit both communities by providing upgrades to recreation, emergency response, and health and social services.

### COST ESTIMATE AND ADDITIONAL FUNDING

The total project cost for Phase I is estimated at \$1.5 million. This project coordinates with the project recommendation in the recently adopted *Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan* (2014).

## Project Benefits

This flood mitigation project provides multiple benefits to the City of Middletown, including flood protection and emergency response benefits; risk and damage reduction; and environmental, economic, and social benefits.

### FLOOD PROTECTION AND EMERGENCY RESPONSE

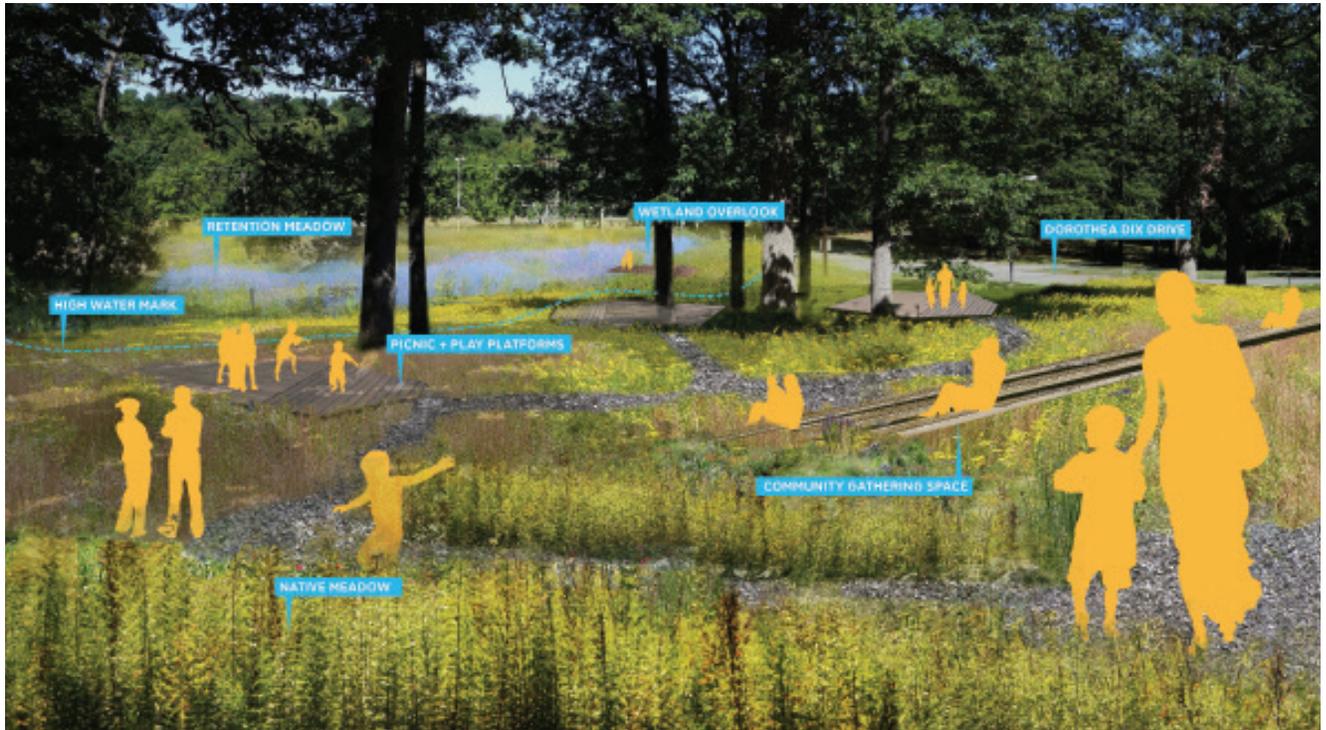
This project has the potential to reduce the impacts of flooding downstream by providing additional storage, control, and infiltration of floodwaters during storm events. It also has the potential to reduce flooding on State Route 78 during severe events, which would enhance emergency access and response on the western side of the City of Middletown and on the western side of the Town of Wallkill.

### ANTICIPATED REDUCTION OF RISK

The improvements proposed in Phase I of the project would reduce the risk and increase the resiliency of key infrastructure assets, natural and cultural assets, and health and social service assets downstream of the project site by increasing the upstream basin’s capacity to handle floodwaters during storm events.

The project would promote the slowing and infiltration of floodwaters and stabilization of erodible stream banks. The construction of a community recreation center (Phase II) would be particularly helpful for vulnerable populations who otherwise lack adequate access to recreational amenities, emergency response and recovery resources, and other public resources. Accordingly, these improvements would increase the capacity of the City of Middletown and the Town of Wallkill to recover from future storm events.

**FIGURE 4.6 - CONCEPTUAL IMPROVEMENTS THAT CONNECT THE COMMUNITY CENTER**



*Pictured above is a conceptual design of improvements at the Dorothea Dix Drive Restoration Project, including a wetlands meadow, picnic and play platforms, and a community gathering place. Image is courtesy of Scape, Inc.*

The reduction in risk was analyzed using the assumptions and factors described in Section 5. The risk reduction benefits and other benefit types are expected include the following:

- Reduced risk of flooding and damages to downstream housing, infrastructure, and health and social service assets; and
- Reduced risk to residents during disaster events.

**ECONOMIC**

The project is likely to directly benefit the local economy in the creation of local, permanent jobs. The long-term development and protection of key City and Town assets, including homes and businesses, is vital to the future financial health of Middletown and Wallkill. As a result of this project, the immediate surrounding area would become more resilient against future storms. The project would reduce inundation for surrounding

properties and transportation infrastructure, which in turn would help to reduce any future maintenance or repair costs associated with flood damage. This project would create approximately 10.72 construction jobs, potentially creating employment for local and regional contractors, in addition to 12.6 total jobs from increased materials and equipment sales for suppliers and support industries. The overarching economic benefits of the project include the following:

- Leveraging the importance of natural and cultural resources to spur interest in the City and Town;
- Protecting local business and historic establishments from flood damage;
- Enticing new businesses to locate in the City; and
- Enhancing the capacity to recover by creating key recreation and cultural resources.



**TABLE 4.4 - TYPE AND QUANTITY OF THE ENVIRONMENTAL BENEFITS AND IMPACTS**

	Type	Quantity
Environmental Assets Secured	Create flood retention area East of Egerton Avenue to reduce flooding impacts in the City.	Construct and develop a 3.5-acre flood retention/wetland area from a 2.5-acre unused parking lot.
Clean-up Accomplished	To be determined	To be determined
Open Space Created	Potential creation of additional wetlands through property acquisitions.	63-acre of property consisting of mostly wetlands.
Importance for Habitat	The creation of new wetland areas would allow for the enhancement of existing wetland habitat, providing healthier and larger contiguous swaths of habitat for indigenous wetland species.	

**ENVIRONMENTAL**

This project has the potential to preserve, protect, and enhance large contiguous areas of wetlands. In addition, improvements would likely help enhance water quality, create a more reliable flow source to support aquatic life, and increase drainage and surface areas for runoff volume infiltration and absorption. Table 4.4 summarizes the environmental benefits associated with Phase I of this project.

**SOCIAL**

The development of additional storage and passive open space would enhance recreational opportunities for citizens while also helping to mitigate flooding. The benefits include less frequent roadway flooding and washouts during storm events and increased mobility for residents, emergency response staff, and other essential personnel during storm events and other emergencies.

The project would benefit all residents of Middletown, especially those who live in or in the immediate area of the project. The results would include safer access to homes, businesses, and other essential facilities (e.g., hospitals, doctor offices, etc.).

During storm events, socially vulnerable populations are more at risk. The level of vulnerability to hazard events is influenced by age or income, strength of

social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These identified populations are less likely to recover from an event and more likely to be severely impacted. Vulnerable populations include the impoverished, certain members of ethnic minorities, people with language barriers, individuals with disabilities, elderly persons, children, renter-occupied households, the institutionalized, and single senior citizen households. This project has the potential to positively benefit the socially vulnerable populations located downstream.

**ADDITIONAL BENEFITS**

In addition to the benefits described above, this project stands to also positively impact land use in the City. This project would have a positive impact on neighboring properties and uses by providing reduced flood risk, which would protect assets and potentially increases property values.

Additionally, completion of this project supports a number of the City’s NYRCR strategies, including:

- **Strategy 1:** Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.
- **Strategy 2:** Enhance and repair existing stormwater



infrastructure, culverts, and drainageways to ensure the City can safely grow the economy, improve safety, and reduce future losses.

- **Strategy 5:** Ensure housing opportunities are both flood-resilient and affordable for current and future residents, of all needs and ages, through local ordinances and mitigation initiatives.
- **Strategy 6:** Preserve, protect, restore, and where possible, enhance or develop the natural, recreational, and cultural assets of the City.

### Project Cost-Benefit Analysis

The creation of upstream flood storage and stormwater retention would improve overall community resilience toward future storms, ensuring the protection of the City's assets and the safety of its residents. In addition, these improvements and enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit City safety and health, as well as mobility, access, and other community needs. The reduction in floodwater on one of the City's main thoroughfares and increased protection for downstream properties and infrastructure collectively position the City, as well as the Town of Wallkill, to benefit from this project. Figure 4.8 articulates these benefits.

### IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents, review of responses, and the completion of planning work is expected to occur over a 15-month period.

### REGULATORY REQUIREMENTS

It is anticipated that the completion of this project would require assistance from NYSEFC. Based on the proposed project description, this project may be eligible for financial assistance (e.g., CWSRF, DWSRF, and GIGP) from the New York State Environmental Facilities Corporation (NYS EFC). In addition, this project may also require approval from NYS DEC due to possible proximity to eligible State-regulated wetlands. Local City of Middletown and Town of Wallkill approvals may also be required.

### JURISDICTION

Jurisdiction for this project would rest with the City of Middletown and the Town of Wallkill.



## SUMMARY

### Dorothea Dix Drive Flood Retention/Wetland Construction Restoration Project (Phase I)

- Investment: \$1.5 million
- Flood level reduction: Immediate: 0; Long-term: up to several feet in concert with Phase II and the completion of other projects identified in this plan
- Assets protected: Immediate: 5; Long-term: 10
- Repetitive flood properties removed: Immediate: 0; Long-term: 5
- Potential future loss prevented: Immediate: 0; Long-term: \$1 million+
- Jobs created: Immediate: 10.72 FTE; Long-term: \*
- Strategies addressed: Immediate: 4; Long-term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the U.S. Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending.*

# West Main Street Streambank Mitigation

## Project Background

The area of the Monhagen Brook at West Main Street between Maple Avenue and California Avenue routinely floods. As a result, fast moving floodwaters lead to extensive erosion both during and after storm events. Residential and commercial properties have become more susceptible to flood damage in recent years as the streambank has weakened. This area provides a unique opportunity, as there is a fairly large floodplain on the south side of the Monhagen Brook. Modifications to the channel, enhancements to the floodplain, and streambank mitigation in this area have the potential to significantly reduce the flooding and the impacts of flooding to nearby adjacent properties.

Implementing a project that improves flow conditions and reduces erosion will help the West Main Street area greatly during future storm events. Utilizing both hardening and innovative greening methodologies should produce the most stable result for the streambanks. The re-channelization would include deepening and widening the channel, making it more capable of handling flows from storm events.

directly into the City of Middletown. Undersized and aging stormwater infrastructure and large areas with impervious surfaces exacerbate flooding issues. The intersection of West Main Street and Monhagen Avenue is particularly vulnerable to flooding as it sits in close proximity to the banks of Monhagen Brook. Floodwaters following Hurricane Irene reached six feet along West Main Street and the National Flood Insurance Program (NFIP) has designated several properties here as repetitive loss (RL) properties.



*Pictured above is the Monhagen Brook off West Main Street. Photo is courtesy of Tetra Tech, Inc.*

## CONNECTION TO THE DISASTER

The Monhagen Brook is one of the major sources of flooding, because much of the watershed channels

### FIGURE 4.7 - LOCATION OF PROPOSED PROJECT



*Pictured above is a map of the location of the proposed West Main Street Streambank Project. Image is courtesy of Scape, Inc.*



### DESCRIPTION OF PROJECT

The West Main Street Streambank Mitigation project will include the following:

- Improve flow and reduce erosion along West Main Street near Monhagen Brook;
- Hardening and greening methods will create more stable streambanks; and
- Deepening and widening of the channel will allow larger flows to be accommodated.

### COST ESTIMATE AND ADDITIONAL FUNDING

The total project cost is estimated at **\$1.5 million to \$2.0 million.**

### Project Benefits

This flood mitigation project would provide multiple benefits to the City of Middletown, including risk and damage reduction, as well as economic and social benefits. Flood reduction along West Main Street and the surrounding residential neighborhoods would also

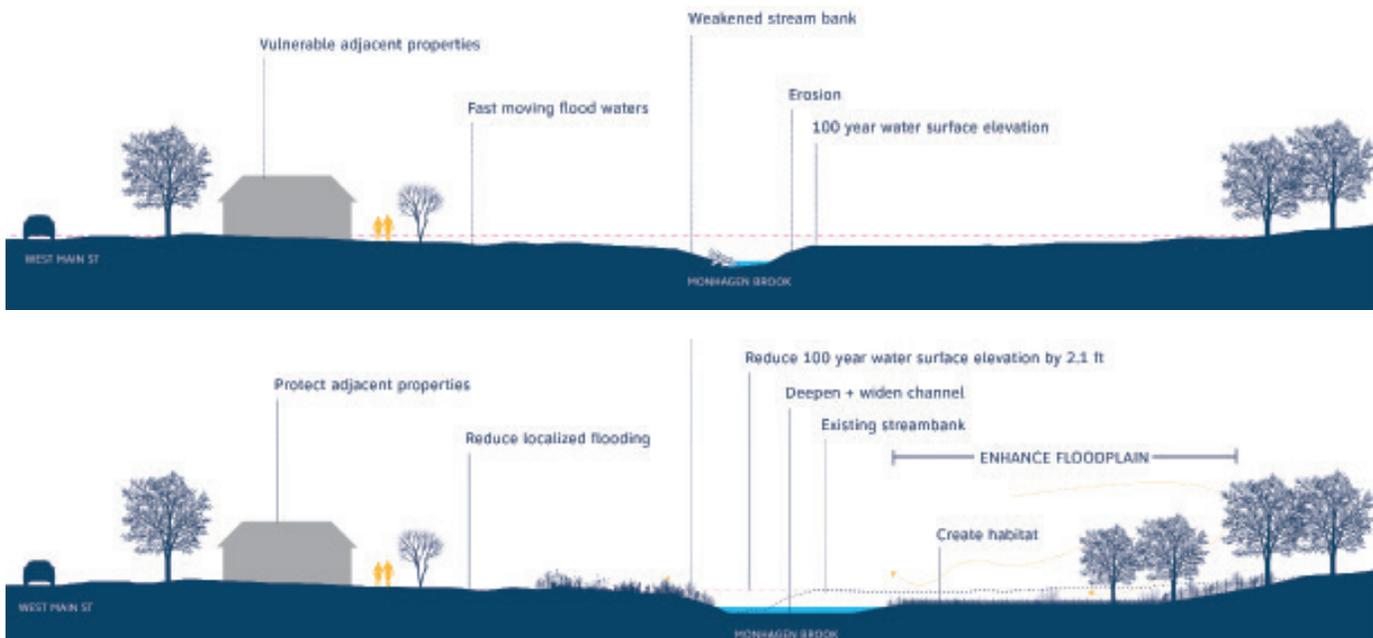
lessen the risk of vulnerable populations, continuity of services during disasters, and operable transportation routes during disasters. Reducing the debris in the Monhagen Brook would diminish the likelihood that vulnerable populations will become inaccessible following a flood event. Maintaining the flow of Monhagen Brook would reduce localized flood, reduce erosion, and stabilize the streambanks. Visitors and residents alike benefit with safer homes and businesses from this project.

Ensuring adequate water supply and flow through Monhagen Brook also supports the local drinking water supply. The Monhagen Brook acts as the main source of drinking water for the City.

### FLOOD PROTECTION AND EMERGENCY RESPONSE

This project would provide property protection to adjacent properties during storm events and reduce the amount of erosion cause by flooding. The bank stabilization will decrease wall and bank failure, thereby increasing safety for residents that own adjacent properties.

**FIGURE 4.8 - MONHAGEN BROOK OFF WEST MAIN STREET CROSS-SECTION**



*Pictured above is the design for the improvements for the Monhagen Brook off West Main Street. Image is courtesy of Scape, Inc.*



The model shows that benefits in terms of WSE and floodplain extent reduction would be limited to the areas just downstream of the West Main Street Bridge, resulting in reduced flooding impacts for the properties on both sides of Monhagen Brook. However, the model does not account for the contribution of the Maple Hill Park Tributary to the flooding conditions at this location.

### ANTICIPATED REDUCTION OF RISK

The improvements proposed in this project would reduce the risk and increase the resiliency of key infrastructure assets, health and social service assets, and economic assets adjacent to the project site by enhancing flow during storm events and by lessening the amount of overland flow.

The improvements would have a beneficial impact on adjacent properties along Sterling Street, Genung Street, Academy Avenue, and Sprague Avenue. This project has the potential to secure one asset (i.e., Jiffy Lube) and to eliminate the flooding risks associated with this asset. The project also has the potential to reduce the risk for seven assets, including the City of Middletown Department of Public Works (DPW) facility and recycling drop-off facility. The project also has the potential to reduce the risk to several upstream (i.e., culverts and storage buildings) assets and downstream assets (i.e., one building, culvert and wetland).

The reduction in risk to the upstream and downstream assets is attributable to both reductions in WSE and/or a change in risk area from “Extreme” to “High” or from “High” to “N/A,” based on the change in inundation extents. The original inundation extents are based on FEMA DFIRM data.

### ECONOMIC

This project would create approximately 10.73 - 14.3 construction jobs, potentially creating employment for local and regional contractors, in addition to 12.6 - 16.8 new support jobs from increased materials and equipment sales for suppliers and support industries. This injected funding into the regional construction supply line encourages economic growth through

additional induced spending. Induced spending occurs as those employees and businesses benefiting from the construction work then spend money on discretionary goods and services. The potential induced benefit includes additional permanent jobs, increased taxes, and increased expendable income.

In addition to economic growth spurred by construction, these improvements aim to create a more resilient City while also creating greater confidence for private investors in Middletown. As the City prioritizes and implements infrastructure projects that address lingering flood safety and accessibility issues, these investments illustrate a commitment to the future and will encourage individuals and private businesses to continue to support initiatives in the City of Middletown. By protecting the streambanks and properties along the Monhagen Brook, this project will benefit Main Street business growth and will bolster the City’s reputation as a regional commercial and cultural hub.

Utilizing green infrastructure to complete the project indicates that the City of Middletown’s investment is long-term and focused on positively impacting both the environment and nearby residents. This investment will encourage Middletown’s younger population to remain in the City rather than move away. With a median age of 33.7 and 43% of the population being between the ages of 20.0 and 49.0, there is a large workforce already in place for the City.

While this project will certainly create economic opportunity, there are limited direct economic benefits anticipated (e.g., permanent jobs, direct additional spending, and direct additional taxes).

### ENVIRONMENTAL

The environmental benefits of the project were analyzed using available project data and assumptions, as well as associated HEC-RAS models, for an assessment of the following potential impacts:

- Type and quantity of environmental assets secured by the action;



**TABLE 4.5 - TYPE AND QUANTITY OF THE ENVIRONMENTAL BENEFITS AND IMPACTS**

	Type	Quantity
Environmental Assets Secured	Bank restoration along West Main Street of the Monhagen Brook to improve flow conditions, reduce erosion, and provide additional flood attenuation.	Approximately 2.1 feet reduction in the 100-year floodwater level elevation.
Clean-up Accomplished	Remove sediments and clean up accumulated debris along the streambed to improve stream functioning in the Monhagen.	Approximately 450 linear feet of debris clean-up associated with the bank restoration. Establishment of one in-stream structure.
Open Space Created	No additional open space created.	
Importance for Habitat	Would create a more natural stream corridor leading to better water quality and healthier environs for native species to flourish.	

- Type and quantity of clean up accomplished by the action;
- Open space created by the action; and
- Importance of the action for high-priority habitats, threatened and endangered species, migration, or habitat connectivity.

Table 4.5 outlines the environmental benefits and impacts of the project. Although no environmental assets were identified as completely secured, there are several environmental benefits associated with this project. The project would result in environmental benefits, including an increase in conveyance capacity and reduction of upstream WSE.

The Consultant Team also conducted an analysis of the project location and impact extent using the following NYS DEC datasets:

- Rare Plants and Animals;
- Significant Natural Communities;
- Natural Communities Vicinity;
- State Regulated Wetlands;
- Classified Water Bodies;
- Surface Source Intake Zones;
- Bird Conservation Areas;
- Forest Matrix Blocks; and
- Forest Linkage Zones.

**TABLE 4.6 - CLASSIFIED STREAMS**

Regulation	Standard	Classification
855.5-182	C	C

Source: NYS DEC, 2014

**TABLE 4.7 - RARE PLANTS AND RARE ANIMALS**

**This location is in the vicinity of one or more:**

None

Source: NYS DEC, 2014

The results showed that the project is not near a potential or historic record with an instance of occurrence of any threatened or endangered species. As indicated above, the expected result of the project is to improve conditions within and along the Monhagen Brook. Although no wetland areas were identified in the project impact area, the reduction in WSE during smaller interval storm events could lead to the revitalization of wetland areas in the affected area. The Monhagen Brook is identified as a Class C waterway, indicating that its water supports fisheries and is suitable for non-contact activities.

Tables 4.6 and 4.7 summarize the classified streams and rare plant and animals that could be affected by this project.



## SOCIAL

Flood reduction along West Main Street and the surrounding residential neighborhoods would decrease the risk of vulnerable population issues, continuity of services during disasters, and operable transportation routes during disasters.

West Main Street serves as one of the major access points in and out of the City on the western end. This area routinely floods during storm events, impacting emergency and essential personnel. Maintaining the flow of the brook will reduce localized flood and allow operations to continue as planned. Visitors and residents alike would benefit from this project through the creation safer homes and businesses.

Additionally, the Monhagen Brook is a primary source of drinking water for the City. Ensuring adequate water supply and flow through Monhagen Brook also supports the local drinking water supply.

## SOCIALLY VULNERABLE POPULATIONS

During storm events, socially vulnerable populations are more at risk. Vulnerability to hazard events is influenced by age or income, strength of social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These populations are less likely to recover from an event and are more likely to be severely impacted. The area of this project has a population that is vulnerable to natural hazards including flooding.

## ADDITIONAL BENEFITS

In addition to the benefits described above, completion of this project supports a number of the City's NYRCR strategies, including:

- **Strategy 1:** Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.
- **Strategy 2:** Enhance and repair existing stormwater infrastructure, culverts, and drainageways; to ensure the City can safely grow the economy,

improve safety, and reduce future losses.

- **Strategy 5:** Ensure housing opportunities are both flood-resilient and affordable for current and future residents, of all needs and ages, through local ordinances and mitigation initiatives.
- **Strategy 6:** Preserve, protect, restore, and where possible, enhance or develop the natural, recreational, and cultural assets of the City.

## Project Cost-Benefit Analysis

Improving flow conditions and reducing erosion will benefit overall community resilience toward future storms, ensuring the protection of the City's assets and the safety of its residents. In addition, these improvements and enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit City safety and health, as well as mobility, access, and other community needs

## IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents, review of responses, and the completion of planning work is expected to occur over a 15-month period.

## REGULATORY REQUIREMENTS

It is anticipated that the completion of this project will require approval from NYS DEC due to potential Article 15 and/or Water Quality Certification requirements. In addition, this project may require an appropriate hydraulic analysis based on current scientific principles, along with local City of Middletown approvals.

## JURISDICTION

Jurisdiction for this proposed project rests with the City of Middletown.



## SUMMARY

### West Main Street Streambank Mitigation

- Investment: \$1.5 million to \$2.0 million
- Flood level reduction: Immediate: -2.1 feet 100-year WSE Change; Long-term: TBD
- Assets protected: Immediate: 1; Long-term: 4
- Repetitive flood properties removed: Immediate: 0; Long-term: 0
- Potential future loss prevented: Immediate \$1 Million; Long-term: Alleviate damages associated with debris and have the potential to protect properties that suffered previous damages over \$7 million.
- Jobs created: Immediate: 10.73-14.3 FTE; Long-term: TBD
- Strategies addressed: Immediate: 4; Long Term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the U.S. Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending.*

# Culvert Improvements at West Main Street and Monhagen Avenue

## Project Background

The Monhagen Brook is one of the major causes of flooding, because much of the watershed channels directly into the City of Middletown. Undersized and ill-maintained culverts exacerbate flooding issues. The intersection of West Main Street and Monhagen Avenue is particularly vulnerable to flooding since it sits in close proximity to the banks of the Monhagen Brook. As a major intersection, it is important to keep traffic moving throughout the life cycle of a disaster.

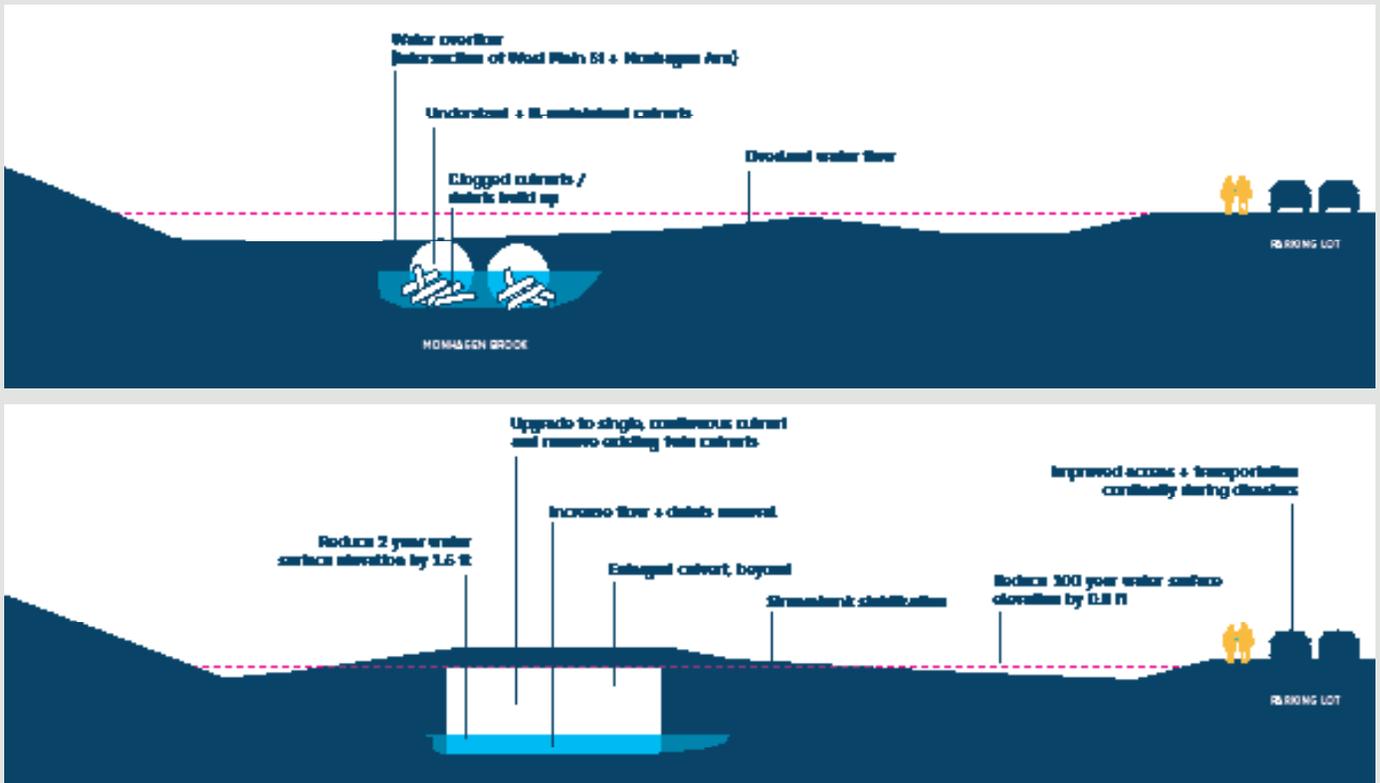
During storm events, large volumes of water and debris flow through the twin circular culverts under West Main Street. These culverts become clogged and waters are forced over the banks, flooding the City. The proposed project includes the removal of the existing twin culverts and upgrades to that section with a single, continuous culvert and improved entrance conditions. This will

increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project will also include streambank mitigation of the daylighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert.

## CONNECTION TO THE DISASTER

As previously stated, the Monhagen Brook has caused major flooding in the City of Middletown. Debris build-up causes floodwater back-up, creating an increase of overland flow that severely damaged the City of Middletown DPW building downstream along Monhagen Avenue. Thus, many of the vehicles and heavy equipment that could have been used during the disaster were then inaccessible and rendered useless. Floodwaters from Hurricane Irene reached

**FIGURE 4.9 - CONCEPTUAL DESIGN OF POTENTIAL SITE ENHANCEMENTS**



*Pictured above is a conceptual design of the potential site enhancements at the intersection of West Main Street and Monhagen Avenue. Image is courtesy of Scape, Inc.*



six feet along West Main Street, and damage from this storm, particularly along West Main Street and Monhagen Avenue, totaled \$2,000,619. Debris clogging the culvert and Monhagen Brook also had to be removed by City personnel.

### DESCRIPTION OF PROJECT

The project will include the removal of the existing twin culverts and the upgrade to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project would also include streambank mitigation of the daylighted section of Monhagen Brook between Monhagen Avenue and the culvert entrance.

### COST ESTIMATE AND ADDITIONAL FUNDING

The total project cost is estimated at \$2 million.

### Project Benefits

This flood mitigation project provides multiple benefits to the City of Middletown, including risk and damage reduction, as well as economic and social benefits.

By diminishing flooding instances along the intersection of West Main Street and Monhagen Avenue, transportation reliability and continuity during storm events can be enhanced. As a frequently traveled intersection, it is important to keep it operational and safe for travel.

Freeing Monhagen Brook of debris also decreases the likelihood that vulnerable populations will become isolated during or following a flood event. Maintaining a clear brook will reduce localized flooding and allow operations to continue as planned.

Ensuring adequate water supply and flow through Monhagen Brook also supports the local drinking water supply. The Monhagen Brook is a main source of drinking water for the City.

### FLOOD PROTECTION AND SAFETY

This project has the potential to diminish the flooding impacts caused by overland flow to the DPW yard, to protect adjacent properties from bank failure, and to eliminate the potential for debris build-up during disaster events.

Preliminary modeling results show that by improving the structure (e.g., installing a 20-foot by 8-foot box culvert), only minimal benefits in terms of WSE reduction and floodplain extent will occur. In addition to the culvert upgrade, the model shows that channel hardening provides better benefits in terms of WSE but only limited improvements regarding floodplain extent.

### ANTICIPATED REDUCTION OF RISK

The improvements proposed in this project would reduce the risk and increase the resiliency of key infrastructure assets, health and social service assets, and economic assets adjacent the project site by enhancing flow during storm events and lessening the amount of overland flow. The improvements will have a beneficial impact by increasing flow through the culvert and by reducing potential flooding damages to surrounding infrastructure, residences, and businesses.

This project has the potential to secure one asset (i.e., Jiffy Lube) and has the potential to eliminate the risks associated with flooding to this asset. The project also has the potential to reduce risk to downstream culverts, storage buildings, and properties on Dolson Avenue. One culvert would have its risk reduced from high to moderate for both the 100-year and 500-year events. The reduction in risk to the downstream assets would be attributable to both reductions in WSE and/or a change in risk area from “Extreme” to “High,” or from “High” to “N/A,” based on the change in inundation extents. The original inundation extents are based on FEMA DFIRM data.

### ECONOMIC

This project would create approximately 14.3 construction jobs, potentially creating employment for local and regional contractors, in addition to 16.8 new

support jobs from increased materials and equipment sales for suppliers and support industries\*. This injected funding into the regional construction supply line encourages economic growth through additional induced spending. Induced spending occurs as those employees and businesses benefiting from the construction work in turn spend money on other goods and services. The potential induced benefit includes additional permanent jobs, increased taxes, and increased expendable income that may be spent on additional local goods and services.

In addition to the economic growth spurred by construction, improvements aimed at building a more resilient City will also create greater confidence for private investors in Middletown. As the City prioritizes and implements infrastructure projects that address lingering flood safety and accessibility issues, it demonstrates its commitment to the future and will encourage individuals and private businesses to invest in Middletown. By creating safer, more reliable access to the downtown, this project will benefit business growth and will bolster the City’s role as regional commercial and cultural hub.

This project also encourages Middletown’s younger population to stay in the City and grow their families here, rather than move away. With a median age of 33.7, and with 43% of the population between the ages of 20 and 49, the City already has access to a solid workforce.

**Positive economic impacts are expected to be seen regarding future recovery and repair spending following a disaster. The reduction in floodwater inundation will increase resiliency and restore a sense of safety for the Community.**

While this project will certainly create economic opportunity, limited direct economic benefits are anticipated (e.g., permanent jobs, direct additional spending, and direct additional taxes).

**ENVIRONMENTAL**

The environmental benefits of the project were analyzed using available project data and assumptions, as well as associated HEC-RAS models, to assess the potential following impacts:

- Type and quantity of environmental assets secured by the action;
- Type and quantity of clean up accomplished by the action;
- Open space created by the action; and
- Importance of the action for high-priority habitats, threatened and endangered species, migration, or habitat connectivity.

Table 4.8 outlines the type and quantity of the environmental benefits and impacts of the project. Although no environmental assets were identified as

**TABLE 4.8 - TYPE AND QUANTITY OF THE ENVIRONMENTAL BENEFITS AND IMPACTS**

	TYPE	QUANTITY
Environmental Assets Secured	Culvert Improvements at West Main Street and Monhagen Avenue to manage flow and reduce potential flooding at a major intersection.	
Clean-up Accomplished	The redirection of water into twin culverts under West Main Street has caused significant debris to accumulate and force water over the banks and flood the intersection.	
Open Space Created	No additional open space created.	
Importance for Habitat	The increase in culvert capacity at West Main Street and Monhagen Avenue, along with channel bank hardening, will minimize redirection of waters. Creating a continuous culvert with improved entrance conditions would increase flow. It would also avoid flooding upstream and reduce WSE and floodplain extent. This will create a more reliable flow source to support aquatic life and water quality in the Monhagen Brook.	



completely secured, several environmental benefits are associated with this project. The project will result in the following environmental benefits:

- Increase conveyance capacity; and
- Reduction of upstream WSE and floodplain extent.

The Consultant Team also conducted an analysis of the project location and impact extent using the following NYS DEC datasets:

- Rare Plants and Animals;
- Significant Natural Communities;
- Natural Communities Vicinity;
- State Regulated Wetlands;
- Classified Water Bodies;
- Surface Source Intake Zones;
- Bird Conservation Areas;
- Forest Matrix Blocks; and
- Forest Linkage Zones.

**TABLE 4.9 - CLASSIFIED STREAMS**

Regulation	Standard	Classification
855.5-182	C	C

Source: NYS DEC, 2014

**TABLE 4.10 - RARE PLANTS AND RARE ANIMALS**

This location is in the vicinity of one or more:
None

Source: NYS DEC, 2014

The results showed that the project is not near any potential or historic record for any threatened or endangered species. As indicated above, the project should improve conditions within and along the Monhagen Brook. Although no areas of wetlands were identified in the project impact area, the WSE reduction during smaller interval storm events could lead to the revitalization of wetland areas that may exist in the affected area. The Monhagen Brook is

identified as a Class C waterway. This designation indicates that its water supports fisheries and is suitable for non-contact activities.

### SOCIAL

Flood reduction measures at the intersection of West Main Street and Monhagen Avenue ensures reliable and much needed transportation continuity during storm events. As it is frequently traveled, it is important to keep this intersection operational and safe. Debris removal from the brook also reduces the probability for isolation of vulnerable populations following a flood event. Maintaining a clear brook could reduce localized flooding and allow operations to continue as planned. Ensuring an adequate water supply and flow through Monhagen Brook also supports the local drinking water supply. The Monhagen Brook serves as a main source of drinking water for the City.

### SOCIALLY VULNERABLE POPULATIONS

During storm events, socially vulnerable populations are at increased risk. Vulnerability levels to hazard events are influenced by age, income, strength of social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These populations are less likely to recover from an event and more likely to feel the impacts of a disaster. The area of this project has a population that is vulnerable to natural hazards including flooding.

### ADDITIONAL BENEFITS

In addition to the benefits described above, this project stands to also positively impact land use in the City. This project has a positive impact on neighboring properties and uses by providing reduced flood risk. Reducing flood risk both protects assets and potentially increases property values. This project protects two transportation assets, West Main Street and Monhagen Avenue, from future flooding damage.



Additionally, completion of this project supports a number of the City's NYRCR strategies, including:

- **Strategy 1:** Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.
- **Strategy 2:** Enhance and repair existing stormwater infrastructure, culverts, and drainageways; to ensure the City can safely grow the economy, improve safety, and reduce future losses.

### Project Cost-Benefit Analysis

By upgrading culverts to have a constant span and improving the entrance conditions, the Community will improve flow conditions from the Monhagen Brook into these culverts. In addition, it will benefit overall Community resilience toward future storms, ensuring the protection of the City's assets and the safety of its residents. These improvements and enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit Community safety and health, as well as mobility, access, and other community needs. The reduction in floodwater along one of the City's main thoroughfares, along with the increased protection for downstream properties and infrastructure, positions the City to benefit from this project. The Summary articulates the benefits.

### IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents, review of responses, and the completion of planning work is expected to occur over a 15-month period.

### REGULATORY REQUIREMENTS

It is anticipated that the completion of this project will require NYS DEC approval due to potential Article 15 and/or WQC requirements. Additionally, the U.S. Army Corp of Engineers needs to be contacted, and the City of Middletown must secure local approvals.

### JURISDICTION

Jurisdiction for this project rests with the City of Middletown.



## SUMMARY

### Culvert Improvements at West Main Street and Monhagen Avenue

- Investment: \$2 million
- Flood level reduction: Immediate:> 1 foot; Long-term: > 1 foot
- Assets protected: Immediate: 1; Long-term: 5
- Repetitive flood properties removed: Immediate: -0.8 feet 100-year WSE; Long-term: TBD
- Potential future loss prevented: Immediate: \$1 Million +; Long-term: TBD
- Jobs created: Immediate: 14.3 FTE; Long-term: \*
- Strategies accomplished: Immediate: 2; Long-term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the United States Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs and 8.4 total jobs per \$1,000,000 in construction spending.*

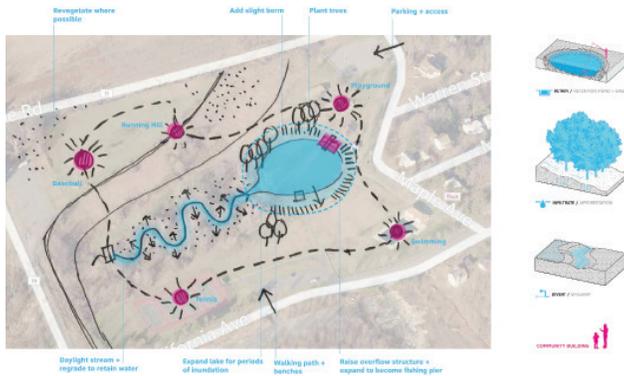




### CONNECTION TO THE DISASTER

During Hurricane Irene, the reinforced concrete pipe that conveys outlet flow from the pond in Maple Hill Park overflowed and could not handle the excess flows from the pond. This caused flooding and flood damage in some residents' yards and homes, specifically those homes through which the ditch and culvert pass. Approximately 20 linear feet of the northerly bank of the drainage channel and 40 linear feet of the southerly bank of the drainage channel eroded and partially collapsed; this collapse occurred near the rear of properties on the south side of West Main Street.

**FIGURE 4.11 - CONCEPTUAL DESIGN**



*Pictured above is a conceptual design of enhancements for Maple Hill Park. Image is courtesy of Scape, Inc.*

### DESCRIPTION OF PROJECT

This project will improve the existing berm/dam and will create additional floodwater retention while enhancing the Maple Hill Park as a recreation amenity. The work will include a new trail around the newly created pond and will incorporate native wetland plants to enhance pond health and to reduce the potential for eutrophication. Improvements could also include pond overlooks, fishing areas, benches and visual enhancements, and other recreational amenities.

This project could also work in concert with the other upstream wetlands construction and stormwater retention projects to alleviate or reduce flooding downstream along West Main, Monhagen Avenue, Fulton, Sterling, and Dolson.

### REGIONAL COORDINATION

This project would involve regional coordination to serve residents in both the City of Middletown and the Town of Wallkill. Coupled with other projects, it has the potential to reduce flooding impacts in the City while offering recreational enhancements to both communities.

### COST ESTIMATE AND ADDITIONAL FUNDING

The estimated total project cost is \$500,000 to \$2 million. This project would leverage \$1.3 million from the Orange County CDBG-DR funding slated for flood retention and stormwater improvements. This project coordinates with the project recommendation in the recently adopted Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan (2014) and has the potential to leverage other funding sources.

### Project Benefits

By improving the floodwater retention and enhancing the recreational area of Maple Hill Park, the City provides numerous benefits to its residents, including risk and safety improvements, damage reduction, and economic and social benefits.

### FLOOD PROTECTION AND EMERGENCY RESPONSE

Modification to the existing retention pond could provide significantly more flood storage, potentially affecting localized flooding, particularly for lower storm events (i.e., nuisance flooding). Flood reductions could be seen along West Main Street, Monhagen Avenue, Fulton Avenue, Sterling Street, and Dolson Avenue.

Currently, very little additional storage is available in the system. Raising the berm and increasing the storage footprint would prevent more storm events leading to the berm overtopping and could prevent overland flooding issues. This project would also help to regulate flows into the tributary and improve flow conditions downstream. Preliminary assessment shows that impacts are minimal at the 100-year flood due to

**FIGURE 4.12 - PROPOSED PROJECT LOCATION OF MAPLE HILL PARK**



*Pictured above is the proposed project location of the Maple Hill Park improvements, bordered by California Avenue, Maple Avenue, and Mt. Hope Road. Image is courtesy of Scape, Inc.*

the amount of runoff from the fairly large watershed; however, slight reductions could be realized. More detailed study would be required to fully determine the complete level of flood reductions.

**ANTICIPATED REDUCTION OF RISK**

Maple Hill Park is located outside the defined Risk Areas of the City of Middletown; however, it impacts the inundation extents and WSE during flooding events for downtown Middletown by its floodwater retention capacity. Improving the floodwater retention and enhancing the recreational area of Maple Hill Park would increase the resiliency of key natural and cultural resources.

Although the risk reductions on this project are asset-specific, defensive flood protection measures should fortify the downtown Middletown area against flooding, particularly along West Main Street, Monhagen Avenue, and Sterling Street.

**ECONOMIC**

This project would create approximately 3.58 – 14.3 construction jobs, potentially creating employment for local and regional contractors, in addition to 4.2 – 16.8 total jobs from increased materials and equipment sales for suppliers and support industries. This injected funding into the regional construction supply line encourages economic growth through additional induced spending. The employees and businesses that benefit from the construction work will be more likely to spend additional money on discretionary goods and services. The potential benefit could lead to additional permanent jobs, increased taxes, and increased expendable income.

In addition to economic growth spurred by construction, these improvements aimed at building a more resilient city will also create greater confidence for private investors in Middletown. As the City prioritizes and implements infrastructure projects that address lingering flood safety and accessibility issues, these investments illustrate a commitment to the future and will encourage individuals and private businesses to



## TABLE 4.11 - TYPE AND QUANTITY OF THE ENVIRONMENTAL BENEFITS AND IMPACTS

	Type	Quantity
Environmental Assets Secured	Modify existing retention pond to provide more storage; regulate flow into a tributary; and improve flow conditions downstream of West Main Street Bridge tributary.	Approximately 5% reduction in 100-year flows.
Clean-up Accomplished	Not listed	Not listed
Open Space Created	No additional open space created.	
Importance for Habitat	The improvement of the existing berm/dam in Maple Hill Park will create additional floodwater retention and improve flow conditions downstream. This will create a more reliable flow source to support aquatic life and water quality within the Monhagen Brook.	



*Pictured here is a stormwater drain in the City of Middletown. Proper stormwater management is critical to protecting and enhancing the environment. Photo is courtesy of Tetra Tech, Inc.*

continue to invest in Middletown. By creating safer and more reliable access in and around the City, this project will benefit business growth and will bolster the City’s continued role as regional commercial and cultural hub.

Finally, improvements to the existing berm/dam will have a positive economic effect on future recovery and repair spending, as it reduces the need to repair impacted properties from flooding events. This project will result in the structure becoming resilient against future storms and will reduce inundation for both downstream properties and transportation infrastructure. This benefit, in turn, would help to reduce any future maintenance or repair costs associated with flood damage.

While this project will certainly create economic opportunity, there are limited direct economic benefits anticipated (e.g., permanent jobs, direct additional spending, and direct additional taxes).

### ENVIRONMENTAL

The environmental benefits of the project were analyzed using available project data and assumptions, as well as associated HEC-RAS models, to assess the potential following impacts:

- Type and quantity of environmental assets secured by the action;
- Type and quantity of clean-up accomplished by the action;
- Open space created by the action; and
- Importance of the action for high-priority habitats, threatened and endangered species, migration, or habitat connectivity.

Table 4.11 outlines the type and quantity of the environmental benefits and impacts of the project. Although no environmental assets were identified as being completely secured, several environmental benefits are associated with this project. The project should result in the following environmental benefits:

- Creation of additional storage capacity and reduced WSE; and
- Improved flow conditions downstream of existing pond.

The Consultant Team conducted an analysis of the projects location and impact extent using the following NYS DEC datasets:

- Rare Plants and Animals;
- Significant Natural Communities;
- Natural Communities Vicinity;
- State Regulated Wetlands;
- Classified Water Bodies;
- Surface Source Intake Zones;
- Bird Conservation Areas;
- Forest Matrix Blocks; and
- Forest Linkage Zones.

The results showed that the project is not near a potential or historic record of occurrence for any threatened or endangered species. As indicated above, the project should improve conditions in Maple Hill Park. The project is not likely to affect endangered species; however, during the construction of the improvements, consideration for these species will be made. Although no areas of wetlands were identified in the project impact area, the WSE reduction during smaller interval storm events could lead to the revitalization of wetland areas that may exist in the affected area. The Monhagen Brook is identified as a Class C waterway, which indicates that its water supports fisheries and that it is suitable for non-contact activities.

**TABLE 4.12 - CLASSIFIED STREAMS**

Regulation	Standard	Classification
855.5-182	C	C

Source: NYS DEC, 2014

**SOCIAL**

The improvements to the Maple Hill Park berm/dam will enhance recreational opportunities for citizens within the Park while also alleviating or reducing flooding downstream from the Park. The benefits include less frequent roadway flooding and washouts during storm events, thus increasing mobility

**TABLE 4.13 - RARE PLANTS AND RARE ANIMALS**

<b>This location is in the vicinity of one or more:</b>
None

Source: NYS DEC, 2014

for residents, emergency response staff, and other essential personnel during storm events and other emergencies.

The project will benefit all residents of Middletown, especially those who live near or in the immediate area and downstream of the project. The results will include safer access to homes, businesses, and other essential facilities (e.g., hospitals, doctor offices, etc.).

**SOCIALLY VULNERABLE POPULATIONS**

During storm events, socially vulnerable populations are more at risk. Vulnerability to hazard events is influenced by age or income, strength of social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These populations are less likely to recover from an event and more likely to be severely impacted. The area of this project has a population that is vulnerable to natural hazards including flooding.

**ADDITIONAL BENEFITS**

In addition to the benefits described above, this project stands to also positively impact land use in the City. This project has a positive impact on neighboring properties and uses by providing reduce flood risk, which helps protect assets and potentially increases property values. The project also ensures ongoing scenic and recreational value by repairing necessary infrastructure to allow continued science and recreational value of the Maple Hill Park.



Additionally, completion of this project supports a number of the City’s NYRCR Strategies including:

- **Strategy 1:** Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.
- **Strategy 2:** Enhance and repair existing stormwater infrastructure, culverts, and drainageways; to ensure the City can safely grow the economy, improve safety, and reduce future losses.
- **Strategy 5:** Ensure housing opportunities are both flood-resilient and affordable for current and future residents of all needs and ages through local ordinances and mitigation initiatives.
- **Strategy 6:** Preserve, protect, restore, and where possible enhance or develop the natural, recreational, and cultural assets of the City.

### Project Cost-Benefit Analysis

Improving the existing small berm/dam at Maple Hill Park will create additional floodwater retention and enhance the park as a recreational amenity. The proposed project will benefit overall community resilience toward future storms, ensuring the protection of the City’s assets and the safety of its residents. In addition, these improvements and enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit Community safety and health, as well as mobility, access, and other community needs. The reduction in floodwater on one of the City’s main thoroughfares and increased protection for downstream properties and infrastructure collectively position the City and Town to benefit from this project. The Summary articulates the benefits.

### IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents, review of responses, and the completion of planning work is expected to occur over a 15-month period.

### REGULATORY REQUIREMENTS

It is anticipated that the completion of this project will require (1) assistance from the NYSEFC, as the project may be eligible for financial assistance (CWSRF, DWSRF, GIGP), (2) the NYS DEC due to potential Article 15 requirements, including a dam safety permit, and (3) local City of Middletown approval.

### JURISDICTION

Jurisdiction for this project is within the City of Middletown and the Town of Walkkill.



## SUMMARY

### Maple Hill Park Improvements

- Investment: \$500,000 - \$2 million
- Flood level reduction: Immediate: ~5% reduction in 100-year flows; Long-Term:
- Assets protected: Immediate: 1; Long-Term: 0
- Repetitive flood properties removed: Immediate: 0 ; Long-Term: TBD
- Potential future loss prevented: Immediate: ; Long-Term:
- Jobs created: Immediate: 3.58 – 14.3 FTE; Long-Term: \*
- Strategies supported: Immediate: 4; Long-Term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the U.S. Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending.*



## Featured Projects

### Bridge Upgrade to Middletown New Jersey Railroad Bridge

#### Project Description

Dolson Avenue serves as one of the main thoroughfares in and out of the City of Middletown from the southern side of the City. Dolson Avenue is also a major commercial corridor in the City. Flooding that occurs on this roadway severely impacts access to and from the City. The Monhagen Brook runs from north to south, adjacent to the east side of Dolson Avenue. The Middletown New Jersey Railroad crosses the Monhagen Brook at Dolson Avenue just north of Republic Plaza. Still in service, this railroad line delivers shipments of polystyrene pellets to a plastic container manufacturing plant.

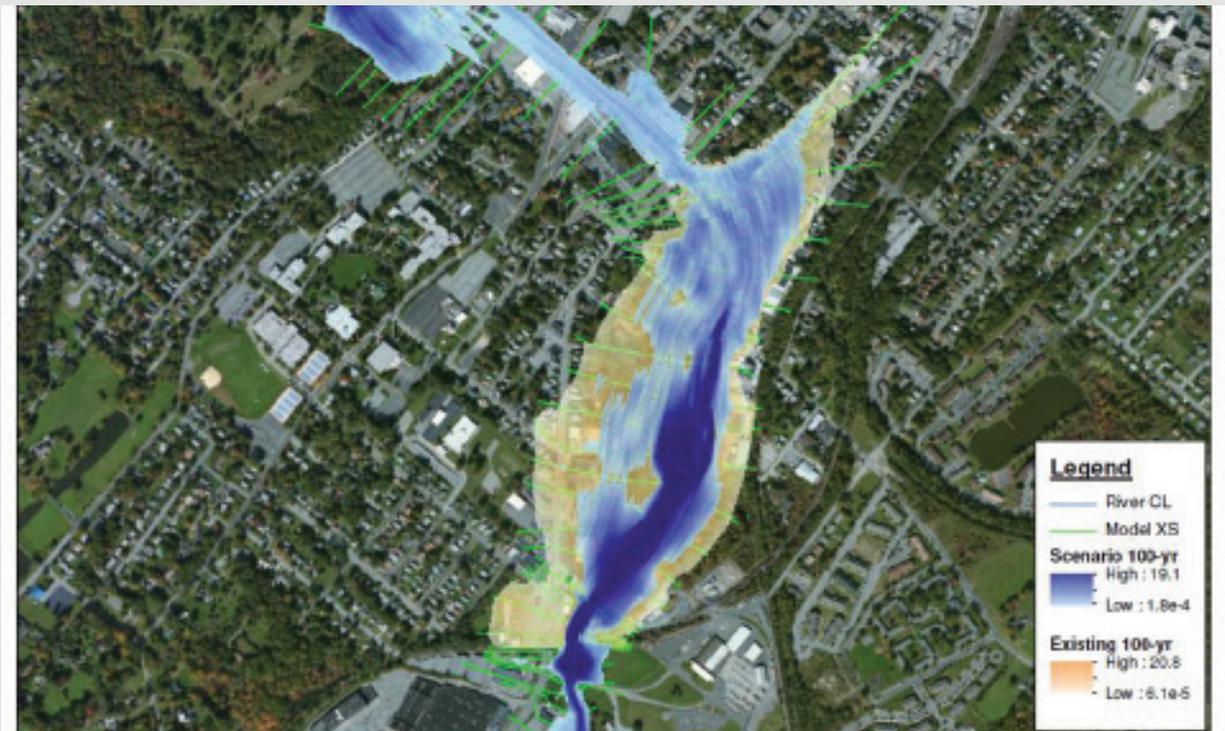
#### CONNECTION TO THE DISASTER

Monhagen Brook is a large source of flooding for the City of Middletown. Due to the bridge’s low clearance and the narrow culvert in place at the railroad, the damming effect has caused local flooding. During Hurricane Irene, Dolson Avenue was inundated with floodwaters in the area of the Middletown New Jersey Railroad Bridge. Access to and from the City was essentially cut off due to the flooding. Several of the properties and some of the roadway infrastructure were damaged as a result of the flooding.

#### DESCRIPTION OF PROJECT

The Middletown New Jersey Railroad Bridge, which crosses the Monhagen Brook north of Republic Plaza, is identified as a pinch point. The proposed project consists of widening both the culvert and bridge, which would allow for additional flow during storm events and reduce flooding. Reducing the threat of damage to the railroad line allows commerce to continue during and after a storm event.

**FIGURE 4.13 - POTENTIAL PROJECT IMPACT AREA**



Pictured above is a flood inundation map depicting the potential project impact area that could be addressed by a bridge upgrade at the Middletown-New Jersey Railroad Bridge. Image is courtesy of Tetra Tech, Inc.



## COST ESTIMATE AND ADDITIONAL FUNDING

The total project cost is estimated at \$1+ million.

### Project Benefits

This project provides multiple benefits to the City of Middletown, including risk and damage reduction, and economic and social benefits. This project has the potential to significantly reduce both the inundation extent and water surface elevation during severe storm events. It also has the potential to completely eliminate flooding on Dolson Avenue during a 100-year event. The project has potential to significantly reduce the inundation extent of floodwaters in the Sterling Street neighboring during a 100-year event as well. The following summarizes the anticipated benefits of the project based upon the historic losses, results of the HEC-RAS modeling and additional analysis.

### FLOOD PROTECTION AND SAFETY

The Middletown New Jersey Railroad Bridge is major cause of flooding within the City. The capacity of this bridge is significantly undersized for the flows. Creating a clear span at this location would significantly reduce upstream flooding and remove several properties from the 100-year floodplain. Of the projects that were assessed with the available models, this project has the potential for the largest impact to flood reduction.

### ANTICIPATED REDUCTION OF RISK

The improvements proposed in this project would reduce the risk and increase the resiliency of key infrastructure, health and social service, and economic assets adjacent the project site by enhancing flow during storm events and lessening the amount of overland flow. The improvements will have beneficial impact by increasing flow under the bridge and reducing potential flooding damages to the railroad and Dolson Avenue and surrounding infrastructure, residences, and businesses. This project has the potential to secure three assets (the assets secured are the Jiffy Lube, Shell Gas Station, and Dolson Avenue). The project has the potential to eliminate the risks associated with flooding

to the Jiffy Lube, Shell, and Dolson Avenue, while also reducing the risk to multiple upstream culverts, storage buildings, and wetlands. The reduction in risk to the upstream assets is attributable to both reductions in water surface elevation and/or a change in risk area from “Extreme” to “High,” or “High” to “N/A” based the change in inundation extents. The original inundation extents are based on FEMA DFIRM data.

### ECONOMIC

This project would create approximately 7.15 construction jobs potentially creating employment for local and regional contractors in addition to 8.4 new support jobs from increased materials and equipment sales for suppliers and support industries. This injected funding into the regional construction supply line encourages economic growth through additional induced spending. Induced spending occurs as employees and businesses benefiting from the construction work in turn spend money on other goods and services. The potential induced benefit includes additional permanent jobs, increased taxes, and increased expendable income that may be spent on additional local goods and services.

Though this project is expected to create few local jobs, its impact is substantial regarding the economic stability of the City of Middletown. These improvements aim to build a more resilient City, which creates a greater confidence for private investors in the City. As the City prioritizes and implements infrastructure projects that address lingering flood safety and accessibility issues, these investments illustrate a commitment to the future and will encourage individuals and private businesses to continue to invest in Middletown. Ensuring flooding along Dolson Avenue is decreased and continuity of operations is maintained for the railroad, this project will allow the Middletown economy to experience marginal down time after storm events and allow activities to continue.

The Middletown New Jersey Railroad Bridge upgrade project is expected to reduce flooding impacts caused by the bridge’s current positioning. Upgrades made to the bridge and its associated culvert will afford the area



**FEATURED PROJECTS**

of Dolson Avenue with more reliable and safer access to those living in the immediate vicinity while allowing emergency vehicles to operate uninterrupted during a flood emergency. While this project will certainly create economic opportunity, there are limited direct economic benefits anticipated (e.g., permanent jobs, direct additional spending, and direct additional taxes).

**ENVIRONMENTAL**

The environmental benefits of the project were analyzed using available project data and assumptions, as well as associated HEC-RAS models for an assessment of the potential impacts on the following:

- Type and quantity of environmental assets secured by the action.
- Type and quantity of clean up accomplished by the action.
- Open space created by the action.
- Importance of the action for high-priority habitat, threatened and endangered species, migration, or habitat connectivity.



*Pictured above is the Middletown-New Jersey Railroad Bridge. Photo is courtesy of Tetra Tech.*

**TABLE 4.14 - TYPE AND QUANTITY OF THE ENVIRONMENTAL BENEFITS AND IMPACTS**

	Type	Quantity
Environmental Assets Secured	The bridge improvements will alleviate a pinch point along the Monhagen Brook and allow additional flow.	
Clean-up Accomplished	Potential for cleanup of accumulated debris and sedimentation during bridge improvements.	
Open Space Created	No additional open space created.	
Importance for Habitat	The bridge upgrades will provide a more continuous flow through the Monhagen Brook and flooding upstream and reduce water surface elevation. This will create a more reliable flow source to support aquatic life and water quality within the Monhagen. The bridge upgrades will significantly improve conditions for the 100-year and 500-year events upstream of the bridge.	

Although no environmental assets were identified as being completely secured, there are several environmental benefits associated with this project. The project will result in environmental benefits such as an increase in conveyance capacity.

An analysis of the projects location and impact extent using the following NYS DEC datasets:

- Rare Plants and Animals;
- Significant Natural Communities;
- Natural Communities Vicinity;
- State Regulated Wetlands;
- Classified Water Bodies;
- Surface Source Intake Zones;
- Bird Conservation Areas;
- Forest Matrix Blocks; and
- Forest Linkage Zones.

The results showed that the project is not near any potential or historic record of occurrence of any threatened or endangered species. As indicated above the expected result of the project will improve conditions within and along the Monhagen Brook. The project is not likely to affect the identified endangered species; however, during the construction of the improvements, consideration for the existence of these species will be made. Although no areas of wetlands were identified within the project impact area, the reduction in water surface elevation during smaller interval storm events could lead to the revitalization of wetland areas that may exist in the affected area. The Monhagen Brook is identified as a Class C waterway, which indicates that its water supports fisheries and is suitable for non-contact activities.

**TABLE 4.15 - CLASSIFIED STREAMS**

Regulation	Standard	Classification
855.5-182	C	C

Source: NYS DEC, 2014

**TABLE 4.16 - RARE PLANTS AND RARE ANIMALS**

**This location is in the vicinity of one or more:**

None

Source: NYS DEC, 2014

## SOCIAL

Addressing pinch points along the Monhagen Brook enables the City to review where vulnerable assets lie in the wake of flood threats. When identified, changes such as widening of the culvert and bridge can be lifesaving for vulnerable populations and the local economy. Allowing additional flow from this project will reduce localized flood and allow operations to continue as planned. Visitors and residents alike will benefit as safer homes and businesses will be the result of this project. The Monhagen Brook is a main source of drinking water for the City. Ensuring adequate water supply and flow through Monhagen Brook also supports the local drinking water supply.

## SOCIALLY VULNERABLE POPULATIONS

During storm events, socially vulnerable populations are more at risk. Vulnerability to hazard events is influenced by age or income, strength of social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These populations are less likely to recover from an event and more likely to be severely impacted. The area of this project has a population that is vulnerable to natural hazards including flooding.



### ADDITIONAL BENEFITS

In addition to the benefits described above, this project stands to also positively impact land use in the City. This project has a positive impact on neighboring properties and uses by providing reduced flood risk, which helps protect assets and potentially increases property values. This project protects two transportation assets, the Middletown New Jersey Railroad and Dolson Avenue, from future flooding damage.

Additionally, completion of this project supports a number of the City’s NYRCR Strategies including:

- **Strategy 1:** Reduce the impact of flooding on the built environment in the City, including critical facilities, infrastructure, businesses, and housing.
- **Strategy 2:** Enhance and repair existing stormwater infrastructure, culverts, and drainageways; to ensure the City can safely grow the economy, improve safety, and reduce future losses.

### Project Cost-Benefit Analysis

The protection of two transportation assets in the City (railroad and Dolson Avenue) from future flooding events will benefit overall Community resilience toward future storms, ensuring the protection of the City’s assets and the safety of its residents. In addition, these improvements and enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit Community safety and health, as well as mobility, access, and other community needs. The reduction of flood damages to the Middletown New Jersey Railroad and Dolson Avenue and increased protection for downstream properties and infrastructure collectively position the City to benefit from this project. The Summary articulates the benefits.

### IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents, review of responses, and the completion of planning work is expected to occur over a 15-month period.

### REGULATORY REQUIREMENTS

It is anticipated that the completion of this project will require (1) NYS DEC approval due to the potential need for Article 24 (freshwater wetlands) permitting and (2) local City of Middletown approvals.

### JURISDICTION

The Middletown New Jersey Railroad has jurisdiction over the project area.



## SUMMARY

### Bridge Upgrade to Middletown New Jersey Railroad Bridge

- Investment: \$1+ million
- Flood level reduction: Immediate: -5 feet 100-year WSE Change; Long-term: reduce upstream flooding and remove several properties from the 100-year floodplain
- Assets protected: Immediate: 3; Long-term: 7
- Repetitive flood properties removed: Immediate: Long-term: potential prevent flooding of several residential areas including those in the Sterling Street, Genung Street, and West Main Street neighborhoods
- Potential future loss prevented: Immediate: \$2+ million ; Long-term: TBD
- Jobs created: Immediate: 7.15 FTE; Long-term: \*
- Strategies accomplished: Immediate: 2; Long-term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the U.S. Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending.*



## Sterling Street/Genung Street/West Main Street Buy-Out/Elevation Program

### Project Description

Many properties in the Sterling Street, Genung Street, and West Main Street neighborhoods have experience repetitive loss as a result of flooding from numerous storms. The City of Middletown currently has 126 NFIP policies. Currently, the City has a total of 58 claims with total loss payments amounting to \$545,362. Additionally, the City of Middletown currently has six total Repetitive Loss (RL) structures, four of which are single-family residences and two of which are non-residential. This project coordinates with the project recommendation in the recently adopted Middletown/Walkill HMP and has the potential to leverage HMGP and PDM funding.

### CONNECTION TO THE DISASTER

The neighborhood of Sterling and Genung Streets routinely floods and is impacted by storm events frequently. This section of the City is located in an extreme risk area and contains socially vulnerable populations. Areas along West Main Street, mainly in Downtown Middletown, are also located in an extreme risk area and contain socially vulnerable populations.

During Hurricane Irene, residences were completely inundated along Sterling and Genung Streets. West Main Street was also flooded, which prohibited access to and from the City from the west.



*Pictured above is the Sterling Street neighborhood. Photo is courtesy of Eric Thayer.*



## DESCRIPTION OF PROJECT

Creating a fund establishing a buy-out or elevation program for those properties repetitively flooded in the Sterling Street, Genung Street, and West Main Street neighborhoods is the goal of this project. The buy-out/elevation program will enhance recreational opportunities for citizens within the newly formed open space while also helping to mitigate flooding. As a result, there is the potential to create additional greenway areas. The health and social benefits include demolishing blighted or condemned buildings that pose a health and safety threat to City residents. The project will benefit all residents of the City of Middletown, especially those who live in the immediate area. The results will include safer access to homes, businesses, and other essential facilities such as hospitals and doctor offices.



*Pictured above are homes along West Main Street. Photo is courtesy of Tetra Tech, Inc.*

## COST ESTIMATE

The total project cost is estimated at \$1 million.

## Project Benefits

This flood mitigation project provides multiple benefits to the City of Middletown, including risk and damage reduction, and economic and social benefits. This project has the potential to fund acquisitions and elevations of properties that are repetitively flooded

in the Sterling and Genung Streets neighborhood and the West Main Street neighborhood. The following summarizes the anticipated benefits of the project based on the historic losses, results of the HEC-RAS modeling and additional analysis.

## FLOOD PROTECTION AND EMERGENCY RESPONSE

The Sterling/Genung neighborhood flooding is largely influenced by the constriction with the Middletown New Jersey Railroad Bridge, which is contributing upwards of five feet of floodwater to these properties. Without fixing this constriction, numerous properties will continue to be repetitively affected.

## ANTICIPATED REDUCTION OF RISK

The health and social benefits include demolishing blighted or condemned buildings which pose a health and safety threat to City residents or elevating homes to prevent future flood damages that can result in health and safety precautions. The project will benefit all residents of the City of Middletown, especially those who live in the immediate area. The results will include safer access to homes, businesses, and other essential facilities such as hospitals and doctor offices.

## ECONOMIC

This project would create approximately 7.15 construction jobs potentially creating employment for local and regional contractors in addition to 8.4 total jobs from increased materials and equipment sales for suppliers and support industries once the fund is established and buy-outs/elevations begin\*. This injected funding into the regional construction supply line encourages economic growth through additional induced spending. Induced spending occurs as employees and businesses benefiting from the construction work in turn spend money on other goods and services. The potential induced benefit includes additional permanent jobs, increased taxes, and increased expendable income that may be spent on additional local goods and services.



Though this project is expected to create few local jobs, its impact is substantial regarding the economic stability of the City. A project focusing on building a more resilient city creates greater confidence for private investors in Middletown. As the City prioritizes and implements infrastructure projects that address lingering flood safety and accessibility issues, these investments illustrate a commitment to the future and will encourage individuals and private businesses to continue to invest in Middletown.

Finally, the funding initiative will have a positive economic effect on future recovery and repair spending. This project will result in a reduction of future maintenance or repair costs associated with flood damage.

While this project will certainly create economic opportunity, there are limited direct economic benefits anticipated (e.g., permanent jobs, direct additional spending, and direct additional taxes).

### ENVIRONMENTAL

The environmental benefits of the project were analyzed using available project data and assumptions, as well as associated HEC-RAS models for an assessment of the potential impacts on the following:

- Type and quantity of environmental assets secured by the action.
- Type and quantity of clean up accomplished by the action.
- Open space created by the action.
- Importance of the action for high-priority habitat, threatened and endangered species, migration, or habitat connectivity.

Although no environmental assets were identified as being completely secured, there are several environmental benefits associated with this project. The project will result in the following environmental benefit:

- Creation of pedestrian friendly green space, sidewalks, and landscaping.

Better environmental quality within the building due to health and safety improvements and any renovation associated with the project.

### SOCIAL

The buy-out/elevation program will enhance recreational opportunities for citizens within the newly formed open space while also helping to mitigate flooding. The health and social benefits include the demolition of blighted or condemned buildings, which pose a health and safety threat to the residents of the City.

The project will benefit all residents of Middletown, especially those who live or in the immediate area. The results will include safer access to homes, businesses, and other essential facilities (hospitals, doctor offices, etc.).

### SOCIALLY VULNERABLE POPULATIONS

During storm events, socially vulnerable populations are more at risk. Vulnerability to hazard events is influenced by age or income, strength of social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These populations are less likely to recover from an event and more likely to be severely impacted. The area of this project has a population that is vulnerable to natural hazards including flooding.

In addition to the benefits described above, this project stands to also leverage additional funding from FEMA. As a “gap” funding source, the CDBG-DR program is intended to fulfill recovery needs not fully met by other public assistance programs. By leveraging HMGP and PDM funding to support a portion of this project, the City may increase the overall benefit and availability of the limited CDBG-DR funds for other projects and initiatives. The project also creates scenic and recreational value by removing the flood-prone structures to create recreational open space once funding is operational.

Additionally, completion of this project supports a number of the City’s NYRCR Strategies, including:

- **Strategy 3:** Develop planning capacity and zoning capabilities to help promote integrated and functional relationship with community partners.
- **Strategy 4:** Provide and promote services, which sustain human health and well-being throughout the life cycle of a disaster.
- **Strategy 5:** Ensure housing opportunities are both flood-resilient and affordable for current and future residents of all needs and ages through local ordinances and mitigation initiatives.
- **Strategy 6:** Preserve, protect, restore, and where possible enhance or develop the natural, recreational, and cultural assets of the City.

### Project Cost-Benefit Analysis

This project will benefit overall Community resilience toward future storms, ensuring the protection of the City’s assets and the safety of its residents. In addition, these improvements and enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit Community safety and health, as well as mobility, access, and other community needs. The reduction in floodwater on one of the City’s main thoroughfares and increased protection for downstream properties and infrastructure collectively position the City and Town to benefit from this project. The summary articulates the benefits.

### IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents, review of responses, and the completion of planning work, is expected to occur over a 15-month period.

### REGULATORY REQUIREMENTS

It is anticipated that the completion of this project will require NYS DEC and local City of Middletown approvals.

### JURISDICTION

N/A



## SUMMARY

### Sterling Street / Genung Street / West Main Street Buy-Out / Elevation Program

- Investment: \$1+ million
- Flood level reduction: Immediate: 0; Long-term: The Sterling/Genung flooding is largely influenced by the constriction with the NJ Railroad Bridge, which is contributing upwards of 5 feet of floodwater to these properties. Without fixing this constriction, numerous properties are repeatedly affected.
- Assets protected: Immediate: 1; Long-term: properties in the neighborhoods of Sterling Street, Genung Street, and West Main Street
- Repetitive flood properties removed: Immediate: up to 5; Long-term: TBD
- Potential future loss prevented: Immediate: 1 million +; Long-term: TBD
- Jobs created: Immediate: 7.15 FTE; Long-term: TBD\*
- Strategies accomplished: Immediate: 4; Long-term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the U.S. Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending. reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending.*



## SUNY Orange County Community College Public Safety/Emergency Operations Center/Fire/Emergency Medical Services/Shelter

### Project Background

The City of Middletown is in need of an area where emergency services may station equipment during disasters. The southern peninsula of the City of Middletown is highly susceptible to flooding during storms and requires such a centralized service area. Emergency services rely heavily on a centralized location in order to ensure that essential resources are provided to those most in need. During emergency situations this need for reliable centralization increases. This project will contribute to overall resource availability and deployment for emergency responders in and around Middletown. In turn, this will ensure that vital emergency services and critical asset network capabilities are not disrupted.

### CONNECTION TO THE DISASTER

As an emergency service center establishment project, this initiative has no associated historic losses. However, providing safe, reliable, and rapid emergency response services is vital to the City's recovery during a disaster. Some damages and losses from previous disasters can be attributed to old paradigm response efforts. The centralized location of an emergency services and shelter station allows the residents of Middletown to



*Pictured above is Webb Horton House SUNY Orange County Community College. Photo is courtesy of Eric Thayer.*

use resources as they become activated. By centrally locating these services around a particularly flood-prone area, residents are aware of the resource opportunities available prior to a storm and will know where to relocate, should the need arise during disaster. Additionally, the service station's dual role as a resource center and shelter location provides a place of refuge for Middletown residents who may be displaced during a disaster.

### DESCRIPTION OF PROJECT

This project will focus on the initial steps of site identification and acquisition for the creation of a multi-faceted emergency services station located in southern Middletown adjacent to the State University of New York (SUNY) – Orange County campus. This station will serve as a public safety station and shelter for both Middletown residents and SUNY students during storm events and will more effectively meet the needs of the expanding campus as well as the City's residents during storm events. This project will contribute to overall resource availability and deployment for emergency responders in and around Middletown, thus ensuring that vital emergency services and critical asset network capabilities are not disrupted. Additionally, this location would house the backup communications center that services all jurisdictional agencies. Finally, an area will be included within the building that can be rapidly modified to house an Emergency Operations Center in times requiring relocation, which would provide the redundancy to maintain operations within the jurisdiction.



*Pictured above is the Central Firehouse. Photo is courtesy of Eric Thayer.*



## COST ESTIMATE

The total project cost is estimated at \$300,000.

## Project Benefits

This emergency services project provides multiple benefits to the City of Middletown, including risk and damage reduction, and economic and social benefits.

## EMERGENCY RESPONSE

This project would provide effective and necessary emergency response to the southern side of the City and to the SUNY Orange County campus. During Hurricane Irene flooding along Fulton Avenue prohibited effective and timely emergency response to this area of the City. This project would address that issue as well as the growing campus population.

## ANTICIPATED REDUCTION OF RISK

This project has the potential to reduce vulnerability of Middletown assets by housing emergency response equipment.

## ECONOMIC

This project would create approximately 2.36 construction jobs potentially creating employment for local and regional contractors in addition to 2.77 new support jobs from increased materials and equipment sales for suppliers and support industries\*. This injected funding into the regional construction supply line encourages economic growth through additional induced spending. Induced spending occurs as employees and businesses benefiting from the construction work in turn spend money on other goods and services. The potential induced benefits include additional permanent jobs, increased taxes, and increased expendable income that may be spent on additional local goods and services.

With a project focusing on the protection of local assets, the economy of Middletown will be preserved and protected through this project. In addition to economic growth spurred by construction, these

improvements aimed at building a more resilient city will also create greater confidence for private investors in Middletown. As the City prioritizes and implements emergency service projects that address lingering safety and accessibility issues, these investments illustrate a commitment to the future and will encourage individuals and private businesses to continue to invest in Middletown. By creating safer more reliable access throughout the City, this project will benefit business growth and will bolster the City's continued role as regional commercial and cultural hub.

While this project will certainly create economic opportunity, there are limited direct economic benefits anticipated (e.g., permanent jobs, direct additional spending, and direct additional taxes).

## ENVIRONMENTAL

The environmental benefits of the project were analyzed using available project data and assumptions, or an assessment of the potential impacts on the following:

- Type and quantity of environmental assets secured by the action.
- Type and quantity of clean up accomplished by the action.
- Open space created by the action.
- Importance of the action for high-priority habitat, threatened and endangered species, migration, or habitat connectivity.

Although no environmental assets were identified as being completely secured, there are environmental benefits associated with this project. The project will result in environmental benefits including better environmental quality within emergency service station due to health and safety improvements and any renovation associated with the project.

## SOCIAL

The health and social aspects of this project regarding the protection of life safety pose the greatest benefit to Middletown. Providing safe, reliable, and rapid emergency response services is vital to the City’s recovery during a disaster. The centralized location of an emergency services and shelter station allows the residents of Middletown to use the resources as they become activated. By centrally locating these services around a particularly flood-prone area, residents are aware of the resource opportunities available prior to a storm and will know where to relocate, should the need arise.

## SOCIALLY VULNERABLE POPULATIONS

During storm events, socially vulnerable populations are more at risk. Vulnerability to hazard events is influenced by age or income, strength of social networks, and neighborhood characteristics. Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. These populations are less likely to recover from an event and more likely to be severely impacted. The area of this project has a population that are vulnerable to natural hazards including flooding.

## ADDITIONAL BENEFITS

In addition to the benefits described above, completion of this project supports one of the City’s NYRCR Strategies including:

- **Strategy 4:** Provide and promote services, which sustain human health and well-being throughout the life cycle of a disaster.

## Project Cost-Benefit Analysis

This project will more effectively serve the needs of the expanding campus as well as the City’s residents during storm events. This project will benefit overall Community resilience toward future storms, ensuring the protection of the City’s assets and the safety of its residents. In addition, these improvements and

enhancements to Community facilities and emergency response assets are critical for promoting growth in the City of Middletown.

Based on available information and preliminary designs, the proposed project would benefit Community safety and health, as well as mobility, access, and other community needs. The reduction in floodwater on one of the City’s main thoroughfares and increased protection for downstream properties and infrastructure collectively position the City and Town to benefit from this project. The Summary articulates the benefits.

## IMPLEMENTATION TIME FRAME

General project implementation, including preparation of bid documents, review of responses, and the completion of planning work is expected to occur over a 15-month period.

## REGULATORY REQUIREMENTS

It is anticipated that the completion of this project will require NYS DEC and local City of Middletown approvals.

## JURISDICTION

Jurisdiction for this project rests with the City of Middletown.



## SUMMARY

### SUNY Orange County Community College PS / EOC / FIRE / EMS / SHELTER

- Investment: \$300,000
- Flood level reduction: Immediate: 0; Long-term: none; however, will effectively serve the needs of the expanding SUNY campus, as well as the City’s residents during storm events.
- Assets protected: Immediate: 0; Long-term: 0
- Repetitive flood properties removed: Immediate: 0; Long-term: 0
- Potential future loss prevented: Immediate: 0; Long-term: TBD
- Jobs created: Immediate: 2.36 FTE; Long-term: TBD
- Strategies accomplished: Immediate: 1; Long-term: 6

*\* The FTE construction jobs were estimated based on a methodology developed by the U.S. Department of Commerce Economics and Statistics Administration as presented in the September 2013 Economic Impact of Hurricane Sandy: Potential Economic Activity Lost and Gained in New Jersey and New York. This study estimated job creation from recovery spending on infrastructure projects in New York and reported 7.15 construction jobs and 8.4 total jobs per \$1 million in construction spending.*



*Photo is courtesy of Eric Thayer.*

# Section 5

Additional Materials



*Photo is courtesy of Eric Thayer.*

## Section 5: Additional Materials

### Additional Resiliency Recommendations

Table 5.1 lists the Additional Resiliency Recommendations for the City of Middletown.

TABLE 5.1 - ADDITIONAL RESILIENCY RECOMMENDATIONS				
Strategy	Project Name	Short Project Description	Estimated Cost	Regional Project (Y/N)
Strategies 3, 4, and 6	Middletown Comprehensive Plan Update and Greenway/ Green Infrastructure Plan Element	<p>This project would be part of either a new Comprehensive Master Plan or a Comprehensive Plan Amendment. This project would help develop goals, guide coordinate funding, identify connections (trail, bike, pedestrian), and cultivate zoning/design standards to enhance the quality of living and design of the City.</p> <p>This project would be coordinated with the development of the Heritage Trail Extension Segments 2 and 3 which are currently funded and pending approval by the New York State Department of Transportation (NYS DOT). This project seeks to leverage the existing \$5.8 million of funding for the development of the trail and other associated improvements. The development of this trail is planned for 2015. This project has the potential to create additional stormwater storage and retention while also providing additional emergency access within the City during disaster and storm events. There is the potential to provide funding for changes to future plans for use of emergency vehicles on the trail system. This may include ordinance preparation and implementation of design standards.</p>	\$110,000	Y



**TABLE 5.1 - ADDITIONAL RESILIENCY RECOMMENDATIONS (CONT'D)**

Strategy	Project Name	Short Project Description	Estimated Cost	Regional Project (Y/N)
Strategies 3, 4, 5, and 6	Business Improvement District (BID) College Expansion	<p>The Business Improvement District (BID) expansion and Memorandum of Understanding (MOU) project with State University of New York (SUNY) Orange County Community College and Touro College seeks to work on improvements and connections with the downtown. This project will build on compensatory sidewalk and streetscape improvements being completed by SUNY Orange County Community College along Wawayana Avenue.</p> <p>This project would expand the BID district to include both colleges and Wawayanda Avenue to coordinate streetscape improvements and to create a coordinated design and investment effort. It would incentivize the adaptive reuse of the Classic Hosiery Building on the corner of Fulton Avenue and Wawayanda Avenue for use as student housing and first-floor retail/commercial businesses. It seeks to incentivize the creation of medical office buildings in proximity to Touro College. This addition would help the City build resiliency in housing, economic development, and health and social services. There is also the opportunity to allow for dormitory housing in the BID district to provide additional housing opportunities and to help bolster the economy of the downtown by promoting and attracting live/work investment use types.</p>	\$50,000	Y
Strategies 1, 2, 3, and 4	O&W Station Green Stormwater Design	<p>This project focuses on design standards to help facilitate private investment in green infrastructure, beautification, and enhancements of sense of place. There is the potential to make a specific green infrastructure/stormwater management recommendation for the redevelopment/ adaptive reuse of the O&amp;W station.</p> <p>This project would help leverage tax credits and economic development funding for site development and would facilitate additional investment by the Middletown Community Health Center in the City. The project can result in the creation of additional health and social services on the north side of the City.</p>	\$30,000	N
Strategy 1	Monhagen Outfall Upgrade	There is the potential to upgrade the existing outfall east of State Route 211, upstream of Pilgrim Estates, to provide additional storage capacity in the existing basin.	\$300,000	N



**TABLE 5.1 - ADDITIONAL RESILIENCY RECOMMENDATIONS (CONT'D)**

Strategy	Project Name	Short Project Description	Estimated Cost	Regional Project (Y/N)
Strategies 3, 4, 5, and 6	Business Improvement District (BID) College Expansion	<p>The Business Improvement District (BID) expansion and Memorandum of Understanding (MOU) project with State University of New York (SUNY) Orange County Community College and Touro College seeks to work on improvements and connections with the downtown. This project will build on compensatory sidewalk and streetscape improvements being completed by SUNY Orange County Community College along Wawayana Avenue.</p> <p>This project would expand the BID district to include both colleges and Wawayanda Avenue to coordinate streetscape improvements and to create a coordinated design and investment effort. It would incentivize the adaptive reuse of the Classic Hosiery Building on the corner of Fulton Avenue and Wawayanda Avenue for use as student housing and first-floor retail/commercial businesses. It seeks to incentivize the creation of medical office buildings in proximity to Touro College. This addition would help the City build resiliency in housing, economic development, and health and social services. There is also the opportunity to allow for dormitory housing in the BID district to provide additional housing opportunities and to help bolster the economy of the downtown by promoting and attracting live/work investment use types.</p>	\$50,000	Y
Strategies 1, 2, 3, and 4	O&W Station Green Stormwater Design	<p>This project focuses on design standards to help facilitate private investment in green infrastructure, beautification, and enhancements of sense of place. There is the potential to make a specific green infrastructure/stormwater management recommendation for the redevelopment/adaptive reuse of the O&amp;W station.</p> <p>This project would help leverage tax credits and economic development funding for site development and would facilitate additional investment by the Middletown Community Health Center in the City. The project can result in the creation of additional health and social services on the north side of the City.</p>	\$30,000	N
Strategy 1	Monhagen Outfall Upgrade	There is the potential to upgrade the existing outfall east of State Route 211, upstream of Pilgrim Estates, to provide additional storage capacity in the existing basin.	\$300,000	N



**TABLE 5.1 - ADDITIONAL RESILIENCY RECOMMENDATIONS (CONT'D)**

Strategy	Project Name	Short Project Description	Estimated Cost	Regional Project (Y/N)
Strategy 1	Thomas Jefferson Place Stormwater Retention/ Detention	Exploring the potential of constructing a detention pond upstream of Watts Park, starting at the dead end of Thomas Jefferson Place. This project coordinates with the project recommendation in the recently adopted Town of Wallkill/City of Middletown Natural Hazards Mitigation Plan (HMP) (2014) and has the potential to leverage Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) funding.	\$750,000 to \$1 million	N
Strategy 4	Emergency Communication Upgrade	<p>Install technology capable of providing the Public Safety Answering Point (PSAP) or EOC with the ability to send voice and text notification to phones throughout the Community to provide information.</p> <p>This process should be customizable during times of emergency to target the smallest block range in the jurisdiction through the entire City. This technology should also allow various types of messages to be developed in times of need and to should allow different messages to be transmitted to different people, depending on their needs and location.</p> <p>The development of a jurisdictional and regional Tactical Interoperable Communications Plan (TICP) would provide the City of Middletown with the available frequencies and patches required to ensure continuous communications at all times, regardless of a disaster. This process could include all primary agencies providing support to the jurisdiction as well as secondary and tertiary agencies that may be deployed into the jurisdiction to provide life safety operations. The planning process would be followed by training on the use of interoperability, and utility could be tested through the Homeland Security Exercise Evaluation Program (HSEEP) validation process.</p>	\$500,000	Y
Strategy 1	Channel Daylighting and Riparian Improvements between 280 State Route 211 East and Lloyds Lane/ Shoprite Plaza	This project would implement channel daylighting and riparian improvements to address flooding behind the Pizza Hut south of State Route 211, southwest of Shoprite (behind the store's loading bay), and behind Wallkill Plaza on Dunning Road, where stormwater flow from surrounding areas is channelized and sent underground as it drains to Silver Lake.	\$1,000,000 - \$1,500,000	Y



**TABLE 5.1 - ADDITIONAL RESILIENCY RECOMMENDATIONS (CONT'D)**

Strategy	Project Name	Short Project Description	Estimated Cost	Regional Project (Y/N)
Strategies 3, 4, 5, and 6	Business Improvement District (BID) College Expansion	<p>The Business Improvement District (BID) expansion and Memorandum of Understanding (MOU) project with State University of New York (SUNY) Orange County Community College and Touro College seeks to work on improvements and connections with the downtown. This project will build on compensatory sidewalk and streetscape improvements being completed by SUNY Orange County Community College along Wawayana Avenue.</p> <p>This project would expand the BID district to include both colleges and Wawayanda Avenue to coordinate streetscape improvements and to create a coordinated design and investment effort. It would incentivize the adaptive reuse of the Classic Hosiery Building on the corner of Fulton Avenue and Wawayanda Avenue for use as student housing and first-floor retail/commercial businesses. It seeks to incentivize the creation of medical office buildings in proximity to Touro College. This addition would help the City build resiliency in housing, economic development, and health and social services. There is also the opportunity to allow for dormitory housing in the BID district to provide additional housing opportunities and to help bolster the economy of the downtown by promoting and attracting live/work investment use types.</p>	\$50,000	Y
Strategies 1, 2, 3, and 4	O&W Station Green Stormwater Design	<p>This project focuses on design standards to help facilitate private investment in green infrastructure, beautification, and enhancements of sense of place. There is the potential to make a specific green infrastructure/stormwater management recommendation for the redevelopment/adaptive reuse of the O&amp;W station.</p> <p>This project would help leverage tax credits and economic development funding for site development and would facilitate additional investment by the Middletown Community Health Center in the City. The project can result in the creation of additional health and social services on the north side of the City.</p>	\$30,000	N
Strategy 1	Monhagen Outfall Upgrade	<p>There is the potential to upgrade the existing outfall east of State Route 211, upstream of Pilgrim Estates, to provide additional storage capacity in the existing basin.</p>	\$300,000	N



## Master Table of Projects

Table 5.2 summarizes all Proposed Projects, Featured Projects, and Additional Resiliency Recommendations developed by the Community. Projects in this table have not been ranked or prioritized.

**TABLE 5.2 - MASTER PROJECT TABLE**

Strategy	Project Name	Short Project Description	Project Category	Estimated Cost	Regional Project (Y/N)
Strategies 1, 2, 5, and 6	Monhagen Brook Culvert and Dredging Project	<p>This project would bridge the funding gap of an existing project for the dredging and culvert upgrades near the point of confluence for Monhagen and Draper Brooks.</p> <p>This project would work in concert with the upstream culvert and streambank improvement project completed or currently underway as well as the proposed upstream wetlands creation and retention area creation to reduce flooding to the City, including the Sterling Street neighborhood routinely impacted by flooding. This will leverage approximately \$150,000 of existing funding. This project corresponds with the project recommendation in the recently adopted Town of Wallkill/City of Middletown HMP (2014) and has the potential to leverage HMGP and PDM funding. This could include the acquisition of adjacent property and adaptive reuse of the sub-station building for park and water access.</p>	Proposed	\$1.5 million - \$2 million	N
Strategies 1, 2, 5, and 6	Dorothea Dix Drive Flood Retention/ Wetland Construction/ Restoration Project	<p>The first phase of the project will include the acquisition of the 8.2-acre property, and the demolition and removal of the existing parking lot area. It will include the engineering, construction, and re-channelization of the Monhagen Brook; the development of the first phase of wetland mitigation areas; and the construction of the first phase of recreational features that include some sections of the proposed trail system and interpretive signage.</p> <p>The second phase will include the renovation of the existing vacant building to be used as a community recreation center, which could also function as an Emergency Operation Center (EOC) and shelter. This phase would also include (1) the acquisition and preparation of a portion of the 63-acre property adjacent to the Phase I potential project site to create additional areas of mitigated wetlands, and (2) the development of the second phase of boardwalk and trail construction, and other recreation features. Phase II is not proposed as part of this funding round.</p>	Proposed	\$1.5 million	Y

**TABLE 5.2 - MASTER PROJECT TABLE (CONT'D)**

Strategy	Project Name	Short Project Description	Project Category	Estimated Cost	Regional Project (Y/N)
Strategies 1, 2, 5, and 6	West Main Street Streambank Mitigation	Restoration of the streambanks and surrounding riparian area to improve flow conditions, reduce erosion, and provide additional flood attenuation, if possible. Consideration for regenerative design techniques could be used.	Proposed	\$1.5 million - \$2 million	N
Strategies 1 and 2	Culvert Improvements at West Main Street and Monhagen Avenue	The project will include the removal of the existing twin culverts and the upgrade of that section of culvert to a single, continuous culvert with improved entrance conditions that would increase flow through the culvert and reduce potential flooding damages to surrounding infrastructure, residences, and businesses. The project will also include streambank mitigation of the day-lighted section of Monhagen Brook between Monhagen Avenue and the entrance of the culvert.	Proposed	\$2 million	N
Strategies 1, 2, 5, and 6	Maple Hill Park Improvements	This project will improve the existing berm/dam to create additional floodwater retention while enhancing the facility as a recreational amenity. This can work in concert with the other upstream wetland construction and stormwater retention projects to alleviate or reduce flooding downstream along West Main Street, Monhagen Avenue, Fulton Avenue, Sterling Street, and Dolson Avenue.	Featured	\$500,000 - \$2 million	Y
Strategies 1 and 2	Bridge Upgrade to Middletown New Jersey Railroad Bridge	The Middletown New Jersey Railroad Bridge is identified as a pinch point as it crosses the Monhagen Brook. The proposed project would upgrade the bridge, which includes widening the culvert and bridge. This project will improve flow capacity and convey floodwaters. Reducing the threat of damage to the railroad line allows commerce to continue during and after a storm event.	Featured	\$1 million+	N
Strategy 4	SUNY Orange County Community College	Identify a site and work with SUNY Orange County Community College to acquire a site for the creation of a PS/EOC/Fire/EMS/Shelter station on the southern side of the City to more effectively serve the needs of the expanding campus as well as the needs of the City's residents during storm events.	Featured	\$300,000	Y
Strategies 3, 4, 5 and 6	Sterling Street/ Genung Street and West Main Street Buy-Out/Elevation Program	The goal of this project is to create a fund establishing a buy-out or elevation program for those properties repetitively flooded in the Sterling Street, Genung Street, and West Main Street neighborhoods. The buy-out/elevation program will enhance recreational opportunities for citizens in the newly formed open space while also helping to mitigate flooding.	Featured	\$1 million	N



**TABLE 5.2 - MASTER PROJECT TABLE (CONT'D)**

Strategy	Project Name	Short Project Description	Project Category	Estimated Cost	Regional Project (Y/N)
Strategies 3, 4, 5, and 6	Business Improvement District (BID) College expansion	<p>The Business Improvement District (BID) expansion and Memorandum of Understanding (MOU) project with State University of New York (SUNY) Orange County Community College and Touro College seeks to work on improvements and connections with the downtown. This project will build on compensatory sidewalk and streetscape improvements being completed by SUNY Orange County Community College along Wawayana Avenue.</p> <p>This project would expand the BID district to include both colleges and Wawayanda Avenue to coordinate streetscape improvements and to create a coordinated design and investment effort. It would incentivize the adaptive reuse of the Classic Hosiery Building on the corner of Fulton Avenue and Wawayanda Avenue for use as student housing and first-floor retail/commercial businesses. It seeks to incentivize the creation of medical office buildings in proximity to Touro College. This addition would help the City build resiliency in housing, economic development, and health and social services. There is also the opportunity to allow for dormitory housing in the BID district to provide additional housing opportunities and to help bolster the economy of the downtown by promoting and attracting live/work investment use types.</p>	Additional Resiliency	\$50,000	N
Strategies 1, 2, 3, and 4	O&W Station Green Stormwater Design	<p>This project focuses on design standards to help facilitate private investment in green infrastructure, beautification, and enhancements of sense of place. There is the potential to make a specific green infrastructure/stormwater management recommendation for the redevelopment/adaptive reuse of the O&amp;W station.</p> <p>This project would help leverage tax credits and economic development funding for site development and would facilitate additional investment by the Middletown Community Health Center in the City. The project can result in the creation of additional health and social services on the north side of the City.</p>	Additional Resiliency	\$30,000	N
Strategy 1	Monhagen Outfall Upgrade	There is the potential to upgrade the existing outfall east of State Route 211, upstream of Pilgrim Estates, to provide additional storage capacity in the existing basin.	Additional Resiliency	\$200,000	N



**TABLE 5.2 - MASTER PROJECT TABLE (CONT'D)**

Strategy	Project Name	Short Project Description	Project Category	Estimated Cost	Regional Project (Y/N)
Strategy 1	Thomas Jefferson Place Stormwater retention/detention	Exploring the potential of constructing a detention pond upstream of Watts Park, starting at the dead end of Thomas Jefferson Place. This project coordinates with the project recommendation in the recently adopted Town of Walkkill/City of Middletown Natural Hazards Mitigation Plan (HMP) (2014) and has the potential to leverage Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) funding.	Additional Resiliency	\$750,000 - \$1 million	N
Strategy 4	Emergency Communication Upgrade	<p>Install technology capable of providing the Public Safety Answering Point (PSAP) or EOC with the ability to send voice and text notification to phones throughout the Community to provide information.</p> <p>This process should be customizable during times of emergency to target the smallest block range in the jurisdiction through the entire City. This technology should also allow various types of messages to be developed in times of need and to should allow different messages to be transmitted to different people, depending on their needs and location.</p> <p>The development of a jurisdictional and regional Tactical Interoperable Communications Plan (TICP) would provide the City of Middletown with the available frequencies and patches required to ensure continuous communications at all times, regardless of a disaster. This process could include all primary agencies providing support to the jurisdiction as well as secondary and tertiary agencies that may be deployed into the jurisdiction to provide life safety operations. The planning process would be followed by training on the use of interoperability, and utility could be tested through the Homeland Security Exercise Evaluation Program (HSEEP) validation process.</p>	Additional Resiliency	\$500,000	Y
Strategy 1	Channel Daylighting and Riparian Improvements between 280 State Route 211 East and Lloyds Lane/ Shoprite Plaza	This project would implement channel daylighting and riparian improvements to address flooding behind the Pizza Hut south of State Route 211, southwest of Shoprite (behind the store's loading bay), and behind Walkkill Plaza on Dunning Road, where stormwater flow from surrounding areas is channelized and sent underground as it drains to Silver Lake.	Additional Resiliency	\$1,000,000 - \$1,500,000	Y



## COLLABORATIVE CONNECTIONS FOR PUBLIC ENGAGEMENT

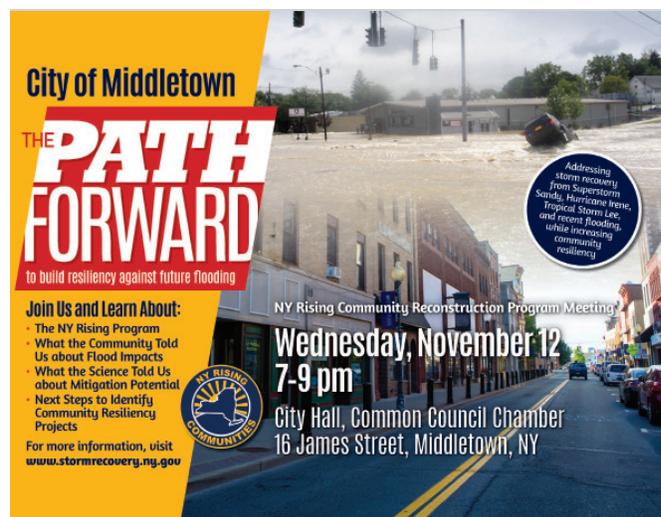
The City of Middletown NYRCR Committee Members effectively led the charge for public outreach to encourage attendance at biweekly Planning Committee Meetings and the four Public Engagement Events held over the 7-month planning process. Despite its proximity to major media markets and many competing messages for residents’ and business owners’ attention, there was consistently high attendance at Public Engagement Events, where the NYRCR Program, public opinion, and information about the City of Middletown NYRCR Plan were shared.

**Committee Members who communicated the importance of public involvement in the planning process played a significant role in the consistently high attendance at Public Engagement Events.**

Unquestionably, collaborative connections throughout the Community are integral to recovery and resiliency efforts, from immediate post-disaster activities to identifying and implementing projects that guard against future devastation from storms. The public engagement process for the NYRCR City of Middletown Plan was essential to identifying community-driven resiliency initiatives.

The communications strategy formed at the beginning of the NYRCR planning process targeted outreach to residents, homeowners, non-resident property owners, business owners, and community and social service organizations across both the public and private sectors. Messages about the NYRCR Plan and those that encouraged attendance at the Public Engagement Events were deliberately channeled to target audiences in formats most accessible to them. This included sensitivity to audiences who might otherwise be disenfranchised from mainstream messaging, or who reflect a significant demographic in the City of Middletown NYRCR Planning Area.

Additionally, posters and brochures that discussed meetings and events, and frequently asked questions about the NYRCR Program, were placed in strategic, high-traffic locations around the City. Tetra Tech, Inc. (Consultant Team) also set up a display booth at the annual Run 4 Downtown, which raises awareness and celebrates the revitalization efforts of Middletown’s downtown area.



Public Engagement Events were advertised in both English and Spanish to encourage maximum attendance by reflecting the City’s demographics. Pictured at top is the advertisement developed in Spanish; below is the same advertisement developed in English. Images are courtesy of Tetra Tech, Inc.

## CRITICAL PUBLIC INPUT

The Committee solicited information and public opinions about Community needs and opportunities relative to storm recovery and building resiliency. Public input about these needs and opportunities, in light of existing and non-existing community resources and critical assets, was instrumental to the development of Proposed and Featured Projects, and Additional Resiliency Recommendations.

## SURVEYS, INTERVIEWS, VOTING EXERCISE

Surveys in both hard-copy and electronic form were developed and distributed to query key Community stakeholder organizations about critical issues, unmet needs, difficulty satisfying needs during disasters, and potential storm mitigation and resiliency initiatives.

While electronic surveys were tabulated using the online survey tool Survey Monkey, hard-copy submittals were manually entered by the Consultant Team. The surveys documented both quantitative and qualitative information, and enabled participants to rank the importance of the six Recovery Support Functions (RSFs) defined by the NYRCR Program. These results were gathered between July and October 2014.

Moreover, the Committee worked with leaders of various service organizations to obtain their input about critical needs as a result of the storms. An electronic survey was developed and issued to leaders from fire departments and law enforcement organizations, as well as employees from utility companies, hospitals, and schools. The surveys gathered information related to the impact from the flooding events and identified specific project ideas from each organization.

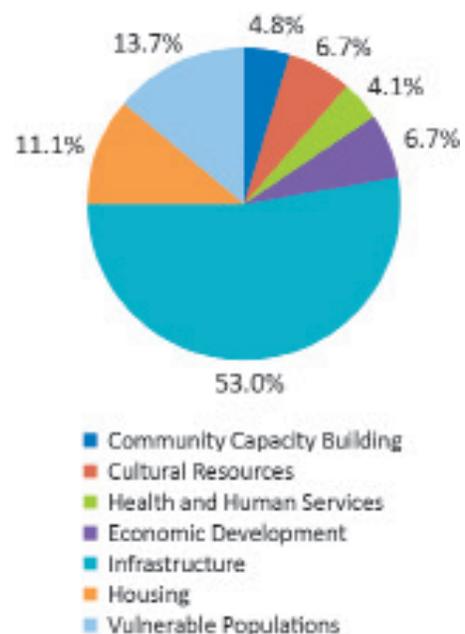
**Particular inquiry was made to agencies that serve vulnerable populations who could have difficulty with self-evacuation, sheltering-in-place, or accessing assistance in a post-event environment.**

The Consultant Team also conducted telephone interviews with key Community stakeholders who did not participate in the online survey. These interviews

enabled more in-depth discussions that yielded valuable input relative to prospective needs and project opportunities.

At Public Engagement Meeting 1, attendees indicated where they felt NYRCR Program dollars for Middletown should be targeted to address storm impacts and build resiliency. “Middletown Money” was distributed by voters in ballot boxes that were labeled according to particular RSFs. Results from these exercises are indicated in Figure 5.2 and align with opinions gathered throughout the NYRCR planning process. Infrastructure was the top priority for project type.

**FIGURE 5.2 - PUBLIC MEETING #1 PRIORITY VOTING RESULTS**



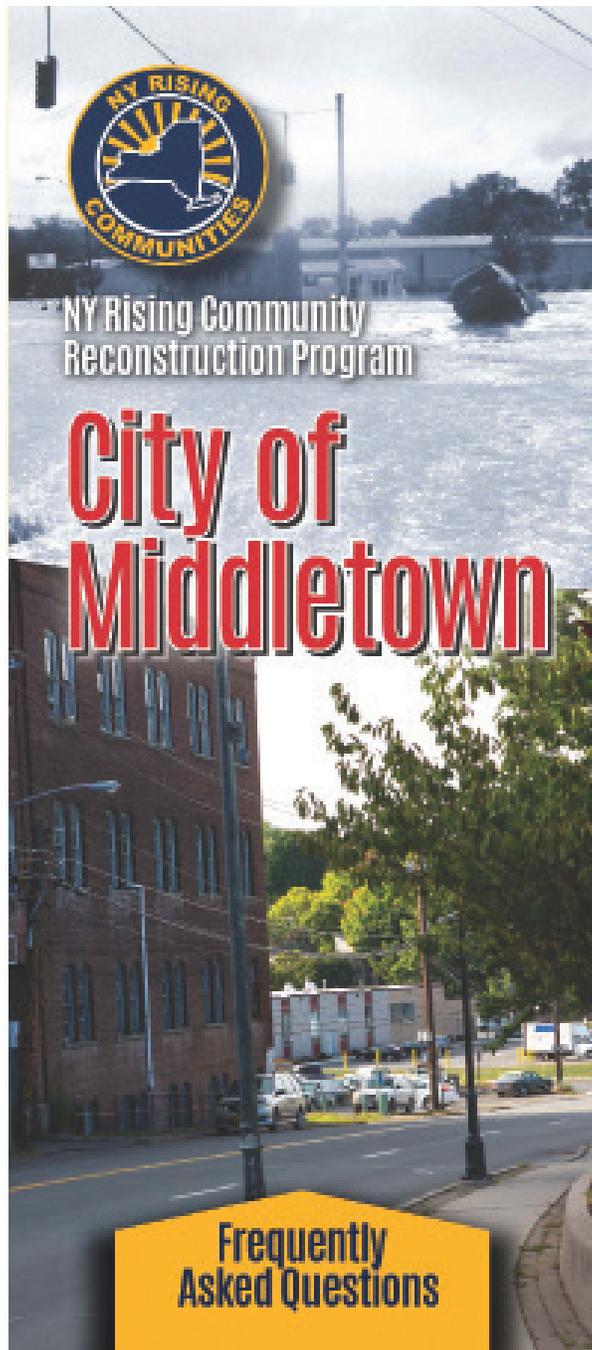
## REGULAR PLANNING COMMITTEE MEETINGS

Since NYRCR Program commencement in Middletown in June 2014, the Committee—composed of local residents, businesspeople, and Community organizational stakeholders—met twice monthly to discuss issues and public input, prospective projects, and next steps in the process. Formal meeting agendas were issued and meetings were held according to Roberts Rules of Order. Each meeting included time for public comment. Subsequently, recorded meeting notes



were made available online to the public on the NYRCR website. Committee meetings were typically held at the Mulberry House Senior Center located at 62-70 West Main Street in the City of Middletown.

All Planning Committee Meetings were advertised on the NYRCR Program website, as well as on websites of many business, community, and civic organizations,



Above is a picture of a brochure of Frequently Asked Questions that was handed out at the Public Engagement Events. Photo is courtesy of Tetra Tech, Inc.

particularly among Committee members’ spheres of influence. Committee meetings were enhanced when municipal government officials and staff attended, as their first-hand knowledge of City resources and response needs was vital to sound plan development.

### GETTING THE WORD OUT

Public outreach efforts incorporated the following variety of multi-media messaging:

- Media alerts;
- Newspaper ads (print and online);
- Informational flyers and posters;
- Website notifications;
- Social media;
- Yard signs; and
- Public access channels.

Four Public Engagement Events were conducted between July 2014 and January 2015 to provide education about the NYRCR Program; obtain input from the City’s residents, property owners, and business owners; review the draft Conceptual Plan; and to review projects based on public input, intelligence gathering, and scientific analysis.



Workshops attracted people of all ages, including high school and college-aged students shown here. Photo is courtesy of Tetra Tech, Inc.

All of the public meetings were held at the City of Middletown City Hall in the Common Council Chambers. To best accommodate all members of the public, the public meetings were recorded and made available to watch on the local public television station and on the City’s website.

### Public Engagement Event 1

The first Public Engagement Event, held in late July 2014, introduced the purpose and intent of the NYRCR Program, what it enables for the Community, and how community members can contribute. Nearly 100 people attended this Public Engagement Event, including a large group of high school students who attended in support of a public policy summer course. The unique opportunity to integrate the ideas and opinions of Middletown’s younger population added value to the planning process. Those in attendance were invited to participate in a voting exercise to determine what types of projects Middletown’s Plan should offer. Maps of damaged areas, the planning area, and areas at risk were displayed for the Community to highlight problem areas during disasters.

### Public Engagement Event 2

The second Public Engagement Event, held in September 2014, introduced the Hydrologic Engineering Centers-River Analysis System (HEC-RAS) to the Community. This tool is used by the hydraulic modeling

team to determine the impact projects will have on water levels once implemented. Initial HEC-RAS results were also shared with those in attendance. The Committee-approved goals and vision statement were displayed, along with draft needs and opportunities.

### Public Engagement Event 3

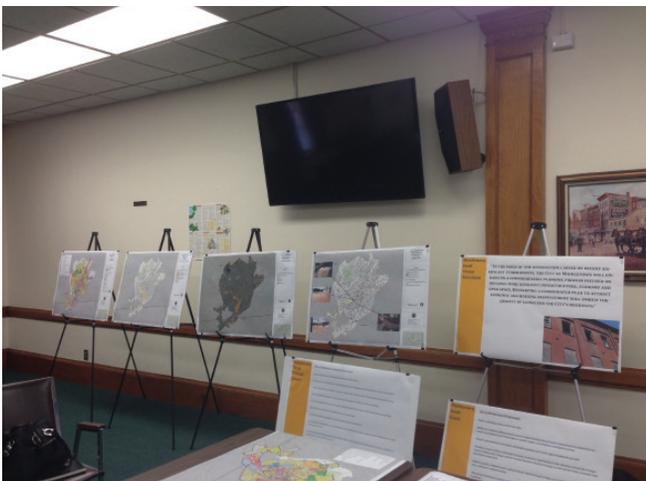
During Public Engagement Event 3, held in November 2014, the Committee shared Proposed and Featured Projects, along with Additional Resiliency Recommendations, with the attending public. At that time, the planning process that resulted in the identification and analytical vetting of these projects and measures was explained. All were corroborated by public input gathered through multiple means during the course of the 7-month process.

### Public Engagement Event 4

The capstone of the second round of the NYRCR Program, Public Engagement Event 4, was the forum where the final City of Middletown NYRCR Plan was presented, along with all the research, information and opinion-gathering results, and scientific and data analysis.

## Risk Assessment Methodology

The following section outlines the initial risk assessment for assets within the City. The analysis incorporated the baseline methodology, enhanced by specific assumptions at the request of the Committee. The baseline methodology included four major components of the analysis: Risk Area, Hazard Factor, Exposure Score, and Vulnerability Score.



Above, maps are displayed at one of the Public Engagement Events. Photo courtesy of Tetra Tech, Inc.



## DATA SOURCES USED

New York Department of State (NYS DOS) provided data from the following sources:

- Environmental Systems Research Institute (ESRI) (2010);
- Federal Communications Commission (2012);
- Federal Communications Commission;
- Insurance Services Office, Inc.;
- National Oceanic and Atmospheric Administration (NOAA);
- National Park Service (2011);
- National Pipeline Mapping System (2003);
- NYS Department of Environmental Conservation (NYS DEC) (2009);
- NYS Department of Health, NYS DOT;
- NYS Division of Homeland Security and Emergency Services;
- NYS Education Department (2000);
- NYS Office for People With Developmental Disabilities;
- NYS Office of General Services; and
- NYS Office of Mental Health.

Local data from Orange County included:

- Building data;
- Buy-out property information;
- Critical facilities;
- Damaged roadways;
- Depth grids;
- Flood hazard areas (FHA);
- Infrastructure;
- Land use;
- Natural resources;
- Parcels;
- Soils;
- Tax data; and
- Zoning.

## COMMUNITY VALUE

The Committee worked with the Consultant Team to assign community value for the identified assets. Assigning community value allowed the Committee to get a geographic picture of where important community assets were located as well as allowing the Committee to weigh potential project impacts on the City in an informed manner. It did not factor into the risk score of individual assets.

The Committee assigned community value as follows:

- **High:** All infrastructure (other than hazardous waste material sites and mile markers), culvert locations from the Hazard Mitigation Plan (HMP) and major access routes, critical facilities (fire stations, emergency medical services [EMS], shelter, City Hall, etc.), health and social services and supportive and special need housing, the Downtown (economic polygon over the Central business district), the Sterling Street neighborhood, the Paramount Theater, and all pharmacies.
- **Medium:** All other cultural and natural resource assets, all remaining housing assets, and all economic assets other than restaurants.
- **Low:** All restaurants and anything else that does not fall into the categories above.

## DESCRIPTION OF METHODOLOGY

The risk assessment for assets within the City incorporated NYRCR baseline methodology, enhanced by specific assumptions at the request of the Committee. The baseline methodology included four major components of the analysis: Risk Area, Hazard Factor, Exposure Score, and Vulnerability Score.

Risk area classifications (extreme, high, or moderate) are determined by the asset’s location relative to mapped risk zones.

The hazard score of 3 was assigned for the hazard factor in the tool (100-year flood water level occurring within a 100-year planning time frame).

The exposure score is determined by the sum of a base score (derived from the risk area in which the asset is located) plus 0.5 point for each of the six landscape feature conditions below, if present. A base score was assigned for exposure to each asset depending on highest-class risk area (Extreme = 2, High = 1, and Moderate = 0.5) in which a significant portion of the asset is located. The total exposure score was calculated for each asset by adding 0.5 point to the base score for each of the following conditions:

- **Defensive flood protection measures** – measures are absent, below base flood elevation (BFE), in poor condition, or lack maintenance commitment;
- **Elevation** – the asset site is below BFE;
- **Freeboard** – elevation of the habitable or occupied portion of the asset is less than 2 feet above BFE;
- **Point of Confluence** – asset is within an area subject to increased flood risk (based on Consultant Team’s judgment or Committee guidance) because of a confluence of merging streams;
- **Stormwater Discharge** – asset is within an area subject to increased flood risk (based on Consultant Team’s judgment or planning guidance) because of stormwater system discharge; and
- **Vegetated Stream Bank Buffers** – asset is within Floodway Fringe (Federal Emergency Management Agency [FEMA] definition).

## VULNERABILITY SCORE

Table 5.3 outlines the methodology, which accounts for an asset with a known length of time of service disruption or complete loss of service.

The City of Middletown worked toward developing a methodology for assessing risk, which considered the unique situation and individual dynamics of areas at risk. To assess true vulnerability, the Committee determined which asset locations required consideration and concluded that because asset-specific information on facility recovery times (after impact by a flooding event) was not available for all assets, standard assumptions based on similar facilities should be used.

**The Committee worked together to develop a tiered-factor approach to assess risk, generating risk scores that accurately reflected vulnerabilities and overall risk within the Community.**

The factor is adjusted based on similar facility types in a descending five-point scale that is reduced by one point determined by its risk area location. For example, as noted in the vulnerability section below, all buildings were assumed to be 5 and all garages and storage buildings were assumed to be 4. Assumptions were reviewed and approved by the Committee. When specific vulnerability information was available, the standard methodology was applied; however, if information was not available, the following assumptions were applied:

## RISK AREA ASSUMPTIONS

- Risk Areas:
  - Extreme risk areas: areas within the 100-year FHA that are within 1,000 feet of a Repetitive Loss Property.
  - High-risk areas: areas within the 100-year FHA.
  - Moderate-risk areas: areas within the 500-year FHA.
  - “Not Applicable (N/A)” risk areas: areas outside of an identified FHA (all assets not located in an Extreme, High, or Moderate Risk Area were identified as N/A, and do not produce a risk score. Assets in this category are given a risk score of “False” in the risk assessment tool).
- Socially Vulnerable Populations:
  - Social Vulnerability Index (SOVI) measures the social vulnerability of populations to environmental hazards. Assets with a SOVI score of Medium or higher were identified as “Yes” in the risk tool.



## ASSUMPTIONS FOR THE LANDSCAPE ATTRIBUTES AND VULNERABILITY

Assumptions for assessing landscape attributes are listed below:

### LANDSCAPE ATTRIBUTES:

- Defensive Flood Protection Measures: all assets were assumed “Yes” if absent, below BFE, in poor condition, or lacking maintenance commitment.
- Elevation: all assets outside the extreme, high, or moderate risk area were assumed “No,” and all assets in the High and Moderate hazard zone were assumed “Yes” if the asset site is below BFE.
- Freeboard: all assets outside the extreme, high, or moderate risk area were assumed “No,” and all building, structure, and bridge assets in the Extreme, High, and Moderate risk areas were assumed “Yes” if elevation of the habitable or occupied portion of the asset is less than 2 feet above BFE.
- Point of Confluence (POC): all assets within 1,500 feet downstream of a major POC (this is a HMP dataset with all streams with 4,300 cubic feet per second [cfs] or more during a 100-year storm event) and within the Extreme, High, or Moderate risk areas are “Yes;” all others are “No.”
- Stormwater Discharge: all assets within 1,000 feet of a major culvert (HMP dataset) and within the Extreme, High, or Moderate risk areas are “Yes.”
- Vegetated Stream Buffers: all assets within the floodway are assumed “Yes;” all others “No.”

### ASSETS IN “EXTREME” AND “HIGH” RISK AREAS

Assumptions for assessing vulnerability for assets in the Extreme or High risk areas are listed below:

#### Vulnerability:

- All buildings were assumed to be 5.
- All garages storage buildings were assumed to be 4.

- All transportation infrastructure and water treatment facilities were assumed to be 3.
- All wells and springs were assumed to be 2.
- All natural and cultural resources other than buildings were assumed to be 2.
- All natural resources were assumed to be 1.

### ASSETS IN THE “MODERATE” RISK AREA

Assumptions for assessing vulnerability for assets in the Moderate risk areas are listed below:

- Stormwater Discharge: “Yes” if the asset is affected by stormwater discharge and “No” if the asset is not affected. Comments justifying impact were provided where available.

While the risk scores differ between the two events as a result of using different hazard scores, the basis for categorizing assets into the Extreme, High, Moderate, or Residual risk levels is the same for the two events, as shown by the similarly colored regions in Figure 2.8. For example, a risk score of 60 in the 100-year event evaluation is shown as 80 in the 500-year event evaluation; however, both scores are classified as Severe risk. Table 5.4 describes each risk category.

#### Vulnerability:

- All buildings were assumed to be 4.
- All garages storage buildings were assumed to be 3.
- All transportation infrastructure and water treatment facilities were assumed to be 2.
- All wells and springs were assumed to be 1.
- All natural and cultural resources other than buildings were assumed to be 2.
- All natural resources were assumed to be 1.



Landscape attributes considered are listed below:

#### Landscape Attributes:

- Point of Confluence: “Yes” if the asset is subject to increased flooding due to an upstream point of confluence, and “No” if the asset is not affected. Comments justifying impact were provided where available.

### RISK REDUCTION ANALYSIS

A risk reduction analysis was completed for those Community Development Block Grant Disaster Recovery (CDBG-DR) Proposed and Featured Projects that are intended to reduce the risk of flood damage to assets. This analysis was limited by the data and information available and the inundation and extents of the data. The analysis was based on the point location of an asset as identified by the City. The risk areas are based on the available Digital Flood Insurance Rate Maps (DFIRMs); however, the HEC-RAS baseline inundation extents do not always align and therefore slight differences may be seen in the analysis.

This analysis identified the number of assets secured as a result of the impact of the CDBG-DR Proposed and Featured Projects. Assets were considered secured if the project impacts result in an elimination of risk indicated by a risk score of 0. The term “secured” is only applicable to this analysis and may not necessarily represent a real-world elimination of flooding impacts.

The analysis was limited to the data available and all discussion regarding reduction in risk was meant to estimate projected impacts to the asset(s). The analysis may not reflect the project’s post-construction conditions or the resulting impacts of a measure once implemented.

#### DETAILS OF THE ANALYSIS

**Risk Area:** A change to this entry (by one category) was made if the HEC-RAS analysis estimates a change in inundation extent and the asset is no longer located in the floodplain.

Risk Area estimates are determined by landscape attributes and vulnerability, which are described below:

- Landscape Attributes: Changes to these entries will be made if the hydraulic analyses indicated an improvement to the following landscape attributes:
  - Defensive flood protection measure: A change to this attribute was made if defensive flood protection measures are proposed to the asset(s) or if the proposed measure provides improved flood defenses in the area.
  - Elevation: A change to this attribute was made if the HEC-RAS analysis indicates a reduction in water surface elevation on the assets site.
  - Freeboard: A change to this attribute was made for elevation projects where the measure increases freeboard to or above the standard.
  - Point of Confluence: A change to this attribute was made if there is a reduction in flow due to an upstream mitigation measure or the asset is moved from its original location further from the point of confluence.
  - Stormwater Discharge: A change to this attribute was made if the proposed project increases stormwater conveyance for those assets currently “Yes” and are within 1,000 feet downstream of a culvert/stormwater-specific project.
  - Vegetated Streambank Buffer: If the asset is no longer in the floodway, a change to this entry will be made.
- Vulnerability: The methodology used to originally assess the Vulnerability score for the assets is included in Table 5.5 below. In accordance with this methodology, if the proposed project changes the Risk Area of an asset the vulnerability score was changed in accordance with the vulnerability methodology outlined above based on the new Risk Area. The risk score will also change if there is an improvement in the capacity of the asset to recover from an event as the vulnerability score was reduced by one category.



**TABLE 5.3 - VULNERABILITY BASED ON IMPACT ON SERVICE OR FUNCTION OF COMMUNITY ASSETS**

Impact	Insignificant 1	Minor 2	Moderate 3	Significant 4	Major 5
A. Economic Assets	Limited interruption in service or short-term reduced service	Service loss for up to 1 week or longer-term reduced services	Service loss for more than 1 week up to 1 month or longer-term reduced service	Service loss for more than 1 month or permanent reduced capacity	Permanent loss of service of the economic asset
B. Health and Social Services Assets	Limited interruption in service or short-term reduced services; Services under more than usual stress but manageable	Service loss of up to 1 week or longer-term reduced services; Services under more than usual stress on several fronts	Service loss for more than 1 week up to 1 month or longer-term reduced service; Services under severe pressure	Service loss for more than 1 month or permanent reduced capacity	Permanent loss of service of any one of the essential services listed
C. Housing Assets	Limited inconvenience	Out of use for up to 1 week	Out of use for more than 1 week up to 1 month	Out of use for up to 6 months OR permanent loss of 15% or less of housing in a group asset	Out of use for more than 6 months OR permanent loss of more than 15% of the housing in a group asset
D. Infrastructure System Assets	Limited interruption in service or short-term reduced service	Service loss for up to 1 week or longer-term reduced services	Out of use for more than 1 week up to 1 month or longer-term reduced service	Service loss for more than 1 month or permanent reduced capacity	Permanent loss of service of any one of the facilities listed
E. Natural and Cultural Resources Assets	Limited interruption in service or short-term reduced service OR Limited loss of access, habitat, or use	Service loss for up to 1 week or longer term reduced services; Minimal natural habitat impacts, temporary loss of public access, temporary loss of open space/tourism assets	Out of use for more than 1 week up to 1 month OR moderate impacts on natural habitats, sustained loss of public access, long-term loss of private open space	Service loss greater than 1 month OR permanently diminished capacity of natural resources; substantial damages of important natural habitat	Permanent loss of service of the cultural asset OR complete loss of important natural habitats
F. Assets Providing Services for Socially Vulnerable Populations	Limited service interruption	Service loss for up to 1 week	Out of use for more than 1 week up to 1 month	Permanent service interruption of more than 1 and less than 6 months	Service interruption of 6 or more months



**TABLE 5.4 - RISK SCORE RANGES**

100-YEAR EVENT	500-YEAR EVENT
<b>Severe (Risk Score &gt;53)</b>	<b>Severe (Risk Score &gt;70)</b>
<p>Risk scores in the “Severe” category occur only if one of the two factors, exposure or vulnerability, is rated 5, and the other is 4 or higher, which could indicate that the asset is in a dangerous situation. Both exposure and vulnerability should be reduced, if possible. Consider relocation a priority option for these assets.</p>	
<b>High (Risk Score 24 - 53)</b>	<b>High (Risk Score 32 - 70)</b>
<p>Risk scores in the “High” category are indicative of conditions that could lead to significant negative outcomes from a storm. Using the risk scoring system, a total of 24 (or 32 for the 500-year event) can be achieved only if the vulnerability is 4 and exposure is 2, or vice versa. A vulnerability of 4 indicates likely loss of service of an asset for an extended period of time. For many assets, this loss may be unacceptable. Actions should be taken to reduce vulnerability, such as elevating or flood-proofing the asset to help avoid a long-term loss of function. A score of 4 for exposure indicates most of the local landscape attributes that help reduce storm damages are absent. Actions to restore landscape attributes may be appropriate. All other risk scores higher than 24 (or 32 for the 500-year event) indicate either the exposure or the vulnerability (or both) are higher than the conditions discussed above, lending more weight to need to take actions that reduce risk. Relocation may be necessary in the future if other means of adaptation or management actions are not effective.</p>	
<b>Moderate (Risk Score 6 - 23)</b>	<b>Moderate (Risk Score 8 - 31)</b>
<p>Risk scores in the “Moderate” category pose moderate to serious consequences, but adaptation may be of lower priority based on one factor, exposure, or because vulnerability remains relatively low. Use a combination of measures to reduce exposure and vulnerability.</p>	
<b>Residual (Risk Score &lt;6)</b>	<b>Residual (Risk Score &lt;8)</b>
<p>Risk scores in the “Residual” category occur when both exposure and vulnerability are relatively low. This situation suggests floods would pose minor or infrequent consequences. However, a vulnerability score of 3 may not be acceptable for critical facilities or assets of high community value, because the community cannot afford to be without these services, even infrequently. Note that risk is never completely eliminated. Some residual risk still remains even after management measures have been implemented. It is recommended that the community monitors conditions and adapts as necessary.</p>	

Source: NYS DOS, 2013



**TABLE 5.5 - RISK ASSESSMENT TOOL**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Academy Avenue Elementary School	Not Applicable (N/A)	Health and Social Services	Schools	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Paramount Theater	N/A	Natural And Cultural Resources	Museums, Performing Arts Centers, Stadiums	Yes	No, Locally Significant	High	Yes	No	No	No	Yes	No	1	3	False	4	0	4	False	4	0
Orange County Community Development	N/A	Health and Social Services	Government And Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Fancher Davidge Park	N/A	Natural and Cultural Resources	Parks And Recreation	Yes	No	Medium	Yes	No	No	No	Yes	No	1	3	False	5	0	4	False	5	0
Middletown Christian School	N/A	Health and Social Services	Schools	No	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Orange County Community College	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
St. Joseph's Cemetery	N/A	Natural and Cultural Resources	Cultural Or Religious Establishments	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
St. Joseph School	N/A	Health and Social Services	Schools	No	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Thrall Library	N/A	Natural and Cultural Resources	Libraries	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Truman Moon Elementary School	N/A	Health and Social Services	Schools	Yes	No, Locally Significant	High	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Twin Towers Middle School	N/A	Health and Social Services	Schools	No	No, Locally Significant	High	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Watts Memorial Park	N/A	Natural and Cultural Resources	Parks And Recreation	No	No	Medium	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Middletown High School	N/A	Health and Social Services	Schools	Yes	No, Locally Significant	High	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Hillside Cemetery	High	Natural and Cultural Resources	Cultural or Religious Establishments	No	No	Medium	Yes	Yes	No	No	Yes	No	1.5	3	2.50	4	30	4	2.50	4	40
Alternative High School	N/A	Health and Social Services	Schools	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
New Beginnings Montesorri School	N/A	Health and Social Services	Schools	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Liberty Street Elementary School	N/A	Health and Social Services	Schools	No	No	High	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
John Chorley Elementary School	N/A	Health and Social Services	Schools	Yes	No, Locally Significant	High	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Middletown Psychiatric	N/A	Health and Social Services	Healthcare Facilities	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Middletown Fire Department	N/A	Health and Social Services	Emergency Operations/ Response	Yes	Yes, Fema	High	No	No	No	Yes	No	No	0.5	3	False	3	0	4	False	3	0
Horton Hospital	N/A	Health and Social Services	Primary/Regional Hospitals	No	Yes, Fema	High	No	No	No	No	No	No	0	3	False	5	0	4	False	5	0
Middletown City Hall	N/A	Health and Social Services	Government and Administrative Services	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
College Hill Apartments	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	Yes	No	No	No	No	1	3	False	3	0	4	False	3	0
David Moore Heights	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Autozone	N/A	Economic	Large Business	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Dunkin Donuts	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Shoprite	N/A	Economic	Grocery/Food Suppliers	Yes	No	Medium	Yes	Yes	No	No	No	No	1	3	False	3	0	4	False	3	0
Mcdonald's	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	5	0	4	False	5	0
Wallkill Engine Response	Yes	Yes, Fema	Emergency Operations/ Response	Yes	No	High	No	No	No	0.5	3	False	5	0	4	False	5	0			
Ontario Hose	N/A	Health and Social Services	Emergency Operations/ Response	No	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Summitfield Apartments	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Ultra Power	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Sunoco	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	Yes	No	No	No	No	No	0.5	3	False	5	0	4	False	5	0
Sunoco	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	No	No	No	No	No	No	0	3	False	5	0	4	False	5	0
Sunoco	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	Yes	No	No	No	No	No	0.5	3	False	5	0	4	False	5	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
St. Theresa's Nursing Home	N/A	Health and Social Services	Daycare and Eldercare	No	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Birch Court Apartments	N/A	Housing	Multi-Family Residence	No	No	Medium	Yes	No	No	No	No	Yes	1	3	False	1	0	4	False	1	0
Playtogs Factory Outlet	N/A	Economic	Grocery/Food Suppliers	Yes	No	Medium	No	No	No	No	No	No	0	3	False	4	0	4	False	4	0
Gulf	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Exxon	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Mobil	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	Yes	Yes	No	No	No	No	1	3	False	4	0	4	False	4	0
Valero	N/A	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	No	Yes	Yes	No	No	No	1	3	False	3	0	4	False	3	0
Brewery Apartments	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Southeast Towers	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	Yes	Yes	No	No	No	1.5	3	False	1	0	4	False	1	0
Overlook Apartments	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Tall Oaks Apartments	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	Yes	Yes	No	No	No	1.5	3	False	3	0	4	False	3	0
Post Office Middletown	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	Yes	Yes	No	No	No	1.5	3	False	3	0	4	False	3	0
Adult Home Erie Station	N/A	Health and Social Services	Daycare and Eldercare	Yes	Yes, Fema	High	No	No	No	No	No	No	0	3	False	4	0	4	False	4	0
The Promenade	Moderate	Health and Social Services	Daycare and Eldercare	Yes	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	1.00	1	3	4	1.00	1	4
Temple Sinai	N/A	Natural and Cultural Resources	Cultural or Religious Establishments	No	No	Medium	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Club Ny	N/A	Economic	Grocery/Food Suppliers	Yes	No	Medium	Yes	Yes	No	No	No	No	1	3	False	1	0	4	False	1	0
Orange County Trust	N/A	Economic	Banks and Financial Services	Yes	No	Medium	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Orange County Trust	N/A	Economic	Banks and Financial Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Taco Bell	N/A	Economic	Restaurants	Yes	No	Low	No	No	No	No	No	No	0	3	False	2	0	4	False	2	0
Colonial Diner	N/A	Economic	Restaurants	Yes	No	Low	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Shortline Bus Terminal	N/A	Infrastructure Systems	Transportation	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Quiznos	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Ymca	N/A	Natural and Cultural Resources	Community Centers	Yes	No	Medium	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Rite Aid Drugstore	Moderate	Economic	Grocery/Food Suppliers	Yes	No	High	No	No	No	No	No	No	0	3	0.50	4	6	4	0.50	4	8
Rite Aid Drugstore	N/A	Economic	Grocery/Food Suppliers	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Cvs Drugstore	N/A	Economic	Grocery/Food Suppliers	No	No	High	No	No	No	No	No	No	0	3	False	3	0	4	False	3	0
Key Bank	Moderate	Economic	Banks and Financial Services	Yes	No	Medium	Yes	Yes	Yes	No	No	No	1.5	3	2.00	2	12	4	2.00	2	16
Coney Island Restaurant	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	Yes	No	No	1	3	False	3	0	4	False	3	0
Ihop	N/A	Economic	Restaurants	Yes	No	Low	Yes	Yes	No	No	No	No	1	3	False	1	0	4	False	1	0
Jiffy Lube	High	Economic	Grocery/Food Suppliers	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	1.50	4	18	4	1.50	4	24
Caribe	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	5	0	4	False	5	0
Middletown Department of Public Works	Extreme	Health and Social Services	Public Works Facilities	Yes	Yes, Fema	High	Yes	Yes	Yes	No	No	No	1.5	3	3.50	4	42	4	3.50	4	56
Middletown Recycling Dropoff	Extreme	Infrastructure Systems	Hazardous Materials, Solid Waste, and Recycling	Yes	No	Low	Yes	Yes	Yes	No	No	No	1.5	3	3.50	4	42	4	3.50	4	56
Ea Morse and Co., Inc.	N/A	Economic	Industrial, Warehousing, and Manufacturing	Yes	No	Low	Yes	Yes	Yes	No	No	No	1.5	3	False	4	0	4	False	4	0
Salvation Army	N/A	Economic	Grocery/Food Suppliers	Yes	No	Medium	Yes	Yes	Yes	Yes	Yes	No	2.5	3	False	3	0	4	False	3	0
Orange County Employment and Training Administration	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Orange County Human Rights Commission	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Orange County Office for the Aging	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Orange County Division of Risk Management	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Orange County Department of Social Services	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	Yes	No	No	No	No	1	3	False	3	0	4	False	3	0
Orange County Youth Bureau	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Middlecrest Crossing Senior Apartments	N/A	Housing	Senior Housing	No	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Shell	High	Economic	Grocery/Food Suppliers	Yes	Yes, Fema	Medium	Yes	Yes	Yes	No	No	No	1.5	3	2.50	5	38	4	2.50	5	50
Edwin Welling Van Duzer Memorial House	N/A	Natural and Cultural Resources	Historic Landmarks and Facilities	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Morrison Hall	N/A	Natural and Cultural Resources	Historic Landmarks and Facilities	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Ginos Motel	N/A	Economic	Lodging	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
St. Joseph's Catholic School Annex	N/A	Health and Social Services	Schools	No	No, Locally Significant	High	No	No	No	No	No	No	0	3	False	1	0	4	False	1	0
Blues Club and Bar	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Middletown Lanes	N/A	Natural and Cultural Resources	Parks and Recreation	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Park Circle	N/A	Economic	Grocery/Food Suppliers	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Hudson Hall	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Biotech Building	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Ice House	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Greenhouses	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Horton Hall	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Orange Hall	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Kindercollege	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Sarah Wells Building	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Harriman Hall	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Physical Education Building	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Learning Resource Center Library	N/A	Natural and Cultural Resources	Libraries	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
George F. Shephard Student Center	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Alumni and College Associations	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Information Technology Services	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Christine Morrison House	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Tennis Courts	N/A	Natural and Cultural Resources	Parks and Recreation	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Autumn Green	N/A	Health and Social Services	Higher Education Institutions	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Middletown City Court House	N/A	Health and Social Services	Government and Administrative Services	Yes	No, Locally Significant	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
District Attorney Office	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Seventh Day Adventist Church	N/A	Natural and Cultural Resources	Cultural or Religious Establishments	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Emergency Housing Group	N/A	Health and Social Services	Government And Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Globe Hotel	N/A	Economic	Lodging	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Middletown Flea Market	N/A	Economic	Grocery/Food Suppliers	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Davidge Park	N/A	Natural and Cultural Resources	Parks And Recreation	Yes	No	Medium	Yes	Yes	No	Yes	Yes	Yes	2.5	3	False	1	0	4	False	1	0
First Federal Savings of Middletown	N/A	Economic	Banks and Financial Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Kfc	N/A	Economic	Restaurants	No	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Nina's Restaurant	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Kuhls Highland House	N/A	Economic	Restaurants	No	No	Low	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Empty Bottle Saloon	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Poor Bobbys Hard Times Tavern	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Destefanos Olde Erie Pub	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Bullpen	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Middletown Police Department	N/A	Health and Social Services	Emergency Operations/Response	Yes	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Advanced Oxygen Medical Services	N/A	Health and Social Services	Healthcare Facilities	No	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Td Bank	N/A	Economic	Banks and Financial Services	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Td Bank	N/A	Economic	Banks And Financial Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Brady's Pub	N/A	Economic	Restaurants	No	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Fast Forward Tavern Inc.	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Twin Oaks Bar and Grill	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Tu Casa	N/A	Economic	Restaurants	No	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Switch Inn	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0

**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
The Medicine Shoppe	N/A	Economic	Grocery/Food Suppliers	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Genpak	N/A	Economic	Industrial, Warehousing and Manufacturing	Yes	No	Low	Yes	Yes	Yes	No	No	Yes	2	3	False	2	0	4	False	2	0
Pit Stop	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Net Tavern	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
One Under	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Players	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Planet Wings	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Mary's Bar And Grill	N/A	Economic	Restaurants	No	No	Low	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Skyline Bar And Grill	N/A	Economic	Restaurants	Yes	No	High	Yes	Yes	No	No	No	No	1	3	False	3	0	4	False	3	0
Divas's Enterprises	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Downtown Tavern	N/A	Economic	Restaurants	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Sutton Hill Apartments	N/A	Housing	Multi-Family Residence	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Badabing Pizza and Pasta	N/A	Economic	Restaurants	No	No	Low	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Red Barn Discount Pet Foods	N/A	Economic	Grocery/Food Suppliers	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Citgo	N/A	Economic	Grocery/Food Suppliers	No	Yes, Fema	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Wendy's Restaurant	N/A	Economic	Restaurants	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Quick Check	N/A	Economic	Grocery/Food Suppliers	No	Yes, Fema	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Middletown Elks Lodge 1097	N/A	Natural and Cultural Resources	Community Centers	Yes	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Ahrc	N/A	Health and Social Services	Higher Education Institutions	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Linden Avenue Park	N/A	Natural and Cultural Resources	Parks and Recreation	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Applebee McPhillips Funeral Home	N/A	Natural and Cultural Resources	Cultural or Religious Establishments	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Department of Motor Vehicles	N/A	Health and Social Services	Government and Administrative Services	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Mulberry House Senior Center	N/A	Natural and Cultural Resources	Community Centers	Yes	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Middletown	N/A	Health and Social Services	Government and Administrative Services	Yes	No, Locally Significant	High	Yes	Yes	No	No	No	No	1	3	False	4	0	4	False	4	0
Middletown Atc	N/A	Health and Social Services	Healthcare Facilities	Yes	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Middletown Hostel #10368	N/A	Housing	Supportive Housing	No	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Margaretville Hostel #2107	N/A	Housing	Supportive Housing	No	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Middletown Hostel #1804	N/A	Housing	Supportive Housing	Yes	Yes, Fema	High	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Middletown Hostel #46	High	Housing	Supportive Housing	Yes	Yes, Fema	High	Yes	Yes	No	No	Yes	No	1.5	3	2.5	4	30	4	2.5	4	40
Digital Radio Broadcasting, Inc. - 94.9 Mhz-W235bi	N/A	Infrastructure Systems	Telecommunications	No	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Digital Radio Broadcasting, Inc. - 95.7 Mhz-W239ac	N/A	Infrastructure Systems	Telecommunications	No	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Wamc - 106.3 Mhz-W292dx	N/A	Infrastructure Systems	Telecommunications	No	No	High	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Monhagen Brook	Extreme	Infrastructure Systems	Transportation	Yes	No	High	Yes	No	Yes	Yes	No	Yes	2	3	4	5	60	4	4	5	80
Power Dr. Inside	N/A	Infrastructure Systems	Transportation	Yes	No	High	Yes	Yes	No	No	No	No	1	3	False	2	0	4	False	2	0
Genung Street	N/A	Infrastructure Systems	Transportation	Yes	No	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Sprague Avenue	N/A	Infrastructure Systems	Transportation	No	No	High	Yes	No	No	No	No	No	0.5	3	False	2	0	4	False	2	0
Or - Fulton Ave. - Middletown Mgp	N/A	Infrastructure Systems	Hazardous Materials, Solid Waste, and Recycling	Yes	No	Low	Yes	Yes	Yes	Yes	Yes	No	2.5	3	False	4	0	4	False	4	0



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Highland Ave-Walkill (General Switch)	N/A	Infrastructure Systems	Hazardous Materials, Solid Waste, and Recycling	Yes	No	Low	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Or - Genung Ave. - Middletown Mgp	N/A	Infrastructure Systems	Hazardous Materials, Solid Waste, and Recycling	No	No	Low	Yes	No	No	No	No	No	0.5	3	False	4	0	4	False	4	0
Middletown Stp	N/A	Infrastructure Systems	Wastewater	Yes	Yes, Fema	High	No	Yes	Yes	Yes	Yes	Yes	2.5	3	False	5	0	4	False	5	0
Monhagen Brook	N/A	Natural and Cultural Resources	Water Bodies	Yes	No	Medium	Yes	Yes	No	No	No	No	1	3	False	1	0	4	False	1	0
Shortline Bus Depot	N/A	Infrastructure Systems	Transportation	Yes	No, Locally Significant	High	No	No	No	Yes	No	No	0.5	3	False	2	0	4	False	2	0
Mount Carmel Church	N/A	Natural and Cultural Resources	Cultural or Religious Establishments	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	3	0	4	False	3	0
Monhagen Upstream Swamp	N/A	Natural and Cultural Resources	Wetlands and Marshes	Yes	No	Low	Yes	No	No	Yes	Yes	Yes	2	3	False	1	0	4	False	1	0
Wetland Behind Fancher-Davidge Park	N/A	Natural and Cultural Resources	Wetlands and Marshes	Yes	No, Locally Significant	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
Sewer Treatment Plant	High	Infrastructure Systems	Wastewater	Yes	No, Locally Significant	High	Yes	Yes	No	No	No	No	1	3	2	5	30	4	2	5	40
Fulton Street Culvert	Moderate	Infrastructure Systems	Stormwater	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	3.5	2	21	4	3.5	2	28
Culvert	Extreme	Infrastructure Systems	Stormwater	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	5	3	45	4	5	3	60
State Route 211 East Side Of City	N/A	Infrastructure Systems	Transportation	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	False	2	0	4	False	2	0
Academy Avenue At Fulton Avenue	Extreme	Infrastructure Systems	Transportation	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	5	3	45	4	5	3	60
Dolson Avenue	High	Infrastructure Systems	Transportation	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	4	3	36	4	4	3	48
West Main Street	Extreme	Infrastructure Systems	Transportation	No	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	5	3	45	4	5	3	60



**TABLE 5.5 - RISK ASSESSMENT TOOL (CONT'D)**

Asset Information							Landscape Attributes							Risk Assessment				Optional: Risk Assessment (500-Year Event)			
Asset	Risk Area	Asset Class	Asset Sub-Category	Socially Vulnerable Populations	Critical Facility	Community Value	Defensive Flood Protection Measures	Elevation	Freeboard	Point Of Confluence	Stormwater Discharge	Vegetated Streambank Buffers	Landscape Attribute Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score	Hazard Score	Exposure Score	Vulnerability Score	Risk Score
Culvert	High	Infrastructure Systems	Stormwater	No	No, Locally Significant	High	No	Yes	Yes	Yes	Yes	Yes	2.5	3	3.5	3	31.5	4	3.5	3	42
Culvert	Extreme	Infrastructure Systems	Stormwater	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	5	3	45	4	5	3	60
Culvert	Extreme	Infrastructure Systems	Stormwater	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	5	3	45	4	5	3	60
Fulton Avenue Culvert	Extreme	Infrastructure Systems	Stormwater	Yes	No, Locally Significant	High	Yes	Yes	Yes	Yes	Yes	Yes	3	3	5	3	45	4	5	3	60
Mount Hope Park	N/A	Natural And Cultural Resources	Parks And Recreation	No	No	Medium	Yes	No	No	No	No	No	0.5	3	False	1	0	4	False	1	0
City Square Park	N/A	Natural And Cultural Resources	Parks And Recreation	Yes	No, Locally Significant	High	No	No	No	No	No	No	0	3	False	1	0	4	False	1	0



## GLOSSARY

BCA	Benefit-Cost Analysis
BID	Business Improvement District
BFE	Base Flood Elevation
CDBG-DR	Community Development Block Grant Disaster Recovery
cfs	Cubic feet per second
CPL	Clark Patterson Lee
Committee	NYRCR City of Middletown Planning Committee
Community	NYRCR City of Middletown Community
Consultant Team	Tetra Tech, Inc.
CRS	Community Ratings System
CWSRF	Clean Water State Revolving Fund
DPW	Department of Public Works
DFIRM	Digital Flood Insurance Rate Map
DWSRF	Drinking Water State Revolving Fund
EBDR	East Branch Delaware River
EMS	Emergency Medical Service
EOC	Emergency Operations Center
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
FHA	Flood Hazard Area
FTE	Full-time equivalent
GIS	Geographic Information Systems
GIGP	Green Innovation Grant Program
GOSR	Governor’s Office of Storm Recovery
HEC-RAS	Hydrologic Engineering Center - River Analysis System
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HSEEP	Homeland Security Exercise Evaluation Program
HUD	U.S. Housing and Urban Development
MSA	Metropolitan Statistical Area
MTA	Metropolitan Transit Authority
N/A	Not applicable
NFIP	National Flood Insurance Program



## GLOSSARY

NOAA	National Oceanic and Atmospheric Administration
NYRCR	New York Rising Community Reconstruction
NYS DEC	New York State Department of Environmental Conservation
NYS DOS	New York Department of State
NYS DOT	New York State Department of Transportation
NYS OEM	New York State Office of Emergency Management
NYSEFC	New York Environmental Facilities Corporation
OC OEM	Orange County Office of Emergency Management
PDM	Pre-Disaster Mitigation
POC	Point of Contact
POC	Point of Confluence
PS	Public Safety
PSAP	Public Safety Answering Point
RL	Repetitive Loss
RRA	Risk Reduction Analysis
RSF	Recovery Support Functions
SART	State Agency Review Team
SOVI	Social Vulnerability Index
SRL	Severe Repetitive Loss
SUNY	State University of New York
SUNY Orange	State University of New York – Orange County Community College
TICP	Tactical Interoperable Communications Plan
U of SC	University of South Carolina
WOQ	Water Quality Certification
WSE	Water surface elevation



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