RESILIENT DANBURY

CURRENT + FUTURE CONDITIONS ANALYSIS

CIRCA Connecticut Institute for Resilience and Climate Adaptation

DANBURY CONNECTICUT

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July 2023

RESILIENT DANBURY

Downtown Danbury serves nearly 80,000 City residents as well as the greater Danbury region. The project area is located along Main Street (State Route 53), extending westward to Deer Hill Avenue and eastward to Town Hill Avenue, and consists of a mix of commercial corridors and high-density residential areas.

This document summarizes the results of Task 3: Current & Future Conditions Analysis and examines the climate vulnerabilities related to flooding and heat in the downtown Danbury community.

PROJECT TEAM

CIRCA

David Murphy – Director of Resilience Engineering

John Truscinski – Director of Resilience Planning

City of Danbury

Matthew Cassavechia – Director of Emergency Management & Emergency Medical Services

Antonio Iadarola – Director of Public Works & City Engineer

Consultant Team

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Citizen + Technical Advisory Committee (CTAC)

Cpt Thomas Corbett	Community Emergency Response Team, Team Coordinator
Sharon B. Calitro, AICP	City of Danbury Planning and Zoning, Director
Susan M. Tomanio	City of Danbury Elderly Services, Director
Kara Prunty, MPA, MPH	City of Danbury Health and Human Services , Director
Jeff Rieck	City of Danbury Housing Authority, Executive Director
Tim Nolan	City of Danbury Highway Services, Superintendent
Warren Levy	City of Danbury City Council - At Large, Council Member
Joseph Cavo	City of Danbury City Council - At Large, Council Member
Vinny DiGilio	City of Danbury City Council - 2nd Ward, City Council President, Council Member
Duane E. Perkins	City of Danbury City Council - 5th Ward, Council Member
Fred Visconti	City of Danbury City Council - 5th Ward, Council Member
Paul T. Rotello	City of Danbury City Council - 6th Ward, Council Member
Dr. Derek DeLeon	Nuvance Health , Chief Academic Officer
Joseph DaSilva	Affordable Housing Development, Developer
Marlene Moranino	CT Institute for Comm. Greater Danbury Community Health Center, Board Chair
Bill Diamond	Danbury Ice Arena
Jenny Guerra	Danbury War Memorial
Mike Seelig	Danbury School District, Superintendent

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PROJECT OVERVIEW

Downtown Danbury has endured decades of flooding caused by an aging, undersized drainage system, referred to as the "East Ditch." Downtown Danbury is vulnerable to the impacts of extreme heat due to large areas of impervious surfaces and lack of tree cover. Future increases in rainfall and temperature pose risks to vulnerable populations and critical assets such as affordable housing and critical roadways.

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA) initiated Resilient Connecticut in 2018 as a component of the U.S. Department of Housing and Urban Development (HUD) National Disaster Resilience Competition award to the State of Connecticut. The CIRCA Resilient Connecticut Phase III – Resilient Danbury project further develops the work completed within Phases I and II, which included the assessment of flooding and extreme heat risks due to climate change, and the identification of areas of shared risk within Fairfield and New Haven Counties.

The East Ditch watershed in Danbury, CT was identified as one of these areas of shared risk. Resilient Danbury is focused on developing solutions to mitigate current and future climate-induced flooding and extreme heat impacts to community assets and critical facilities and routes within downtown Danbury.

LEGEND

- Tree Cover
- Public Green Space
- Impervious Ground Surface
- Impervious Building Surface
- Pervious Surface
- Watershed Boundary

PROJECT EXTENT

Deer Hill Ave. to Town Hill Ave. Park Place to Pahquioque Ave.

1.25 square miles

Over **40** Community Buildings within project area

RESILIENT DANBURY PROJECT SCOPE

*The mission of Resilient Danbury is to develop a climate resilience strategy and **implement this pilot project** focused on reducing risk to people, homes, businesses, and infrastructure in the downtown gateway neighborhoods from flooding and extreme heat, and to foster long-term prosperity in Danbury.*

1 **Data Collection and Review**
Collect and review existing data and perform constructability review of existing designs.

2 **Survey**
Field survey for critical drainage structure locations and elevations

3 **Current & Future Conditions Analysis**
Model existing stormwater system and pre-existing planned improvements under current and future conditions. Establish baseline for extreme heat impacts.

4 **Adaptation Options and Concept Design**
Identify flood- and heat-risk mitigation options and select preferred alternatives. Develop conceptual designs and renderings for the selected alternatives.

5 **Cost/Benefit Analysis**
Develop cost estimates and potential benefits for preferred alternatives based on FEMA BCA methodology.

RESILIENT DANBURY

IN CONTEXT WITH THE BIGGER PICTURE

Danbury supports resilience across multiple layers of government and through numerous initiatives aimed at both extreme heat mitigation as well as flood risk mitigation. The graphic to the right shows a selection of the municipal and regional resilience initiatives in the Danbury area, including the Resilient Danbury project. A summary of a few of these resources is provided below.

The **2017 and 2021 Hazard Mitigation Plans** detail the flooding impacts associated with the undersized drainage system in downtown Danbury. The recommendation in the plan is to construct the 2002 proposed improvements to the drainage system which consist of adding stormwater capacity to the system.

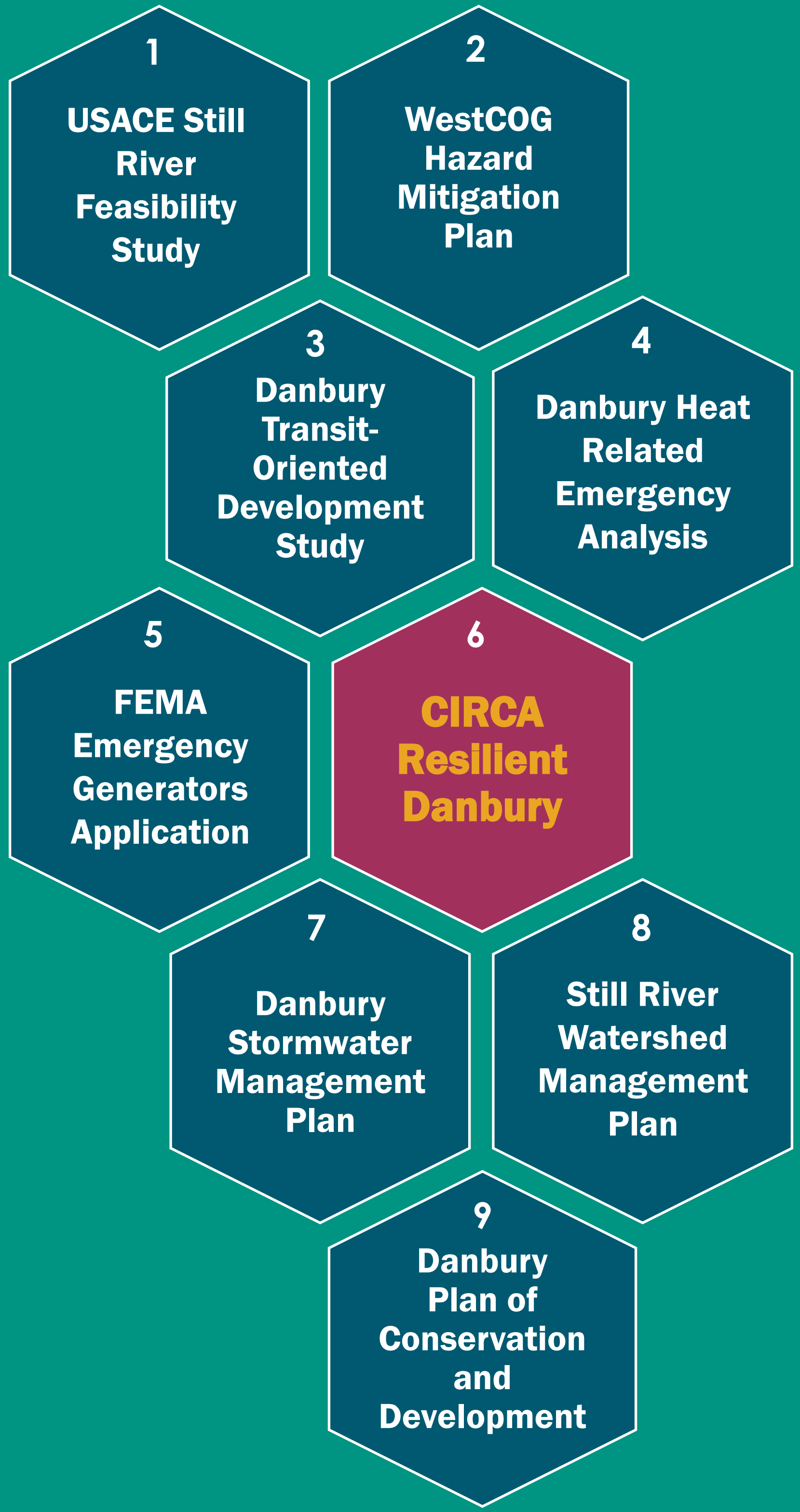
The **2019 Still River Watershed Management Plan** is focused on improving the water quality of the Still River to protect habitat and wildlife while also enhancing climate resilience and creating a community amenity.

The **2023 Plan of Conservation and Development**, developed by the City with input from the community, identifies specific goals/focus areas for growth and development over the next 10 years. Focus areas include land use and environmental resources, cultural resources, housing, economic development, mobility, services and facilities, and future land use.

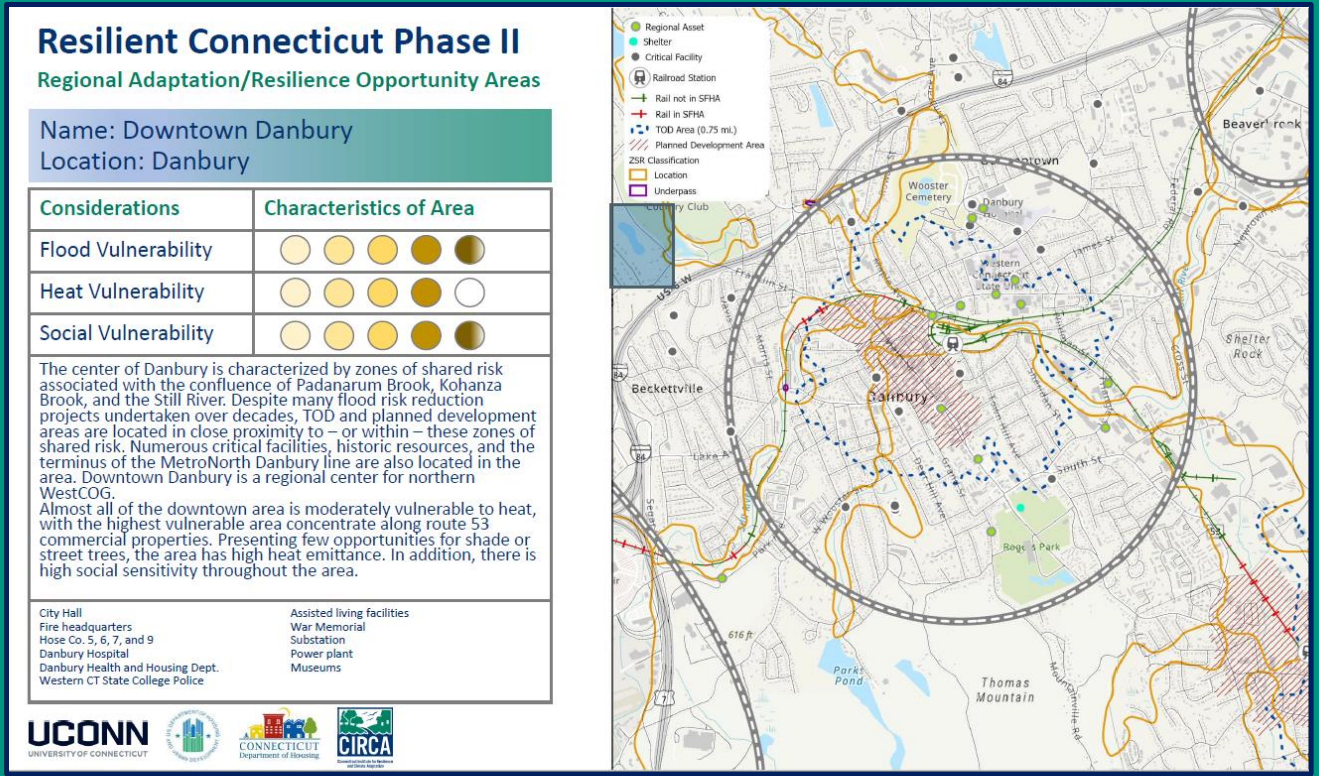
Lastly, the **City of Danbury Heat Related Emergency Analysis**, an on-going study, is focused on how extreme heat affects health. Health impacts and temperature data in downtown Danbury are currently being collected.

LEAD PLANNING ENTITIY:

1 – United States Army Corps of Engineers (USACE)
2 – Western Connecticut Council of Governments (WestCOG)
3, 4, 7, 9 – City of Danbury
5 – Federal Emergency Management Agency (FEMA)
6 – Connecticut Institute for Resilience & Climate Adaptation (CIRCA)
8 – Still River Partners and Connecticut Department of Energy and Environmental Protection (CT DEEP)



ONE PIECE OF A LARGER EFFORT



Resilient Connecticut Phase II

Regional Adaptation/Resilience Opportunity Areas

Name: Downtown Danbury
Location: Danbury

Considerations	Characteristics of Area
Flood Vulnerability	
Heat Vulnerability	
Social Vulnerability	

The center of Danbury is characterized by zones of shared risk associated with the confluence of Padanarum Brook, Kohanza Brook, and the Still River. Despite many flood risk reduction projects undertaken over decades, TOD and planned development areas are located in close proximity to – or within – these zones of shared risk. Numerous critical facilities, historic resources, and the terminus of the MetroNorth Danbury line are also located in the area. Downtown Danbury is a regional center for northern WestCOG.
Almost all of the downtown area is moderately vulnerable to heat, with the highest vulnerable area concentrate along route 53 commercial properties. Presenting few opportunities for shade or street trees, the area has high heat emittance. In addition, there is high social sensitivity throughout the area.

City Hall	Assisted living facilities
Fire headquarters	War Memorial
Hose Co. 5, 6, 7, and 9	Substation
Danbury Hospital	Power plant
Danbury Health and Housing Dept.	Museums
Western CT State College Police	

HISTORICAL CONTEXT + BACKGROUND

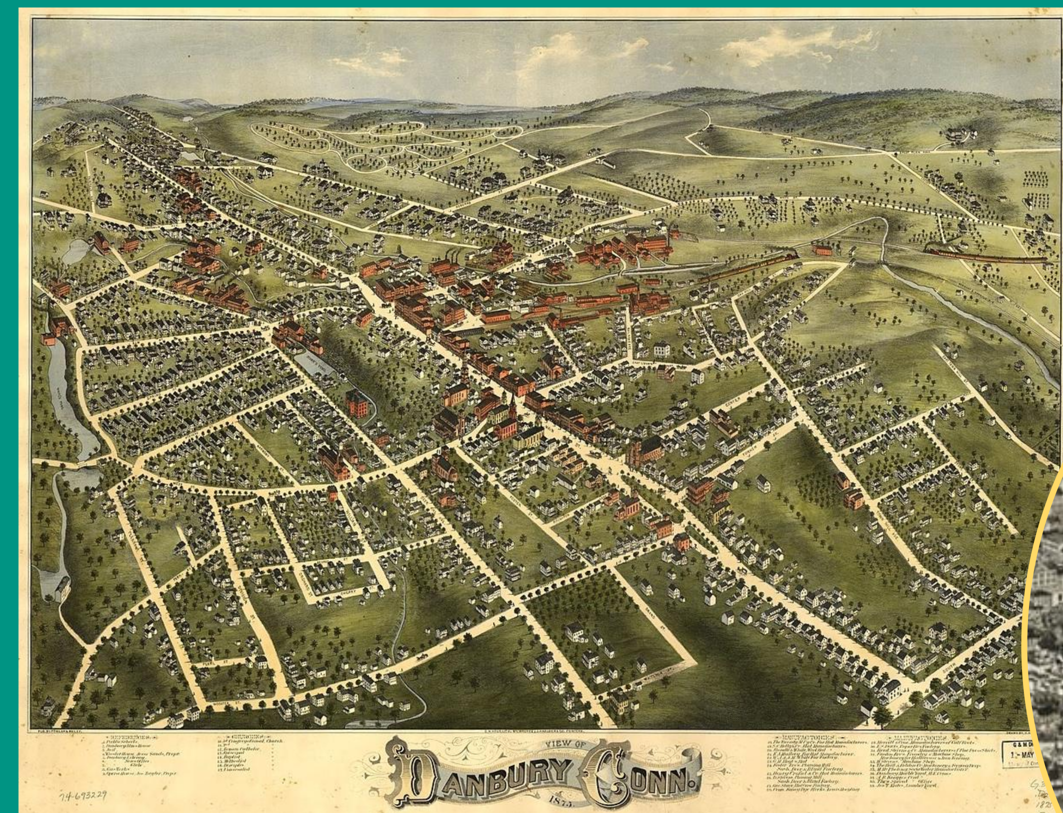
The City of Danbury was chartered as a city in 1889. At different times in its history, It was known as Beantown for the high-quality of bean crop grown there and as "hat city" when it was a center for the nation's hat production. Danbury is situated in low-lying land south of the Berkshire Mountains and Candlewood Lake, and north of Wooster Mountain.

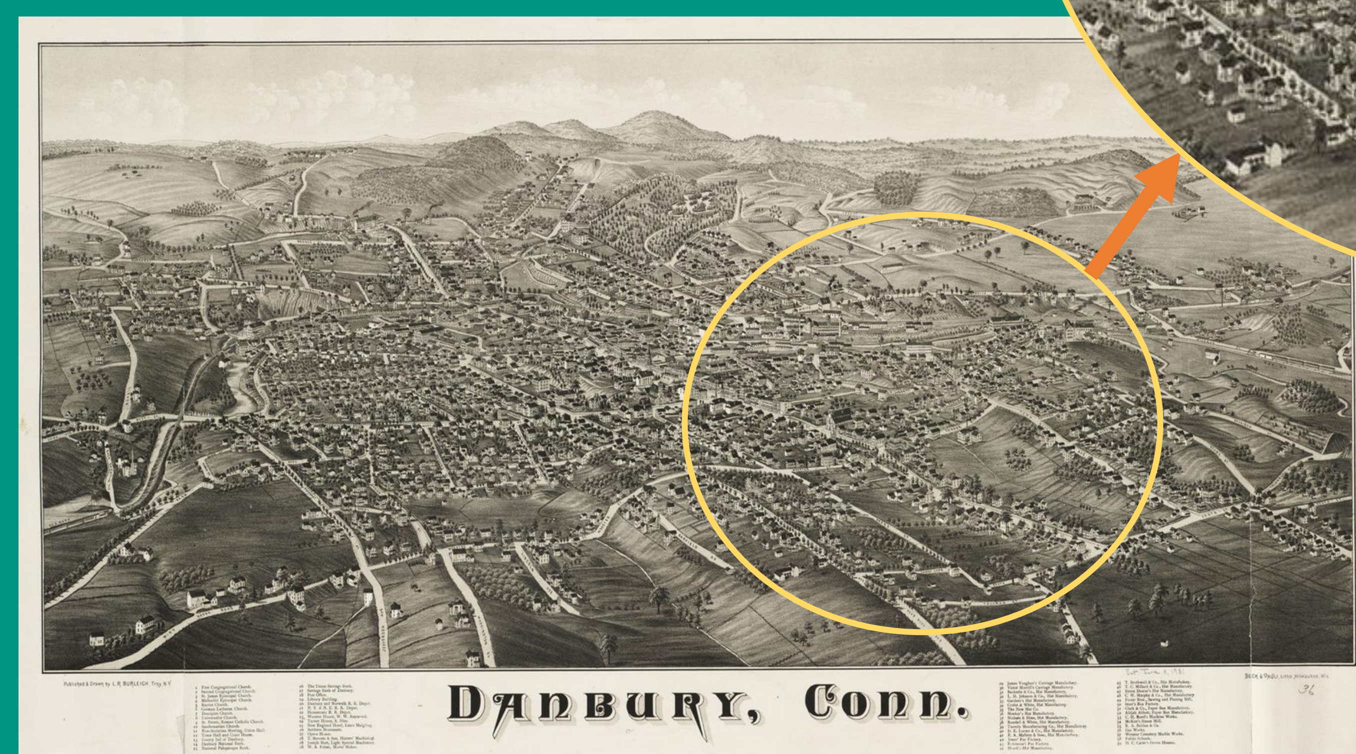
Danbury was called Pahquioque or Paquiack, which means "open plain" or "cleared land", by the Native Americans, the Pahquioque. The colonists who later settled in this area, first called this area "Swampfield" after the wetlands in downtown Danbury, and later changed the name to "Danbury" after the town in England.

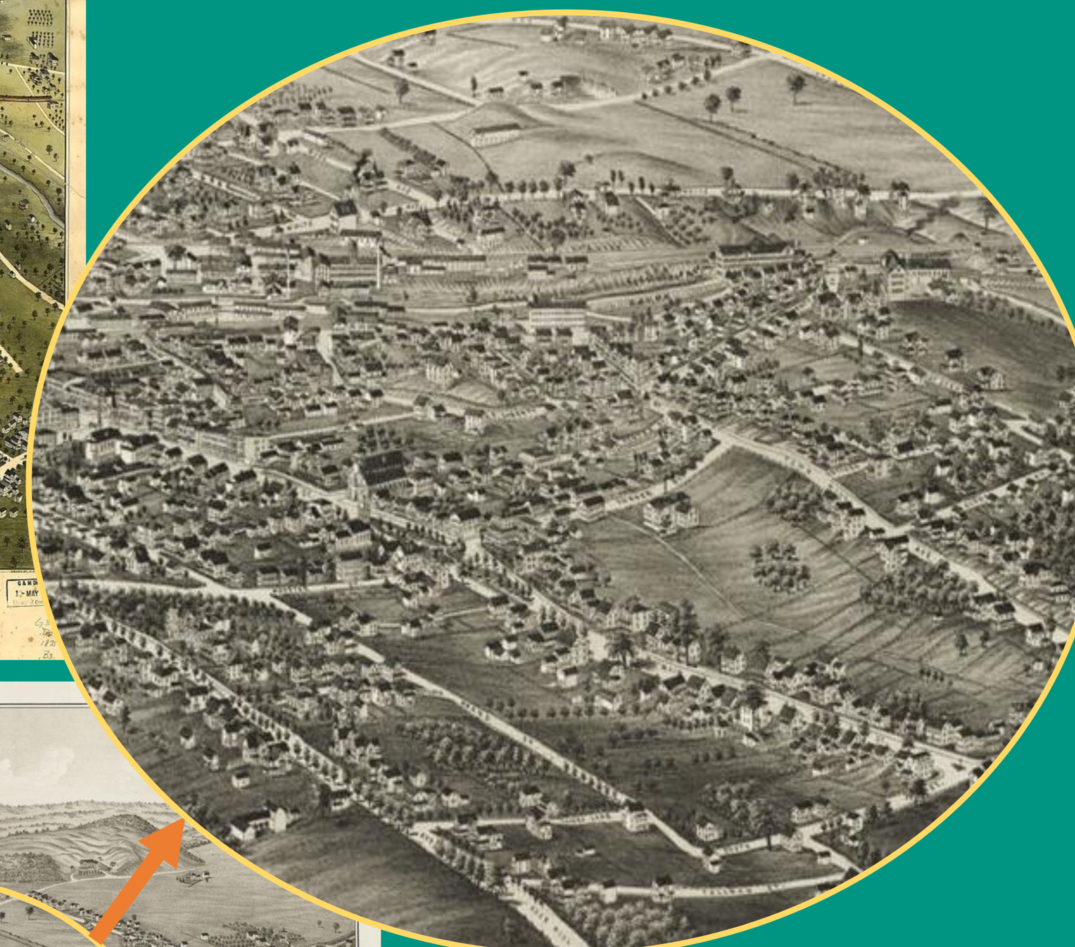
In the late 19th century, the East Ditch was constructed to convey waste and stormwater to the Still River. Part of the ditch is visible in the zoomed in excerpt of the historic map to the right.

Downtown Danbury has developed considerably since the 1800s. Development has provided increased amenities such as additional housing and commercial spaces but has also increased the impervious cover leading to higher temperatures and increased stormwater runoff. The extreme heat and flooding concerns in Danbury are expected to worsen over time. Storm frequency and intensity as well as maximum temperatures are expected to increase.

This project is focused on mitigating these impacts to the community while also providing improved amenities to downtown Danbury.







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DANBURY

DOWNTOWN DANBURY CURRENT-DAY EAST DITCH FLOODING

August 13th, 2001

September 16th, 2002

September 16th, 2002

June 2nd, 2022

June 2nd, 2022

June 2nd, 2022

There is significant drainage-related flooding in Downtown Danbury as shown in the photos above, which were all taken at the Main Street and Elmwood Place intersection. Flooding occurs in the streets and, under certain conditions, extends onto adjacent properties and into basements.

DOWNTOWN DANBURY SOCIAL VULNERABILITIES

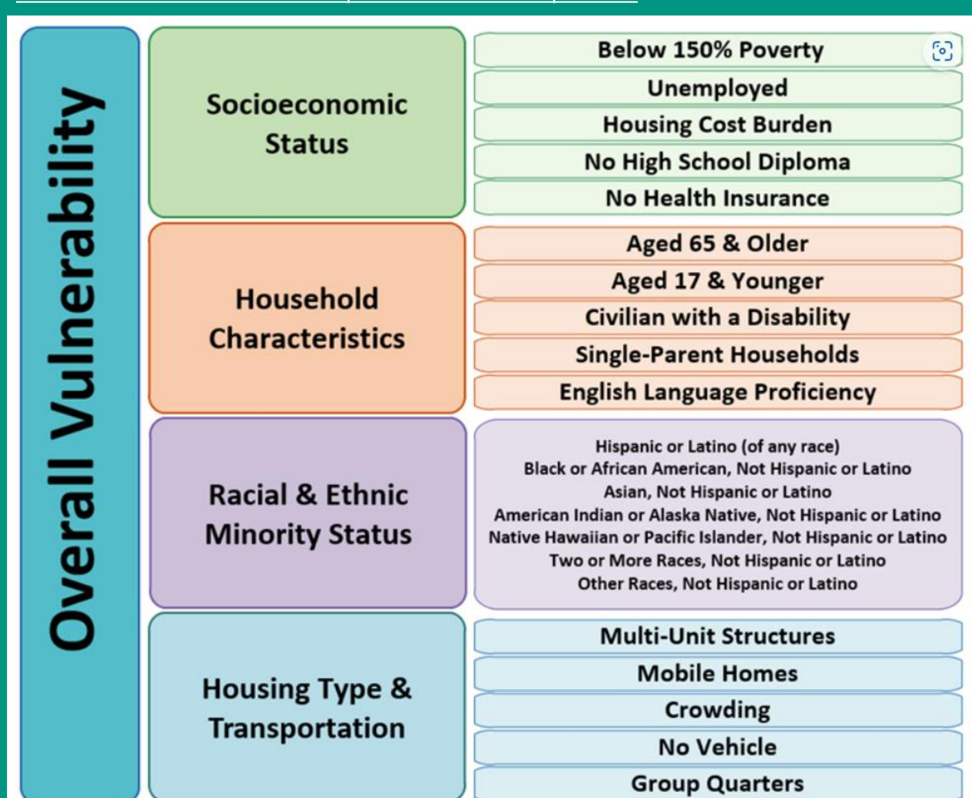
Social vulnerability refers to the potential negative impacts to communities caused by flood, heat, wind, and other external stresses. Factors that increase vulnerability include poverty, lack of access to transportation, and minority status. These factors may weaken a community's ability to prevent loss and damages.

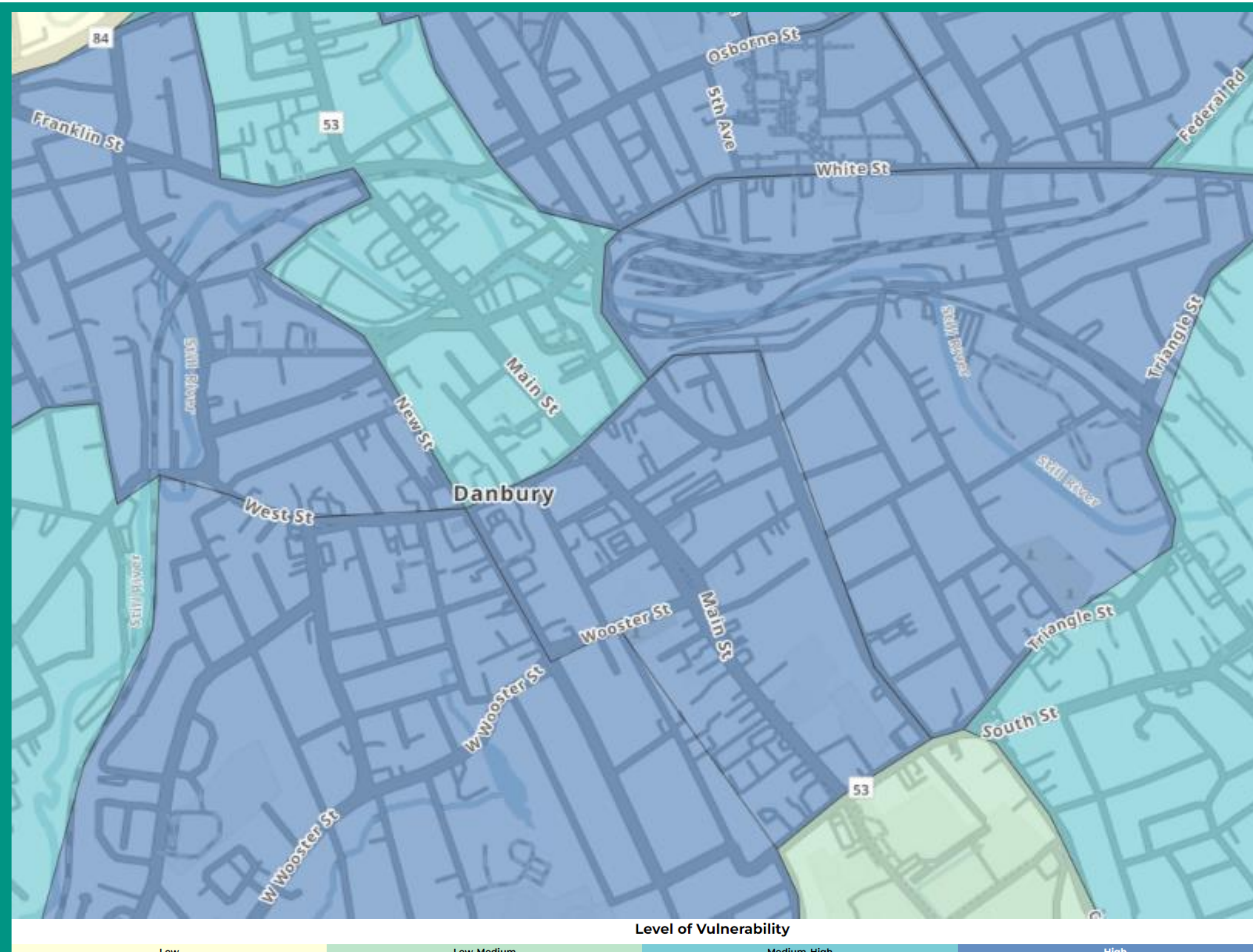
Understanding social vulnerability within the community allows emergency response planners and public health officials to identify the communities and areas that will most likely need support before, during, and after a hazardous event.

The Centers for Disease Control and Prevention (CDC) has developed a **Social Vulnerability Index (SVI)** that uses US Census data to identify vulnerability at the census tract level based on 16 social factors.

SVI – Contributing Factors:

CDC SVI Documentation 2020 | Place and Health | ATSDR





The Centers for Disease Control and Prevention (CDC) developed a Social Vulnerability Index (SVI) to aid in identifying populations that will need support before, during, and after a hazardous event. Link: CDC/ATSDR Social Vulnerability Index (SVI)

RESILIENT DANBURY

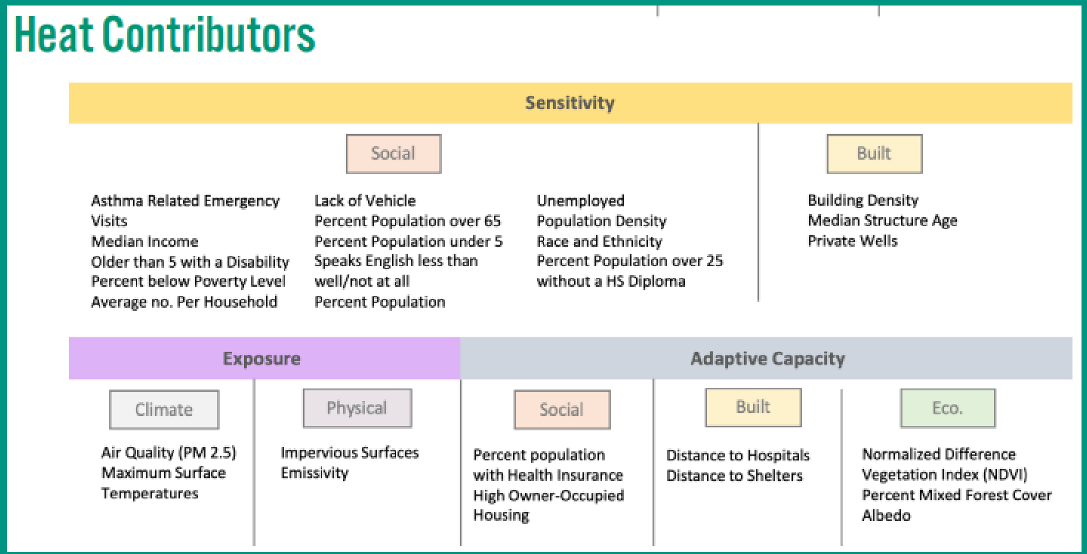
DOWNTOWN DANBURY + EXTREME HEAT

The project area has **high heat** and **moderately high heat** vulnerability, as assessed by CIRCA's Climate Change Vulnerability Index (CCVI) as shown. The high and moderately high rating is due to the high social vulnerability in the area, dense housing, high concentrations of impervious area, lack of tree cover, lack of connected green space, and lack of sufficient cooling center capacity.

Primary impacts from extreme heat include health effects such as heat stroke, dehydration, and dizziness, which can lead to death in extreme cases. Primary impacts can be harder to attribute to an extreme heat event because they may affect people who are already vulnerable, such as children, the elderly, and those with pre-existing medical conditions.

The City of Danbury is working with local private healthcare officials to track and document heat-related hospital visits and emergency response. This information will be used to target mitigation strategies within the community.

Secondary impacts include lost work time and increased electrical consumption.



CIRCA Climate Change Vulnerability Index – Contributing Factors

Link: https://resilientconnecticut.uconn.edu/ccvi/

CIRCA Climate Change Vulnerability Index (CCVI) Heat Vulnerability Map

FLOOD MODELING AND VALIDATION

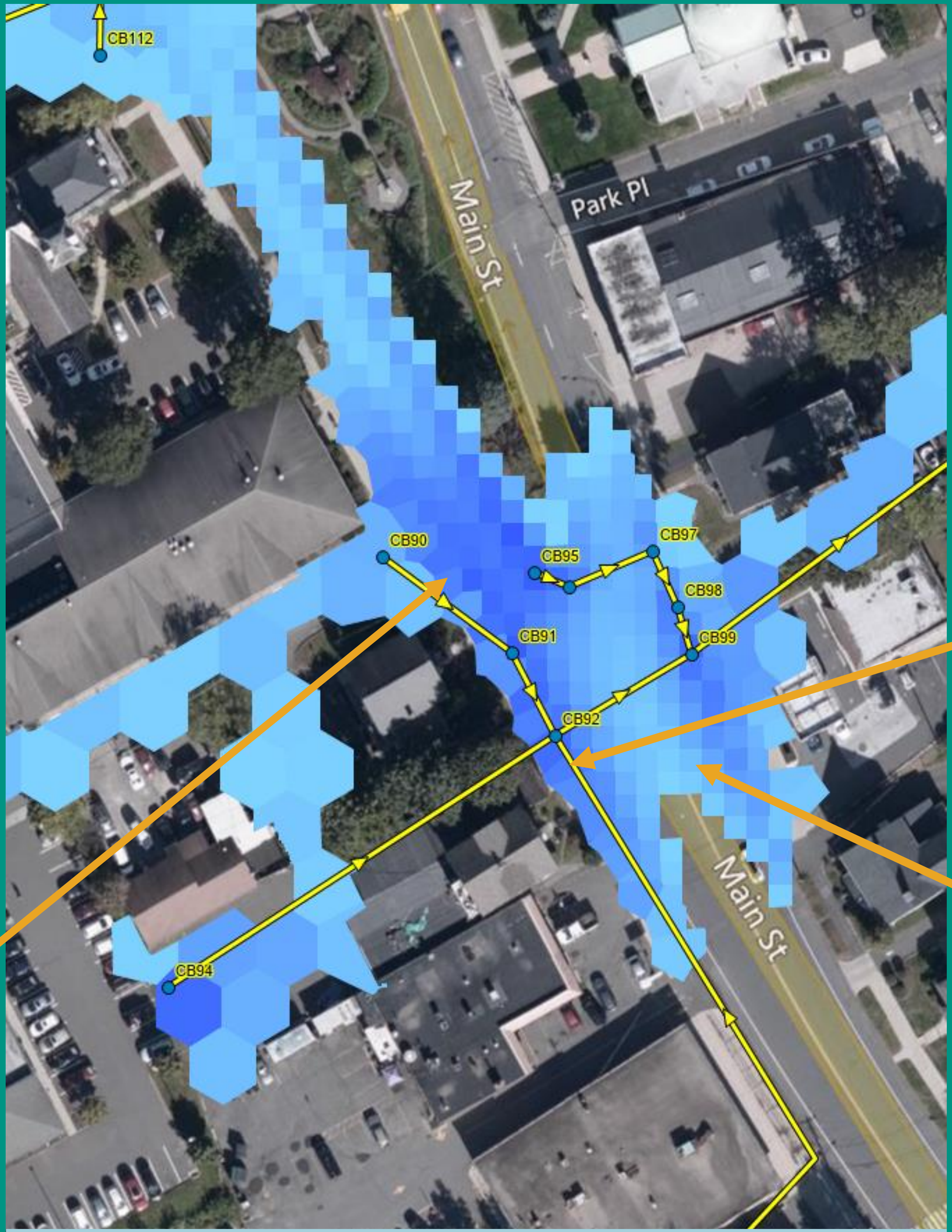
The existing Danbury stormwater drainage system was analyzed using the CHI PCSWMM software which integrates two-dimensional modeling of surface flooding with the EPA Stormwater Management Model (SWMM) for conveyance of flow through subsurface structures. The hydrologic properties of each subcatchment within the modeled drainage basin were determined from available topographic, land use, soils, and hydrography data. Rainfall infiltration rates were calculated using the Modified Green-Ampt Method. Soil data from the National Cooperative Soil Survey - Web Soil Survey was used to assign infiltration parameters to the soils throughout the watershed. Land use data was obtained from the Connecticut Environmental Conditions Online (CTECO). Analyses for the current and future climate conditions were completed for the 100% (1-year), 50% (2-year), 20% (5-year), 10% (10-year), 4% (25-year), and 1% (100-year) annual chance storm event.[1]

A model validation process was completed early in the flood model development. A large flooding event occurred within the watershed on June 2nd, 2022. Based on meteorological observations at a nearby airport precipitation gauge, the rainfall that occurred during this event was approximately equivalent to a 20% annual chance (5-year) storm. Photos of flooded streets captured by residents and city officials during this storm were examined; approximate flood depths and extents were calculated and compared against simulated flood depths and extents produced from the PCSWMM model. Generally, the model performed well at capturing the flood depths and extents within the areas depicted in the photographs.

For additional information on the technical analysis, please refer to the **Resilient Danbury East Ditch Flooding and Extreme Heat Mitigation Existing and Future Conditions Technical Report**.

[1]Current climate conditions were based on NOAA Atlas 14 Point Precipitation Data and Natural Resources Conservation Service Type III Synthetic Rainfall Distribution. Future climate conditions are based on the mid-century projections (2049-2069) in the 2019 Connecticut Physical Climate Science Assessment Report.

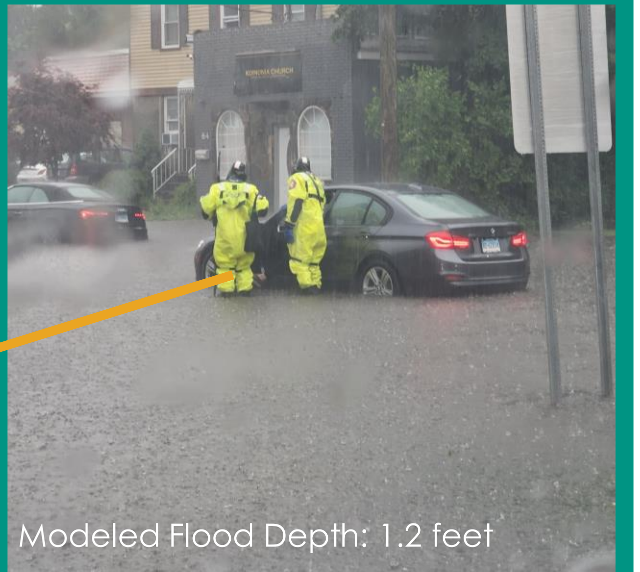
Modeled Flood Depth: 1.6 feet



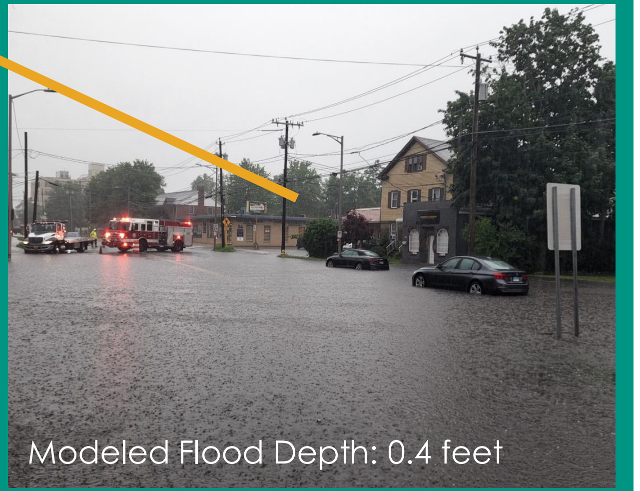
5-Year Storm (20% Chance) Modeled Flood Extents

Flood Date: June 2nd, 2022

2.12 inches in 2 hours
20% Annual Chance
(5-Year) Storm
2-Hour Storm Duration



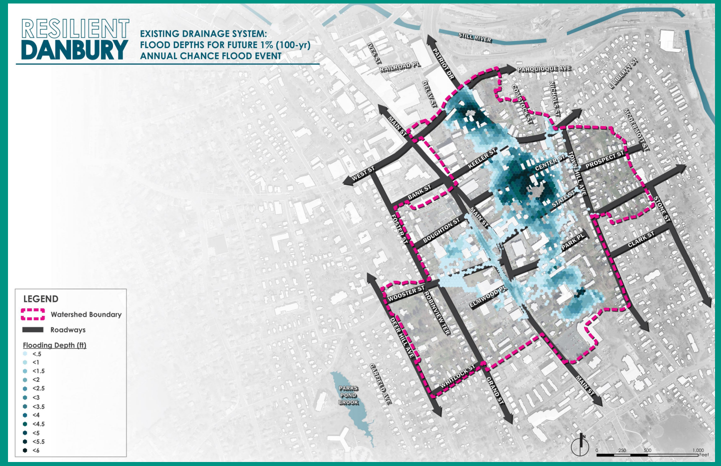
Modeled Flood Depth: 1.2 feet



Modeled Flood Depth: 0.4 feet

DEFINING THE RISKS

CURRENT + FUTURE FLOOD EXTENTS



CURRENT + FUTURE FLOOD DEPTHS

EXTREME HEAT VULNERABILITIES

WHAT'S AT RISK?

BUILDINGS IMPACTED BY FLOODING

TRANSPORTATION INFRASTRUCTURE

COOLING CENTERS

CRITICAL COMMUNITY ASSETS

DEFINING THE RISKS

EXISTING SYSTEM
CURRENT AND FUTURE FLOOD EXTENTS

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD EXTENTS FOR CURRENT 100% (1-yr), 10% (10-yr), & 1% (100-yr) ANNUAL CHANCE FLOOD EVENTS

The maximum flooding extents for each recurrence interval were determined through PCSWMM modeling. The flood extents for the 100% (1-year), 10% (10-year), and 1% (100-year) annual chance of exceedance storms under current climate conditions are shown to the right.

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD EXTENTS FOR CURRENT & FUTURE 100% (1-yr) ANNUAL CHANCE FLOOD EVENTS

The maximum flooding extents for each recurrence interval were determined through PCSWMM modeling. The maximum flood extents for the 100% (1-year) annual chance of exceedance storm under current and future climate conditions are shown to the right.

The model results show major areas of surface flooding at the following locations:

- Main Street between Boughton Street and Elmwood Place
- State Street
- Center Street

Number of Inundated Buildings	
Scenario	Annual Chance of Storm (Return Period)
	100% (1-Year)
Current Climate Conditions	17
Future Climate Conditions	37

LEGEND

- Current 100% Annual Chance Flood
- Future 100% Annual Chance Flood
- Watershed Boundary
- Roadways

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD EXTENTS FOR CURRENT & FUTURE 10% (10-yr) ANNUAL CHANCE FLOOD EVENTS

The maximum flooding extents for each recurrence interval were determined through PCSWMM modeling. The maximum flood extents for the 10% (10-year) annual chance of exceedance storm under current and future climate conditions are shown to the right.

The model results show major areas of surface flooding at the following locations:

- Center Street
- Park Place
- Affordable housing parking lot just south of Park Place
- Southern Main Street
- Wooster Street near the Main Street Intersection
- Liberty Street Near the intersection with Pahquioque Avenue

Number of Inundated Buildings	
Scenario	Annual Chance of Storm (Return Period)
	10% (10-Year)
Current Climate Conditions	75
Future Climate Conditions	98

LEGEND

- Current 10% Annual Chance Flood
- Future 10% Annual Chance Flood
- Watershed Boundary
- Roadways

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD EXTENTS FOR CURRENT & FUTURE 1% (100-yr) ANNUAL CHANCE FLOOD EVENTS

The maximum flooding extents for each recurrence interval were determined through PCSWMM modeling. The maximum flood extents for the 1% (100-year) annual chance of exceedance storm under current and future climate conditions are shown to the right.

The model results show major areas of surface flooding at the following locations:

- Center Street
- State Street
- Park Place
- The parking lot within the affordable housing complex just south of Park Place
- Southern Main Street
- Wooster Street near the Main Street Intersection
- Liberty Street Near the intersection with Pahquioque Avenue

Number of Inundated Buildings	
Scenario	Annual Chance of Storm (Return Period)
	1% (100-Year)
Current Climate Conditions	99
Future Climate Conditions	137

LEGEND

- Current 1% Annual Chance Flood
- Future 1% Annual Chance Flood
- Watershed Boundary
- Roadways

EXISTING SYSTEM
CURRENT AND FUTURE FLOOD DEPTHS

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD DEPTHS FOR CURRENT 100% (1-yr) ANNUAL CHANCE FLOOD EVENT

The map to the right shows the flooding depth for the 100% annual chance of exceedance (1-year) storm event for the existing drainage system under current climate conditions. The table below summarizes the peak flood depth and maximum flood duration for three (3) locations in the watershed area.

There is significant flooding at Southern Main Street and Center Street for the 100% annual chance of exceedance storm. It is likely that these areas will experience lack of roadway access at least once a year.

	Peak Flood Depth (ft)	Max. Flood Duration (min)
Location*	**Existing System Current Climate Conditions**	
	100% Annual Chance (1-Year) Storm	
Southern Main St	1.23	29
Affordable Housing	0.39	44
Center St	2.43	18

*Locations as indicated by the yellow star markers.

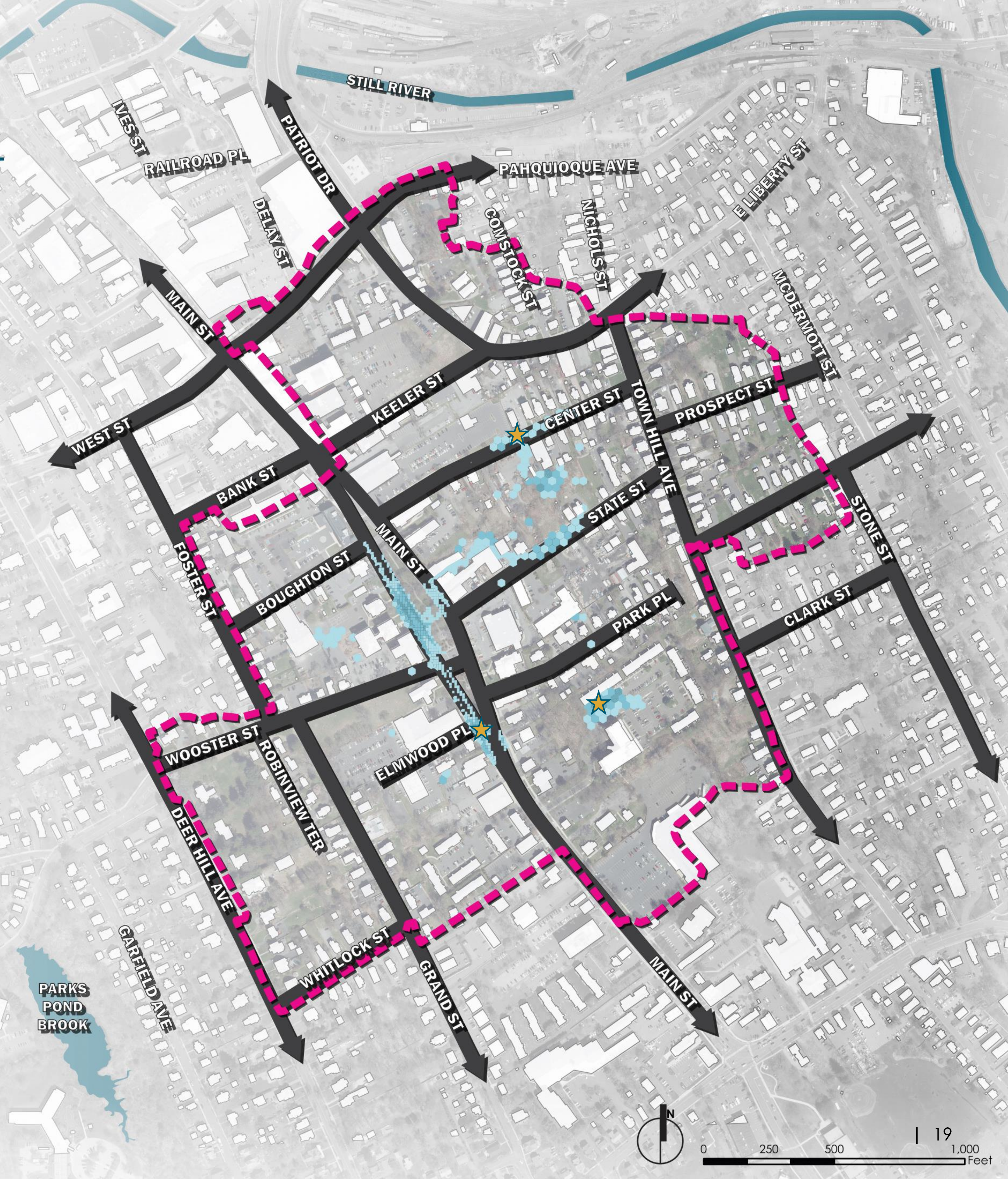
LEGEND

Watershed Boundary

Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6



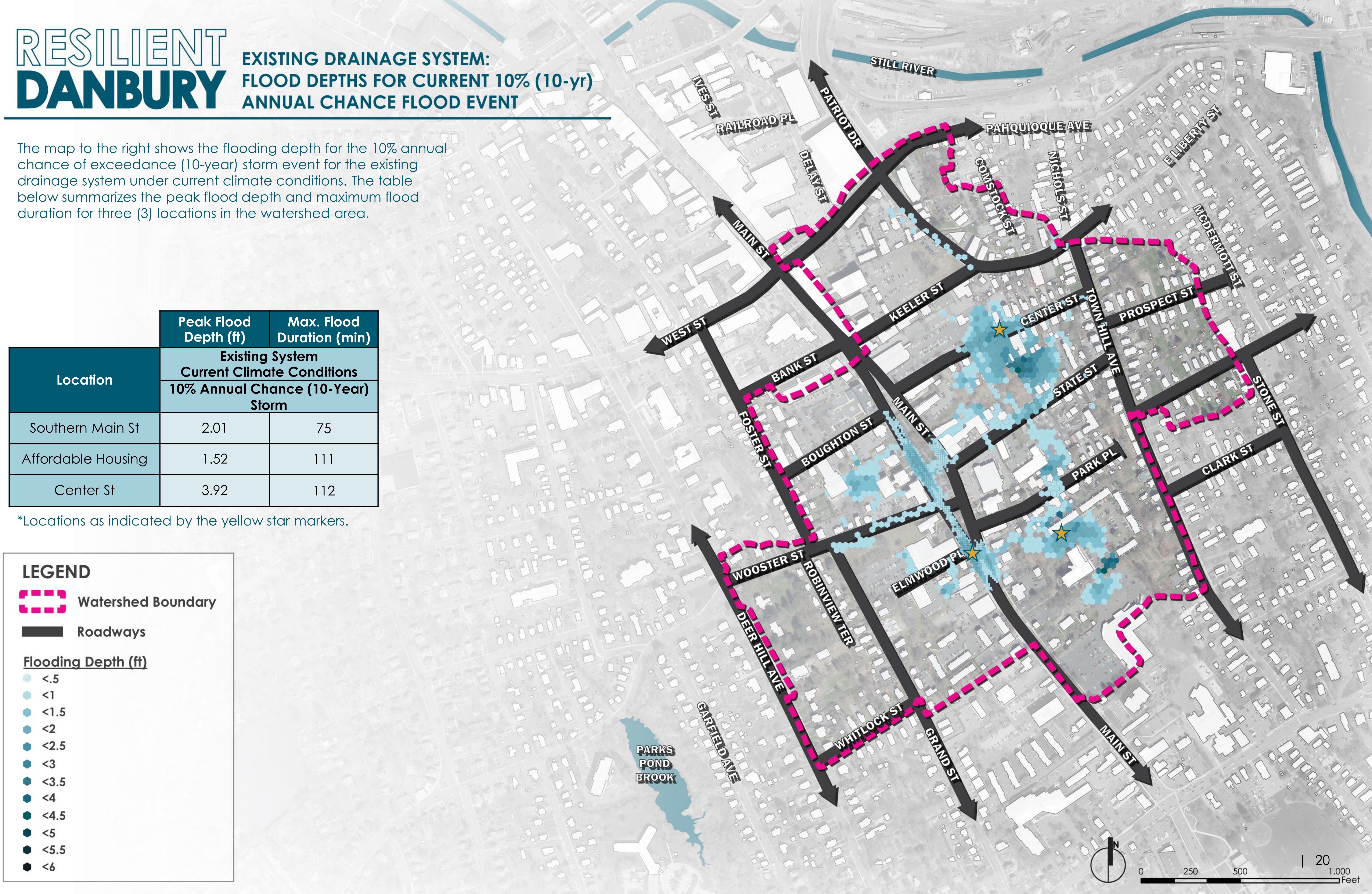
RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD DEPTHS FOR CURRENT 10% (10-yr) ANNUAL CHANCE FLOOD EVENT

The map to the right shows the flooding depth for the 10% annual chance of exceedance (10-year) storm event for the existing drainage system under current climate conditions. The table below summarizes the peak flood depth and maximum flood duration for three (3) locations in the watershed area.

Location	Peak Flood Depth (ft)	Max. Flood Duration (min)
	Existing System Current Climate Conditions	
	10% Annual Chance (10-Year) Storm	
Southern Main St	2.01	75
Affordable Housing	1.52	111
Center St	3.92	112

*Locations as indicated by the yellow star markers.



RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD DEPTHS FOR CURRENT 1% (100-yr) ANNUAL CHANCE FLOOD EVENT

The map to the right shows the flooding depth for the 1% annual chance of exceedance (100-year) storm event for the existing drainage system under current climate conditions. The table below summarizes the peak flood depth and maximum flood duration for three (3) locations in the watershed area.

Location	Peak Flood Depth (ft)	Max. Flood Duration (min)
	Existing System Current Climate Conditions	
	1% Annual Chance (100-Year) Storm	
Southern Main St	2.26	110
Affordable Housing	1.86	189
Center St	5.68	224

*Locations as indicated by the yellow star markers.

LEGEND

Watershed Boundary

Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD DEPTHS FOR FUTURE 100% (1-yr) ANNUAL CHANCE FLOOD EVENT

The map to the right shows the flooding depth for the 100% annual chance of exceedance (1-year) storm event for the existing drainage system under future climate conditions. The table below summarizes the peak flood depth and maximum flood duration for three (3) locations in the watershed area.

Location	Peak Flood Depth (ft)	Max. Flood Duration (min)
	Existing System Future Climate Conditions	
	100% Annual Chance (1-Year) Storm	
Southern Main St	1.68	51
Affordable Housing	1.81	70
Center St	1.28	46

*Locations as indicated by the yellow star markers.

LEGEND

- Watershed Boundary
- Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD DEPTHS FOR FUTURE 10% (10-yr) ANNUAL CHANCE FLOOD EVENT

The map to the right shows the flooding depth for the 10% annual chance of exceedance (10-year) storm event for the existing drainage system under future climate conditions. The table below summarizes the peak flood depth and maximum flood duration for three (3) locations in the watershed area.

Location	Peak Flood Depth (ft)	Max. Flood Duration (min)
	Existing System Future Climate Conditions	
	10% Annual Chance (10-Year) Storm	
Southern Main St	2.26	101
Affordable Housing	2.73	177
Center St	1.28	209

*Locations as indicated by the yellow star markers.

LEGEND

- Watershed Boundary
- Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6

RESILIENT DANBURY

EXISTING DRAINAGE SYSTEM: FLOOD DEPTHS FOR FUTURE 1% (100-yr) ANNUAL CHANCE FLOOD EVENT

The map to the right shows the flooding depth for the 1% annual chance of exceedance (100-year) storm event for the existing drainage system under future climate conditions. The table below summarizes the peak flood depth and maximum flood duration for three (3) locations in the watershed area.

Location	Peak Flood Depth (ft)	Max. Flood Duration (min)
	Existing System Future Climate Conditions	
	1% Annual Chance (100-Year) Storm	
Southern Main St	2.56	206
Affordable Housing	3.28	365
Center St	6.49	423

*Locations as indicated by the yellow star markers.

LEGEND

Watershed Boundary

Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6

EXTREME HEAT CONTRIBUTORS

RESILIENT DANBURY

HEAT CONTRIBUTORS

EXISTING HEAT CONTRIBUTORS

- Limited of tree canopy and open space
- Impervious ground surface
- Impervious building surfaces
- Changing (warming) climate

WHAT'S AT RISK?

RESILIENT DANBURY

BUILDINGS IMPACTED BY FLOODING

The maximum flood extents for the 100% (1-year), 10% (10-year), and 1% (100-year) annual chance of exceedance storms under future climate conditions are shown to the right. The table below summarizes the number of buildings expected to be impacted by flooding under current and future climate conditions for the 100% (1-year), 10% (10-year), and 1% (100-year) annual chance of exceedance storms .

Number of Inundated Buildings			
Scenario	Annual Chance of Storm (Return Period)		
	100% (1-Year)	10% (10-Year)	1% (100-Year)
Current Climate Conditions	17	75	99
Future Climate Conditions	37	98	137

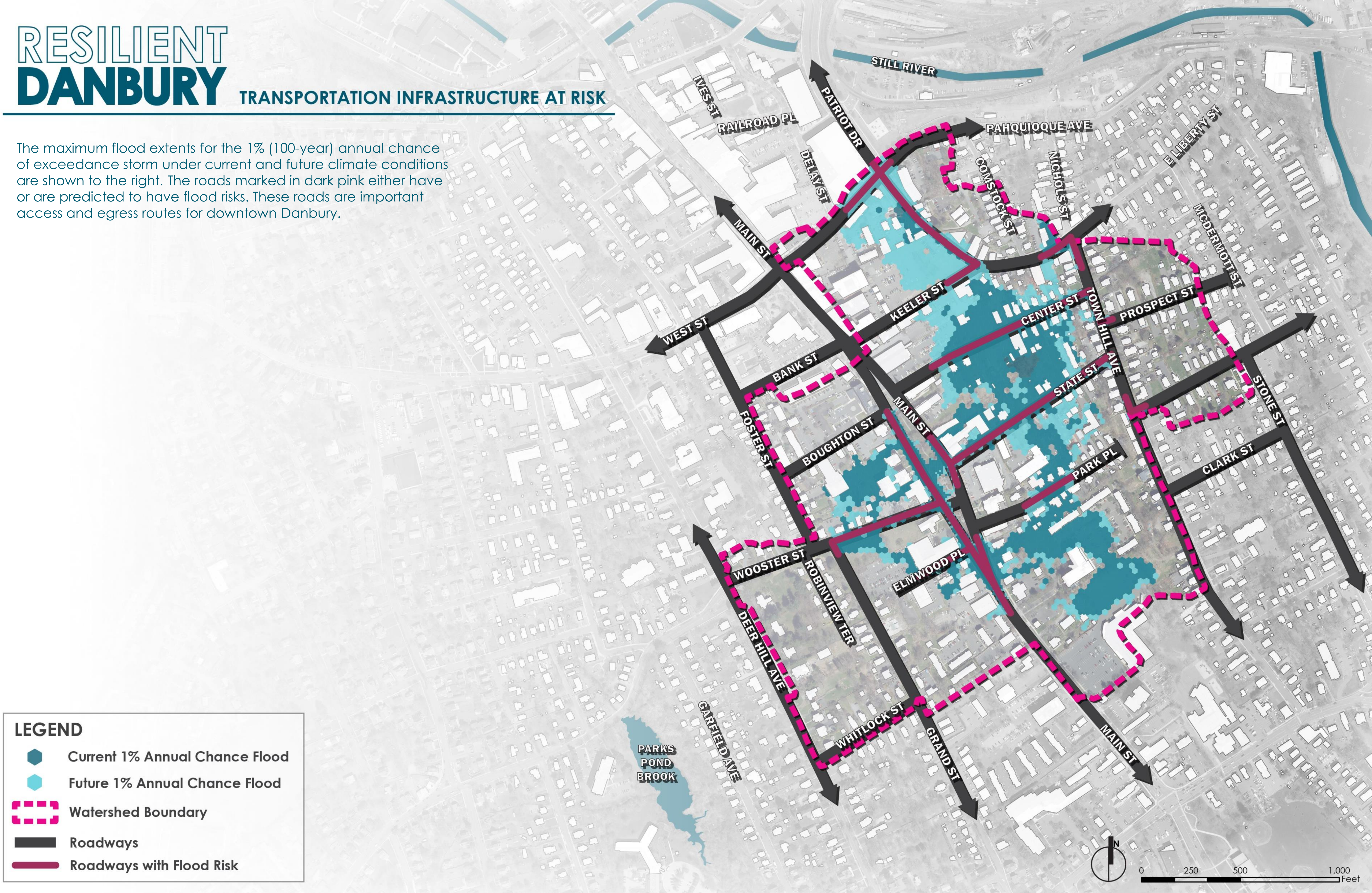
LEGEND

- Future 1% Annual Chance Flood
- Future 10% Annual Chance Flood
- Future 100% Annual Chance Flood
- Watershed Boundary
- Roadways

RESILIENT DANBURY

TRANSPORTATION INFRASTRUCTURE AT RISK

The maximum flood extents for the 1% (100-year) annual chance of exceedance storm under current and future climate conditions are shown to the right. The roads marked in dark pink either have or are predicted to have flood risks. These roads are important access and egress routes for downtown Danbury.



RESILIENT DANBURY

COOLING CENTERS

EXISTING COOLING CENTERS
- New Street Shelter
- Danbury Public Library
- Danbury War Memorial

POTENTIAL COOLING CENTER
- Ice Rink

RESILIENT DANBURY

CRITICAL COMMUNITY ASSETS

Downtown Danbury has several significant community amenities including public buildings such as City Hall and the Post Office, religious and community centers, as well as healthcare facilities and schools.

These critical community assets are detailed in the graphic to the right.

Library/ Post Office/City Hall
1. UNITED STATES POST OFFICE
2. PUBLIC LIBRARY
3. CITY HALL

Religious Center
1. UNIVERSAL CHURCH
2. ALL NATION BAPTIST CHURCH
3. ST. JAMES EPISCOPAL CHURCH
4. TEMPLE BETHEL
5. STRONG GOD CHURCH
6. EMANUEL ASSEMBLY-GOD CHURCH
7. GREATER MERCY TEMPLE CHURCH
8. SACRED HEART CHURCH
9. SEVENTH DAY ADVENTIST CHURCH

Community Center
1. LEBANON-AMERICAN CLUB
2. ECUADORIAN CIVIC CENTER
3. DANBURY COMMUNITY CENTER
4. OUR LADY OF APARECIDA PARISH - BRAZILIAN COMMUNITY CENTER

Affordable Housing
1. AFFORDABLE HOUSING

Healthcare Facility & Senior Center
1. COMMUNITY HEALTH CENTER OF DANBURY
2. PALACE VIEW SENIOR HOUSING
3. GREATER DANBURY COMMUNITY HEALTH CENTER
4. PHARMACY (WALGREENS)
5. PLANNED PARENTHOOD
6. GREATER DANBURY COMMUNITY HEALTH CENTER
7. ELMWOOD HALL SENIOR CENTER
8. DANBURY REGIONAL WIC NUTRITION PROGRAM / OLD JAIL

School/ Educational Centers
1. CENTER FOR EMPOWERMENT & EDUCATION
2. ST. PETER'S SCHOOL
3. SOUTH STREET SCHOOLS
4. SACRED HEART SCHOOL
5. HEAD START CENTER

Public Open Space
1. DANBURY CITY CENTER GREEN
2. DANBURY SKATE PARK
3. ELMWOOD PLACE

State of Connecticut
1. FAIRFIELD COUNTY COURTHOUSE
2. TRAIN STATION

Other
1. ICE RINK
2. MUSEUM AND HISTORICAL SOCIETY
3. GROCERY STORE (PRICE RITE)
4. CONNECTICUT LIGHT & POWER CO
5. BECKERIE & CO. FIRE ENGINE 9

LEGEND

- Ex. Outfalls
- Ex. Conduits
- City of Danbury Parcels
- Future Development Areas
- Watershed Boundary
- Roadways

HAESTAD PROPOSED DRAINAGE SYSTEM

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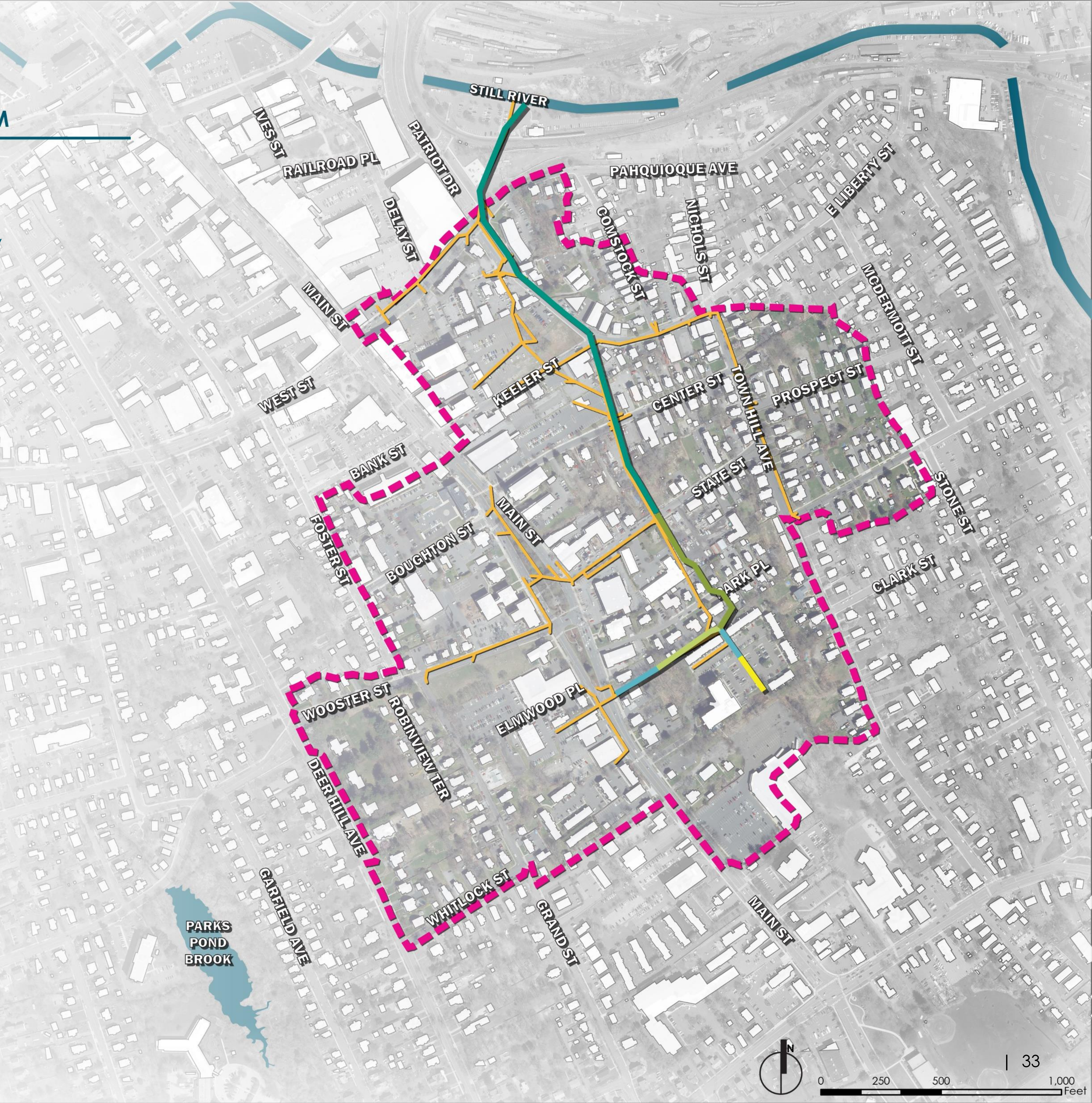
PROPOSED DRAINAGE SYSTEM

Preliminary drainage infrastructure improvements were designed by Roald Haestad in 2003. The layout of the improvements are shown to the right. The proposed Haestad design focuses on reducing flooding within the watershed by significantly increasing pipe sizes, and thereby increasing conveyance of the mainline from just beyond Park Place to the Still River outlet.

The proposed Haestad stormwater drainage system was modeled using the CHI PCSWMM software. The Haestad model was created using the same methodology as was used to create the existing drainage system model. The analysis was completed under current and future climate conditions. Results of the Haestad system performance under current climate conditions are summarized on the following pages.

Results of the Haestad system performance under future climate conditions, the technical analysis, and constructability review are detailed in the **Resilient Danbury East Ditch Flooding and Extreme Heat Mitigation Existing and Future Conditions Technical Report**.

The next phase of the project will determine how to optimize the Haestad improvements to minimize flood and extreme heat risk. The feasibility of incorporating other improvements such as green stormwater infrastructure, streetscape enhancements, and resilience corridor will also be considered.



LEGEND

- 5x10 Box Culvert
- 4x10 Box Culvert
- 48" Pipe
- 42" Pipe
- 36" Pipe
- Ex. Conduits
- Watershed Boundary

RESILIENT DANBURY

PROPOSED HAESTAD DRAINAGE SYSTEM: FLOOD DEPTHS FOR CURRENT 100% (1-yr) ANNUAL CHANCE FLOOD EVENT

Model results for the proposed Haestad drainage system show significantly reduced surface flooding depths and durations compared to the existing drainage system at the following locations for the 100% annual chance of exceedance (1-year) storm event.

- The southern end of Main Street near the Elmwood Place intersection
- State Street, Center Street, and the low-lying area between the two cross streets
- Affordable housing complex just south of Park Place

	Peak Flood Depth (ft)	Max. Flood Duration (min)
Location	Haestad Design Current Climate Conditions	
	100% Annual Chance (1-Year) Storm	
Southern Main St	0	0
Affordable Housing	0	0
Center St	0	0

*Locations as indicated by the yellow star markers.

LEGEND

Watershed Boundary

Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6

RESILIENT DANBURY

PROPOSED HAESTAD DRAINAGE SYSTEM: FLOOD DEPTHS FOR CURRENT 10% (10-yr) ANNUAL CHANCE FLOOD EVENT

Model results for the proposed Haestad drainage system show significantly reduced surface flooding depths and durations compared to the existing drainage system at the following locations for the 10% annual chance of exceedance (10-year) storm event.

- State Street, Center Street, and the low-lying area between the two cross streets
- Park Place
- Affordable housing complex just south of Park Place
- Southern Main Street
- Wooster Street near the Main Street Intersection

Location	Peak Flood Depth (ft)	Max. Flood Duration (min)
	Haestad Design Current Climate Conditions	
	10% Annual Chance (10-Year) Storm	
Southern Main St	1.07	27
Affordable Housing	0.61	21
Center St	1.00	32

*Locations as indicated by the yellow star markers.

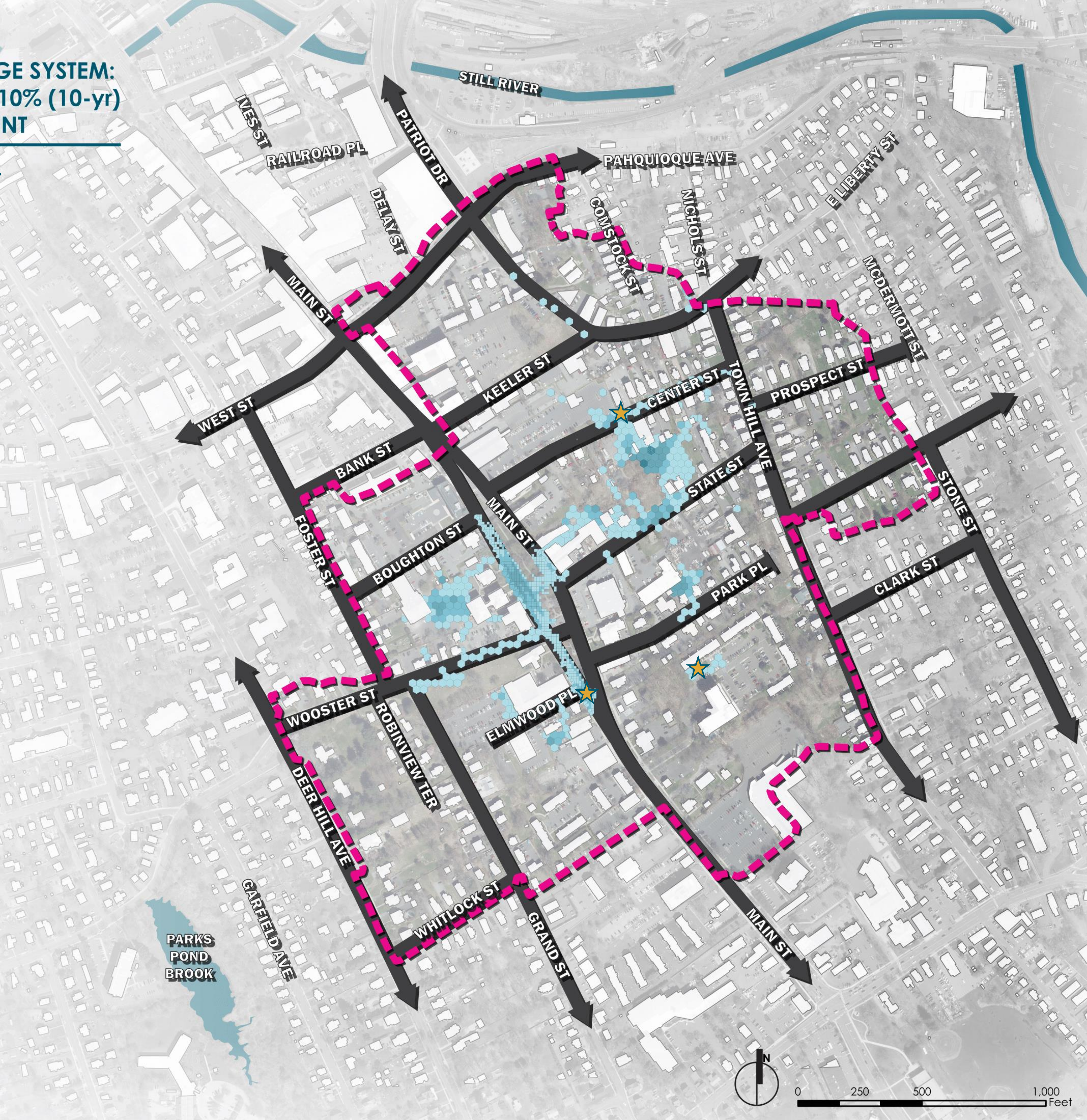
LEGEND

Watershed Boundary

Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6



RESILIENT DANBURY

PROPOSED HAESTAD DRAINAGE SYSTEM: FLOOD DEPTHS FOR CURRENT 1% (100-yr) ANNUAL CHANCE FLOOD EVENT

Model results for the proposed Haestad drainage system show significantly reduced surface flooding depths and durations compared to the existing drainage system at the following locations for the 1% annual chance of exceedance (100-year) storm event.

- State Street, Center Street, and the low-lying area between the two cross streets
- Park Place
- Affordable housing complex just south of Park Place
- Southern Main Street
- Wooster Street near the Main Street Intersection
- Liberty Street Near the intersection with Pahquioque Avenue and the intersection with Town Hill Avenue

Location	Peak Flood Depth (ft)	Max. Flood Duration (min)
	Haestad Design Current Climate Conditions	
	1% Annual Chance (100-Year) Storm	
Southern Main St	1. 92	45
Affordable Housing	1.24	45
Center St	4.86	51

*Locations as indicated by the yellow star markers.

LEGEND

- Watershed Boundary
- Roadways

Flooding Depth (ft)

- <.5
- <1
- <1.5
- <2
- <2.5
- <3
- <3.5
- <4
- <4.5
- <5
- <5.5
- <6

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