



Glen Rock
New Jersey

Hazard Vulnerability Assessment Study of the Master Plan

Draft Review

April 4, 2024



BURGIS
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Ketrace

Bergen County | New Jersey

Hazard Vulnerability Assessment Study (HVAS)

The Municipal Land Use Law (MLUL), (N.J.S.A. 40:55D-28b.(2)(h)), requires adopting a land use element after 2021, to include a climate change related hazard vulnerability assessment study

HVAS Study Outline

1. Analyze current and future threats and vulnerabilities associated with climate change-related natural hazards.
2. Data. utilizing most recent natural hazard projections and best available science provided by the New Jersey DEP and FEMA.
3. Build-out analysis projecting future development, and an assessment of the threats and vulnerabilities.
4. Identify critical facilities including infrastructure for evacuation purposes, resiliency and sustaining quality of life for residents.

HVAS Study Outline

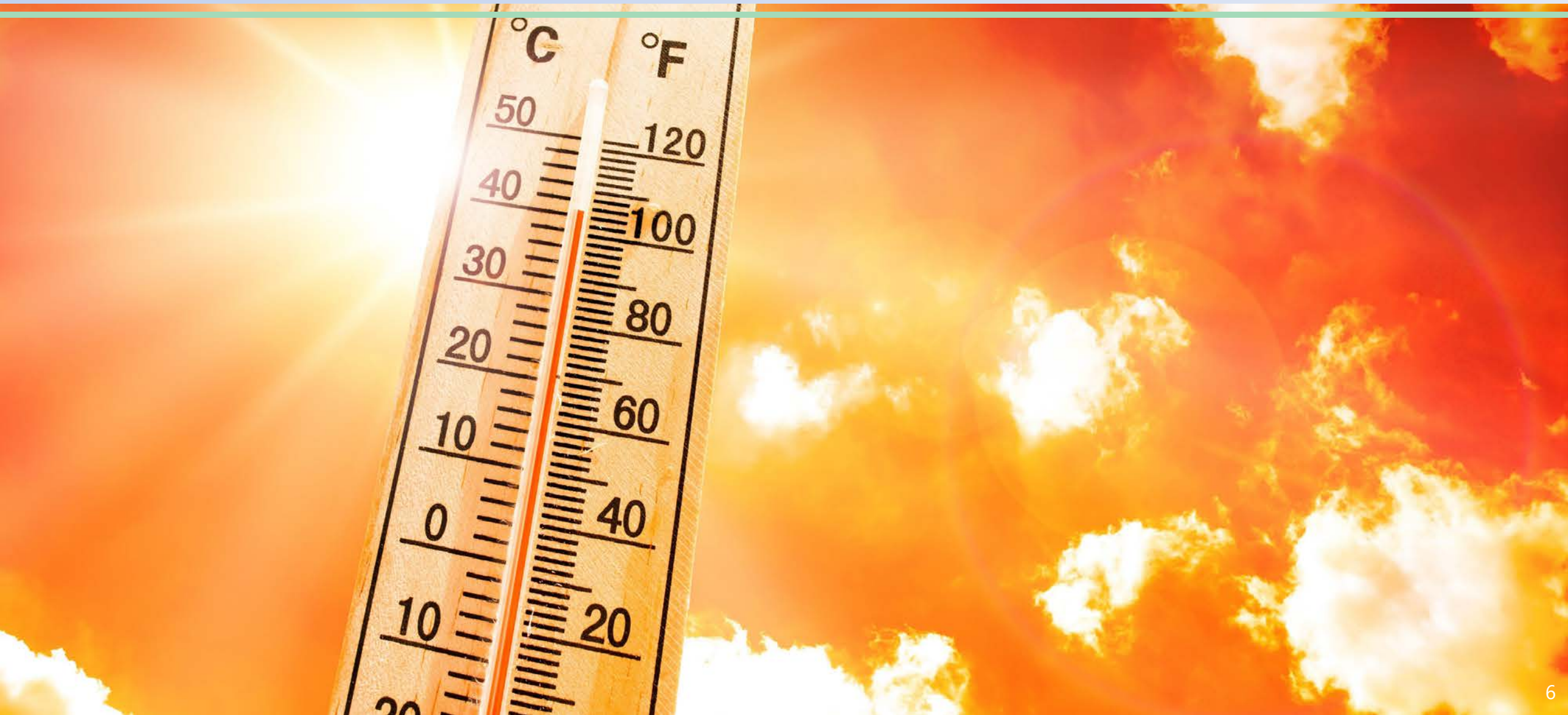
5. Compile strategies and design standards to reduce or avoid risks.
6. Master Plan review of potential impact by natural hazards on relevant parts of the borough's master plan.
7. Adopt policy statements related to climate-change related hazard vulnerability.

Threats and Vulnerabilities

The background of the slide features a close-up, top-down view of water with numerous ripples. The water is a deep teal or blue-green color, and the ripples are concentric circles of varying sizes, creating a textured, shimmering effect. The lighting is bright, causing some highlights on the peaks of the ripples.

1. Increased Temperatures
2. Shifts in Precipitation and Flooding.
3. Drought and Related Effects.
4. Frequency of Events.

Increased Temperatures



Increased Temperatures

The background of the slide is a composite image. On the left side, there is a vertical thermometer with two scales: Celsius on the left and Fahrenheit on the right. The red liquid in the thermometer is rising, indicating a high temperature. On the right side, there is a map of the world, with the continents of North and South America visible. The overall color palette is warm, with shades of orange, yellow, and light blue.

- Significant evidence that the earth's atmosphere has and will continue to warm due to an increase of carbon dioxide (CO₂) and other greenhouse gases.
- Warming of the atmosphere contributes to increased weather-related events such as heat waves, warm weather storms, global sea level rise temperature anomalies and potential ecological changes.

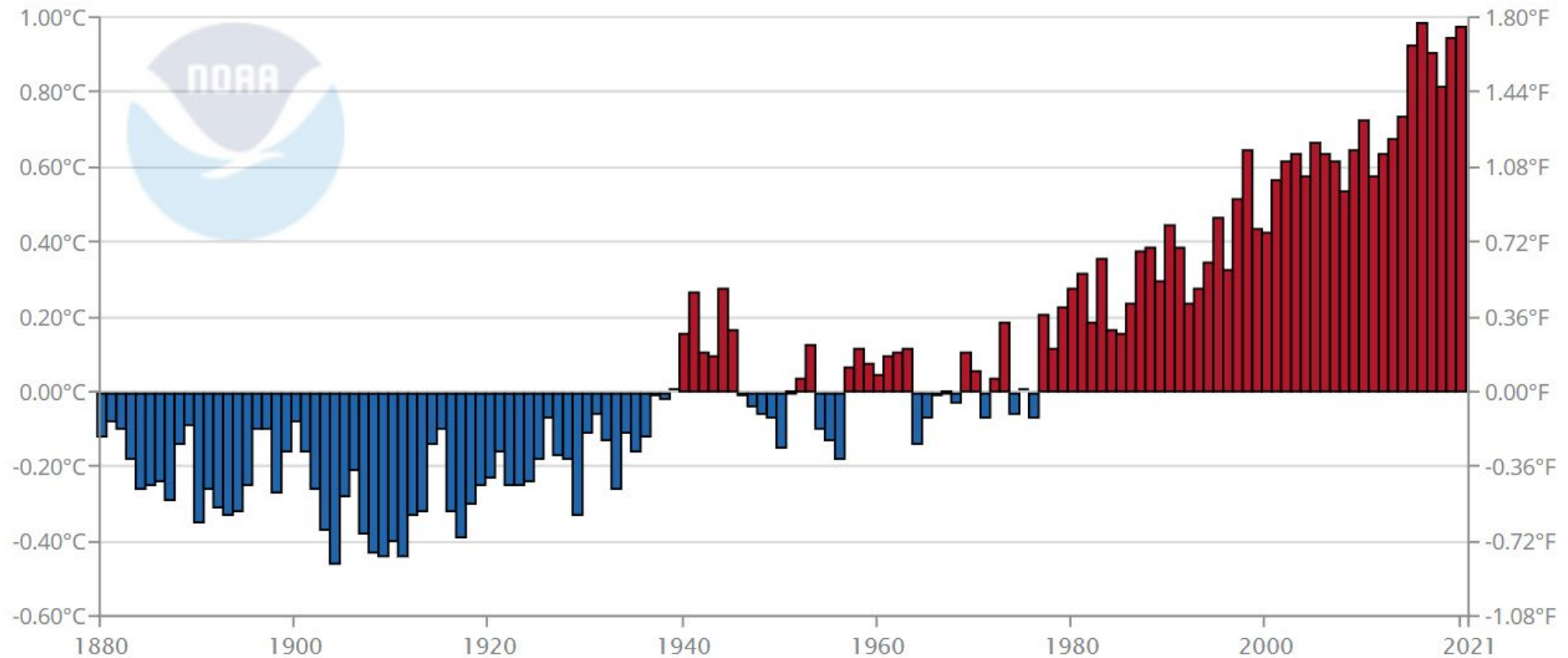
Increased Temperatures

- The 10 warmest years in the historical record have all occurred in the past decade (2014-2023). National Oceanic and Atmospheric Administration (NOAA),
- *"Heat has been the leading cause of weather-related deaths in the United States"* over the last 30 years. National Oceanic and Atmospheric Administration (NOAA),
- Extreme heat days are defined as *"a period of high heat and humidity with temperatures above 90 degrees for at least two to three days"* Heat.gov

Increased Temperatures

Global Land and Ocean

January–December Temperature Anomalies



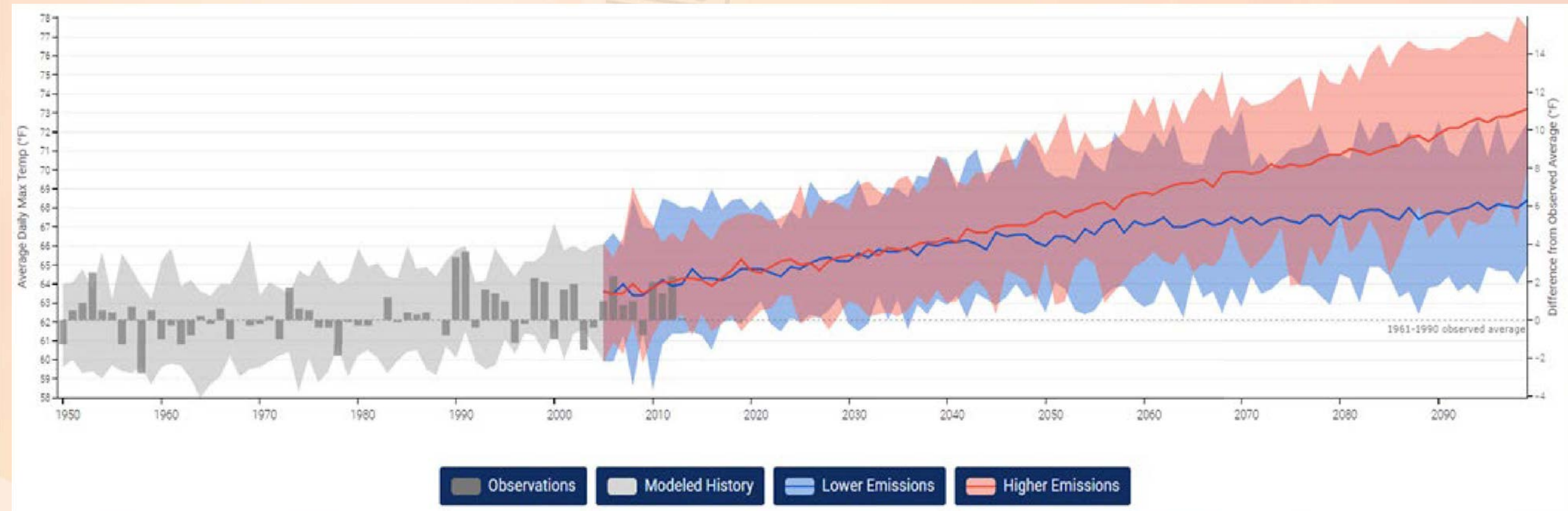
Yearly surface temperature compared to the 20th-century average from 1880–2023. Blue bars indicate cooler-than-average years

Increased Temperatures

Projections:

- Lower-Emission Projections: reducing emissions of global heat-trapping gases to a level of 0 by the year 2040 (RCP 4.5 by the IPCC 2018a).
- Higher-Emission Projections: global heat trapping gases increase through to the year 2100 (RCP 8.5 by the IPCC 2018a).

Increased Temperatures



Increased Temperatures

Indicator	Modeled History (1976-2005)	Early Century (2015-2044)		Mid-Century (2035-2064)		Late Century (2070-2099)	
		Lower Emissions Model Min-Max	Higher Emissions Model Min-Max	Lower Emissions Model Min-Max	Higher Emissions Model Min-Max	Lower Emissions Model Min-Max	Higher Emissions Model Min-Max
Temperature Thresholds							
Annual days with max. temperatures >90°	14 days 11-16	27 days 17-37	29 days 18-38	35 days 19-52	42 days 22-58	43 days 24-66	72 days 30-97
Annual days with max. temperatures >95°	3 days 2-3	8 days 4-14	8 days 4-12	11 days 5-21	16 days 6-25	16 days 6-32	39 days 9-65
Annual days with max. temperatures >100°	0 days 0-0	2 days 0-4	2 days 1-4	3 days 1-7	4 days 1-10	4 days 1-7	15 days 2-35
Annual days with max. temperatures >105°	0 days 0-0	0 days 0-1	0 days 0-1	0 days 0-2	1 days 0-3	1 days 0-3	5 days 0-17
Annual Temperature							
Annual single highest max. temperature °F	97° 96-98	100° 98-103	100° 98-103	101° 99-106	103° 99-107	103° 99-107	107° 99-113
Annual highest max. temperatures ave. over 5 days °F	91° 91-92	94° 92-98	95° 93-97	96° 93-99	97° 94-101	97° 93-102	102° 95-108
Cooling degree days (CDD) (Above 65 °F)	921 degree days 875-991	1,233 degree days 1,018-1,539	1,263 degree days 1,052-1,478	1,389 degree days 1,107-1,749	1,537 degree days 1,170-1,873	1,555 degree days 1,140-2,012	2,169 degree days 1,433-2,784

Increased Temperatures

Lower Emission Projections:

- Cooling Degree Days (65°F+) projected to increase 33 %.
- An increase of 92% in the annual days above 90 degrees in the early century.
- Planning for these extreme heat events will necessitate greater demand on energy infrastructure, water supply and health or community services.

Precipitation & Flooding



Precipitation & Flooding



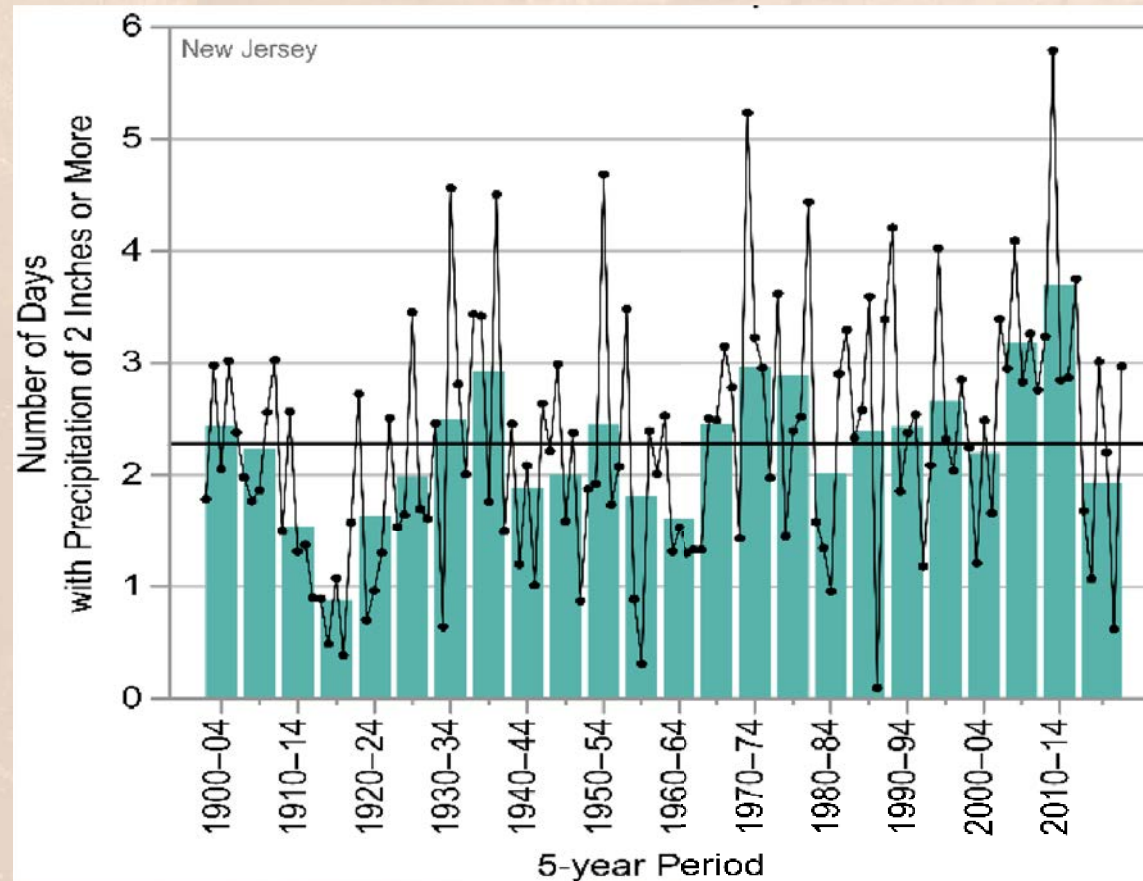
- Climate change anticipated to increase substantial rain events and severe weather conditions.
- These events can bring
 - greater overall precipitation amounts,
 - more rainfall events in a shorter period of time before drainage can convey them or
 - increased frequency between subsequent severe events.

Precipitation

- NJ yearly rainfall -north and central: 49 inches average.
- 2020 NJDEP Scientific Report on Climate Change: Annual precipitation projected, to increase by approximately 5 to 7.5 % by the end of the century. Some local projections up to to 11 % by 2050.
- NOAA's-NCEISC summaries notes annual precipitation for New Jersey has been +/- 3.7 inches above average over the past 16 years.

Precipitation

Number of days with rainfall of 2+ inches or more



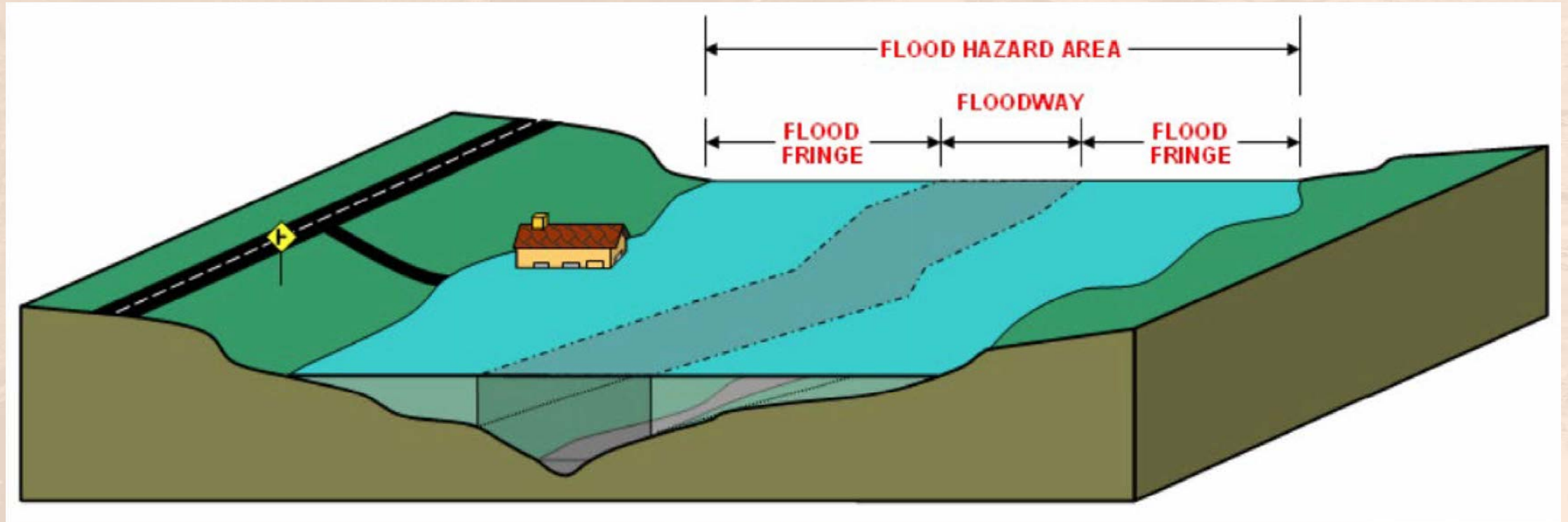
Source: NOAA-National Centers for Environmental Information-State Climate Summaries, NJ 2022
Dots indicate annual values, bars show averages of 5-year periods, horizontal black lines indicate long term averages.

Precipitation & Flooding-(NJDEP)

- NJDEP Flood Hazard Area. 2023-Design flood elevation (DFE): 100-year flood plus an additional 2 feet where elevation known or plus 3 feet where not established to account for amount of projected rain events.
- This additional amount of water provides a factor of safety in cases when the 100-year flood is exceeded.
- Structures, fill and vegetation that are situated on land that lies below the flood hazard area design flood elevation are described as being "in" or "within" the flood hazard area.

Precipitation & Flooding

What is a flood hazard area?



Source: Basics of Floodplain Management and Planning in New Jersey

Precipitation & Flooding



Precipitation & Flooding

- Flood Hazard Areas : Coincide with the Ho-Ho-Kus and Diamond Brook.
- NJDEP Fall of 2022: Designs based on current FEMA flood mapping are not protective for current and future conditions. They reflect prior flooding patterns and does not reflect influences of climate change.
- Hurricane Ida: Average elevations of 3.1 feet above FEMA's 100-year flood elevation.

Project Title: **2023
Climate Change Related
Hazard Vulnerability
Assessment**

Borough of Glen Ridge
Bergen County, New Jersey



Legend

- Municipal Boundary
- Surrounding Municipalities
- Parcels
- Floodway
- AE Zone
- Wetlands
- Wetlands 50ft Buffer
- Flood Hazard + 3ft
- Streams
- Slopes < 15%
- Steep Slopes > 15%



Map Title: **Environmental Constraints plus
Climate Adjusted Flood Elevation**

Graphic Scale
0 275 540 1,080 Feet

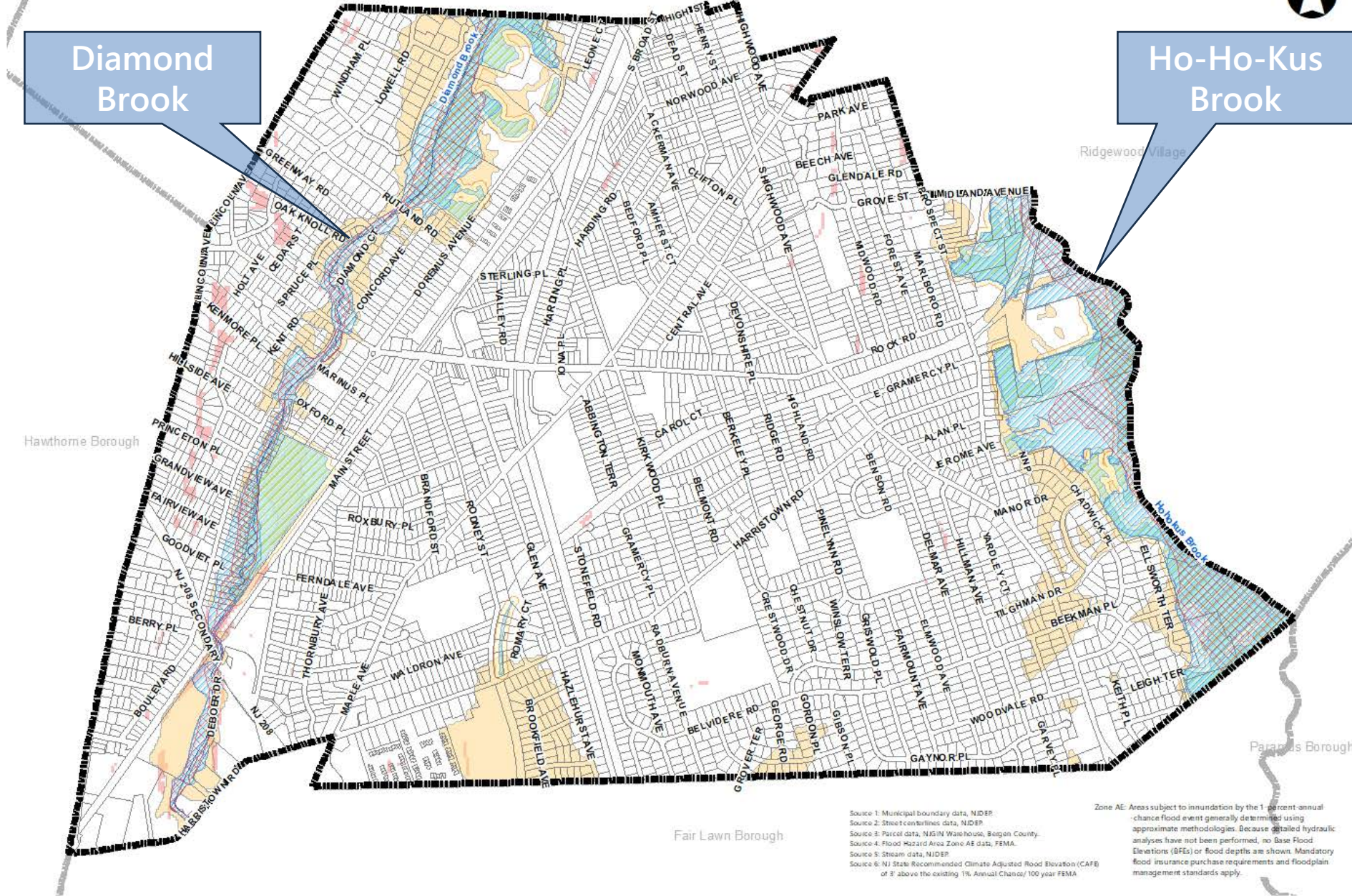
Joseph H. Burgis, III, AICP
Professional Planner
New Jersey License # 2-4102

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Sheet No: 1 of 1
Date: 11.2.23
Drawn: JH
Scale: 1" = 500'

Map No: WYCKOFF-2023-01
WYCKOFF-2023-01
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Diamond Brook

Ho-Ho-Kus Brook



Hawthorne Borough

Ridgewood Village

Parsons Borough

Fair Lawn Borough

Source 1: Municipal boundary data, NIDEP
Source 2: Street centerlines data, NIDEP
Source 3: Parcel data, NJGIS Waterhouse, Bergen County
Source 4: Flood Hazard Area Zone AE data, FEMA
Source 5: Stream data, NIDEP
Source 6: NJ State Recommended Climate Adjusted Flood Elevation (CAFE) of 3' above the existing 1% Annual Chance/100 year FEMA

Zone AE: Areas subject to inundation by the 1-percent annual chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Drought & Related Impacts

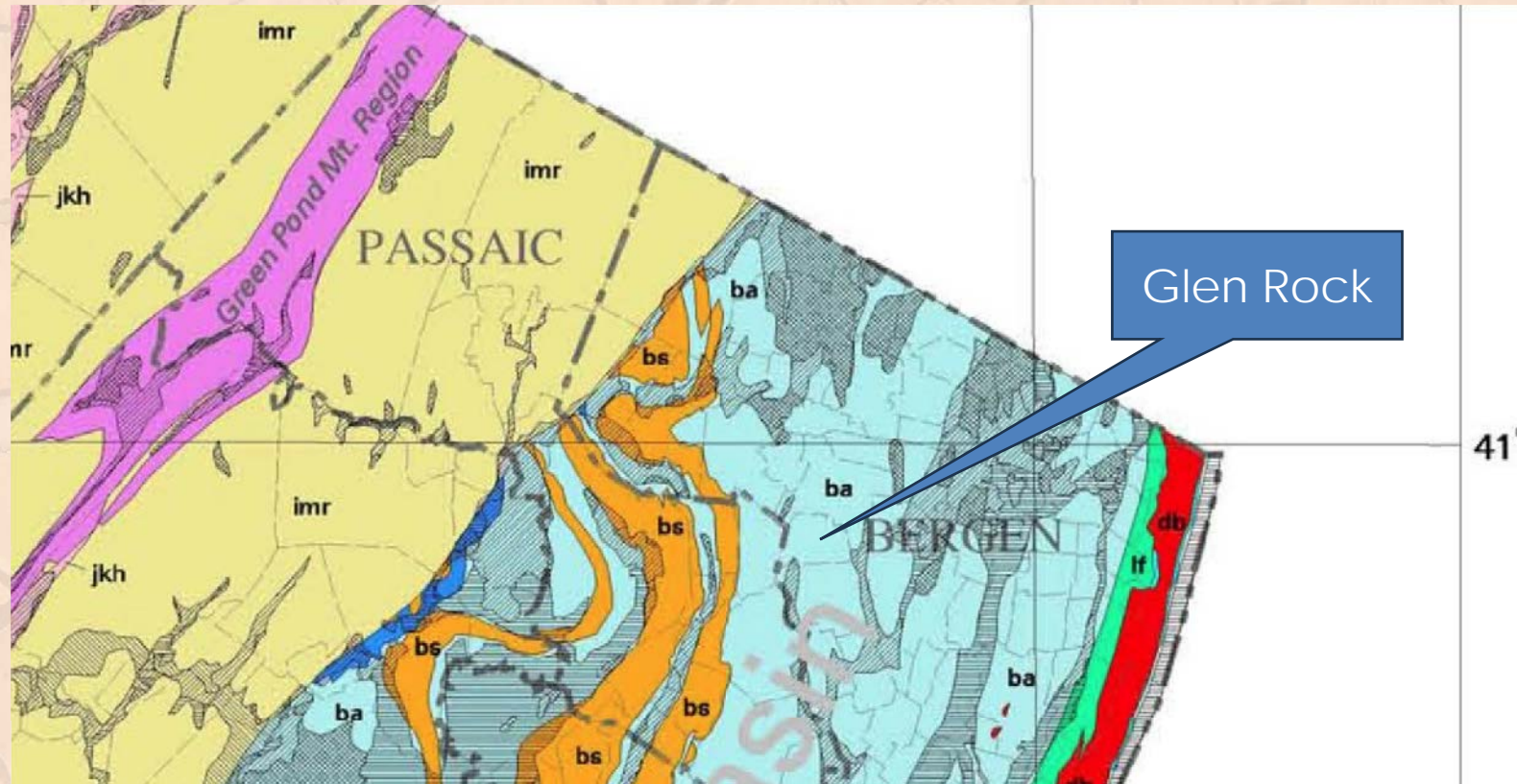


Drought & Related Impacts

- Borough's water supply is provided by Ridgewood Water wells that draw groundwater from the Brunswick Aquifer.
- Increase in drought conditions- impacts potable water supply and potentially water quality.
- While the northeast region of NJ has not experienced as many drought events as other areas, a warming climate can rapidly impact water resources.

Drought & Related Impacts

Brunswick Aquifer



ba
bac

Brunswick aquifer [C] - Sandstone, siltstone, and shale of the Passaic, Towaco, Feltville, and Boonton Formations. Ground water stored and transmitted in fractures. Water is normally fresh, slightly alkaline, non-corrosive and hard. Calcium-bicarbonate type waters dominate. Subordinate calcium-sulfate waters are associated with high total dissolved solids. Includes conglomerate facies (bac) along the northwest margin of the basin.

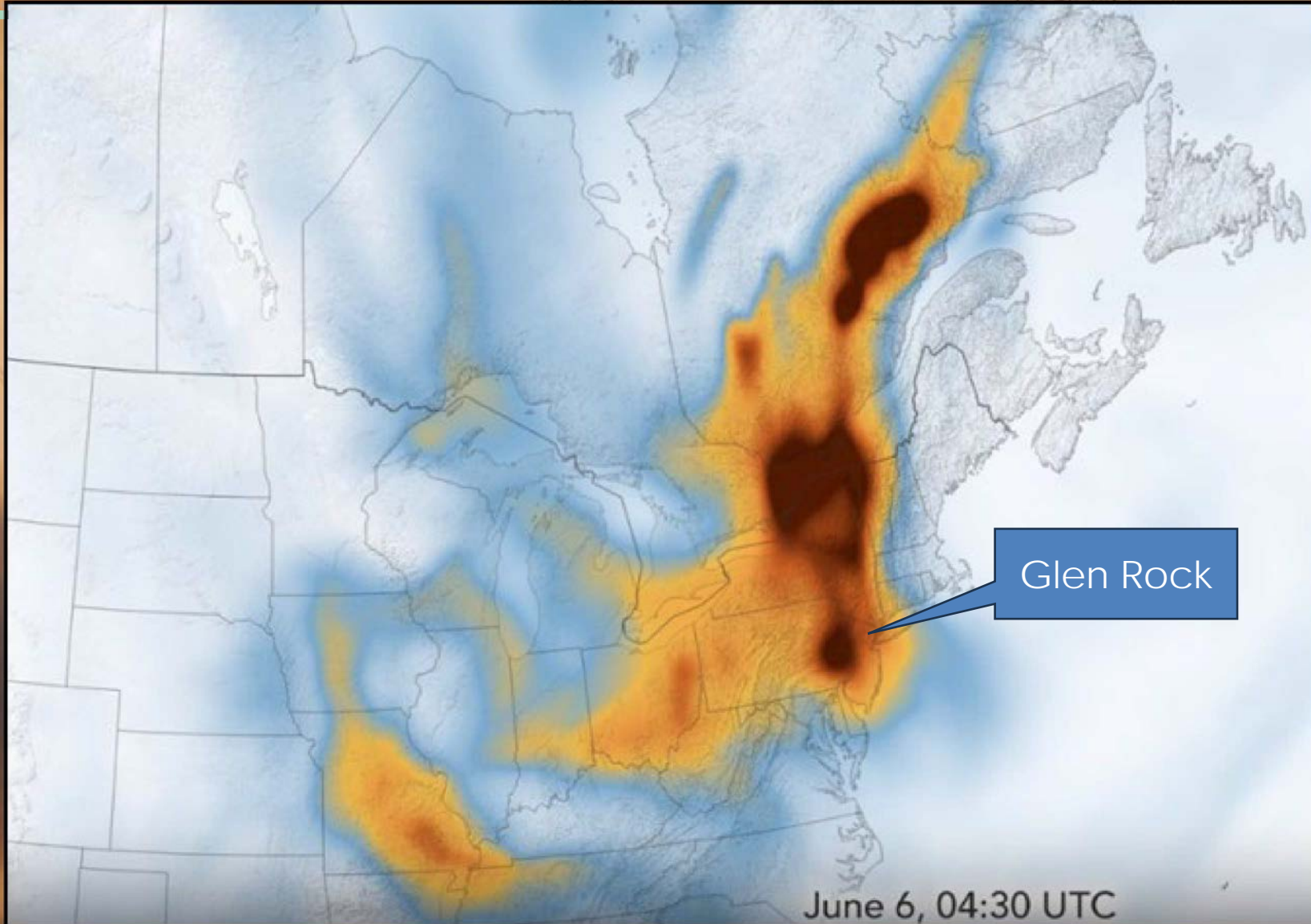
Related Impacts-Wildfires



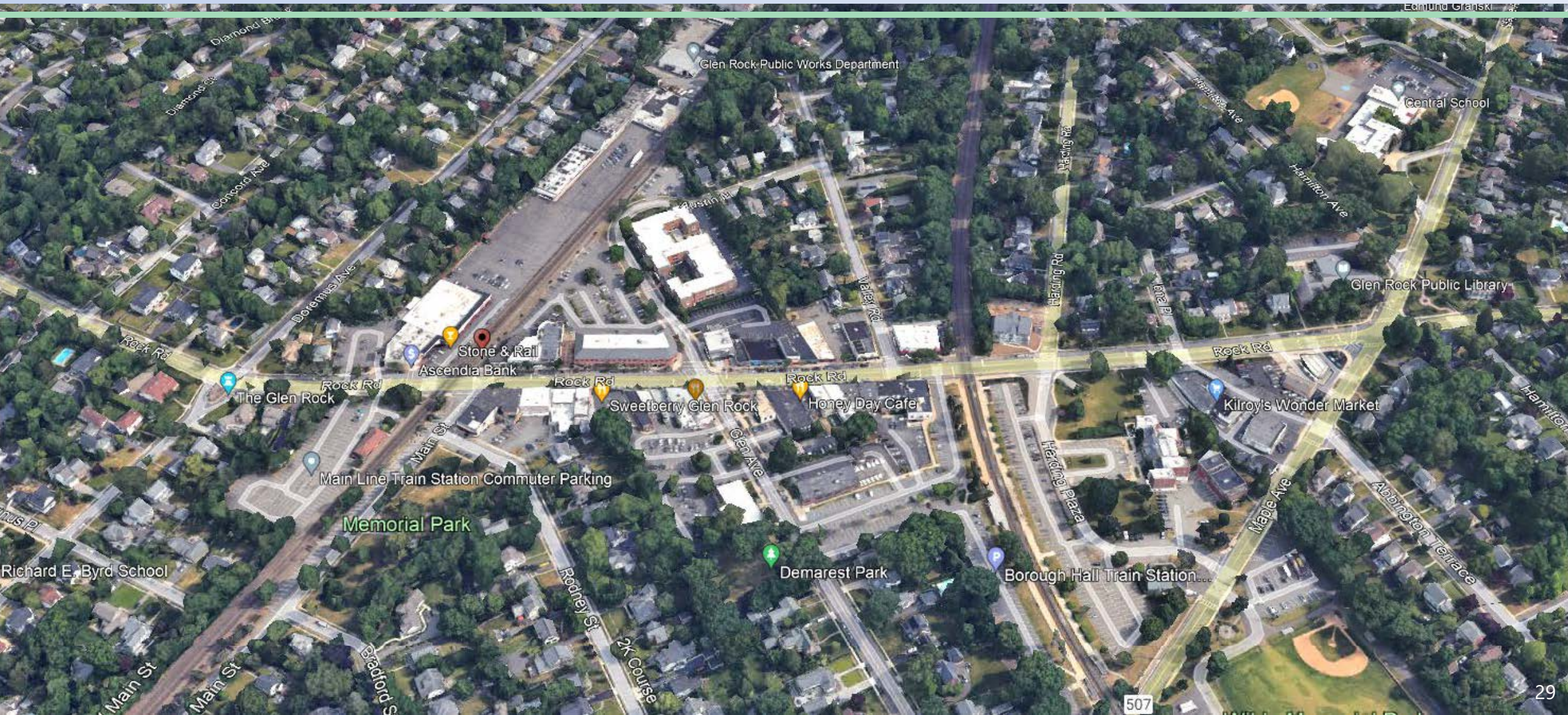
Related Impacts- Wildfires

- While the Borough of Glen Rock is mostly developed and not particularly prone to forest wildfires, some regional areas could be prone to fires.
- Drought conditions can lead to a heightened risk of wildfire hazards.
- A wildfire in the region surrounding the Borough could have residual impacts on air quality impacting susceptible populations within the Borough.

Related Impacts-Wildfires



Build Out Analysis



Build Out Analysis

An aerial photograph of a residential neighborhood, likely in Honolulu, Hawaii, showing streets, buildings, and green spaces. The image is semi-transparent, serving as a background for the text. Labels like 'Honokus Brook' and '507' are visible on the map.

- Buildout analysis projects development built on every available parcel of land as allowed by local and state regulations.
- Applies established zoning criteria to existing vacant lots and areas.

Build Out Analysis

Table 2: Vacant Tracts Buildout Analysis

B	L	ZONE	AREA (SF) BEFORE ENVIRO*	AREA (ACRE) BEFORE ENVIRO*	BUILDABLE AREA		MIN LOT AREA (SF)	PERMITTED DENSITY/ FAR	BUILD OUT POTENTIAL (unit / sf)	Comment
					SF	ACRE				
Residential										
21	19	A-2	3,920	0.09	3,920	0.09	11,200	1	0*	Undersized
23	14	A-2	4,408	0.1012	4,408	0.10	11,200	1	0	Undersized
26	8	A-2	5,223	0.1199	5,223	0.12	11,200	1	0	Undersized
121	16	A-2	18,513	0.425	18,513	0.43	NA	1	1	
127	19	A-2	35,966	0.826	25,677	0.59	NA	1	1	
181	3.02	A-2	18,796	0.4315	18,796	0.43	11,200	1	1	
BUILD OUT POTENTIAL # OF UNITS									3	
Commercial										
37	24.02	C-3	3,920	0.09	3,920	0.09	NA	0.5	1,960	
BUILDOUT POTENTIAL # OF COMMERCIAL SQUARE FEET									1,960	

*Environmentally Constrained areas were removed from each parcel to calculate "buildable area."

Source: MOD IV parcel data, NJ Office of Information Technology, Office of GIS.



Diamond Brook

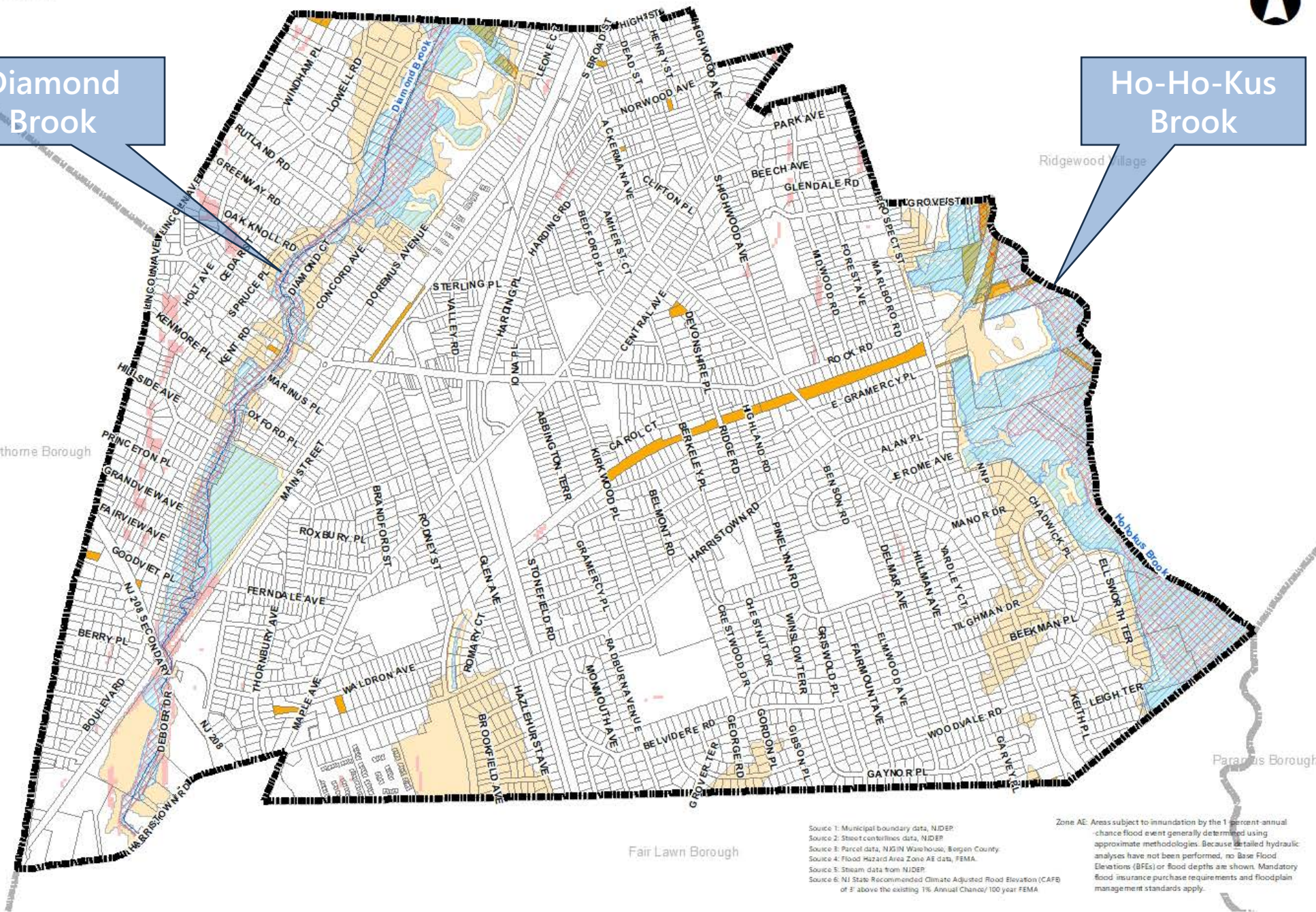
Ho-Ho-Kus Brook

Ridgewood Village

Paradis Borough

Hawthorne Borough

Fair Lawn Borough



2024
 Climate Change Related
 Hazard Vulnerability
 Assessment

Borough of Glen Rock
 Bergen County, New Jersey



- Legend**
- Municipal Boundary
 - Surrounding Municipalities
 - Parcels
 - Floodway
 - AE Zone
 - Flood Hazard + 3 ft
 - Wetlands
 - Wetlands 50 ft Buffer
 - Slopes < 15%
 - Steep Slopes > 15%
 - Streams
 - Vacant Parcels

Year	Description	Scale	Units
1988	1988 Flood Hazard	1" = 100'	Feet
2006	2006 Flood Hazard	1" = 100'	Feet
2013	2013 Flood Hazard	1" = 100'	Feet
2024	2024 Flood Hazard	1" = 100'	Feet

Legend
 Vacant Parcels /
 Environmental Constraints
 and Climate Adjusted
 Flood Elevation (CAFE)



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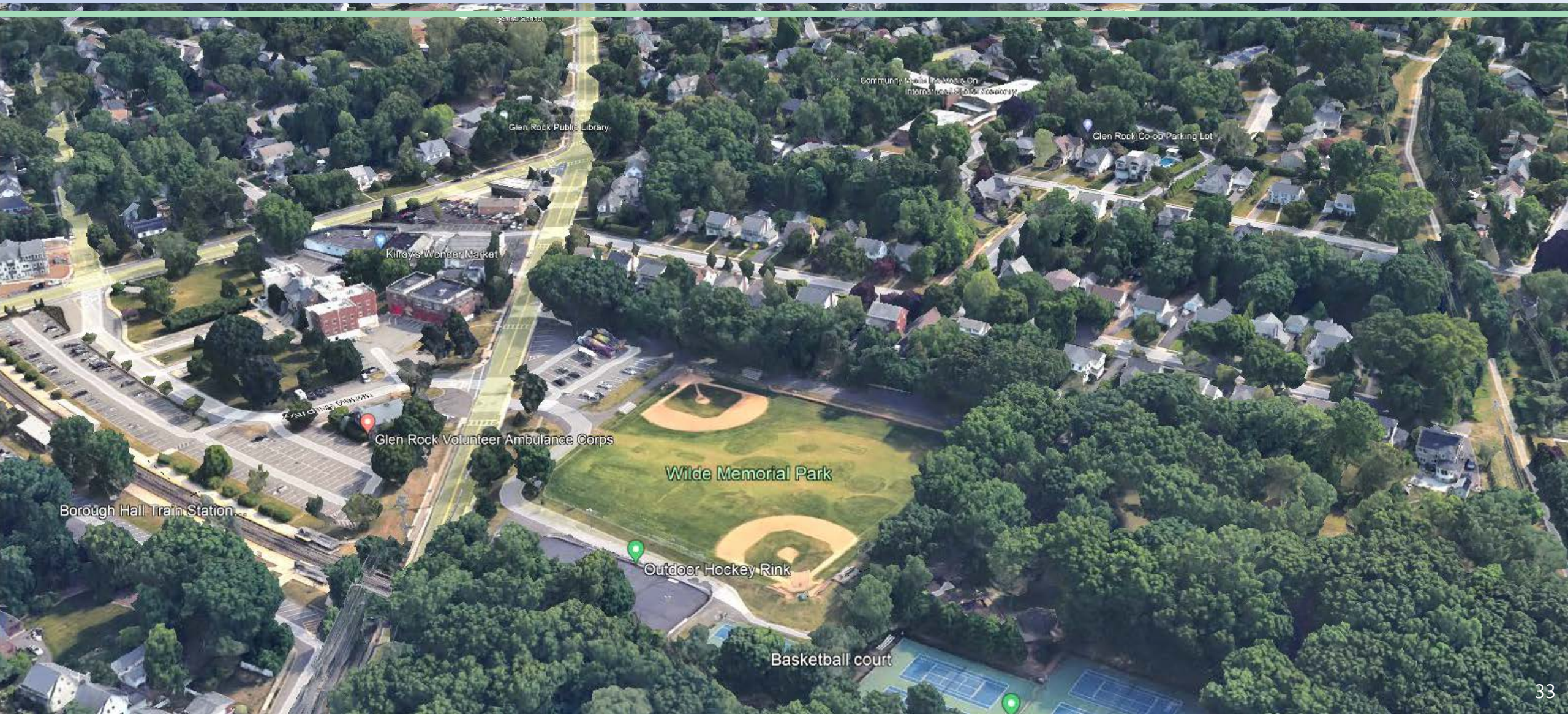
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 Sheet No: 1 of 1
 Date: 11-28-24
 Drawn: JH
 Scale: 1" = 100'

Drawn by: JH
 Checked by: JH
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Source 1: Municipal boundary data, NIDEP
 Source 2: Street centerlines data, NIDEP
 Source 3: Parcel data, NJGIN Warehouse, Bergen County
 Source 4: Flood Hazard Area Base Zone AE data, FEMA
 Source 5: Stream data from NIDEP
 Source 6: NJ State Recommended Climate Adjusted Flood Elevation (CAFE) of 2' above the existing 1% Annual Chance/100 year FEMA

Zone AE: Areas subject to inundation by the 1 percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Review of Critical Facilities

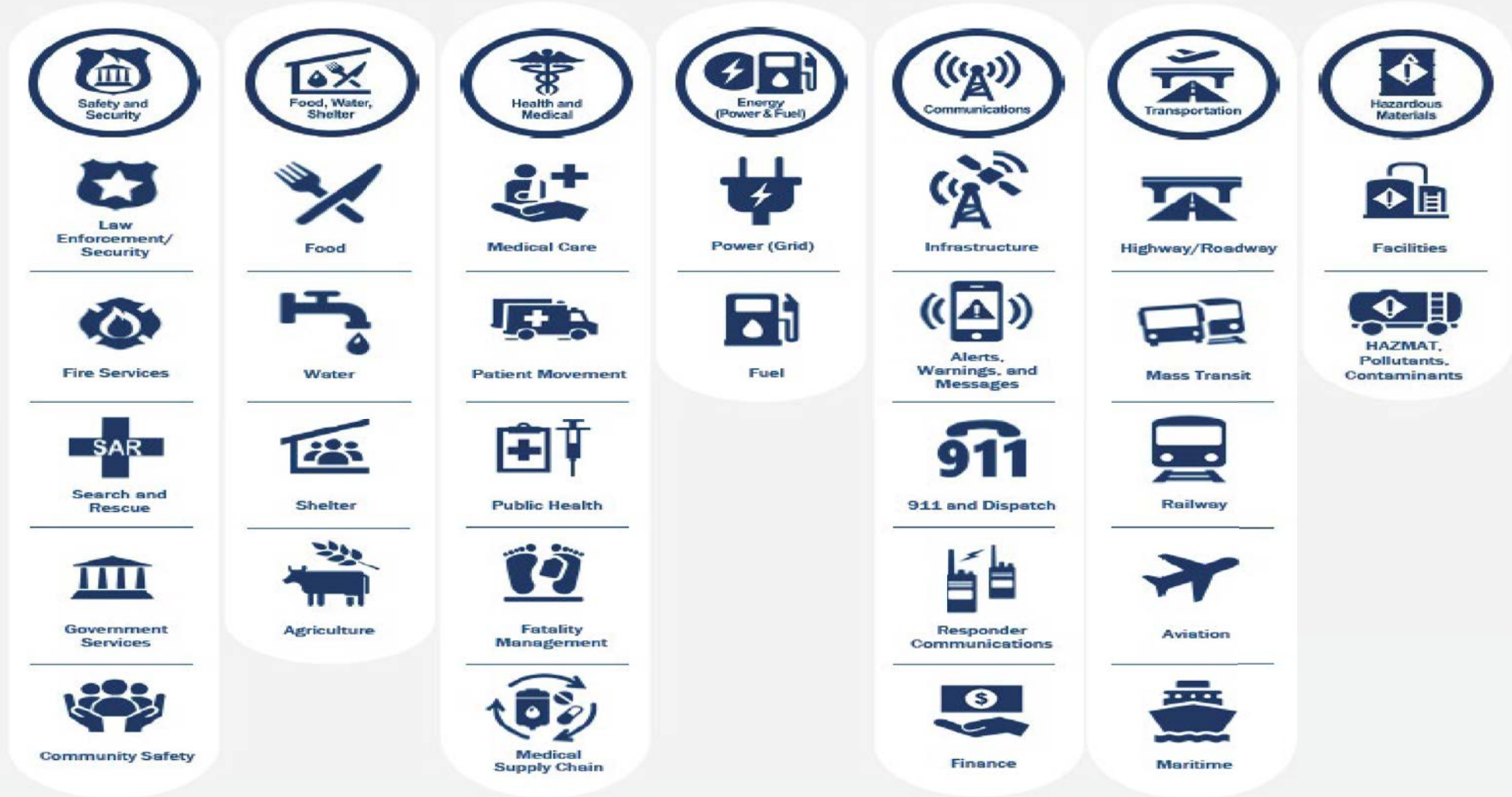


Review of Critical Facilities

- Federal Emergency Management Agency (**FEMA**) :
 - Community lifelines construct for effectiveness in disaster operations.
- Outlines potential critical facilities for decisive intervention.
- Prioritizes and outlines critical business and governmental functions essential for human health and safety or economic security.

Review of Critical Facilities

COMPONENTS of Lifelines



Review of Critical Facilities

- Vulnerable Borough Government Services:
 - No projected municipal building or facility impacts identified.
 - Need for pumping station resiliency in low lying areas.
 - Parks and recreation: passive parks- Faber Field Complex and Thielke Arboretum, potential for increased flooding impacts.
- Vulnerable Infrastructure:
 - Vehicular Bridges and Culverts of the Ho-Ho-Kus Brook and Diamond Brook.
 - Incidental flooding areas emphasizing need for future drainage improvements.



Project Title: 2023
 Climate Change Related
 Hazard Vulnerability
 Assessment

Borough of Glen Rock
 Bergen County, New Jersey



- Municipal Boundary
- Surrounding Municipalities
- Parcels
- Bridge
- Areas of Localized Drainage Conditions
- Culvert
- Gas Station
- Child care facility
- Ambulance
- Fire Department
- Municipal Building
- Police Department
- Rail Station
- School
- Shelter
- AE Zone
- Streams

Rev	Description	Date	Drawn	Out

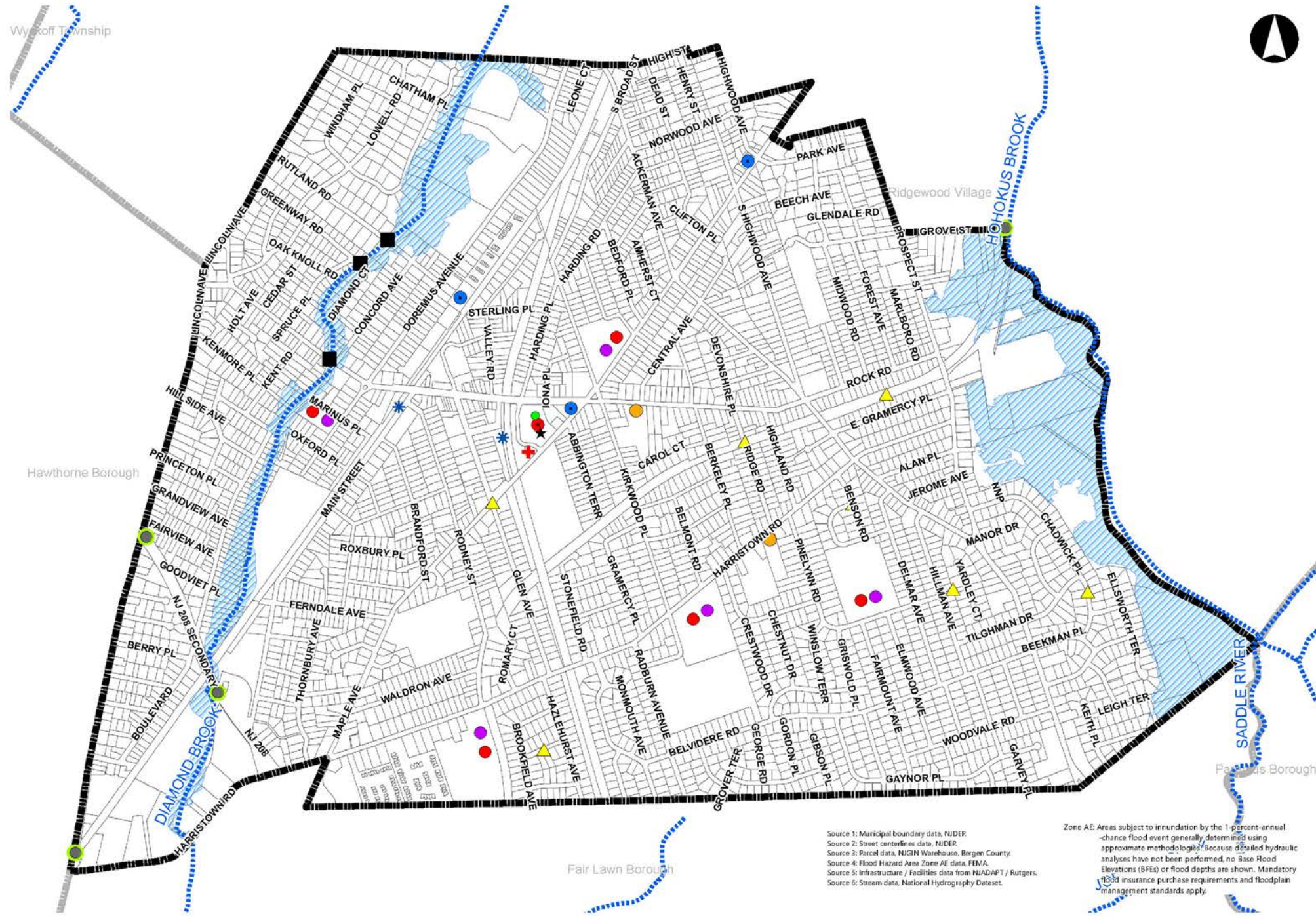
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Critical Facilities



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Project No.: 0883.01
 Sheet No.: 1 of 1
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 Drawn: AE
 Scale: 1" = 827'

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Source 1: Municipal boundary data, NJDEP
 Source 2: Street centerlines data, NJDEP
 Source 3: Parcel data, NJGIN Warehouse, Bergen County
 Source 4: Flood Hazard Area Zone AE data, FEMA
 Source 5: Infrastructure / Facilities data from NJADAPT / Rutgers
 Source 6: Stream data, National Hydrography Dataset

Zone AE: Areas subject to inundation by the 1 percent-annual-chance flood event generally determined using approximate methodologies because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Final Review Categories

5. Strategies and Design Standards implemented to reduce or avoid risks.
6. Master Plan Review the potential impact of natural hazards on relevant components and elements of the master plan.
7. Specific Policy Statements consistency, coordination, and integration of the climate-change related hazard vulnerability assessment.

Strategies and Design Standards

Land Use Policies, Goals and Objectives:

- Support the Master Plan Land Use Plan goals and objectives
- Incorporate green spaces, shade trees, and reflective surfaces to offset the urban heat island effect.
- Incorporate mixed land use and compact development where consistent with master planned efforts and borough context.

Strategies and Design Standards

Land Use Regulations:

- Update Borough flood hazard regulations to align with NJDEP standards.
- Enhance and advance sustainability practices in land use regulations.
 - Encourage energy efficient heating and cooling;
 - Minimizing waste;
 - Incorporating resource-efficient or recycled materials;
 - Promoting water conserving design features.

Strategies and Design Standards

Green Infrastructure:

- Encourage green roofs, green walls, and permeable pavements. To absorb excess heat, reduce surface temperatures, minimize and delay runoff and enhance overall surface cooling.
- Establish and improve community gardens, parks, and green spaces to provide residents with cooling areas such as shade structures and areas for relief during heatwaves.

Strategies and Design Standards

Tree Preservation and Management.

- Manage tree resources on public lands and street rights-of-way.
- Apply for funding opportunities and promote initiatives aimed at tree resource management.
- Continues to participate in the Tree City USA program
- Planting programs planting of trees in public spaces, along streets, and in parks.

Strategies and Design Standards

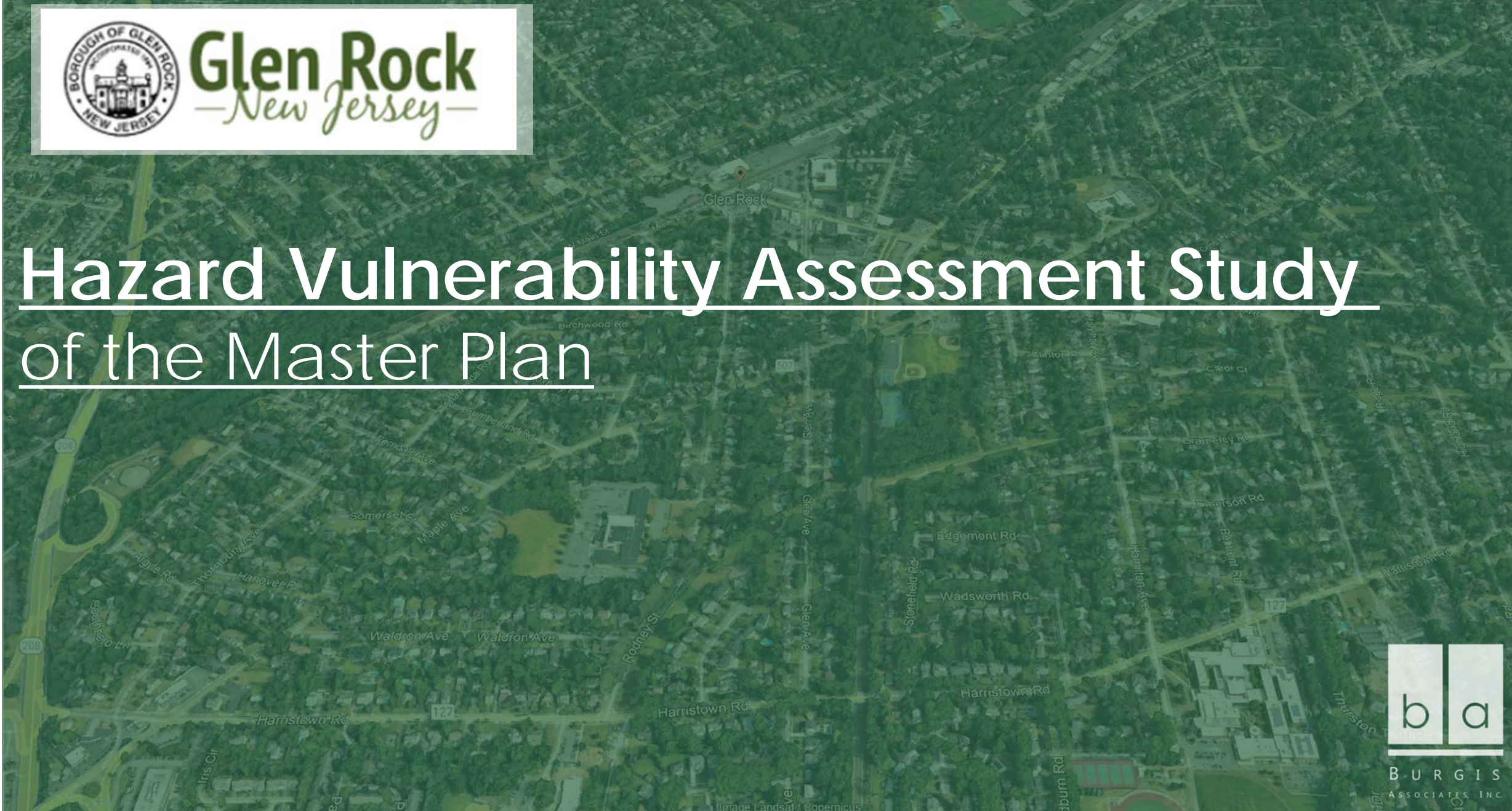
Community Engagement and Vulnerable Populations:

- Engage community organizations to identify and address the needs of vulnerable populations, such as the elderly, fixed income residents, during extreme heat events.
- Develop outreach programs to vulnerable populations to be aware of available resources and assistance.
- Collaborate with local health departments and healthcare providers to develop health-focused interventions and responses to heat or extreme weather events.



Glen Rock
New Jersey

Hazard Vulnerability Assessment Study of the Master Plan



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Input and Q&A -Thank you