A More Resilient Keansburg

Laura Geronimo, Emma Kilkelly, Laura Landau, Anna Marshall, Isabel Rodriguez, Ashlyn Spector & Max Vazquez
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Rutgers University, Bloustein School of Planning & Public Policy

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Link to Additional Resources

Keansburg StoryMap: https://storymaps.arcgis.com/stories/fc5e9ca03da1499f8fd7b9386e607310
Keansburg ArcGIS WebApp:
https://rutgers.maps.arcgis.com/apps/webappviewer/index.html?id=54e15c008b58434da96b7c7f10a0564e

1. Background and Context

1.1 Studio Description

The goal of this report is to help develop a municipal resilience plan for the Borough of Keansburg. The resilience plan will soon be a required component of New Jersey's plan endorsement process, pursuant to Governor Phil Murphy's Executive Order 89 (EO 89). Deliverable 1 in this report is a Flood Risk Assessment highlighting the areas of Keansburg most at-risk. Deliverable 2 is a Social Vulnerability Assessment, serving as an opportunity to consider whether Keansburg's vulnerable populations are affected differently by coastal flooding as compared to the whole community; and whether socially vulnerable populations face different risks compared to other populations within the community (NJDEP 2020).

Among other requirements, EO 89 requires the State Office of Planning Advocacy (OPA) to incorporate findings from the biannual State Climate Change Report into the State Development and Redevelopment Plan through its rules and guidance for municipal planning. OPA administers plan endorsement, a voluntary review process of municipal plans through which local governments can receive technical assistance and prioritization of funding or financing. Per EO 89, a municipality seeking plan endorsement will be required to submit a resilience plan in its self-assessment report, an early step in the process. New Jersey is a home-rule state, meaning most land use decisions are delegated to municipalities. Plan endorsement aims to better coordinate state, county and local government planning actions and goals. To incentivize participation, OPA offers benefits such as lower interest rates for loans, water quality improvement projects, or funding for road improvements.

The Borough of Keansburg has never applied for plan endorsement, but as the report below demonstrates, the town has taken many steps to incorporate resiliency into their planning processes. This report summarizes and builds upon this prior work. These products may be useful if the Borough decides to pursue plan endorsement in the future.

1.2 Background on Keansburg

Keansburg is a one-square-mile borough located in northeastern Monmouth County along the Raritan Bay. Like the rest of Monmouth County, the land that is now Keansburg was originally inhabited by the Lenape Native American Tribe. The area was colonized in 1609 and incorporated as the Borough of Keansburg in 1917. Due to its prime bayfront location, Keansburg became a fishing port and popular summer vacation destination for visitors from New York. Today, Keansburg is a year-round residential community, home to approximately 10,000 people, and remains a prime destination for recreational fishing. Badly damaged during Hurricane Sandy in 2012, the Keansburg Beach stretches over 2.5 miles along the waterfront, featuring a newly restored boardwalk, access to natural beauty, and an amusement park. In 2020, the American Shore and Beach Preservation Association recognized the Keansburg Beach for its beachfront restoration and replenishment program as one of the nation's best restored beaches. Water and access to it is a vital asset to the Borough, but also exposes residents, businesses, and critical infrastructure to potential flood risk.

2. Chapter 1: Flood Risk Assessment

The following section provides a broad assessment of Keansburg's flood risk, based on previous planning work, historical flooding damage and original analyses. The flood risk assessment applied a mixed methods approach using both qualitative and quantitative techniques. We provide an overview of flood risk in Keansburg, describe the municipalities experience during hurricane Sandy, and summarize the flood risk scenarios recommended by the Department of Environmental Protection (NJDEP) that serve as the basis for our GIS analysis. Our team maintained contact with Keansburg's construction official and floodplain manager, Mr. Ed Striedl, who helped us update flood resilience planning efforts that the municipality has undertaken since Sandy. He also provided insights regarding challenges in flood mitigation planning and implementation.

Using the flood risk scenarios suggested by the NJDEP we provide an analysis of the potential flood risk to physical infrastructure in Keansburg, with a focus on residential property and critical infrastructure. The studio considered a broad range of data sources and existing tools for this analysis. Regarding our empirical findings, the studio maintained ongoing communication with Mr. Striedl to ground truth and ensure the accuracy of these empirical findings.

Methodologies, Strengths, and Limitations

Qualitative	- Plan Analysis - Interviews with Floodplain Manager and Emergency Management
Quantitative	- Comparison of data sources and analysis tools - GIS analysis of flood risk to built infrastructure - Data Sources - Monmouth County Building and Parcel data - State of New Jersey Division of Taxation MOD-IV database - Flood layers from NJFloodmapper
Strengths	- Mixed methods approach 'Listening' approach - Ground truthing of empirical findings
Limitations	- Qualitative: Limited number of perspectives - Quantitative - Simplified GIS analysis: Not an in-depth hydrological study - Evolving property assessment due to revaluation process

2.1. Big Picture

As a waterfront community, Keansburg faces flood risks from sea level rise, storm surges and high precipitation events. The risks are accentuated by the Borough's unique "bowl" shape, in which its center sits lower than the rest of the land. Keansburg's flooding problems have been noted to be more serious at the deepest part of this "bowl," which is further accentuated by the town's engineered dunes.

Historically, Keansburg had a body of water in its town center, where the "bowl" bottoms out and flooding problems are most severe (Map 1). The latest available map with the waterbody visible is dated 1901. Next available maps from 1944 no longer show this feature, suggesting the land was filled to allow for development. Understanding the historical topography of the land helps explain why the town is prone to flooding today.

Nearly all (98%) of the town's land area is designated as a Special Flood Hazard Area (Category AE) by the Federal Emergency Management Agency (FEMA). In other words, the majority of Keansburg faces at least a 1% annual chance of flooding every single year. The Borough is most vulnerable to flooding during storm or severe rain events, again, accentuated by its "bowl" topology.

In its Floodplain Management Plan, Keansburg identified three areas affected by repetitive loss due to flooding; collectively, these areas occupy a significant portion of the central and eastern swathes of town. As of 2019, the Borough contains 66 Repetitive Loss properties, which have experienced 138 "losses," meaning flood damage claims. Cumulatively, these properties have received nearly $4.5 million in National Flood Insurance Program (NFIP) payments.

In light of rising water levels and more frequent and intense storms, Keansburg may face an even larger risk of flooding in the future, exacerbated by the area's particular vulnerability to sea level rise (Figure 1). Yet, like other small towns, Keansburg faces staffing and budgeting constraints that shape the ways the town manages its flooding vulnerability. One key way that the Borough has been able to assess and respond to its flood risk has been through post-disaster funding and support -- most recently, as a result of Hurricane Sandy in 2012.

2.1.1. Historical Flooding: Hurricane Sandy

In October of 2012, Hurricane Sandy made landfall in New Jersey. The storm moved slowly up the coast causing extensive coastal flooding and storm surge which resulted in extensive damage. Between 2012 and 2013, the Borough received $4 million in FEMA Public Assistance funding for structural repairs and reconstruction, in addition to over $2.6 million in Individual Assistance support for basic household and individual needs after the storm. In NFIP claims alone, the Borough racked up nearly $41 million in losses (FEMA, 2019).

In the 1960s, the U.S. Army Corps of Engineers built a 2.6-mile-long dune around Keansburg Beach to prevent the town from flooding. Six decades later, Hurricane Sandy substantially damaged the dune, leading to major flooding and structural damage. The protective dune breached in two locations: Lawrence Avenue and Raritan Avenue (Map 2).

The powerful storm surge and high tide combined with the increasing sea level rise proved too powerful for the dune to fully protect Keansburg. According to the 2015 Master Plan Re-examination, about 50% of the structures in the Borough were inundated with flood waters ranging from two to six feet. The resulting structural damage, lingering floodwaters and roughly 40,000 cubic yards of debris

hindered the town's ability to respond. At least 22 roads were obstructed or flooded enough to prevent circulation of emergency vehicles, while structural damage rendered the Police Department inoperable. Meanwhile, some residents were left without power for upwards of two weeks after the storm. Five homes were destroyed and 347 were substantially damaged.

The values of 1,300 properties dropped as a result of Hurricane Sandy. Many businesses temporarily closed after the storm, but by 2015, some had yet to reopen. At that time, Keansburg experienced a 5.3% loss in home values and tax revenues. As also noted in the 2015 Floodplain Management Plan, damage to residential properties was the largest source of structural damage and tax loss for the Borough. To date, 25 properties remain to be demolished as a result of the storm, which could cost the town $20,000 per demolition (personal communication with floodplain manager).

Figure 1: Sea Level Rise in New Jersey

Sea Level Rise in New Jersey

Between 1979 and 2019, sea levels along New Jersey's coastlines increased at an average annual rate double that of the entire planet's: 0.2 inches per year, compared to 0.1 inches, respectively (NJ STAP report, 2019). Sea level rise is a particular concern in New Jersey because of natural land subsidence and anthropogenically-influenced factors, like the effects of climate change.

Natural subsidence is primarily occurring through a phenomenon known as **Glacial Isostatic Adjustment**. In the last Ice Age, mile-thick ice sheets covered North America as far south as New Jersey. The extreme mass of this ice temporarily altered subsurface layers of the earth. A bowl shape was formed where the ice lay, and the displaced materials were pushed to the outer edges creating a bulging area of land, where New Jersey now resides. After the ice sheet melted, the weight lifted, and the subsurface layers slowly began to rebound back to their original shape. This allows the bowl-shaped area to rise back up, but also means the bulging sides are lowering back to the original height.

Global climate change is contributing to changes in historical weather patterns, increased intensity and frequency of storm events and sea level rise. A main contributor of global climate change is anthropogenic, or human-released, carbon dioxide emissions into the Earth's atmosphere. Excessive emissions intensify the Earth's greenhouse effect, which leads to an overall warming of atmospheric temperatures. Increased temperatures melt ice caps and glaciers, and as the ocean absorbs more heat, water expands and take up more space. Melting ice and ocean thermal expansion are the main causes of sea level rise. If carbon emissions continue at a moderate rate, coastal New Jersey is projected to see increased sea levels ranging from 1.4 to 3.1 feet by 2070, and 2.0 to 5.2 feet by 2100. (NJ STAP report, 2019).

2.1.2 Flooding Scenarios

For the purposes of this studio, this analysis considers future flooding scenarios for the years 2050 and 2100, as advised by NJDEP. These scenarios are based on moderate global emissions projections developed by the Intergovernmental Panel on Climate Change.

Table 1: Flooding Scenarios

Scenario	Description	Data Source
3' sea level rise	Permanent inundation, including extent of mean higher high water (MHHW).	NOAA Office for Coastal Management
3' sea level rise, plus 1% annual chance flood	Permanent inundation, including extent of MHHW, and projected coverage of 1% annual chance flooding event. Consistent with "10' total water level" in NJFloodMapper.	Rutgers, NJFloodMapper
5' sea level rise	Permanent inundation, including extent of mean higher high water (MHHW).	NOAA Office for Coastal Management
5' sea level rise, plus 1% annual chance flood	Permanent inundation, including extent of MHHW, and projected coverage of 1% annual chance flooding event. Consistent with "12' total water level" in NJFloodMapper.	Rutgers, NJFloodmapper

Under moderate global emissions scenarios, high tide and storm flooding events will become more frequent and reach greater magnitudes. In accordance with Governor Murphy's EO 23 and 89, State agencies must include environmental justice and science-backed climate change projections in their regulations and responsibilities. For plan endorsement, the State Planning Commission is considering new rules and guidance for municipalities to complete climate resilience and social vulnerability plans or reports as part of the municipal self-assessment process.

As the Borough's most destructive flooding event in recent years, Hurricane Sandy serves as a comparison for these projected scenarios. Hurricane Sandy brought four to five feet of floodwaters to Keansburg, but by 2070, such inundation levels will likely become annual occurrences (Kopp et al. 2019). The extent of Hurricane Sandy's storm surge most closely aligns with the 5' sea level rise scenario, which represents permanent inundation of presently dry land. At just three feet of sea level rise, another Hurricane Sandy-level storm surge on top of this would lead to roughly double the amount of flooding – 10 feet, versus four to five feet.

2.2 Previous Flood Resilience Planning

Since Hurricane Sandy, Keansburg has taken steps to assess its own risk to flooding and identify future avenues for improved resilience. The Borough leveraged grants, technical assistance, and voluntary programs both to recover after the storm and to be better prepared for the next one. The following timeline in Figure 2 summarizes all of the resilience planning efforts that the town has participated in since Hurricane Sandy. Small descriptions of each plan are included in Appendix A, as well as tables with status updates on action items obtained from municipal staff through the studio:

Figure 2: Past 10 Years of Hazard and Risk Mitigation Documentation
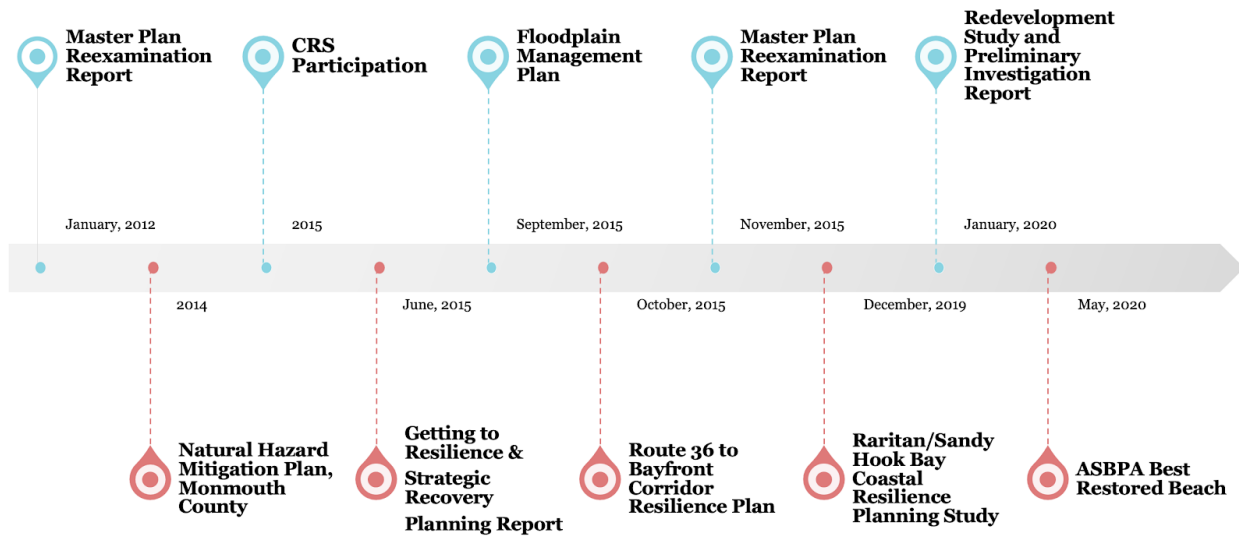
Like many small coastal municipalities, Keansburg relied on post-disaster funding to support this work and has made progress on implementing many of its action items. Hurricane Sandy offered a window into one potential future for Keansburg. In terms of Plan Endorsement, Keansburg has already laid the groundwork for a comprehensive resilience plan. One key takeaway, however, from this previous work should be that the town relied on funding and support as it became available after Hurricane Sandy. In the absence of such funding, consolidating its previous work into a unified document for Plan Endorsement would fall on the Borough alone, which already faces existing capacity and fiscal constraints.

2.3 Current and Future Flood Risk Analysis

The studio used a mixed methods approach to understand the current and future flood risk challenges affecting Keansburg. This process involved regular conversations with municipal staff, as well as spatial analyses of the built environment and its exposure to flood risk under future scenarios.

2.3.1: Background

Keansburg is a primarily residential community: 89% of its 3,300 parcels is classified as residential (Map 3). Majority (86%) of those residences are single family dwellings. Keansburg, however, is a highly developed town, unsurprisingly considering the town's long history. Occupying just one square mile, the Borough hosts around 10,000 residents in 2,656 detached homes, making for a relatively dense community. In a similar vein, much of the town's housing stock was built before 1935, long before any major resilience work or any comprehensive understanding of flood mitigation practices. Retrofitting strategies and other mitigation actions targeted at existing structures may be one avenue for Keansburg to reduce its flood risk.

As a low-lying waterfront community, Keansburg experiences different types of flooding. Keansburg may experience inland flooding from precipitation and creek overflow, coastal flooding from storm events, and permanent inundation due to sea level rise. Hurricane Sandy, for example, brought relatively little rain to the area, but its five-foot high storm surge breached the Borough's dunes, leading to fast and strong floodwaters in the downtown area. In addition, the town can experience high tide, or

"nuisance" flooding. This is especially the case when high tides coincide with heavy precipitation. Nuisance flooding can inconvenience both residents and businesses, as well as disrupt essential functions. People may need to move their cars out of flood-prone areas, and they may be forced to walk longer distances and through floodwaters to reach their homes or businesses. These situations illustrate the frustrations and inconveniences that accompany the slow creep of flooding related to sea level rise. Permanent inundation from sea level rise can be attributed to both land subsidence and expanding oceans (Figure 1).

The Borough's highly developed built environment emphasizes the community's unique risk of flooding events. Property taxes serve as the Borough's most profitable revenue source. Hurricane Sandy exemplified how flood risks threaten Keansburg's tax base: the town reported a 5.3% loss in property values and tax revenues three years after the storm. The following analyses on property and critical infrastructure dives deeper to identify Keansburg's assets and vulnerabilities today and in the future.

2.3.2 Future Scenario Analysis

To better understand Keansburg's future flood risks, the studio used GIS, public data and information provided by the County and NJFloodmapper to examine the four scenarios recommended by NJDEP. The following analysis provides a rough estimate of Keansburg's future flood risks under four pre-identified scenarios (Map 4, 5, 6 and 7). This assessment identifies buildings and parcels that may be affected by flooding but does not attempt to estimate potential damage scale or losses. This analysis is not a hydrological assessment, nor does it account for Base Flood Elevations or already elevated or mitigated structures. Instead, this analysis may be used as an overview of potential flood risk exposure in Keansburg. Please see Appendix A for detailed notes on methodology, data sources and limitations.

Scenario 1: Estimates of flood risk to buildings under 3ft sea level rise

This scenario refers to permanent inundation from three feet of sea level rise. Under this scenario, 826 buildings may face potential risk of flooding, representing 25% of Keansburg's total building stock (Table 2). The area most at risk coincides with Keansburg's "bowl" topology, just behind the beach and along Route 56 (Carr Avenue), an important commercial corridor in Keansburg. This analysis estimates that 32 commercial buildings may be affected by inundation, as well as 11 publicly-owned properties and over 700 residences. Most of those dwellings, notably, are single-family homes, but several multi-family structures are also at risk, including four larger apartment buildings and 75 multi-family structures.

This analysis estimates that these 826 buildings constitute 20% of Keansburg's tax base, with a net taxable value of over $105 million (see Table 2 below). Majority of structures affected by this scenario are residential, which are both the primary land use in Keansburg as well as a primary source of municipal revenues, providing funds for schools, public works, and other local services.

Scenario 2: Estimates of flood risk to buildings under a 3ft SLR + 1% annual chance flood [represented as "10 total water level"]

This scenario refers to permanent inundation from three feet of sea level rise, plus water levels from a 1% annual chance flood. A much broader area of Keansburg is affected. As much as 68% of the municipality's net tax base could be at risk, and over 80% of structures would be affected by inundation. (see Table 2 below).

Scenario 3: Estimates of flood risk to buildings under a 5ft SLR:

This scenario refers to permanent inundation from five feet of sea level rise. Under this scenario, 58% of the municipality's tax base may be affected, as well as 40% of commercial and 65% of residential buildings (see Table 2 below).

Scenario 4: Estimates of flood risk to buildings under a 5ft SLR + 1% annual chance flood [represented as "12 total water level"]

This scenario refers to permanent inundation from five feet of sea level rise, plus water levels from a 1% annual chance flood. Over 90% of Keansburg's tax base would be affected, representing a net taxable value of nearly $480 million. Nearly every building in Keansburg faces flood risks under this scenario.

Table 2: Summary of Future Flooding Scenario Impacts

The following table summarizes the expected impact on land and buildings under different flood scenarios, and how this might affect proportions of the Borough's tax base:

Scenario	Number	(%)	Acreage	(%)	Improvement Value	(%)	Land Value	(%)	Net Taxable Value	(%)
3ft SLR	826	25%	268.77	22%	$ 71,656,600.00	20%	$ 33,792,200.00	19%	$ 105,448,800.00	20%
5ft SLR	2093	63%	705.00	58%	$ 203,870,600.00	58%	$ 100,694,900.00	57%	$ 304,565,500.00	58%
10ft TWL	2723	82%	985.23	81%	$ 291,763,900.00	83%	$ 145,858,500.00	83%	$ 437,622,400.00	68%
12ft TWL	2987	90%	1079.62	88%	$ 320,290,700.00	91%	$ 159,522,000.00	91%	$ 479,305,500.00	91%

Note: A more detailed breakdown of the flood risk scenarios by property classification and dwelling type can be provided upon request. Please also note that these are rough estimates, and also note that the tax assessments are currently going under a re-evaluation, so this data may soon be outdated. Finally, as shown in section 2.4.1, actual property values likely differ from those assessed in the MOD-IV database.

2.3.3: Elevated and Flood-Mitigated Structures Building Analysis

Keansburg officials have worked hard to mitigate flood risks in their community, particularly by ensuring new structures and those undergoing substantial improvements are raised to FEMA-identified Base Flood Elevations (BFEs). Doing so not only lowers Keansburg's potential risk of flood-related damage, but also improves its CRS rating, allowing residents to access lower flood insurance premiums. These lower premiums are important for retaining the affordability of homes in Keansburg. The Borough provided the studio with data on permits issued for elevated, floodproofed and otherwise mitigated buildings. Mitigations can include abandoning water-sensitive uses of first floors or installing drains. Permits issued included both new structures, as well as substantially improved existing ones.

Since 2013, Keansburg issued over 400 permits for elevations and flood mitigation, roughly 63% of which were for elevating existing structures (Figure 3). Most of these elevations were concentrated in Keansburg's "bowl," where flood risks are known to be more severe (Map 8). Just under 40% (170) of these permits reported receiving funds from the Reconstruction, Rehabilitation, Elevation and Mitigation (RREM) Program, a State-run grant to help homeowners rebuild after Hurricane Sandy.

Figure 3: Number of Building Permits Issued for Elevated Structures

	Issued	Completed*
New	151	112
Elevated	272	203
Mitigated	6	5
Unknown	2	2
Total	**431**	**322**

Completed structures identified by issuance of Certificate of Occupancy.

2.3.4 Critical Infrastructure Analysis

To better understand the vulnerability of the community in terms of flooding, we must look at the amount of critical infrastructure at risk. Critical infrastructure in this case is defined as assets necessary for the function of the society and economy. Within our definition of critical infrastructure, we include critical emergency infrastructure and critical social infrastructure. Critical social infrastructure refers to socially important spaces, community assets, and institutions that contribute to the sense of community, as well as provision of services. Critical emergency infrastructure refers to services and facilities that provide essential functions to Keansburg's operations. All of this infrastructure is vital to community well-being, so damages or disruption could impair Keansburg's functions, potentially adversely affecting residents. Map 9 and 10 provide a visual understanding of infrastructure and spaces affected by permanent water inundation at 3 and 5 feet, as well as 10- and 12-foot storm surge values, while Table 3 offers a specific list of all assets mapped.

2.3.4.1 Critical social Infrastructure

Critical social infrastructure refers to socially important spaces, community assets, and institutions that contribute to the connection of the community. To understand the types of social infrastructure Keansburg has, a combination of pre-existing web tools, anecdotes from community members, and internet research was done to accumulate the 20 socially oriented spaces (Table 3). Importantly, many of this infrastructure was identified by the community as being important for community character, Keansburg's identity, and social cohesion. As represented visually in Map 3 and quantitatively in Table 3, over 50% of identified critical social infrastructure will be lost to 5-foot permanent water inundation. As learned from interviews with community members, outdoor recreation is important to Keansburg. Under the 3-foot water inundation level, three out of the five parks will be affected. While green spaces have more flexibility to be of use under flooding conditions (as buffers, or still partly usable if not all of the space is inundated), their loss to the community is of importance. Also, notably, the structures that will remain unaffected by permanent 3- and 5-foot inundation will be three of the four borough's public schools. These schools also serve as emergency shelters, which will be addressed further in critical infrastructure.

Critical emergency infrastructure refers to hospitals, fire stations, emergency responders, and any spaces used in emergency management plans. These assets were mapped to understand their risk from flooding. One half of Keansburg's EMS/Fire, their police department, and all long-term care facilities will be flooded at the 5-foot inundation mark. Due to the older population present in Keansburg, having their long-term care facilities at risk poses a greater social vulnerability problem. Roads were mapped (Map 11) to understand water level risks that will in turn affect how the borough plans evacuation routes and accessibility to parts of the community.

Table 3. Name, address, and infrastructure classification for all assets, buildings, and spaces used in this analysis.

Infrastructure Name	Address	Classification	Infrastructure Type	Notes
Keansburg EMS/New Point Comfort Fire Station	192 Carr Ave	Fire/EMS	Critical	
Keansburg Fire Company #1	13 Manning Pl	Fire/EMS	Critical	
Keansburg Police Department	331 Carr Ave	Police	Critical	
Keansburg Community Health Center	100 Main St	Healthcare	Critical	
Bayshore Senior Day Center	100 Main St	Long Term Care	Critical	
Laurel Bay Health & Rehab	32 Laurel Ave	Long Term Care	Critical	
Bayside Manor	7 Laurel Ave	Long Term Care	Critical	
Resa Treatment Center	199 Main St	Healthcare	Critical	
Water Treatment and Desalination Plant	Frazee Place	Utility	Critical	
The Viking House	109 Main St	Boarding House	Social	
Capuccio's Hotel	2 Maplewood Ave	Boarding House	Social	
Belvedere Hotel	15 Laurel Ave	Boarding House	Social	
Keansburg Municipal Building	29 Church St	Municipal Building	Social	
Keansburg Waterfront Library	55 Shore Blvd	Library	Social	
Keansburg Historical Society Building	59 Carr Ave	Historic	Social	
Caruso Pre-K	161 Ramsey Ave	Childcare	Social	
St. Ann's Childcare Center	121 Main St	Childcare	Social	
Port Monmouth Road School	142 Port Monmouth Rd	Schools	Social	Evacuation Shelter
Joseph C. Caruso Elementary School	81 Frances Pl	Schools	Social	Evacuation Shelter
Joseph R. Bolger Middle School	100 Palmer Pl	Schools	Social	Evacuation Shelter
Keansburg High School	140 Port Monmouth Rd	Schools	Social	
St. Ann's Roman Catholic	311 Carr Ave	Houses of Worship	Social	
St. Mark's Episcopal	247 Carr Ave	Houses of Worship	Social	
First United Methodist	21 Church St	Houses of Worship	Social	
Anchor Bible Church	180 Carr Ave	Houses of Worship	Social	
St. John's Playing Fields	St. John's Pl	Parks	Social	
Forest Park	Forest Ave	Parks	Social	
Donohue Playground	Carr Ave	Parks	Social	
Collins Field	Railroad Ave	Parks	Social	
Friendship Park	Main St	Parks	Social	
St. Mark's Soup Kitchen	247 Carr Ave	Food Banks/Kitchens	Social	
Project Paul	211 Carr Ave	Food Banks/Kitchens	Social	
American Legion	348 Carr Ave	Social	Social	

2.4 Other Relevant Property Characteristics

2.4.1 Property Values

Property taxes provide the main source of revenue for Keansburg's general budget, supporting public schools, maintenance of public parks and beaches and provision of emergency services. After Hurricane Sandy, property values declined significantly, reflecting damage from the storm. In recent years, however, as the Borough has recovered, so too have property values. The following analysis examines assessed property values over the past two decades, pulling information from FEMA, Zillow, and the State's MOD-IV databases.

Key Findings From MOD-IV
- The mean assessed value of a single-family home in Keansburg is $89,143, but property values range widely across the borough (standard deviation of about $43,000).
- On average, single family homes appreciated in value between 2000 and 2010, but the tax assessor data indicates that homes may have decreased in the last decade, possibly due to Hurricane Sandy.
- These valuations may be outdated as there is a new valuation under study. The new re-evaluation has appraised property in Keansburg at a higher value than the previous year by about $9 million (personal communication with Mr. Striedl).

Findings from FEMA Community Profiles
FEMA's Community Profiles Tool provides trends on property values.
- Property values fell sharply after 2009, likely exacerbated by the Great Recession and later the impact of Hurricane Sandy.
- In recent years Keansburg home values seem to be rebounding but remain below the median for New Jersey.

Figure 4: FEMA estimates of median property values in Keansburg (2009-2019)

Figure Source: FEMA Community Profiles

Findings from Zillow
Zillow is a real estate company that markets and tracks property transactions. Their research branch provides trends and projections on property values.
- The average home value in Keansburg is $211,384.
- This is up 9.9% from last year and Zillow predicts that home prices will rise another 7.5% in the coming year.

Figure 5: Zillow Estimates of Home Values in Keansburg:

Figure Source: Zillow Home Value Index

Summary of Findings

      All three sources indicate that flood impacts from Hurricane Sandy likely negatively affected home values. Keansburg staff have reported that the Borough faces new development pressures, and these anecdotes are supported by data from FEMA and Zillow. Flood risks combined with development pressures may reduce Keansburg's stock of affordable housing. For example, luxury high-rise apartments may raise rents in the area. Conversely, Keansburg already supports its fair share of affordable rental units. Providing more affordable rental units may result in the concentration of low-income housing, and of vulnerable populations located in flood-prone areas. Keansburg faces the challenge of balancing these pressures.

2.4.2: Rental and Owner-Occupied Housing

      Households who rent their homes versus own face different vulnerabilities when it comes to flood risks -- a topic that is discussed further in the Social Vulnerability Analysis. The following analysis looks at distribution of owner- and rental-occupied housing throughout Keansburg.

      Renter-occupied units are concentrated in areas to the north near the waterfront, as well as inland closer to route 36, and near Waackaack Creek (Map 12.1). These areas also are where the majority of the larger apartment buildings are located. The percentage of owner-occupied units is highest in eastern Keansburg, though there are some concentrations in the center of town as well (Map 12.2). In general, Keansburg is relatively split between owner- and renter-occupied units. In 2013, the Borough adopted a floodplain ordinance that required rental units in flood-risk areas to be elevated before being released to occupants.

2.5. Regulatory Environment and The Future

2.5.1 Future Environment

Keansburg's regulatory framework is key to mitigating future flood risks. Through its previous resilience planning work, Keansburg has adopted ordinances and development regulations that can help shape future developments to be more flood resilient. In 2015, the Borough adopted an ordinance to require that base flood elevations were to be determined by the "best available data," meaning it could use newer preliminary FIRMs (pFIRMs), which required higher base flood elevation standards. As mentioned in the Floodplain Management Plan, the surge elevations of Hurricane Sandy were slightly less than those identified in the Borough's pFIRMs.

In 2015, the Borough also began participating in the Community Rating System (CRS), earning enough credits to start at a Level 7. CRS opens up subsidized flood insurance premiums for property owners if their municipalities adopt more stringent floodplain management rules. In exchange for their policies, property owners must also abide by specific flood-resilient building codes or other regulations to mitigate their potential losses. As of 2020, just over 1,500 households hold flood insurance in Keansburg, with the average policy costing around $1,067. The number of policyholders in Keansburg has dropped since Hurricane Sandy, though this could be due to the destruction or abandonment of homes.

In recent years, the Borough has demonstrated interest in pursuing redevelopment projects to bolster the town's population and tax base. In 2005, the Borough adopted a resolution designating the entire town as an Area in Need of Rehabilitation, allowing it to offer tax abatements and other incentives to interested developers. Any new development will have to adhere to these new flood-protective measures.

2.5.2 Comments on FEMA Maps, Building Codes, CRS ratings, Insurance, and Affordability

Delays in Updating NFIP FIRMs and Base Flood Elevations (BFEs): As per NFIP rules, FIRMs are to be updated every three to five years. FIRMs dictate policy premiums and BFEs that guide elevation standards for new development or substantial renovations to properties that hold flood insurance. Due to delays in the re-mapping process, Keansburg uses FIRMs from 2009, even before Hurricane Sandy. Based on correspondence with the town's floodplain manager, Mr. Striedl, the new FIRMs may be finalized as far out as 2024. Keansburg has adopted the higher BFE from the 2014 pFIRM, which was never finalized because of revisions relating to appeals. If the new FIRMs adopt even higher BFEs, however, there is uncertainty about how this will affect forthcoming developments, building codes, CRS ratings and insurance premiums.

CRS Ratings: Changes to FIRMs could raise the BFEs applied to new developments and renovations to existing structures. Keansburg has at least one major new development coming to Carr Avenue and hopes to pursue more in the coming years. Uncertainties about the new BFEs in particular raises new questions about development costs and compliance. Property owners looking to renovate their homes may raise their properties to the 2014 pFIRM BFE, only to find out with the new FIRMs, they are below the new BFE. Because of NFIP grandfathering rules, so long as owners maintain their insurance policy, they would not be considered out of compliance, but it still could raise concerns about safety and risk during flood events. In turn, this could affect the town's CRS ratings, which depend heavily on gaining credits to move up levels by adopting even more stringent floodplain regulations than NFIP minimums.

Keansburg's CRS rating of 7 is currently under review. While it is expected to remain the same, it is dependent on factors and decisions outside of the municipality's control. These decisions could have real impacts on affordability in Keansburg, and local floodplain managers urge some degree of understanding and compassion as the new flood maps and CRS standards are drawn up. To deal with the uncertainty, floodplain managers in Keansburg have urged property owners to build several feet above the BFE of current FEMA maps as this will likely help lower insurance premiums. However, for every additional foot there is an added cost, and it is difficult for property-owners to justify the return on investment in a climate of uncertainty.

Building Codes and Local Enforcement: Finally, Mr. Striedl says that enforcing building code compliance has become more difficult now that there is no permitting requirement for improvements, such as roofing, siding, window, and decks. This limits the Borough's oversight on the quality and scale of building improvements. Keansburg's Building Code Enforcement and Construction Office, headed by Mr. Striedl, used permits to track improvements both to earn credits for the Borough's CRS rating, as well as to determine whether or not property owners were required to implement flood-mitigation measures, like elevating structures to BFEs. If the structures are substantially damaged, meaning that the costs of repairs or improvements are more than 50% of the property's value, then owners are required to abide by Keansburg's floodplain standards, including raising the structure above BFE. Without this permitting system, it is harder to track the cumulative investment into properties that may be subject to these rules.

2.6 Summary of Flood Risk Analysis

Findings from the flood risk analysis illustrate the potential effects of four different flooding scenarios (3ft and 5ft of sea level rise, plus 1% annual flood each). The team used a range of tools and data sources to analyze how these flood scenarios would impact the built environment in Keansburg, with a focus on economic corridors, buildings and homes, critical infrastructure, and social infrastructure. This assessment sought to gauge the Borough's existing resilience guidance and work, hopefully to envision a framework for a resilience element in its municipal master plan. Such an element would enable the town to apply for plan endorsement, which could open up new technical assistance, funding, and other means of support to help create a more resilient Keansburg.

Our findings indicate that the built environment in Keansburg faces flood challenges as it is currently arranged, but the Borough has leveraged a number of voluntary programs to address these risks. The town experienced severe flood damage during Hurricane Sandy. Being a coastal community, Keansburg's economic strengths rely on its beach access and waterfront views; however, its "bowl-like" shape intensifies flood risks in the coast and center, where water is difficult to pump out. Given that Keansburg is a residential community, the primary flood vulnerability is to existing housing stock. Hurricane Sandy demonstrated just how this vulnerability plays out in the event of a severe flood or storm event, with the 5.3% drop in property values and tax revenues.

From our analysis, under a 3ft SLR scenario, flooding may affect 20% of the municipality's tax base. Three feet of sea level rise would impact important commercial corridors along Route 56 (Carr Avenue), as well as surrounding residential neighborhoods. The flood risks to Keansburg's built environment multiply under a 5ft SLR scenario, affecting more than half of the municipality's tax base. In addition, as detailed in the critical infrastructure section, important infrastructure like several nursing homes and fire

stations are at higher risk with 5 ft of SLR. Under the storm surge scenarios (10ft and 12ft TWL), almost the entire area of Keansburg seems to be affected.

One aim of this flood risk assessment analysis is to help the municipality identify those assets and infrastructure that are most vulnerable to flood risk under different scenarios to help shape a potential comprehensive resilience plan or a resilience element to its master plan. Evidently, Keansburg has pursued many avenues to protect its residents, investments, and future from future flood damage through planning for resilience and participating in NFIP and CRS, among other efforts. Completing a resilience plan or element would enable the Borough to pursue plan endorsement as well, potentially opening up more doors for future technical support, funding, and other benefits.

Takeaways: Key Findings and Challenges
- Keansburg is a residential, low-lying coastal municipality with a 'bowl-like' geography.
- The built environment in Keansburg is already densely developed, intensifying flood risks.
- Under a 3ft SLR scenario, already 20% of the municipality's tax base may be at risk.
- Under a 5ft SLR scenario, over half of the critical infrastructure identified in Keansburg are at risk. This includes threats to EMS/Fire, Police, and long-term care facilities.
- Our analysis indicates that storm surge combined with sea level rise pose great risk to the municipality. The experience of Hurricane Sandy exposed this vulnerability.
- Changing regulations at the state and federal level make it difficult to maintain stable CRS ratings, which in turn could affect the flood insurance premiums and housing affordability.
- Development pressures in Keansburg that could exacerbate affordability challenges.
- Because there are no permits required for certain building improvements, the municipality has less authority to enforce building code compliance and track improvements relevant to CRS.
- The municipality is resource- and capacity-constrained.

Chapter 2: Social Vulnerability Assessment

3. Introduction: What is social vulnerability?

In the field of disaster research, there are many definitions of "vulnerability." Vulnerability mainly includes "the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard" (Blaikie et al. 1994, p.9). Characteristics relating to social, cultural, economic, and political factors help in understanding the susceptibility of a population or community to a hazard. These characteristics include socio-economic status, race, ethnicity, gender, age, physical ability, and language, all of which affect a community's ability to recover from hazards.

In addition to vulnerability, hazard and exposure also illustrate the risks a community faces. Hazard refers to the factor that has the potential to cause harm, and exposure is the extent to which a population comes into contact with a hazard (NJDEP 2020). All three factors (Figure 6) make up the vulnerability assessment, which is a key component of coastal resilience.

Figure 6. Relation between hazards, exposure, vulnerability, and risk (NJDEP 2020).

This vulnerability assessment serves as an opportunity to consider whether Keansburg's vulnerable populations are affected differently by a specific hazard (coastal flooding), as compared to the whole community; and whether socially vulnerable populations face different risks compared to other populations within the community (NJDEP 2020).

4. Demographic Overview

Historically, Keansburg's population has remained relatively stable and homogenous. As of 2019, the Borough is home to roughly 9,600 residents, nearly three-fourths of whom identify as white (U.S. Census Bureau, 2019). Median household incomes in Keansburg are just under $47,000, comparatively lower than that of the State's ($79,300) and Monmouth County's ($95,700). In recent years, however, Keansburg demographics have begun changing, especially regarding its socially vulnerable populations.

Between 1980 and 2010, Keansburg's population remained relatively steady, shifting between 10,000 and 11,000 residents. But in the past decade, the Borough's population as a whole fell by roughly 5%, a decline pronounced in some neighborhoods over others. Some of this loss has been attributed to 2012's Hurricane Sandy, which significantly damaged and destroyed a number of homes. Roughly 98% of the Borough falls in the Special Flood Hazard Area, meaning geographies with 1% or greater annual chance of flooding. Understanding where Keansburg's socially vulnerable populations live -- specifically, seniors, low-income families, and non-English speaking households -- is critical to understanding and furthering resilience efforts in the Borough.

The most notable increase in population is the southeastern part of the Borough (Census Tract 8016 Block 4), where 300 people moved into between 2010 and 2018. Other areas that experienced an increase are those further inland as noted in Map 13. The Block that has experienced most loss is located just north of the center of town losing almost 40% of its population over the last eight years.

Considering the overall population loss of 5%, this suggests two possible explanations: enough people had moved into Keansburg to compensate for the loss of residents in this area, or those residents moved to a different area of town. In either case, the reverse of this story is true for eastern Keansburg which experienced a population increase of 32%. Should this idea of migration hold, it would appear that residents of Keansburg have either been leaving town during this period or moving east.

Minority groups have shown little to no particular pattern in terms of migration over the 8 years of data presented. In some instances, we can see dramatic surges in the percentage change over time to certain areas of Keansburg for minority populations. For example, there has been a near 300% population increase in the Black community residing in the western portion of Keansburg, as well as a similar surge (larger than 300% increase) for individuals who do not identify as Black, Latinx/Hispanic, or white in southeast Keansburg. Despite the large percentage change seen in these maps, the discrete change is relatively small compared to the population at large. For example, the aforementioned near 300% increase in Black individuals who moved into western Keansburg was a nominal increase of 149 individuals of the total population 1,037.
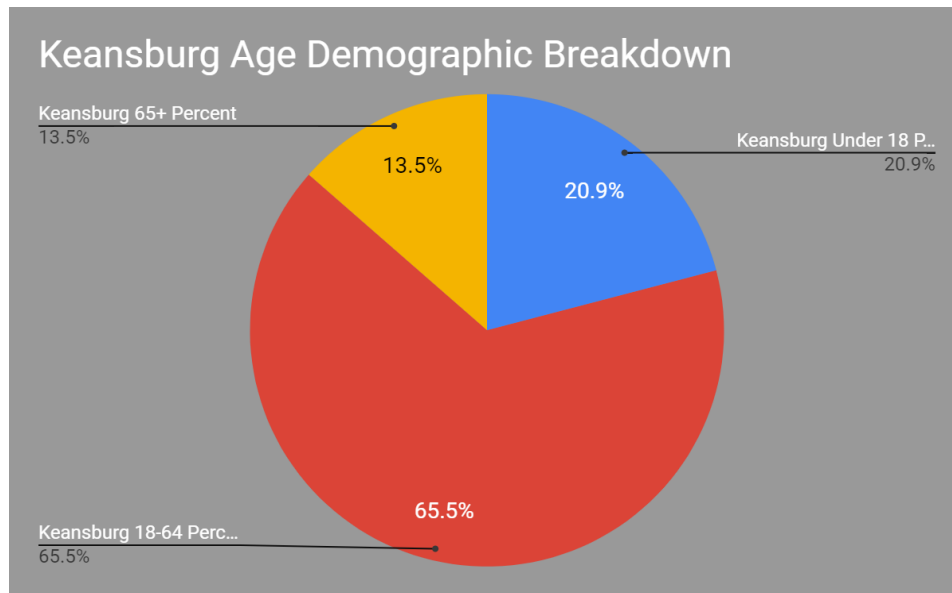
Across the board, all racial groups showed a population decrease in areas that historically have experienced flooding. This is consistent with the previous map showing that, at large, the population in that flood-prone area has decreased. Still, other areas vulnerable to flood risk have seen an increase in their population share of minority groups over the last eight years.

5. Social vulnerability in Keansburg

While nearly the entirety of Keansburg is at risk for flooding, certain residents face additional challenges that make them especially vulnerable. Based on interviews with various community stakeholders, we identified a number of these vulnerable populations in Keansburg. In addition, we heard about some essential assets in Keansburg that could play a role in strengthening the community and building resilience.

5.1 Senior Citizens

Figure 7. Age Breakdown in Keansburg (Source: U.S. Census Bureau, American Community Survey, 2018)

Keansburg Age Demographic Breakdown

Keansburg 65+ Percent
13.5%
13.5%

Keansburg Under 18 P...
20.9%
20.9%

Keansburg 18-64 Perc...
65.5%
65.5%

Seniors are particularly vulnerable to climate impacts because of financial and health burdens that may make it more challenging for them to relocate in the event of a storm. Keansburg's senior citizen population (individuals over the age of 65) makes up 13.5% of its total population -- a figure less than Monmouth County (18.2%) or even the State (16.6%) (see Appendix C for a complete age and demographic breakdown). Still, the senior citizen population is no insignificant portion of the Keansburg whole. The one square-mile community has three senior centers that provide services such as meals, group activities, and housing. Under a five-foot sea level rise scenario, all three sites may likely be affected by flooding. Without specific knowledge of the structures' elevation or freeboard, surrounding support infrastructure, like roads, power lines, and sewers, could be permanently inundated in this scenario. During a storm surge scenario, seniors may face more difficulties evacuating due to physical limitations like disabilities. Further, buildings could become damaged to the point of interoperability, potentially displacing older residents from the community.

5.2 Low-Income Population

Roughly 12% of Keansburg residents live at or below the federal poverty line. One measure of income distress is the Asset-Limited, Income-Constrained, Employed Households (ALICE) index, developed by the United Way of Northern New Jersey. According to NJFloodMapper, the ALICE index measures working households that are unable to afford basic necessities. These households have incomes above the federal poverty level, but below the household survival budget (HSB), which "calculates the cost of basic necessities like housing, childcare, food, transportation, healthcare, technology, and taxes in New Jersey, adjusted for different counties and household types" (NJFloodmapper, Data Sources). According to NJFloodMapper, between 25% and 35% of the households in Keansburg are considered ALICE households.

Low-income families are particularly vulnerable to disaster due to limited financial means to finding temporary accommodations or a new home. These families may face higher risks of displacement as a result of hazard events, such as storms or flooding. Roughly one in four families in Keansburg live at or below the federal poverty line (US Census Bureau, American Community Survey 2018). Income distribution throughout the Borough shows that poverty rates are higher in central neighborhoods, as depicted in Map 18. This distribution also aligns with Keansburg's "bowl" topology, with more low-income households at the lowest elevations (the "base") and fewer along higher grounds (the "rim").

Our interview contacts shared that many of these families are single-parent households supporting multiple children, sometimes with the addition of an elderly grandparent. While Keansburg does not have a high homeless population, the local social service organizations serve many people who are at risk of homelessness by providing temporary housing. Low-income residents are especially vulnerable in the event of a future storm or flooding because they may not have the financial means to pay for a hotel or temporary accommodations if they need to evacuate or if there is damage to their homes.

One of Keansburg's strengths is its feeling of community. The Borough has a large portion of long-time, multi-generational residents, which also allows for more resource sharing. But during a major hazard event, as exemplified during Hurricane Sandy, this could become a weakness. Our contacts in Keansburg shared that during Hurricane Sandy, when Keansburg was severely flooded, many families did not have any other choice than to try to stick it out. Others did not have the option of evacuating and staying with family members in a different location, because they all live in Keansburg.

Low-income families are also susceptible to food insecurity. Keansburg's public schools provide 100% free and reduced lunch as part of the Kids' Feeding Programs by Fulfill NJ (formerly known as The FoodBank of Monmouth & Ocean Counties). The schools provide free and reduced meals during the summer and throughout the school year, and the program follows the income eligibility guidelines provided by the USDA. According to the most recent data from 2017, about 74% of Keansburg students qualify for free and reduced meals (NJDOE 2019). Some residents also rely on local pantries and soup kitchens for food assistance.

5.2.1 Employment

Figure 8. Keansburg Unemployment Rates by Block Group (Source: U.S. Census Bureau, American Community Survey, 2018)
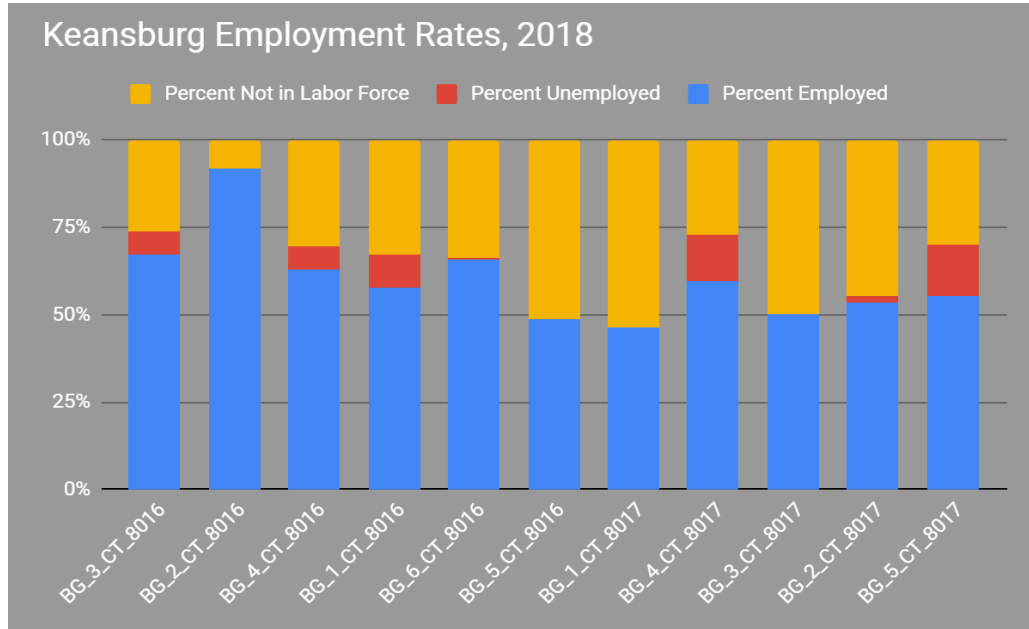
Unemployment in Keansburg appears fairly low across all areas of town. In fact, participation in the labor force at large (64.9%) is consistent with both Monmouth County (65.8%) and the State (65.5%). There are areas of Keansburg, however, where participation in the labor force hover around or below 50%. Areas with lower employment rates may indicate areas where households have more limited financial resources. Those not participating in the labor force could include retired individuals who may have fixed incomes like Social Security or other benefits. People with limited discretionary spending dollars may be more vulnerable to the adverse outcomes of flooding or storm events, such as displacement or property damage, which may require costly repairs.

5.2.2 Renters

Approximately 45% of Keansburg households rent their homes (US Census Bureau, American Community Survey, 2018). In terms of flood risks, renters may not have to worry about structural property damages, but their belongings may still be damaged or destroyed during a flood event. Households that rent can purchase flood insurance that specifically protects their units' contents, but these policies are often more expensive than other types of content insurance. In particular, lower-income households are less likely to be able to afford this extra expense. In addition, flood and storm events can damage a portion of the housing stock, creating a squeeze on the number of affordable rental units. Renters may face higher rates of eviction and have more difficulties obtaining affordable housing in the wake of disasters, potentially resulting in displacement from their social networks, thereby increasing their vulnerability (Hooks and Miller, 2019). Compared to homeowners, renters tend to be lower-income and have more

difficulty obtaining housing in safe places, given the current squeeze on the supply of affordable units generally.

HUD uses a standard called the Fair Market Rent (FMR) to determine payments and limits for its multiple housing assistance programs. According to the FY2021 Small Area FMRs for Monmouth County, NJ, released by HUD, Keansburg has the following FMRs:

Table 4: Keansburg Small Area FMRs by Unit Bedrooms

Keansburg	Efficiency	1-Bedroom	2-Bedroom	3-Bedroom	4-Bedroom
07734	$1,050	$1,200	$1,540	$2,120	$2,350

Source: FY2021 Small Area FMRs for Monmouth County, NJ

Figure 9: Fair Market Rents

Fair Market Rents

The FMR is basically an estimate of how much a rental unit typically costs in a particular area, adjusted for apartment size. By estimating the FMR, HUD can determine the rent-burden that low-income populations in an area face, and try to use systems like vouchers to help fill the gap so that households are not paying more than 30 percent of their income on rent. While the FMR used to be defined as the median rent charged for recently leased apartments, adjusted for apartment size, the definition has undergone several revisions (Schwartz, 2015). As of 1995, the FMR is defined as "the 40th percentile of gross rents for typical, non-substandard rental units occupied by recent movers in a local housing market" (HUD, 2020).

Of all Keansburg renters, approximately 63% are considered rent-overburdened, meaning they pay at least 30% of their gross income on rent. While many of the rentals in Keansburg are market-rate, some offer public assistance for households with incomes below the area median income. There are five apartment buildings in Keansburg managed by public housing authorities. These include McGrath Towers, Church Street Senior Housing 544, Granville Towers, Home at 109 Main St. (operated by Monmouth Housing Authority), and Grandview Apartments. These buildings offer 250 apartments for lower-income households. Of these units, 189 offer rental assistance. This assistance may include Section 8 vouchers, project-based Section 8 contracts, public housing, USDA rental assistance, or HUD programs designed for the elderly and disabled (Affordable Housing Online, 2020). In addition, a new development called The Cove on the Bay opened in January 2019. This building has a total of 186 units, with 55% dedicated to affordable housing and 45% market rate. Given flood risks facing Keansburg, a concentration of affordable housing might increase the numbers of socially vulnerable populations moving into the area. During a flood event, these populations might not have the social networks or resources to evacuate as efficiently. Older and disabled populations in particular may face higher risks.

Both renters and homeowners are made more vulnerable by the lack of information about flood risk in relation to the properties they occupy or purchase. Right now, any new person who moves into a house must obtain a housing certificate of occupancy. In New Jersey, it is not required to disclose information about flooding to homebuyers. If the landlords do not know, then many renters may not know the risk they have either. This is problematic because homebuyers may not be aware of how expensive a flood insurance premium is on their property at the time of purchase. These expenses may be passed on to the renter as well. The increase in housing development also poses a threat to Keansburg's low-income residents because it has the potential to increase overall rent prices in the area and force them out of the community. This poses a particular problem as Keansburg is one of the more affordable areas of Monmouth County and, as such, finding affordable living conditions outside Keansburg and inside Monmouth County would be particularly difficult.

5.3 Non-Native English Speakers

Stakeholder interviews identified a large Spanish-speaking population in Keansburg, as well as a smaller Arabic-speaking population. Demographic data suggests that between 13% and 22% of Keansburg are not native English speakers, but data on specific languages is limited. In many of these cases, children or younger generations serve as translators for their parents. Between children, volunteer Spanish translators, and Google Translate, the social service organizations we spoke to were mostly able to communicate with the residents they serve. However, there does not seem to be a widespread effort to translate materials for parents at the local school.

Non-native English speakers are especially vulnerable in the event of a hazard if they cannot understand emergency or relevant communications. In addition, there is evidence that non-English speakers have more difficulty navigating the formal aid network in the wake of a disaster (Fothergill, et al 1999). Further, non-English speakers may face more difficulties learning about their long-term exposure to coastal hazards, like flooding or storms. For example, when purchasing a home, they may be less informed about flood risk, especially given that there is no disclosure requirement.

6. Strengths & Assets

6.1 Keansburg Beach

Figure 10. Restored Baywalk in Keansburg (Baldwin 2020)

       The Keansburg Beach is an asset to the entire community and larger region. In addition to the natural beauty of the Bayshore, the Beach boasts scenic views of the Manhattan skyline, a fishing pier, and proximity to the local amusement and water park. Beach access is free, and visitors come from across New Jersey and even surrounding states. Following destruction from Hurricane Sandy, the Borough successfully restored 2.5 miles of shoreline through a multi-million-dollar beach replenishment plan. This restoration project was recognized with a National Award for Best Restored Beach in 2020. The beach is a highly-used space for community events and festivals, like the annual Keansburg Day which attracts over 1,500 people with free activities, including fireworks. The Keansburg Recreation Committee also holds weekly live concerts on the beach throughout the summer. These events bring together community members and encourage them to use the beach, strengthening social cohesion and place attachment.

6.2 Community Cohesion

       Many of our interviews touched on the close-knit, small town feeling in Keansburg. The community has a large population of long-term residents, with multiple generations living in close proximity to one another. The local schools are mainly staffed by tenured teachers -- both Keansburg residents and not -- who have invested in the community for the long term. In addition, the Keansburg Police Department has close ties with the community. The collaboration between Keansburg institutions,

including the police, schools, recreation committee, the local churches, and social service organizations has the potential to strengthen the social fabric in Keansburg. Following Sandy, these organizations came together to serve as shelters, provide food, and respond to damage in the community.

6.3 Social Services and Community-Based Organizations

Another strength of Keansburg is the number of social service groups able to help the most vulnerable populations in times of stress and need.

6.3.1 Project PAUL

Project PAUL is a social services group that serves Keansburg and the surrounding area near Keansburg. Their main goal is to prevent homelessness. They have a thrift shop where people can donate clothing and they also have a food pantry which operates two days per week. Project PAUL helps anyone who needs it, and their largest group they offer support to is working mothers and single-parent households. Many clients are on Social Security Disability and Supplemental Security Income and are reliant on food stamps and income. According to interview testimony, many Keansburg residents do not have access to reliable cars or transportation, so Project PAUL brings resources directly to their clients. Every Wednesday, they have a social services representative on-site to help people apply for food stamps and affordable healthcare, as well as access other benefits that otherwise would be difficult to find. Project PAUL is a key asset to Keansburg's vulnerable populations, serving the community for the past four decades. The organization also provides referrals to other community organizations as needed, including for one-on-one mental health resources and contacts at the affordable housing alliance in Eatontown.

6.3.2 St. Ann's Childcare Center

St. Ann's Childcare Center is another important community institution. Keansburg has many single, working mothers, and St. Ann's Childcare Center is a lifeline for its many working parents. It is one of the few childcare centers in Keansburg, and it is in such high demand that there is always a waitlist to get in. One of the attractions of St. Ann's is the relatively low cost of childcare services.

6.3.3 St. Ann's Roman Catholic Church

St. Ann's Roman Catholic Church is an important asset for the large Catholic population in Keansburg. About 3,400 families are served by the church, and there are many families who have attended for generations. St. Ann's Church works closely with Project PAUL, the volunteer fire station, and other community-based organizations to help serve the population. For the most part, working, single mothers are in need of support and resources in Keansburg, and St. Ann's along with other groups are very supportive of their tight-knit community.

Some of these community assets are at higher risk of flooding. Project PAUL and St. Ann's Roman Catholic Church are both located on Carr Avenue, with other groups in close proximity, which was identified as one of the areas most prone to flooding.

7. Questions and Topics for Further Research

Understanding Keansburg's changing demographics is crucial to protecting vulnerable populations in the event of future storms and flooding. The increasingly aging senior population and the influx of residents from new housing developments will both affect the makeup of the community. In addition, current proposals for a sober living home in Keansburg could bring in new vulnerable populations, but also, new resources and capacity to support those in need.

Identifying and understanding the needs of non-white Keansburg residents is also crucial to building community resilience in Keansburg. Our qualitative findings suggest that there are a number of mosques and community centers located outside of Keansburg that serve newer residents. These non-white residents may not be connected to the dominant institutions within Keansburg, such as St. Ann's Church, and could therefore be less likely to rely on their resources in the event of a disaster.

Nearly all of Keansburg's land area is subject to existing flood risk, a challenge that will only increase in the coming years. Addressing flood vulnerability in Keansburg will require a comprehensive look at its changing demographics, particularly socially vulnerable populations that rely on the Borough's strong network of community-based organizations -- sites and facilities that are also threatened by potential floodwaters. Understanding whether Keansburg's most vulnerable residents can access these social services will be key to assessing the Borough's preparedness for future hazard events.

3 Key Findings

This section will provide a brief summary of the key findings from over the course of this studio's work. Each finding has an associated opportunity, constraint, and recommended actions. Opportunities can be defined as areas where Keansburg can build on its strengths and leverage existing resources or previous work to further resilience planning. Constraints are defined as areas that may require further study and outside resources.

1. Keansburg's flood resiliency planning and preparedness can be strengthened by a better understanding of social factors that contribute to resilience.

Opportunity: Keansburg could better support the community by understanding the specific needs of socially vulnerable populations. In addition, state and federal grant programs are increasingly taking into account social factors in the distribution of hazard mitigation and disaster recovery funds. By highlighting the needs of vulnerable populations, Keansburg may be in a better position to make a case for funding to enhance flood resilience of the town.

Constraint: Keansburg lacks a full picture of the social factors that contribute to resilience, especially the needs of more vulnerable populations who may face disproportionate challenges during or after a flood.

Actions:
1. Develop a comprehensive resilience plan that incorporates both social and emergency services.
2. Enhance education of flood risk and resilience to residents through outreach materials and linkage with local schools.
   a. Links to local universities and interest groups can be made to increase citizen science participation, as well as further distribution of information.
3. Develop partnerships with social service organizations within and outside of Keansburg to help facilitate the delivery of social services during times of need.
   a. Example: Develop a partnership with Project Paul to understand where Spanish-speaking communities live and what their needs are.
4. Invest in the translation of all resilience-related outreach material. Work with local social service organizations to identify languages needed for translated materials.

2. Keansburg is a small but mighty town that faces particular challenges to flood risk.

Opportunities: Keansburg has a staff with deep institutional knowledge that can be documented and passed on to other staff members to diversify their knowledge base. Doing so will ensure that knowledge does not get lost as staff members retire, move, or undergo career changes. In addition, Keansburg can leverage new development as a way to bring buildings up to code and enhance physical resilience, while also expanding its tax base and generating resources to support the diverse needs of its residents.

Constraints: Being small, Keansburg has limited resources to work with and it is difficult for the town to balance short-term, everyday administrative tasks with longer-term needs like resilience planning. The town also happens to be dealing with the need to balance a lot of different pressures at once, like serving the needs of more vulnerable populations, managing development, and attending to flood risk.

Actions:
1. Digitize records and make them available online.
   a. For example, emergency management plans and evacuation routes available online would make it more accessible to residents.
2. Transfer learned knowledge from senior leadership (such as Ed) to newer staff and record information on paper.
3. Hold seminars and town meetings to cover hazard and disaster-related preparedness.
   a. For example: Meetings on evacuation procedure, designated shelters, and disaster kits. Meetings on the (voluntary) process of fortifying and updating home/small business infrastructure to meet more flood resilient standards.

3. Keansburg needs to plan for flooding in a complex regulatory environment, and it has an important story to tell.

Opportunities: Keansburg is representative of many small coastal towns along the bay shore and coast of New Jersey. By telling its story from the ground up, Keansburg can help shine light on some of the regulatory constraints that make resilience planning and implementation challenging at the local level. By courageously participating in efforts like this studio, and other resilience planning partnerships, Keansburg can help elevate the needs and concerns of local communities to higher levels of government. This bottom-up perspective is essential for making sure that the regulatory environment evolves in a way that responds to the needs of small towns.

Constraints: Keansburg has continually put in the work and effort to meet state and federal regulations associated with being in a floodplain (e.g.: taking actions to participate in the CRS, such as elevating buildings). However, it is difficult for the municipality to keep up with the changes at the federal and state level (e.g.: new rules and regulations associated with a State Coastal Resilience Plan, changing FEMA flood maps and associated criteria for CRS and NFIP). Also, Keansburg may not have the regulatory tools, capital resources, or enforcement power to implement all of the resilience measures expected from above.

Actions:
1. Catalog flood risk on municipal structures, including public housing.
2. Document the frequency and severity of flooding on streets and major thoroughfares.

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Appendices

Appendix A: Summary of Resilience-Related Plans and Status Update Tables:

Below are short summaries on resilience related plans that Keansburg has participated in since Hurricane Sandy. For some plans we have included tables with status updates based on municipal feedback.

2.2.1 Strategic Recovery Planning Report (2014)

After Hurricane Sandy, Keansburg received grant funding from the New Jersey Department of Community Affairs (NJDCA) to develop a Strategic Recovery Planning Report to support its long-range recovery and resilience planning work. This report covers the destruction and associated costs of infrastructure and property within the borough, as well as community-identified vulnerabilities. Namely, residences and businesses located in low lying areas close to Raritan bay and Waackaack creek were especially vulnerable to flooding. Emergency response was also restricted due to infrastructure and roadway damage. This report includes a list of action items to enhance the resilience of the township. Actions range from updating the Master Plan to include a resilience element, relocating the police station, entering the CRS program, updating flood maps, managing damaged properties, and providing backup power generators, among others. Below is a table with status updates on recommended action items

Strategic Recovery Planning Report (2014): Status update table for Recommended Actions

#	Action Item	Status
1	Reexamine the Boroughs Master Plan Elements and prepare a sustainability element to address post-Sandy strategies and policies related to hazard mitigation, community resilience, and forecasted sea level rise and its impacts.	Ongoing action, which began in the "Getting to Resilience" draft report.
2	Automate and upgrade the zoning and construction permit program	Ongoing action. It is possible that records could be digitized and automated with funding from the CARES Act. However, it is unclear to the municipality if funds will be reimbursed. Secure funding sources are required to complete this action.
3	Renew efforts to make the Route 36 Corridor a redevelopment area a priority	Planning efforts completed in 2015 Route 36 Bayfront Corridor Resiliency Plan

4	Permanently relocate the Keansburg's Police Department activity out of the temporary site, which is in a flood prone area	Action Completed.
5	Finish demolishing the damaged homes that remain standing, vacant, and serve as a hazard to public health and safety.	Ongoing action, as funding and resources permit. The municipality still has 25 structures left and estimates $20,000.00 per unit to demolish.
6	Participate in FEMA's Community Rating System (CRS) program	Currently Keansburg's CRS rating is at level 7 with plans to improve rating. However, as discussed in the section below, there is some uncertainty about maintaining and improving the CRS rating as it is contingent upon how FEMA flood maps are drawn and associated requirements.
7	Amend flood zone lines in flood maps to more accurately depict which properties are truly at risk to flooding	Ongoing action, with a timeframe of about 4 years. Note
8	Install a town-wide Supervisory Control and Data Acquisition (SCADA) system to communicate critical alarms to a central location/operational personnel	Ongoing action. This action may require additional resources and technical support.
9	Provide backup power at key community facilities, including at Borough Hall, the future permanent Police Department site, fire stations and EMS locations, pump stations, and at the water treatment plant	Generators acquired with FEMA grant.
10	Contract a construction company for sand and debris removal after natural disasters	Ongoing action. The municipality does have a designated area for holding debris after a disaster (a parking area). They have a system in place that they used during Sandy.
11	Prepare a Capital Improvement Plan identifying needed capital improvements to improve local resiliency	Ongoing action: As required, the Keansburg CIP is included in the Monmouth County Hazard Mitigation Plans. These are awaiting approval from FEMA and then will be adopted. The Keansburg CIP is a five-year plan that includes

		drainage and roadway improvements near the beach.
12	Develop a GIS database/inventory of Borough-owned infrastructure	Ongoing action: this Studio has developed preliminary maps depicting municipal-owned buildings and parcels.
13	Increase and update signage on streets and empty parcels of land.	Ongoing action: Keansburg participates in the High Water Mark Program and has installed about half a dozen parking regulation size signs on various main roads. It has also installed metal tags nailed to utility poles. These signs and tags indicate the high water mark during Hurricane Sandy and serve to improve public awareness.

2.2.2 Hazard Mitigation Plan (2014/2020)

Keansburg participated in the 2014 and 2020 Multi-Jurisdictional Natural Hazard Mitigation Plan (HMP) Updates for Monmouth County. The plan reviews major historical events and details past loss estimates. It also assesses the potential impact of relevant hazards in Keansburg and estimates potential losses from future hazards. In addition, it identifies potential risk mitigation actions. Given that Keansburg has participated in the Multi-Jurisdictional HMP, it has greater knowledge of its risk, and is better positioned to identify future capital improvement projects that reduce its flood risks.

2.2.3 Getting to Resilience (2014)

In 2014, Keansburg volunteered to participate in the Getting to Resilience (GTR) process, a framework administered by the Jacques Cousteau National Estuarine Research Reserve. The Borough completed a community evaluation questionnaire to assess their existing resilience and preparedness for future flooding, as well as identify recommendations to fill service gaps or strengthen vulnerabilities. This framework helps municipalities think about big picture questions, such as the long-term planning process for sea level rise and how to incorporate coastal hazard considerations into the municipal master plans. Keansburg's GTR report recommends specific maps like overlays of hazards, infrastructure, and building footprints, as well as thinking about long range planning for coastal climate threats.

Getting to Resilience Report (2014): Template Status Update Table for Recommended Actions

#	Report Category	Description	Status
6	Mitigation	Utilize sea level rise and storm surge mapping to identify possible roadways at risk to sea level rise	This studio has provided preliminary maps.
7	Mitigation	Create a detailed mitigation plan for areas that experience repetitive loss	
11	Preparedness	Work with Monmouth County and neighboring municipalities to expand sheltering options	

| 16 | Preparedness | Maintain efforts to update the special needs database | |
| 21 | Municipal Organization | Explore creating a joint Office of Emergency Management between neighboring communities and Keansburg | |

2.2.4 Floodplain Management Plan (2015):

Keansburg developed a Floodplain Management Plan in 2015 to receive points for the FEMA-administered Community Rating System program (CRS). CRS offers discounted flood insurance premiums to residents of towns that adopt more stringent floodplain management regulations. Municipalities earn points and move up levels, which access different percentage-based discounts. Presently, Keansburg is at a Level 7 and remains in good standing with CRS and NFIP.

The Plan provided an overview of the Borough's vulnerabilities using FEMA's Flood Insurance Rate Maps (FIRMs) from 2009, the most up-to-date available information at that time. At that time, more than 90% of properties stood in areas with at least a 1% annual chance of flood (noted as the 100-Year Floodplain in Table 1). The Plan orients itself around the aftermath of Hurricane Sandy, which, at the time the report was written, continued to afflict the area. From 2012 to 2015, the Borough witnessed a 5.3% drop in home values and tax revenues; nearly 1,300 properties depreciated in value as a result of Sandy damage; and some businesses still had yet to reopen.

Table 1: Floodplain Property Data

	Borough Total	100-Year Floodplain	500-year Floodplain[1]	100-Year + 500-Year Floodplain	Percent Located within the 100-Year Floodplain
Structures	3,306	2,907	310	3,217	87.93%
Properties	3,468	3,188	245	3,433	91.93%
Land Area (acres)[2]	776.32	675.56	75.20	750.76	87.03%

1. This does not include the area within the 100-year floodplain.
2. Land area only includes land parcel areas. Waterways and roads are not included in this area.

Source: Keansburg Floodplain Management Plan (2015)

Like the other documents, this Plan recommended numerous action items and prioritized them by feasibility, cost, and timing. For the purposes of this analysis, five actions were identified as most relevant to the studio objectives, listed below:

Floodplain Management Plan (2015): Template Status Update Table for Recommended Actions

Category	Description	Status
Preventative Measures	Develop a GIS Program	
Property Protection	Adopt requirements to maintain the best available data for base flood elevation for properties within the Borough	
Property Protection	Elevate 2,500 homes within the Borough to higher standards and elevations	Ongoing
Property Protection	Relocate the Police Station to the 500-year flood elevation	Complete

Emergency Services	Acquire emergency backup generators for critical care facilities	

2.2.5: Raritan / Sandy Hook Bay Coastal Resilience Planning Study (2019):

Keansburg was also included in the 2019 Raritan/Sandy Hook Bay Coastal Resilience Planning Study. This joint land use study is funded through NJDEP with a federal grant from the U.S. Department of Defense. The study calls to "develop a plan for beneficial reuse of dredge material," and it identifies Keansburg as a potential site to hold Navy dredge material from nearby channels. Specifically, a Keansburg Beach Replenishment project is proposed as a potential beneficial use for these materials. The materials would be used to replenish sands to the beach and restore upland dunes. This kind of project may help reduce erosion and enhance protection for the town from wave action and storm surges.

Appendix B: Note on methodology for part 2.3.2:

Summary: The analysis in section 2.3.3 takes advantage of readily available data sources to derive rough estimates of how different flood scenarios might impact the built environment in Keansburg, as well as the municipality's tax base.

Data Sources and Methodology: First we obtained parcel and building footprints (polygons) available through the Monmouth County GIS portal. We collected data with attribute information about the parcels from the MOD IV Historical Database, which contains over 30 years of real estate parcel data. Data on parcels for year 2019 was joined to the parcel shapes in ArcGIS. The parcels were then clipped to the building footprints. By joining the tax data to the building footprints, we were able to estimate how the municipalities tax base may be affected under different flood scenarios. We were also able to depict the type and number of buildings flooded. To determine which buildings are impacted under different flood scenarios, we obtained data layers representing the four different flood scenarios from colleagues at NJFloodmapper. We used GIS to select (via a simple intersection analysis) the building footprints that intersect water layers represented by the different scenarios. For this analysis, the studio maintained ongoing communication with Mr. Ed Striedl to ground truth and ensure the accuracy of these empirical findings. His feedback helped us to determine some strengths and limitations of the datasets.

Limitations and Disclaimer:

A limitation is that this is not an in-depth hydrological assessment, but rather a rough estimate of what parts of Keansburg's physical infrastructure may be impacted (even if only marginally) under different scenarios. As our correspondent Matt Campo mentioned, a more nuanced, downscaled, and locally specific flood risk analysis should include water dynamics particular to Keansburg. For example, Keansburg has a flood gate that closes when water reaches a certain height. A more detailed hydrological assessment should include how precipitation, storm surge, and the flood gate might interact to affect flooding in Keansburg under different flood scenarios. This type of work may be necessary to determine more accurate damage estimates due to the volume, depth, and velocity of water during a particular event. However, this type of nuanced analysis is beyond the scope of this studio.

The analysis provides basic estimates of flood risk to the municipality's building stock and tax base, using available data. Given the limitations of this cursory analysis, when we use the language

"affected" or "impacted" by water under the different scenarios, we cannot provide exact damage estimates or estimated inundation levels. Rather, we simply suggest that the water levels will likely reach at least the buildings' foundation. If sea level rise causes permanent inundation, this could make it difficult to continue providing basic services to the building, such as sewerage, power, and transportation infrastructure.

Despite the limitations, this analysis provides a rough estimate of the properties at risk and their estimated value, given publicly available data. Further, our contacts in Keansburg confirmed that the 3ft SLR scenario reflects what parts of the Borough generally flood first. In our social vulnerability analysis, evidence from our interviews also seem to confirm the empirical analysis.

Appendix C: Demographic Data

		Keansburg Population Data 2010 (US Decennial Census)							
GeoID	Geographic Area Name	Total	Total White alone	Total Black or African American alone	Total American Indian and Alaska Native alone	Total Asian alone	Total Native Hawaiian and Other Pacific Islander alone	Total Some Other Race alone	Total Two or More Races
34025801 6001	BG 1 CT 8016	764	625	50	0	13	1	36	39
34025801 7001	BG 1 CT 8017	821	612	99	1	27	6	36	40
34025801 6002	BG 2 CT 8016	614	545	35	2	5	0	15	12
34025801 7002	BG 2 CT 8017	551	416	58	0	29	0	37	11
34025801 6003	BG 3 CT 8016	1023	876	48	4	10	0	42	43
34025801 7003	BG 3 CT 8017	858	687	87	3	21	1	29	30
34025801 6004	BG 4 CT 8016	945	865	32	6	9	0	10	23
34025801 7004	BG 4 CT 8017	875	694	62	6	17	0	62	34
34025801 6005	BG 5 CT 8016	937	849	26	0	11	0	29	22
34025801 7005	BG 5 CT 8017	1478	1246	105	0	17	0	68	42
34025801 6006	BG 6 CT 8016	1239	1090	62	1	13	0	44	29

					Keansburg Population Data 2018 (American Community Survey)					
GeoID	Geographic Area Name	Total	Total White alone	Total Black or African American alone	Total American Indian and Alaska Native alone	Total Asian alone	Total Native Hawaiian and Other Pacific Islander alone	Total Some Other Race alone	Total Two or More Races
34025801 6001	BG 1 CT 8016	758	678	0	0	80	0	0	0
34025801 7001	BG 1 CT 8017	694	395	285	0	0	0	14	0
34025801 6002	BG 2 CT 8016	375	375	0	0	0	0	0	0
34025801 7002	BG 2 CT 8017	698	541	0	0	100	0	11	46
34025801 6003	BG 3 CT 8016	1005	783	119	0	22	0	81	0
34025801 7003	BG 3 CT 8017	576	559	0	0	0	0	9	8
34025801 6004	BG 4 CT 8016	1249	1058	76	0	20	0	0	95
34025801 7004	BG 4 CT 8017	1037	796	199	42	0	0	0	0
34025801 6005	BG 5 CT 8016	759	633	58	0	0	0	0	68
34025801 7005	BG 5 CT 8017	1225	1032	73	0	0	0	57	63
34025801 6006	BG 6 CT 8016	1412	1091	11	0	3	0	255	52

					Keansburg Population Differential by Race 2010 - 2018 (US Decennial Census & American Community Survey)					
GeoID	Geographic Area Name	Total	Total White alone	Total Black or African American alone	Total American Indian and Alaska Native alone	Total Asian alone	Total Native Hawaiian and Other Pacific Islander alone	Total Some Other Race alone	Total Two or More Races
34025801 6001	BG 1 CT 8016	6	-53	50	0	-67	1	36	39
34025801 7001	BG 1 CT 8017	127	217	-186	1	27	6	22	40

34025801 6002	BG 2 CT 8016	239	170	35	2	5	0	15	12
34025801 7002	BG 2 CT 8017	-147	-125	58	0	-71	0	26	-35
34025801 6003	BG 3 CT 8016	18	93	-71	4	-12	0	-39	43
34025801 7003	BG 3 CT 8017	282	128	87	3	21	1	20	22
34025801 6004	BG 4 CT 8016	-304	-193	-44	6	-11	0	10	-72
34025801 7004	BG 4 CT 8017	-162	-102	-137	-36	17	0	62	34
34025801 6005	BG 5 CT 8016	178	216	-32	0	11	0	29	-46
34025801 7005	BG 5 CT 8017	253	214	32	0	17	0	11	-21
34025801 6006	BG 6 CT 8016	-173	-1	51	1	10	0	-211	-23

Keansburg Population by Age (American Community Survey, 2018)	
Keansburg Under 18 Total	2047
Keansburg 18-64 Total	6415
Keansburg 65+ Total	1326
Keansburg Under 18 Percent	20.91%
Keansburg 18-64 Percent	65.54%
Keansburg 65+ Percent	13.55%

Map Book

Map 1: Historic Map of Keansburg, NJ (1901)

Keansburg, NJ: Historic Map (1901)

Map Source: U.S. Geological Survey topoView

Map 2: Dune Breaches during Hurricane Sandy in Keansburg, NJ

Hurricane Sandy Storm Surge Extent & Dune Breaches in Keansburg, NJ

12/18/2020, 6:27:37 PM

1:18,500

0   0.1   0.2   0.4 mi

0   0.17   0.35   0.7 km

☐ Keansburg Municipal Boundary

★ Dune Breaches

■ Extent of Flooding
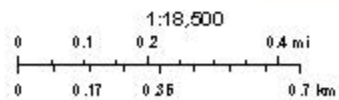
USGS The National Map, National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems, U.S. Census

ArcGIS Web AppBuilder
USGS The National Map, National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National

Map 3: Land Use Classification

Use Classification by Parcel in Keansburg, NJ

Buildings Inundated at 3' Sea Level Rise

Legend

3ft SLR Depth

High

Low

3ft SLR Low-lying Areas

Keansburg Municipal Boundary

Building Inundated

1:18,500

0   0.15   0.3   0.6 Miles

Source: NOAA Office for Coastal Management, NJGIN MOD-IV

Map 5: Estimate of Buildings Inundated Under 3' SLR + 1% Annual Chance Flood

Buildings Inundated at 3' Sea Level Rise & 1% Annual Flood

Map 6: Estimate of Buildings Inundated Under 5' SLR

Buildings Inundated at 5' Sea Level Rise
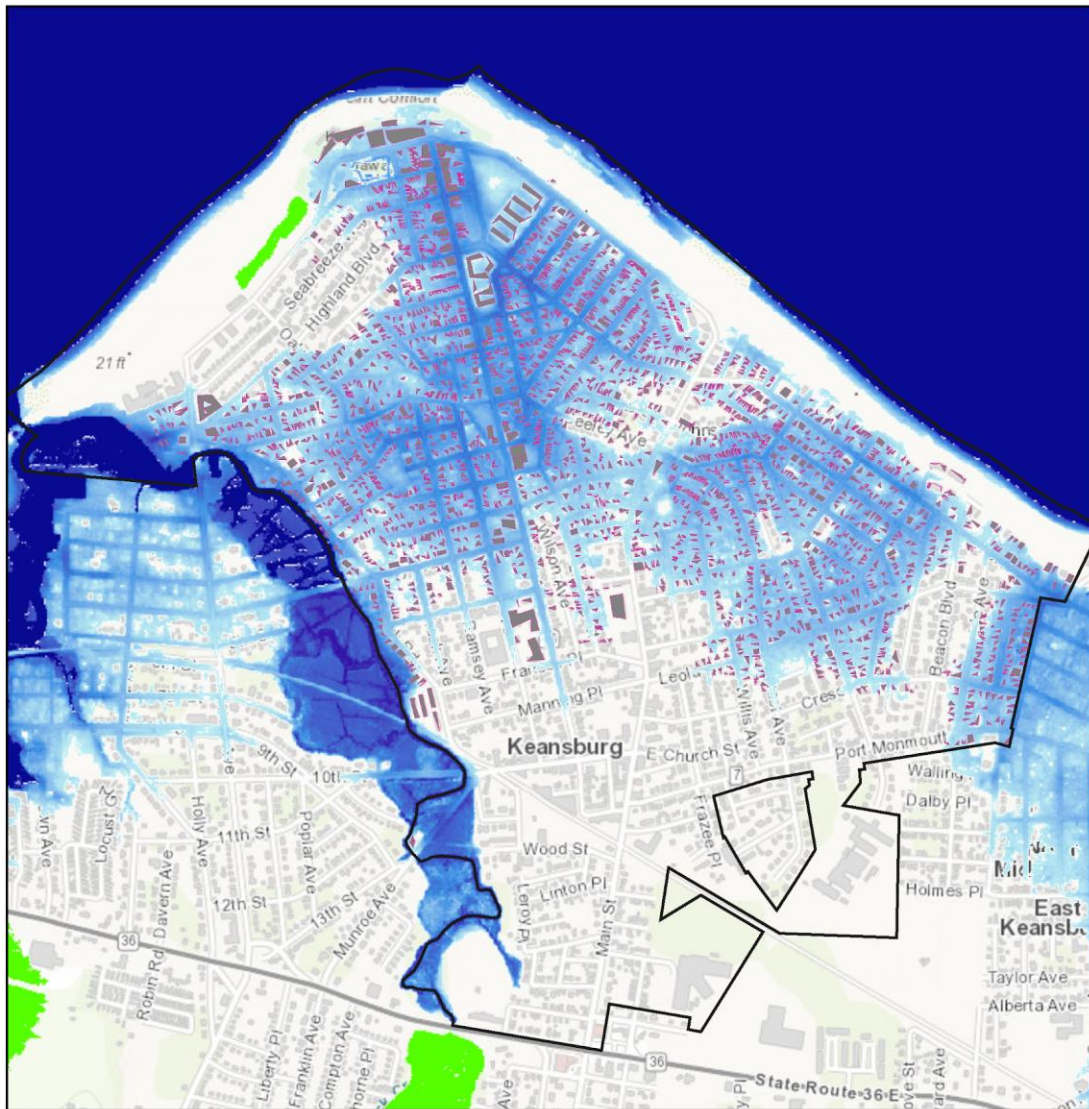
Legend

5ft SLR Depth

High

Low

5ft SLR Low-lying Areas

Building Inundated

Keansburg Municipal Boundary

1:18,500

0   0.15   0.3   0.6 Miles

Source: NOAA Office for Coastal Management

Map 7: Estimate of Buildings Inundated Under 5' SLR + 1% Annual Chance Flood

Buildings Inundated at 5' Sea Level Rise & 1% Annual Flood

12/19/2020, 7:56:28 PM

1:18,500
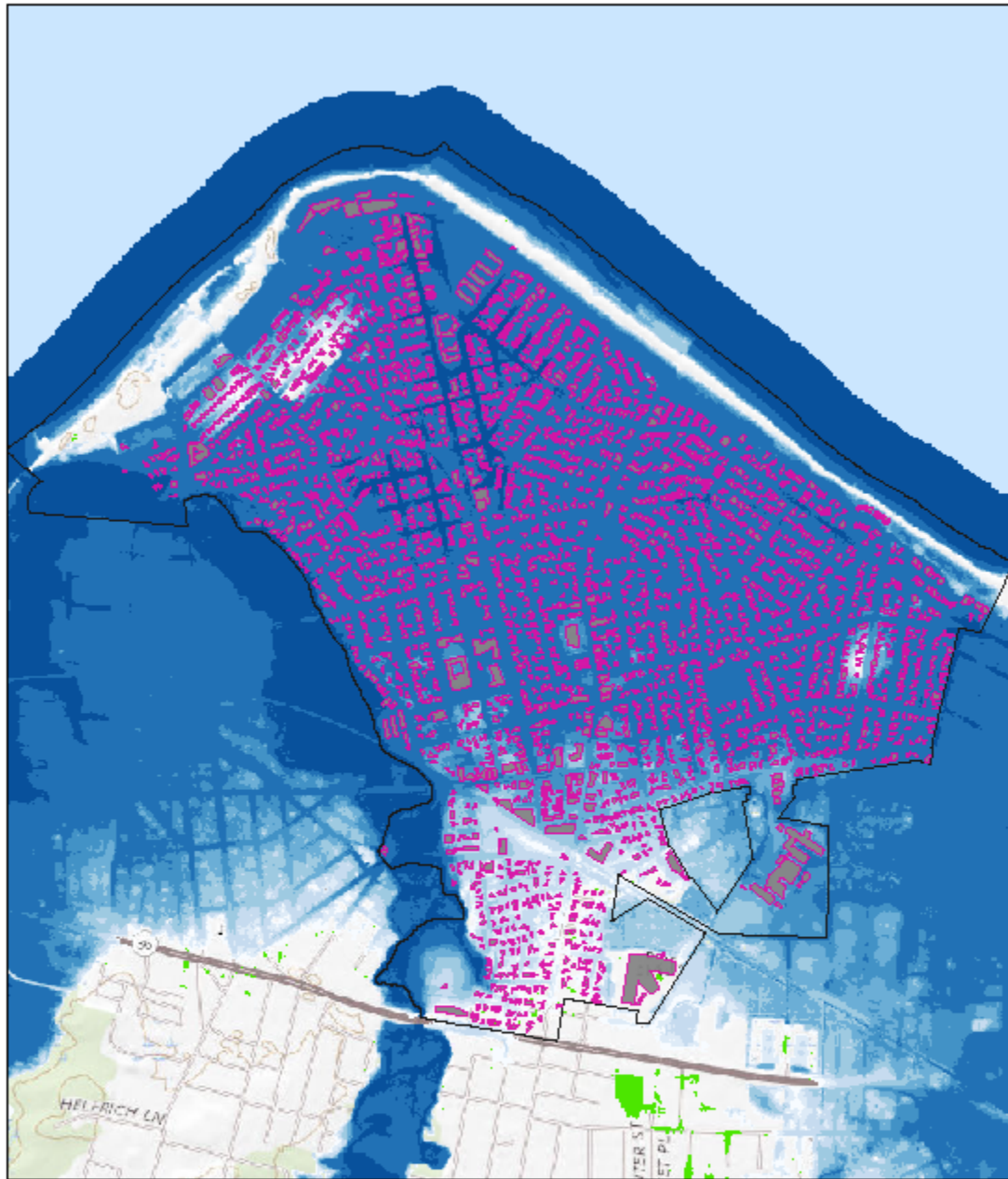
▇ MHHW with 12 ft Inundation Low-lying Areas	☐ 3 - 4 ft
MHHW with 12 ft Inundation	☐ 4 - 5 ft
▬ 0 - 0.5 ft	☐ 5 - 10 ft
▬ 0.5 - 1 ft	▇ 10 - 20 ft
☐ 1 - 2 ft	▇ > 20 ft
☐ 2 - 3 ft	
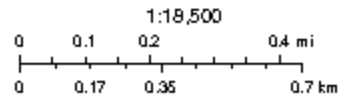
0   0.1   0.2   0.4 mi
0   0.17   0.35   0.7 km

USGS The National Map, National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset, USGS Global Ecosystems, U.S. Census

ArcGIS Web AppBuilder
USGS The National Map, National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National

Map 8: Density Map of Permits Issued (2013-20) for Elevated Structures (New & Alterations)

Elevation Permits Issued in Keansburg, NJ
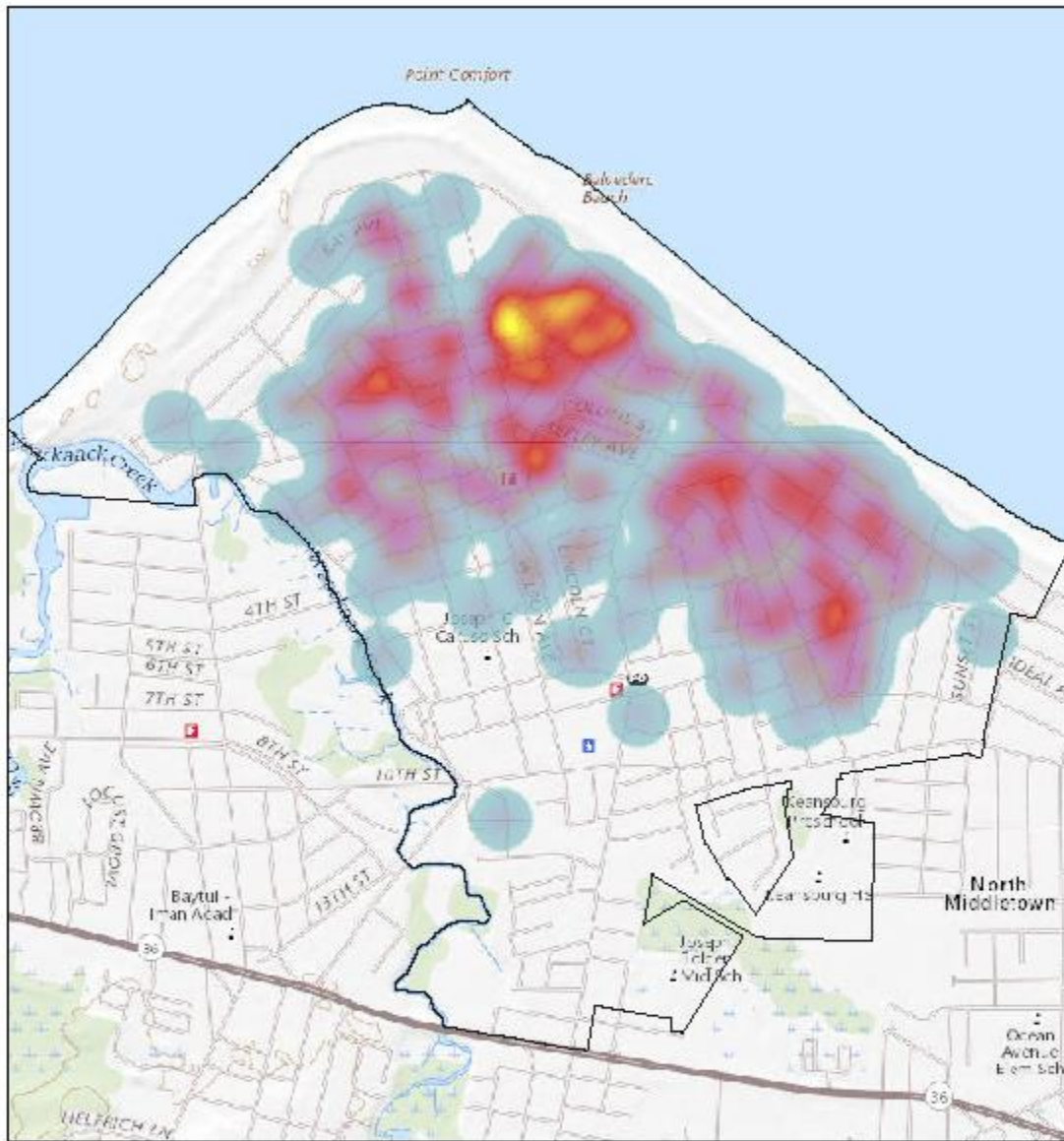
12/18/2020, 6:55:48 PM
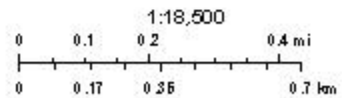
1:18,500

☐ Keansburg Municipal Boundary

0   0.1   0.2   0.4 mi

0   0.17   0.35   0.7 km

USGS The National Map. National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems, U.S. Census

ArcGIS Web AppBuilder
USGS The National Map. National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National

Map 9: Critical Infrastructure Inundated Under 3' SLR, and 3' SLR plus 1% Annual Flood*

*3' sea level rise plus 1% annual flood is represented by "10' sea level rise."

Map 10: Critical Infrastructure Inundated Under 5' SLR, and 5' SLR plus 1% Annual Flood*
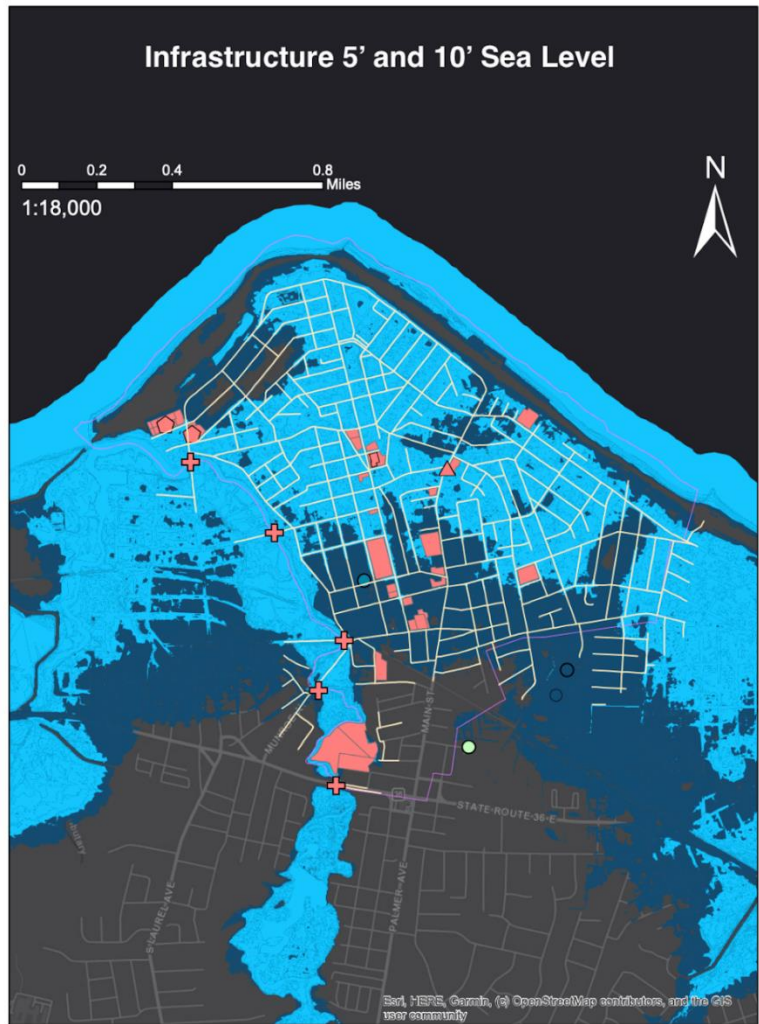
*5' sea level rise plus 1% annual flood is represented by "10' sea level rise."

Map 11: Road Centerlines Segmented by Water Level Inundation

Map 12.1: Distribution of Renter-Occupied Units

Share of Renting Households in Keansburg
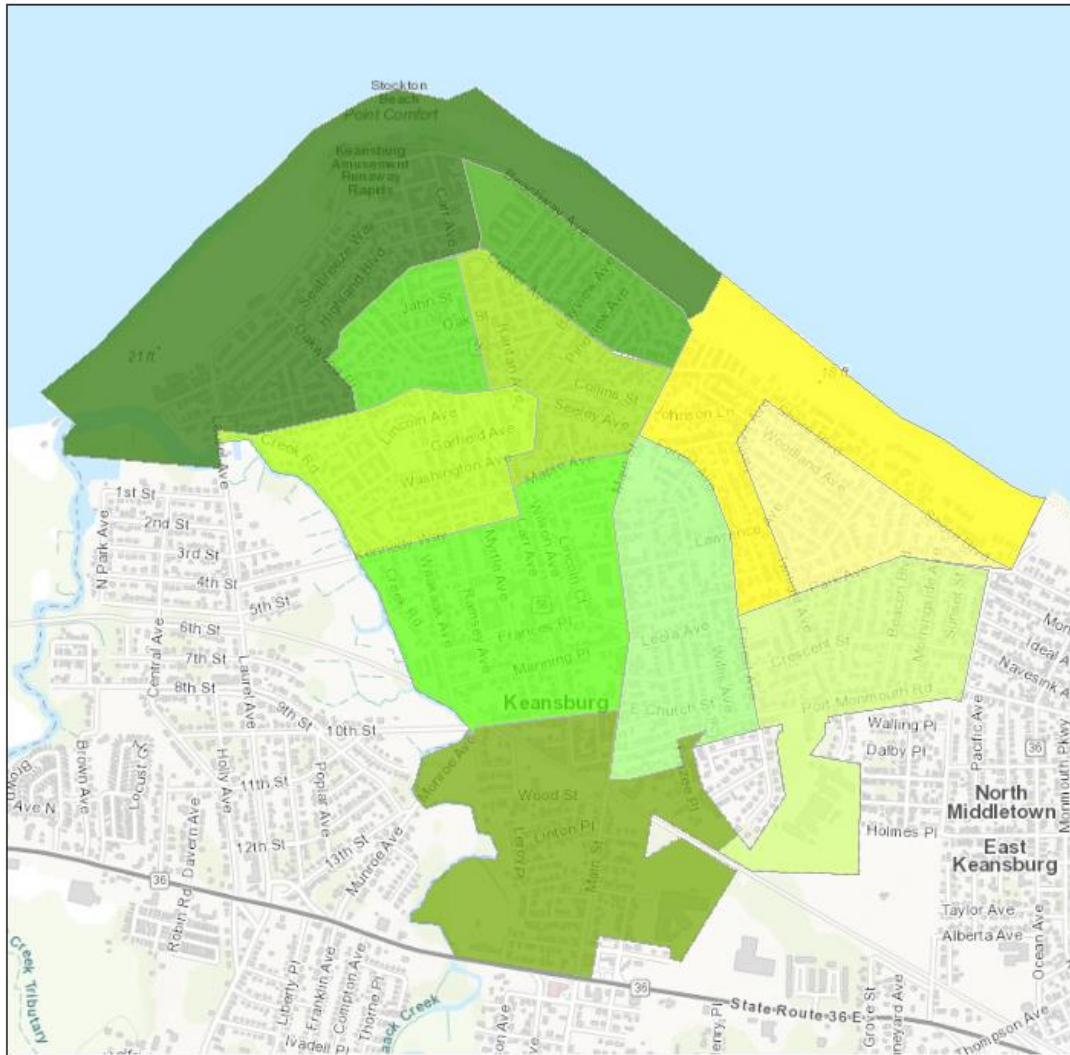
Legend

Share of Renting Households

62.26%	50.25%
61.48%	46.72%
60.57%	45.93%
52.90%	28.33%
51.10%	27.47%
	14.74%

Source: U.S. Census Bureau, 5-Year ACS (2014-18)

1:15,500

0 0.125 0.25   0.5 Miles
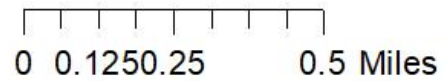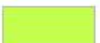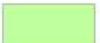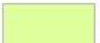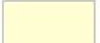
Map 12.2: Distribution of Owner-Occupied Units

Share of Homeowning Households in Keansburg
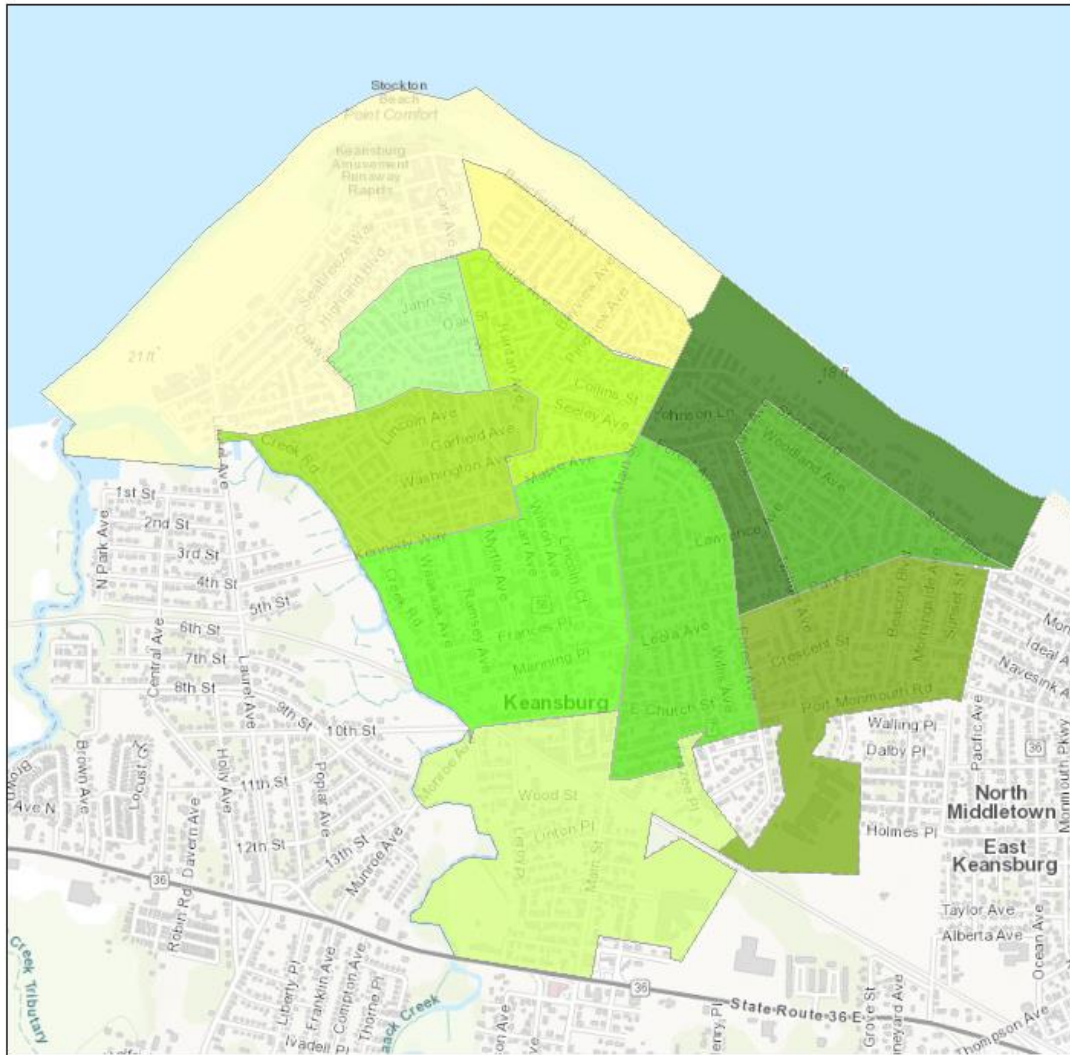
Source: U.S. Census Bureau, 5-Year ACS (2014-18)

Legend

Homeownership Rates

85.26%	49.75%
72.53%	48.90%
71.67%	47.10%
54.07%	39.43%
53.28%	38.52%
	37.74%

1:15,500

0 0.125 0.25   0.5 Miles

Keansburg Population Change by Block Group (2010-18)
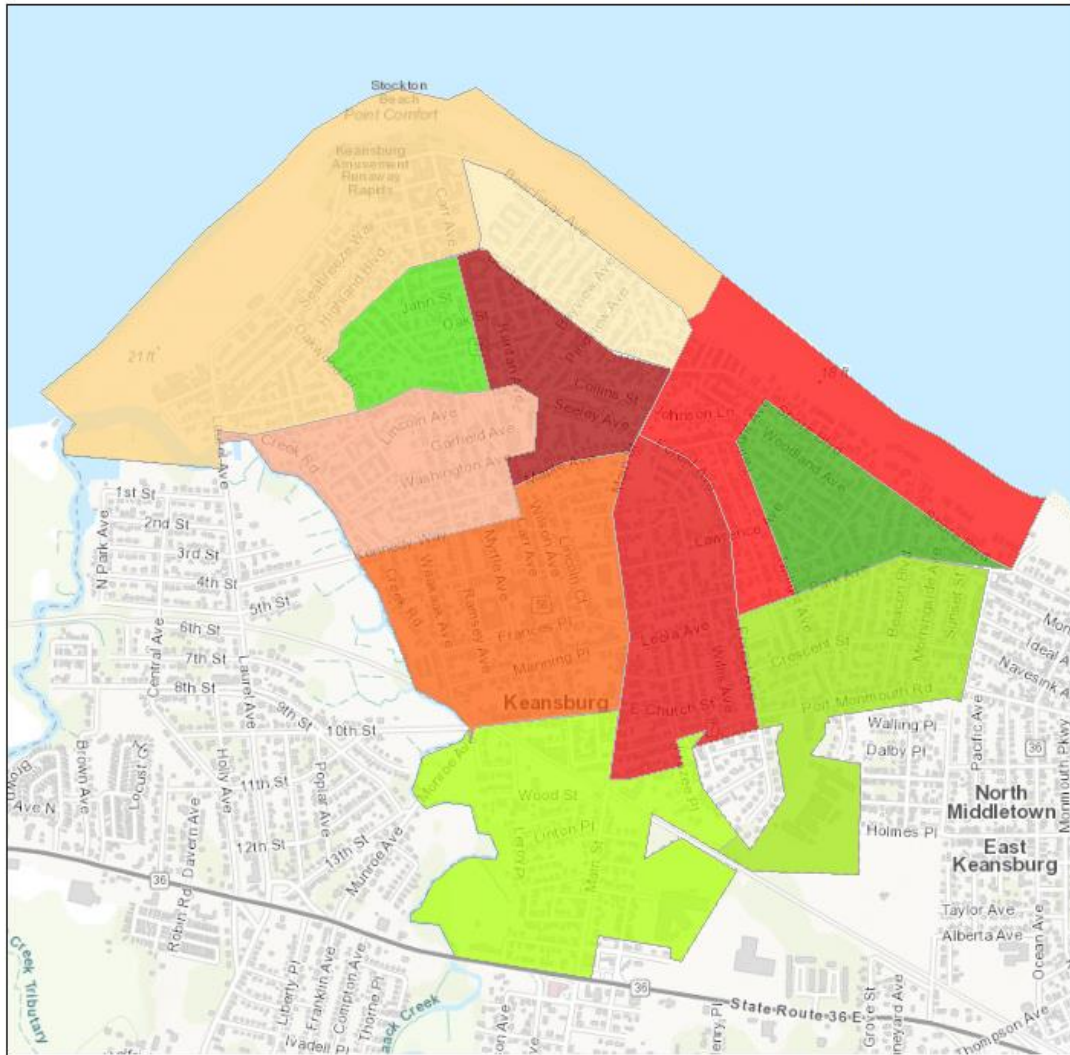
Source: U.S. Census Bureau, 5-Year ACS (2014-18)

Legend

Total Population Change (2010-18)
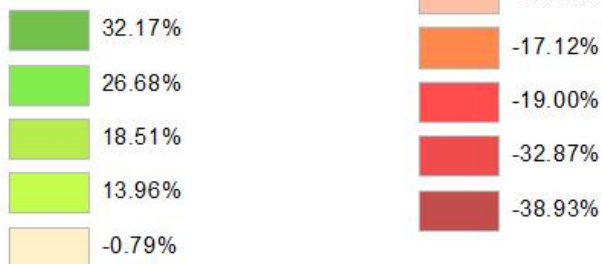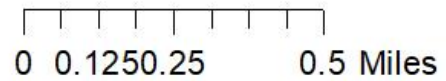
32.17%	
26.68%	
18.51%	
13.96%	
-0.79%	

-1.76%	
-15.47%	
-17.12%	
-19.00%	
-32.87%	
-38.93%	

1:15,500

0   0.125 0.25   0.5 Miles

Keansburg Population Change by Ethnicity: White
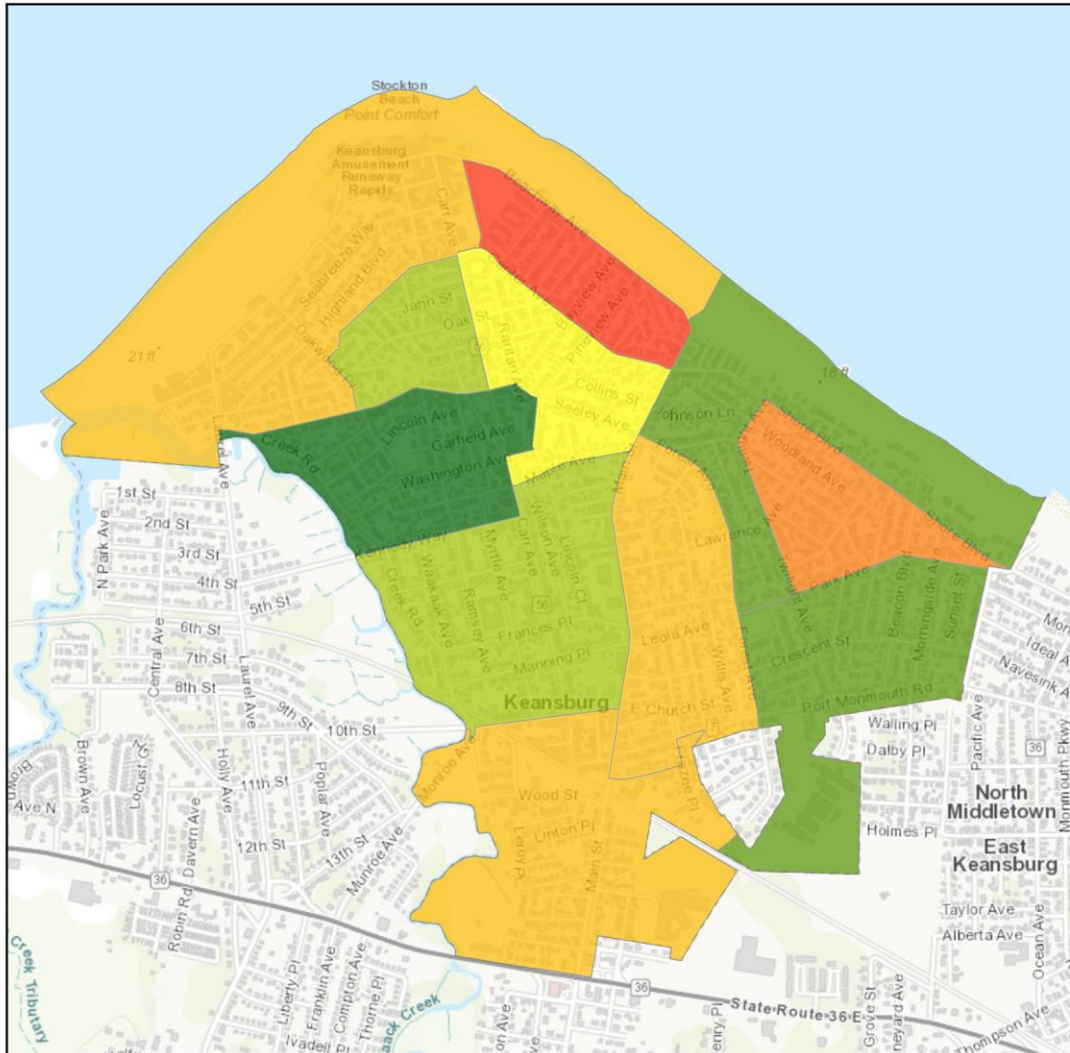
Source: U.S. Census Bureau, 5-Year ACS (2014-18)

Legend
Percent Change, White, 2010-2018

- >21%
- 11% to 20%
- 0% to 10%
- 0% to -10%
- -11% to -20%
- -21% to -30%
- >40%

1:15,500
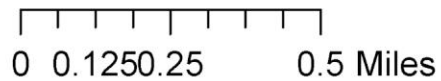
0   0.125 0.25   0.5 Miles
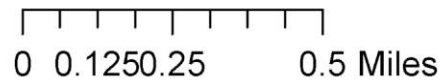
Keansburg Population Change by Ethnicity: Black
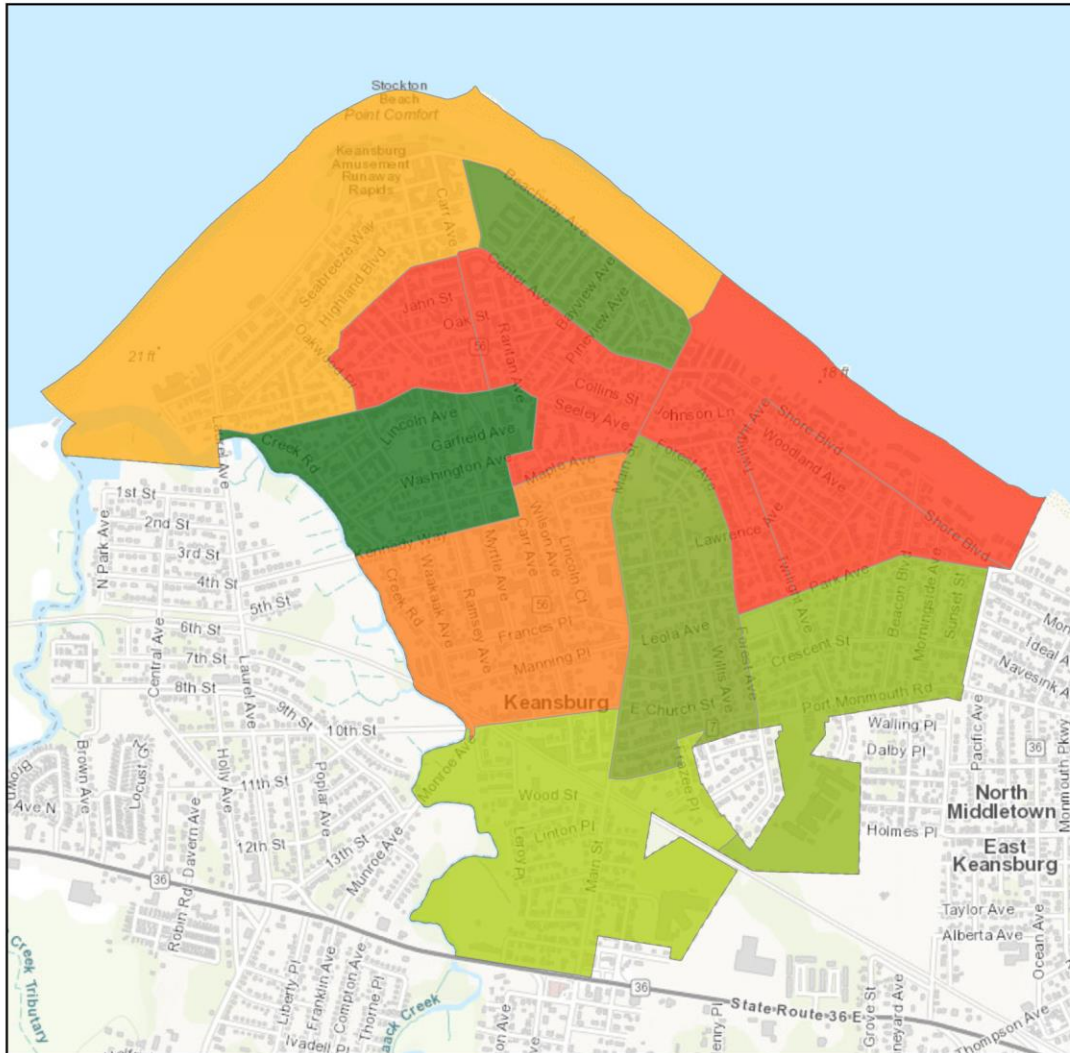
Source: U.S. Census Bureau, 5-Year ACS (2014-18)
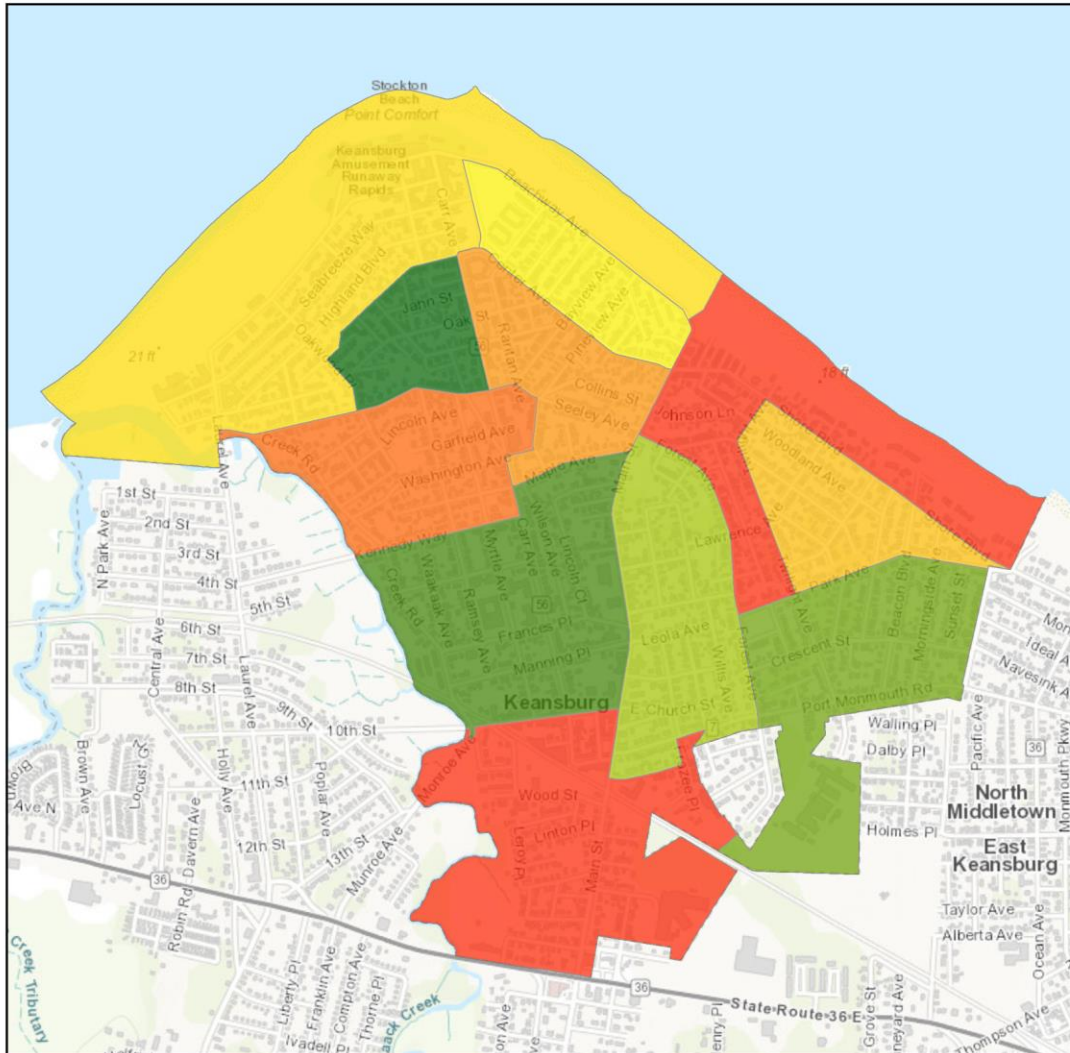
Legend

Percent Change, Black, 2010 to 2018

- 298.00%
- 223.86%
- 197.50%
- 153.33%
- 132.00%
- -42.53%
- -81.36%
- -100.00%

1:15,500

0   0.125 0.25   0.5 Miles

Keansburg Population Change by Ethnicity: Hispanic

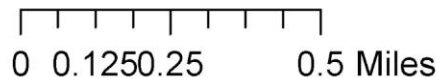Source: U.S. Census Bureau, 5-Year ACS (2014-18)

Legend

Percent Change, Hispanic, 2010 to 2018
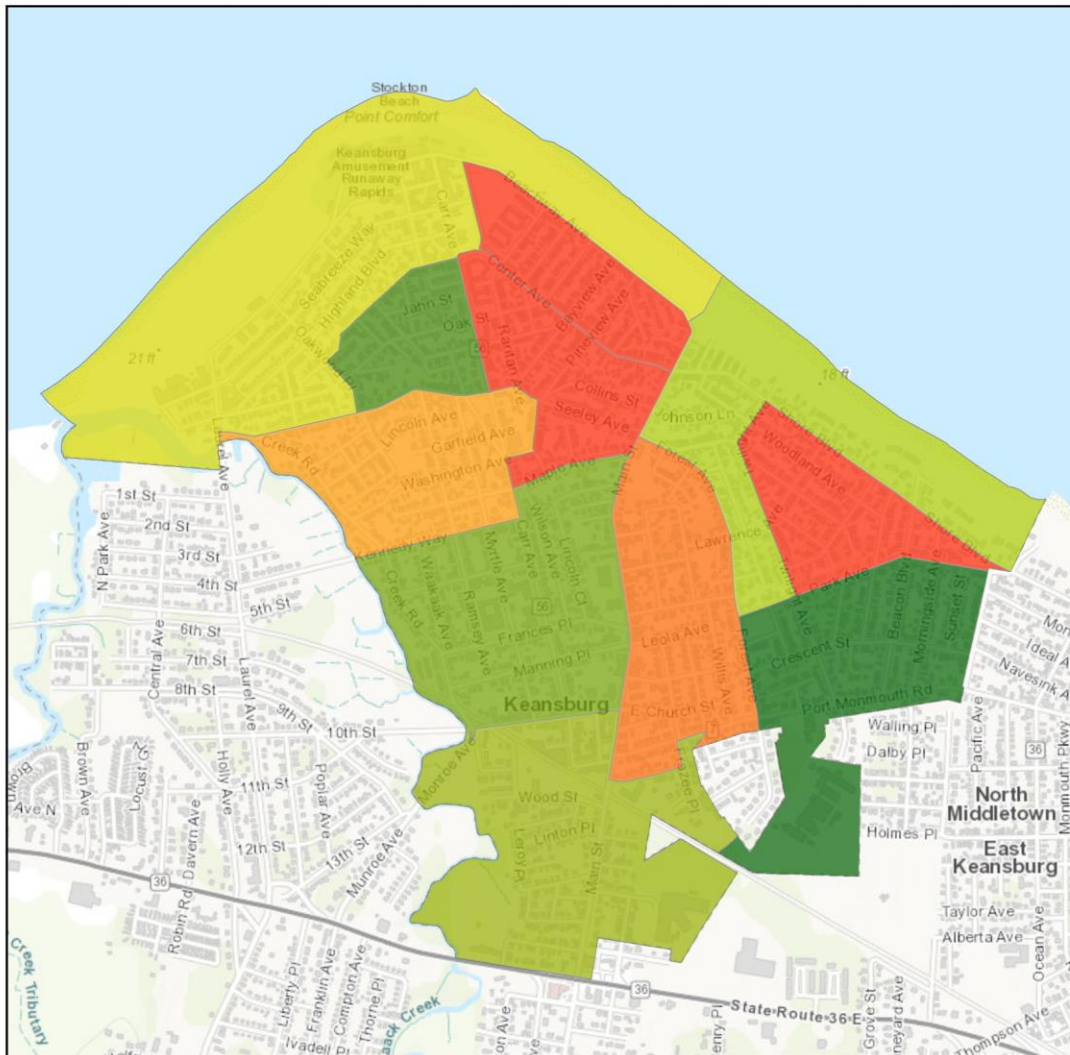
- 156.47%
- 63.27%
- 59.05%
- 38.32%
- -12.50%
- -34.84%
- -60.92%
- -81.21%
- -93.66%
- -100.00%

1:15,500

0   0.125 0.25   0.5 Miles

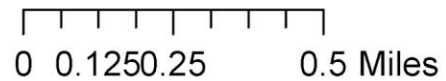# Keansburg Population Change by Ethnicity:
Other Race/Ethnicity

Source: U.S. Census Bureau, 5-Year ACS (2014-18)

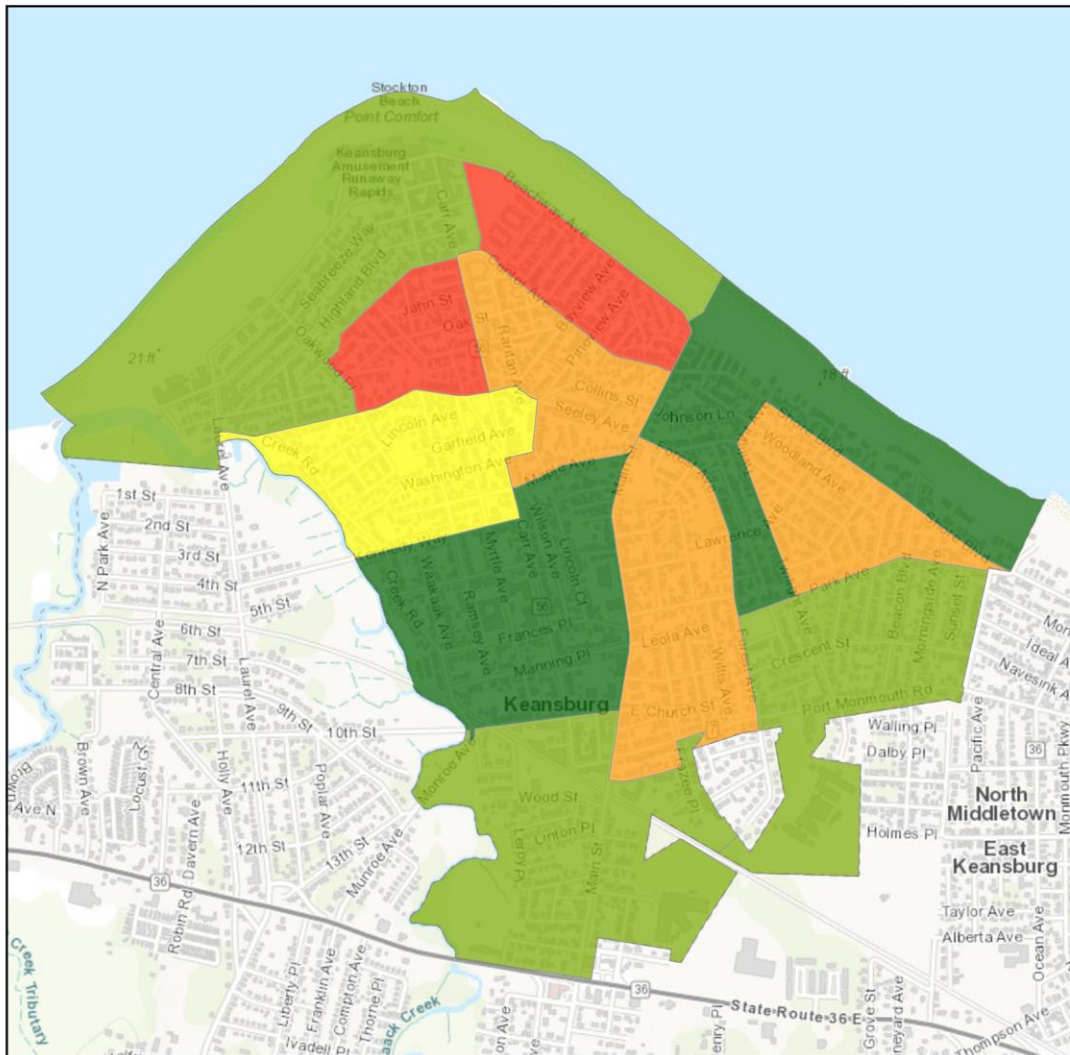## Legend

Percent Change, Other Race/Ethnicity, 2010 to 2018

325.93%

177.78%

129.17%

119.35%

63.27%

40.00%

-19.23%

-33.33%

-100.00%

1:15,500

0   0.125 0.25   0.5 Miles

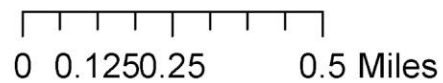## Keansburg Families Living Below the Poverty Line

Source: U.S. Census Bureau, 5-Year ACS (2014-18)

Legend

Income Below Poverty Line Over 12 Month Period

- 0.00%-9.99%
- 10%-19.99%
- 20%-29.99%
- 30%-39.99%
- 40%-50%

1:15,500

0 0.125 0.25   0.5 Miles

Map 19: Critical Infrastructure Affected by Identified Flooding Scenarios

Critical Social Infrastructure with
3', 5', 10', and 12' Sea Level Scenarios

Legend

Infrastructure Type

- Boarding House
- Childcare
- Food Bank/Soup Kitchen
- Historic
- House of Worship
- Library
- Municipal
- Other
- Parks
- School
- Municpal Boundary
- 3' Sea Level
- 5' Sea Level
- 10' Sea Level (3'+1% Storm)
- 12' Sea Level (5'+1% Storm)

1:20,000

0   0.2   0.4   0.8
Miles

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community