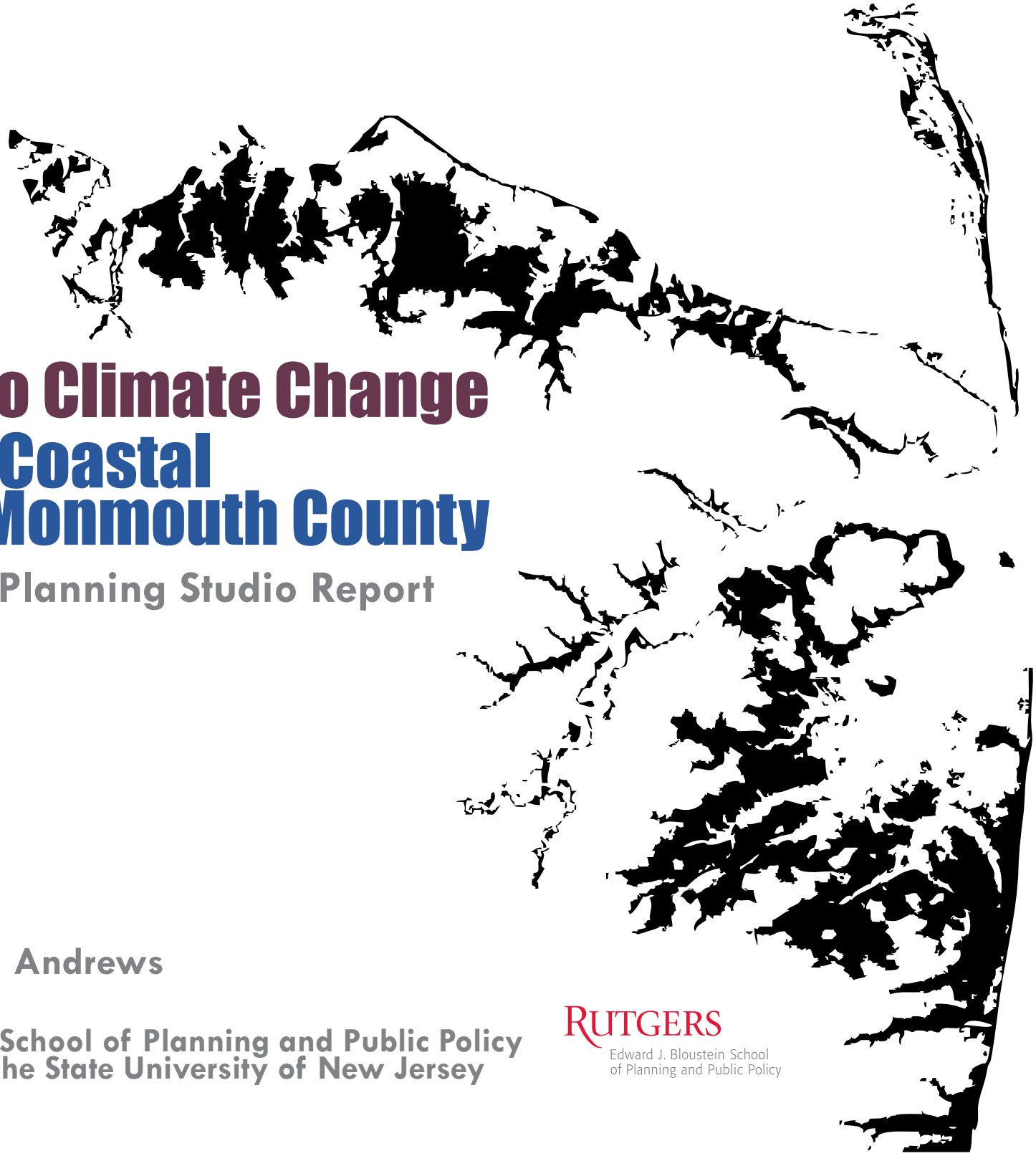

Adapting to Climate Change in Coastal Monmouth County

Environmental Planning Studio Report

Instructor: Clinton Andrews
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Edward J. Bloustein School of Planning and Public Policy
Rutgers University, The State University of New Jersey

RUTGERS
Edward J. Bloustein School
of Planning and Public Policy

2012 Environmental Planning Studio Team

Marcus Ferreira
Christine Bell
Katherine Nosker
Michael Yaffe
Michael D'Orazio
Kyle Davis
Albert Macaulay
Zhuosi (Joyce) Lu
Brian Gibbons

Contents

Highlands House Construction
Credit: Scot K. Bell

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David Listokin, PhD - Professor, Bloustein School of Planning and Public Policy at Rutgers University, and Co-Director, Center for Urban Policy Research of Rutgers University
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Margaret Murnane - Deputy Coordinator, Monmouth County Sheriff's Office, Office of Emergency Management
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Executive Summary

Coastlines are ever evolving, buffeted by the wind and waves, and drifting with the currents. Often, the evolution is gradual, seemingly imperceptible. However, occasionally, the evolution is accelerated by the onset of storms, which can eliminate islands, carve inlets into barrier beaches and completely flood low lying areas. In the New Jersey, there are records of this changing landscape and of humanity's attempts to resist it—lured by the sea and clinging to real property notions of indefinite terra firma—a misplaced assumption on the coast. We have selected three case study towns in Monmouth County New Jersey to illustrate this story and to project what the future holds in the face of climate change and its primary coastal effects: Sea level rise and increased storm severity.

We chose Sea Bright, a small town built on a Barrier Beach that has had inlets form and reform over the centuries, and now has an imposing sea wall, built with external subsidies in 1947, and maintained to date, with external subsidies. The Population has been relatively stable since 1910, but the primary issue here, has been rebuilding more expensive structures following storm events. Notably the sea wall was built behind long since abandoned cottages formerly built on dunes and on a former railroad right of way that was abandoned following repeated storms. This retreat was inevitable due to the impossibility of continually financing rebuilding with local monies (even by wealthy cottage owners). This was the free market operating at its purest.

We chose Middletown, a much larger town geographically and in population that trebled in population following of the construction of the New Jersey Parkway in the 1950's. The inland portions of the town suffer from typical suburban sprawl characteristics that impede the ability of the riverine floodplains from fully performing their natural functions. The coastal portions of the town include the fishing port of Belford and other densely populated areas (Navesink, Leonardo and Fort Monmouth), subject to both coastal and riverine flooding. Here Jetties were built to protect the port and more recently, the New Jersey DEP has been hardening of the dunes to restore beaches along the Bayshore.

Lastly, we also chose Highlands, because it is also on the Bayshore, like Middletown, and is small in area like Sea Bright. However, it differs from both in that it has the highest poverty rate and geographically is bisected by the a Plateau ridge that gives the town its name.

In New Jersey, the effects of climate change represents a unique challenge because the coastal towns of New Jersey are amongst the most densely built and populated in the nation. However, much of this growth has been over the past fifty years, since the construction of the Garden State Parkway in the 1950's, facilitating travel to the shore, attracting vacationers, partial year occupants and full time occupants alike. In part, this has led to the rapid build-up of the New Jersey shore, which in all areas is within two hours of either the New York and/or Philadelphia metropolitan centers.

Federal and state decision making since the Ash Wednesday Storm of 1962 has subsidized development in coastal regions, through shifting the cost of fortification, beach replenishment and flood insurance from the locals to the state and the nation at large. In the past, without significant state and federal aid, after having dune-side cottages repeatedly leveled by storms in the 1890's the wealthy owners of Sea Bright cottages opted for the only choice that the free market would allow: Inland relocation. Now ironically, those who seek continual aid for beach replenishment, sea wall fortification and flood insurance policies that no private insurance actuary would issue—argue that government is imposing increasingly undue regulations on land development in exchange for these sums.

The historical sections of this report detail seemingly ad nauseum how these towns have been historically battered by the sea, dating as far back as the 17th century—prior to significant influence on humanity on climate change. The intent is not to write a history tome, rather, it is to illustrate how these storms are not fluke events, and that the consequences to those who build in the coastal flood plain are doing so at tremendous foreseeable risk, based upon long standing storm patterns found in the historical record. Our analysis then builds off this using state of the art GIS HAZUS modeling and remote sensing LIDAR technologies to interpret the effect of the combination of increased rates of sea level rise and ever increasingly severe storms, on property damage to each of our three study towns in Monmouth County, NJ. This model yields damage data to towns for various storm scenarios; in this report, we explored the 10, 50, 100, and 500 year storms. This information is then transferred to a fiscal model to determine the impacts these storms would have on municipal budgets based on three scenarios: Rebuild, Retreat and Smaller Subsidy.

The Rebuild scenario assumed that all properties damaged in the storm events would rebuild, as history tells us they will. This scenario also assumed that the Federal Emergency Management Agency (FEMA) would pay 75% of debris removal costs, which they currently do, leaving towns with 25% of these costs. The Retreat scenario assumes that all of the substantially damaged buildings (ie those buildings that are 50% or more damaged by storms) would not be rebuilt. This scenario also assumes that FEMA would pick up 75% of debris removal costs. The Smaller Subsidy scenario assumes that half of all substantially damaged properties would rebuild. This scenario assumes that FEMA would only pay 25% of debris removal costs, leaving towns with 75% of these costs. This scenario was formulated to demonstrate what would happen if FEMA made the policy decision to provide less support to coastal towns. The following explains how each town fared for these storms and scenarios:

- Highlands -Based on the fiscal impact analysis of 10, 50, 100, and 500 year storms for the Rebuild, Retreat, and Smaller Subsidy scenarios, Highlands consistently performs best in a retreat scenario. The equalized tax rate is lowest for the retreat scenario for each storm considered, at 1.118 for the 10 year storm, 1.229 for the 50 year storm, 1.299 for the 100 year storm, and .990 for the 500 year storm. Furthermore, the more severe the storm, the better the retreat scenario performs in terms of tax rate for Highlands. In the 500 year storm, the worst storm tested in this model, the Retreat scenario's tax rate was .418 lower than the Rebuild scenario, and .550 lower than the Smaller Subsidy scenario. The tax rate drops substantially in the Retreat scenario for the 500 year storm because of the large loss of population, in proportion to the size of the town. More than one third of people (34%) are lost in that scenario. This means that a far smaller amount of people would be left to receive governmental services, thereby lowering the tax rate significantly. The Smaller Subsidy scenario represents the worst option for Highlands, as it consistently has the highest tax rates for all storms at 1.189 for the 10 year storm, 1.361 for the 50 year storm, 1.494 for the 100 year storm, and 1.541 for the 500 year storm.
- Middletown - In general, based on the fiscal impact analysis of 10, 50, 100, and 500 year storms for the Rebuild, Retreat, and Smaller Subsidy scenarios, the tax rate in-

creased in all scenarios, and the worse the storm is, the higher the tax rate grows. The Municipality of Middletown consistently performs best in a retreat scenario. The equalized tax rate is lowest for the retreat scenario for each storm considered, with an increase of 6% for 10 year Storm, 8% for 50 year Storm, and roughly 10% for 100 year and 500 year Strom. Furthermore, the more severe the storm, the better the retreat scenario performs in terms of tax rate for Middletown. The Smaller Subsidy scenario represents the worst option for Middletown, as it consistently has the highest tax rates for all storms. This is due to the high cost of debris removal. The most significant jump of tax rate occurs on the 500 year storm, which is about 28% tax rate increase. This is also the only one that exceeds 0.6 in all scenarios for all storms.

- Sea Bright - The scenario providing the most consistently low tax rates is the retreat scenario. This is because of the large assessed value in Sea Bright as well as the small population. Seasonal homes, which make up 25% of the housing stock in the town, act as ratables and help offset any loss in assessed value during the 10, 50, 100, and 500 year storms. The large decreases in population of residents and workers also helps significantly decrease the amount of municipal services needed. The smaller subsidy scenario consistently produces the highest tax rates due to the high cost of debris removal. And the rebuild scenario, most consistent with the type of activity seen today, produces increased tax rates linearly. Since it is not affected by loss of tax revenue, the revenue never increases or decreases. Instead the expenditures steadily increase by the amplified intensity and damage of the storms.

The three case studies for the most part show similar trends. However certain municipalities are more affected by the storms. Highlands' budget and tax rate is the most vulnerable with largest percent changes in the tax rate after all four storm scenarios. Sea Bright is the second most vulnerable due to its small population. Middletown is least affected by the storms because of its size and smaller percentage of homes and buildings being located on the coast.

Introduction

a. Overview of Historical Coastal Development

Middletown, "The oldest settlement in New Jersey," was first settled by the Lenni-Lanapé Indians, and then by Europeans Dutch traders as early as 1613. The first documented verification of habitation was in 1626, with fifty families residing there by the 1650's(Mandeville, 1972, p. 35). In April 1665, Governor Nicolls deeded twelve of his English subjects the area now known as Monmouth County, " . . . extending from Sandy Hook to the mouth of the Raritan River, up the river approximately twenty-five miles, then southwest to Barnegat Bay. The area was first known as Navesink, then Middletown and Shrewsbury County, and finally in 1683 as Monmouth County (Klett, 2008)." In the 17th century, a single tract of land was granted to Eliakim Wardell, of what is now known as Sea Bright and Monmouth Beach (Methot, Up & Down the River, 1980). Richard Hartshorne, who resided in Middletown and was owner of Sandy Hook, in a letter written in 1675, described Middletown's landscape as follows: ". . . The naturale Grass of the country is much like that which grows in the Woods of England, which is food enough for our cattle, but by the water side we have fresh meadows and salt marshes. . ." However, from 1665 to 1700 the English settlers started altering the town's natural environment: ". . . the forests gradually receded. Roads for cars and wagons were laid over them. The settlement spread out and salt marsh ceased to be so much sought after as upland meadows were cleared and drained (Mandeville, 1972, pp. 30, 48)."

Middletown's coastline has long been changing through its interactions with wind and water. It is important to note in that the coastline is ever evolving, and attempts to keep the shore static is not only contrary to natural processes, it is very expensive (requiring billions in state and federal subsidies to date) and yet the effort is potentially futile particularly in light of projected sea level rise and more powerful storms projected in the future as a result of climate change.

As early as 1529 Sandy Hook (part of Middletown), was mapped in the wake of Verranzano's explorations. At this time it was a solid land extension from the Highlands. From that point southward there was no fully formed barrier island, with both Shrewsbury Rivers feeding directly out into the open ocean. According to a map made between 1683 and 1685, the barrier island that is now currently known as Sea Bright was then a still forming barrier beach submerged underwater during high tides (Methot, Up & Down the River, 1980). A 1685 survey of Sandy Hook reveals that it was only a quarter of its size in 1927(Mandeville, 1972).

Robert Harthorne's diary entry in 1756 noted that as a result of a January storm, an inlet opened through the barrier beach opposite the Shrewsbury River. A diary entry the following year noted that a second inlet was formed as a result of a storm in January 1757. In January 1778, the British Army's engineers had to create a bridge to enable the army's retreat to Sandy Hook, which prior to the 1757 storm had been connected to Highlands. (Methot, Up &

Figure 1. 1826 New Jersey Map Section
Source: http://mapmaker.rutgers.edu/NJ_1826.jpg

Figure 2. 1834 New Jersey Map Section
Source: http://mapmaker.rutgers.edu/NJ_1834.gif

Down the River, 1980). An illustration of the ever evolving coastline can be seen by comparing an 1826 map with a portion of an 1834 map on the next page, showing how the Old Shrewsbury Inlet reopened in 1830 between Sea Bright and Sandy Hook, making Sandy hook an island again.

However, in approximately 1850, as a result of storms, the Shrewsbury Inlet again re-closed, reconnecting Sandy Hook to Sea Bright and forming what came to be known as Highland Beach (Methot, Up & Down the Beach, 1988, p. 122). In 1865, within fifteen years of the inlet re-closing, the Long Branch and Seashore Railroad was completed and in 1870, the first drawbridge was built between Sea Bright and Rumson (Methot, 1980). In 1880 and again in 1885, the tracks of the rail lines into Sandy Hook were "washed out" at Sea Bright by storms, that also damaged wooden bulkheads and cut deeply into lawns (Methot, 1988, 110). Despite these storms, Highlands Beach, literally only thirty years in existence, already was bounded by three hotels, a steamboat landing, Thomson's Pavilion, Swift House and East View (Methot, 1988, 122).

> Sea Bright was a classic example of how not to develop a beach. Although it was spectacular for a while, most of the early cottages have been relocated or long since been demolished by the sea. The beautiful natural scenery of this young beach, which had only solidly closed itself about thirty years earlier was completely leveled and uncountable yards of topsoil carted over from the mainland and spread. Large and elegant cottages, some of them by any definition, mansions, were built along the beach behind flimsy wooden bulkheads and landscaped with grass and gardens. The properties extended from the ocean to the river . . . (Methot, 1988, 110).

However, a photograph of a fishermen in June Methot's "Up and Down the River", revealed that in 1883 the nearby dunes were twice the height of the men, showing that there were some natural defenses that had not been denuded (Methot, 1980). On January 5, 1889 a storm struck the area, causing much damage to recently developed areas. The effects of the storm's fury was captured in a vintage Philadelphia newspaper article:

> Long Branch, N.J., Jan. 6—The storm which began yesterday raged with great severity all night and did much damage along the coast in this vicinity. The greatest damage was at that portion of Monmouth Beach Between Seabright and St. Peters in Galilee, the costly protestant Episcopal Church on the Beach. Here the sea tore out nearly every bulkhead and washed up under several of the cottages. The surf demolished the bulkhead of the cottage of A.T. Keasby, ex-United States Attorney of Newark; cut a big hole in the handsome lawn, and knocked to pieces one of the brick piers which supported the building. The three cottages of Richard DeGray, of New York, which were undermined by the storm of November 27 escaped damage, but the partly reconstructed bulkheads were knocked to pieces by the angry waters (Special Dispatch to The North American, 1889).

A storm in September of the same year, washed out track between Long Branch and Sea Bright, undermined a number of houses that fell into the ocean, cut a new inlet below Highlands and covered tracks with 2-5 feet of sand (Methot, 1980). This led to the first instance of tactical retreat from the coast. Kobbé [Gustave] noted: "The Monmouth Beach Association having been able to procure the removal of the railroad from its old bed along the bluff to its present site, secured a continuous drive for eight miles along the ocean from Sea Bright to Elberon. The "present site" was a block further inland and it is safe to assume that the railroad was delighted to move back from the surf where they had frequently been washed out (Methot, 1988, 122)."

In spite of the destruction, most cottage owners opted to rebuild, only to be battered by a storm on October 14, 1896: "The ocean washed over the beach to the river in many places between Highland Beach and Seabright. Ocean Avenue was flooded to such an extent that it could be navigated by boat (Methot, 1980, 59)." At Sea Bright a "sea wall" comprising giant piled rocks was destroyed. "The Octagon Hotel was damaged and an owner of two properties lost one house that went adrift into the ocean and the other was taken by the Shrewsbury river, and was found drifting with the tide (Methot 1988, 110). At Highland Beach, the damage was quite extensive. A broad inlet was cut five to six feet deep opposite the head of Island Beach; "through the beach from the ocean to the river . . . The ocean was rushing through this inlet at a great rate last night (Methot, 1980, 59)."

The storms that befell the area on Christmas of 1913 and January 1914 changed coastal development patterns, until state and federal subsidies made it attractive to build in coastal flood zones again. The 1913 Christmas storm caused "[d]amage was heavy all along the coast but it was particularly severe at Sea Bright. Many of the wooden bulkheads were breached and holes cut deep into the lawns behind them (Methot 1988)." "Further, The Octagon [H]otel was badly damaged in the storm Christmas night. It was undermined and the bulkhead in front of it was partly swept away (Methot, 1980)." As a result of the January 1914 storm, June Methot observed:

> "This disastrous storm marked the end of a summer lifestyle of elegance and grandeur which will never be re-created. The sea had won, and the survivors knew it. Some buildings were moved away from the surf; some to the opposite side of the strip. Others, including some very large cottages, were barged across the river to the bluff, including the original Octagon cottage. Others remained where they were and through the 20's and 30's one to two more fell prey to the sea in every major storm." (Methot 1980)

In the 1920's the rail line was removed, with the currently

existing seawall covering the right of way. In April of 1929 The New York Times reported further devastation to coastal Monmouth County, citing wind speeds of 60 mph at Sandy Hook:

> "The High tide inundated the shore between Long Branch, NJ., and Atlantic Highlands, for distances ranges from forty to seventy feet., the flood being from two to four feet deep , and disrupted train service between the two towns. . . . Commuters were forced to travel by bus or motor to Long Branch, Seabright, Monmouth and other intermediate towns. . . . many houses were flooded all along the shore, at Point pleasant, Asbury Park, Seabright, Belford and Monmouth. Some principle highways were made impassable, either by flood waters or drifting sand." (The New York Times, 1929)

In 1934 and 1935 Monmouth County was struck again:

Keansburg, Belford, Atlantic Highlands, Sea Bright and Monmouth Beach were reported flooded. "In some places, including Highlands, fishing boats were washed ashore and pleasure craft were damaged. In others, seafront cottages were reported undermined by the water and in danger of falling into the sea." (The New York Times, 1935)." Of the storms of the 1920's and '30's, in 1988 historian June Methot quoted an unidentified man, old enough to remember:

> "Nothing braved the fall storms in those days except the wooden sides of those grand, summer mansions that graced that slip of land between Sea Bright and Monmouth Beach. Great, breath-holding times, then. You didn't watch the surf spray over the rocks of the Sea Bright Sea wall and possibly flood the streets. Instead, you gasped as each storm wave peeled at the beach houses – sending porches trim and shutters flying in a bleach of sea foam. The real prize was to be in view when one of those grand ladies went out to sea – a house doesn't really "go out" to sea. The sea literally explodes it – the northeast waves would roar beneath the stilted hours, building a pressure underneath with each surge until the roof would explode from the pressure with a geyser of salt water – shoot into the air – and all the sides would fall in upon themselves. At its leisure, the ocean would lap the rubble and pull it out into the surf" (Methot 1988)

June Methot provided a firsthand observation of the 1944 hurricane of 1944 from her childhood home on the northern bank of the North Shrewsbury River: "The shrieking winds roared for 12 hours and reached speeds of 100 m.p.h." The river was 30' above the normal high tide line. "Not until morning did we discover that a sturdy 100—foot dock, 50 to 60 feet of solid concrete bulkhead and one-third of our riverbank had vanished (Methot, 1988)." Following this storm, a $703,000 seawall was built on the former rail right of way, funded jointly by New Jersey, Monmouth County and Sea Bright. Residents, now feeling safer from flooding waters then began spending more money improving their homes (Methot, 1980).

The next major storm was the "Storm of the Century", a.k.a. The Great Ash Wednesday Storm of 1962, which marked an opportunity for changing coastal development patterns, born out of colossal destruction. The Red Bank Register noted that President Kennedy declared the New Jersey Coast a federal disaster area and that locally there was $6 million in damage to public facilities, which would be covered by $2.5 million available immediately for grants to counties and municipalities by the state with the remaining $3.5 million sought from federal Government by Governor Hughes. Far more damage was wrought to private property: "Worst Loss yard for yard, [were] the losses in Sea Bright and Monmouth Beach. . ." (The Red Bank Register, 1962).

Following the storm, NJ Senator Clifford Case argued for the creation of a federal insurance program to cover $45 million in estimated private losses in NJ, of which private insurers would cover only a small amount (Associated Press, 1962). With the creation of the National Flood Insurance Program, New Jersey's failure to use Green Acres funding to purchase devastated properties represented a missed opportunity, as presciently noted by a New York Times journalist in 1963:

> A state plan to purchase large tracts of beachfront that had been denuded by the storms and transform them into public park and bathing areas under its Green Acres program never materialized. The result has been a seemingly large scale program of rebuilding almost to the water's edge at the high water line in areas obviously unprotected by dunes, bulkheads or sea walls. While permitting this, many communities have altered their local building codes in recent months to force the installation of more secure foundations and pilings so the new structures will have a better chance of weathering future severe storms.
> Although the work done by the Corps of engineers has provided barriers against rough seas, it is considered insufficient to protect many shore properties form damage, should a storm similar to that of 1962 again strike the coast. Adequate long-range protection would require the expenditure of many more millions of dollars. . . . About $40,000,000 of the reconstruction funds was spent on public facilities. Of this amount, Washington furnished $18,000,000 through grants-in aid and the state a similar amount, most of it on a matching fund basis."
> (The New York Times ,1963)

The Philadelphia Inquirer noted in a fifty year retrospective piece on the storm of 1962, again reflected on how the 1962 storm represented a missed opportunity, with resulting policies perversely leading to an unprecedented building boom:

> Far from discouraging building on the beach, since 1962 the federal government has inadvertently bucked up development by subsidizing beachfill and flood insurance, and committing billions in disaster assistance for storm recovery.
> Well more than 90 percent of all federal shore-protection projects since 1922 have occurred in the last 50 years, according to data assembled by Western Carolina University researcher Andrew S. Coburn.
> The measures have contributed to an unprecedented building boom and run-up in land prices. Real estate values in the coastal towns from Barnegat Light to Cape May Point have rocketed from $1.2 billion in 1962 to almost $99 billion today.
> (J. L. Wood 2012)

The federal shore protection projects have continued unabated, despite the continued onset of the sea. In 1982, a storm destroyed large areas of dunes and the eastern lane of the access road in Sandy Hook. The government re-pumped the sand back into the area and planted dune grass. By 1988, nearly all of it had eroded away, even without a major storm event (Methot, 1988, 169).

The December 11, 1992 Nor'easter was the worst storm to hit the area since the 1962 Ash Wednesday storm and required the evacuation of 19,000 area residents, with seas 12-18' elevated with the morning high tide, causing two breaks through Sea Bright's sea wall (Methot 1980). State officials reported preliminary estimates of more than $76.5 million in damage to public facilities and the costs of various emergency measures, with damages to private property in the hundreds of millions of dollars (Sherman, 1992). Statewide, 3,200 homes were damaged, with over 2/3 of them located in Monmouth and Ocean counties. However, stricter building codes guarded against even worse building damage totals to those buildings constructed since the 1962 Ash Wednesday Storm:

> If any good news came out of the [1992] storm that bruised the region's coastline two weekends ago, it was the general success of houses constructed under strict building codes to withstand high winds and surging tides, Federal and local government officials say. Moreover, pressures from environmentalists in some beach communities that forced new housing to be set far behind existing dune lines spared those structures heavy damage when the storm swept the dunes away.
> "It takes a storm like this to make believers of a lot of people who resisted these regulations when they were introduced," said Robert A. McCullough, director of construction inspection for Ocean County, where the storm pounded barrier beaches and flooded coastal towns for more than three days.
> (New York Times, 1992).

The Army Corps of Engineers, with federal funding

as well as state and local shares, embarked on a massive 50-year beach replenishment project to last one year, starting south of Sea Bright in 1994 and proceeding north, before replenishing the rest of the county. In the early 2000's, the project began its first round of re-nourishment:

> The ongoing fill project in North Jersey represents an escalation in the Corps' battle with nature. At 21 miles, from Sea Bright to Manasquan, it is the largest beachfill project in the nation's history. If fully funded over 50 years, the $1 billion federal share of the costs would rival the total spent in the history of the program to date. About $5 billion would be required to defend the entire developed Jersey shoreline in the next 50 years; and tens of billions more to hold sandy beaches in front of developed areas nationwide. (Wood, 2000)

However, even with the ongoing beach fill project, storms, such as the 2010 Nor'easter send locals clamoring for even more federal funding:

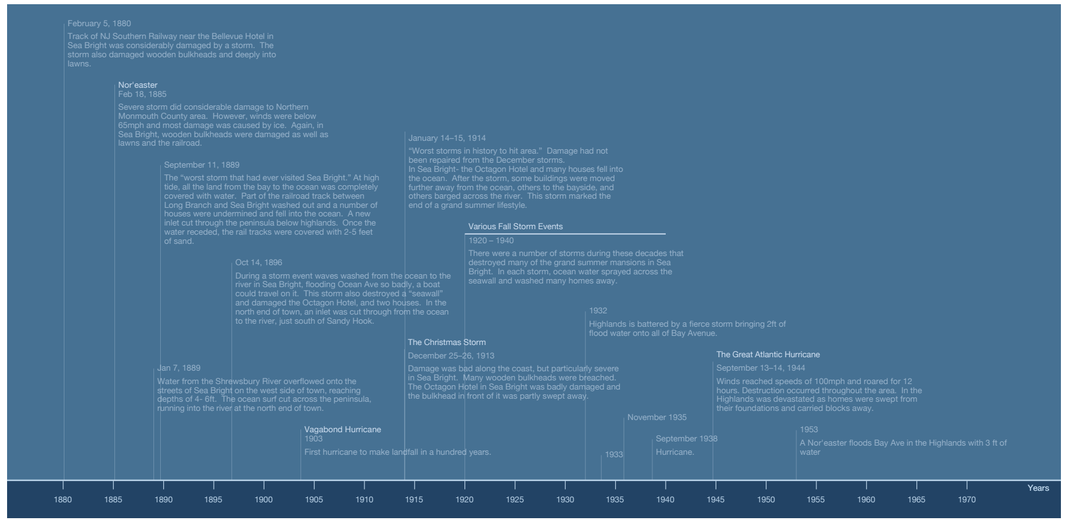
> After a series of winter storms devastated the 27 miles of beaches along the Raritan and Sandy Hook bays, local officials say they need the federal government's help -- now -- to shore up the dunes. Some areas of beach have lost up to 15 feet of sand, barriers that once separated homes and businesses from the Raritan Bay. Near Keansburg and Middletown, breaches in the dunes have resulted in heavy flooding, officials said.

(Spoto, 2010).

Following Hurricane Irene, "a storm surge of 3 to 5 feet along the state's shoreline caused moderate to severe tidal flooding with extensive beach erosion."(Nee, 2011). Predictably, the federal bailout cycle continued: "A $24 million federal investment in beach replenishment, flood mitigation and storm damage reduction projects throughout the New Jersey coastline will give beaches the restoration they need to remain competitive during tourist season," U.S. Sen. Frank Lautenberg (D-Cliffside Park) said Thursday [2/9/2012].(Eder, 2012)

So long as the federal and state governments continue to pay for beach replenishment, sea wall fortifications, and also continues to subsidize flood insurance, we can expect that coastal development will continue unabated throughout coastal New Jersey and the rest of the nation even in the face of climate change.

Storm Events Timeline



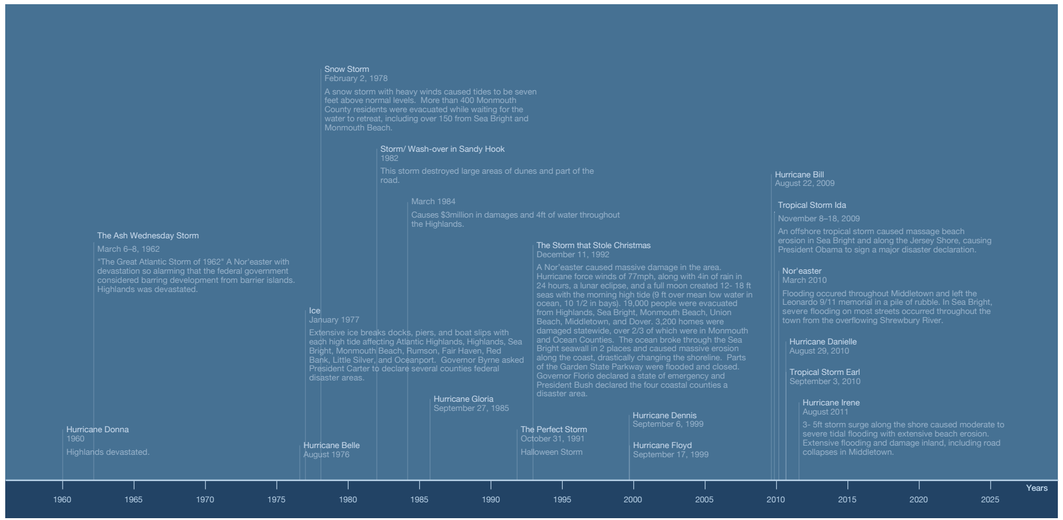
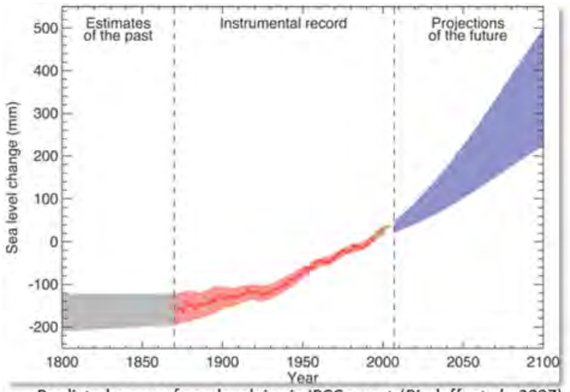


Figure 3. Predicted range of sea- level rise.



Predicted range of sea-level rise in IPCC report (Bindoff, *et al., 2007).*

b. Sea Level Rise:

Sea level is rising along most of the coastlines around the world. The International Panel on Climate Change (IPCC) estimates that the global average sea level will rise between 0.6 and 2 feet (0.18 to 0.59 meters) in the next century. Increases in the rates of sea level raise are caused by increasing global temperatures, which expand ocean water and melt glaciers and ice sheets. The range in projected sea level rise reflects the uncertainty of future global temperatures. The blue area in Figure 3 below graphically illustrates this uncertainty in the rate of sea level rise.

Sea level is not rising uniformly around the world. Current projections indicate substantial variability in future sea level rise at regional and local scales; still, the IPCC has concluded that the impacts are "virtually certain to be overwhelmingly negative." According to the IPCC, sea level rose 5 to 6 inches more in the last century than the global average along the Mid-Atlantic, as coastal lands there are subsiding. The historic rates of median sea-level rise along the New Jersey coast range from 3-4 mm/yr and the projected rates of median sea-level rise in New Jersey are expected to increase to 6mm/yr (Psuty and Silveira, 2007).

Rising sea levels inundate wetlands, erode beaches, and increase the vulnerability of coastal areas to flooding during storms. The most direct affect sea level rise has on the coast during storm events is an overall increase in the base flood elevation. In addition to the swell in base flood heights, shore erosion will inevitably increase the coasts vulnerability to storms by removing sand from the beaches and dunes that protect coastal property from storm waves. As sea-level rises, the effects of storms produce greater inundations and are able to reach farther inland (Psuty and Silveira, 2007). Flooding from rainstorms may become worse if higher temperatures lead to increasing rainfall intensity during severe storms. Smaller storms, which were of little concern before, now may reach levels and locations that were attained rarely in the past (Psuty and Silveira, 2007).

c. Definition of Mitigation and Adaptation

As defined by the Intergovernmental Panel on Climate Change, adaptation is "adjustment in natural or human systems to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2012)."

Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation:

Anticipatory adaptation is adaptation that takes place before the impacts of climate change are felt; Autonomous adaptation, also known as spontaneous adaptation, does not constitute a conscious response to climactic stimuli but is triggered by ecological changes and by market changes in human systems (Smit et al., 2000). Planned adaptation is the result of deliberate policy decisions, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain or achieve a desired state. Urban and regional systems will likely experience all three type of adaptation as the climate changes, but certainly, the spontaneous adaptive measures are likely to be very costly and disruptive. Planning adaptation is clearly much preferable.

Adaptive capacity refers to "The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities."

Researchers have identified specific elements of adaptive capacity, such as: Availability of and access to human and financial resources, flexible and appropriate institutions, strong networks and access to climate information (Yohe and Tol, 2002; O'Brien et al., 2004a; Janssen and Ostrom, 2006; Smit and Wandel, 2006). Therefore, enhancing any of these capacities could be considered a climate change adaptation.

In addition, moving 'from words to deeds' (Smith et al., 2009: 54) requires a number of abilities, such as being able to resolve conflicting perceptions, political objectives, and cultural support (Haddad, 2005; Menne and Bertollini, 2005; Patt and Dessai, 2005; Burch and Robinson, 2007; Fussel 2007; Nelson et al., 2007).

Disaster and hazard mitigation is a component of climate change adaptation. In practice, the definition of hazard mitigation is not that different from that of climate change adaptation. Hazard mitigation is defined by the Stafford Act as "[a]ny action taken to reduce or eliminate the long-term risk to human life and property from natural hazards."

In the process of hazard planning, strategies can be developed to alter, avert, adapt or avoid a hazard. Altering a hazard involves eliminating or reducing the frequency of its occurrence, such as by triggering avalanches, cloud seeding or stabilizing stream banks. Averting a hazard involves redirecting the impact from a vulnerable location, such as by constructing dikes, levees and dams. Adapting to a hazard is defined as modifying design standards such as high wind and earthquake resistant building codes. By contrast, hazard avoidance is defined as keeping people away from hazard areas such as through zoning laws, the purchase of development rights, and/or creating disincentives to building in hazardous areas.

d. Federal Law Overview

1968 The National Flood Insurance Act, 42 U.S.C.

4001, et seq.

In 1968 Congress sought to stop reimbursing people from flood losses a practice occurring since the 1962 Northeaster, and sought to establish a national flood insurance program, placing at least some of the costs on the ratepayers. Congress recognized that:

(5) the Nation cannot afford the tragic losses of life caused annually by flood occurrences, nor the increasing losses of property suffered by flood victims, most of whom are still inadequately compensated despite the provision of costly disaster relief benefits; and

(6) it is in the public interest for persons already living in flood-prone areas to have both an opportunity to purchase flood insurance and access to more adequate limits of coverage, so that they will be indemnified, for their losses in the event of future flood disasters.

(b) The purpose of this Act, therefore, is to--

(1) substantially increase the limits of coverage authorized under the national flood insurance program;

(2) provide for the expeditious identification of, and the dissemination of information concerning, flood-prone areas;

(3) require States or local communities, as a condition of future Federal financial assistance, to participate in the flood insurance program and to adopt adequate flood plain ordinances with effective enforcement provisions consistent with Federal standards to reduce or avoid future flood losses; and

(4) require the purchase of flood insurance by property owners who are being assisted by Federal programs or by federally supervised, regulated, or insured agencies or institutions in the acquisition or improvement of land or facilities located or to be located in identified areas having special flood hazards.

42 U.S.C. § 4002(a) The director of the Federal Emergency Management Agency ("FEMA") was authorized to administer the National Flood Insurance Program, 42 U.S.C.A. § 4011 which was an amendment enacted in 1978, signifying the beginning of FEMA'a administration of the NFIP. Accordingly, all FEMA NFIP payouts start from 1978 and not the date of the inital enactment of NFIA

However, despite good intentions, the act perversely attracted development in flood zones. In 2000, the Philadelphia Inquirer admonished that the act was premised on faulty design: "Normally, insurance rates are based on risk. The greater the flood risk, the more you pay. The flood program gives huge discounts to its riskiest customers — older, flood—prone properties — while charging newer properties full rates. Three of every 10 of the National Flood Insurance Program's properties are still subsidized: 1.2 million properties, resulting in an average annual shortfall of 450 million on those properties." (G. M. Wood 2000)

The Inquirer further that non-essential vacation homes were offered flood insurance: "Six of every 10 National Flood Insurance Program Properties are in beach towns, including vacation homes and investment properties on storm prone barrier islands. All told, $309 billion in federally backed coastal property is at risk, including $11 billion in New Jersey. Coastal areas account for a growing share of the program's most expensive claims, including seven of the 10 costliest disasters. (G. M. Wood 2000)

As of 2000, repetitive loss properties represented "fewer than 2 percent of all properties with federal flood insurance yet account for nearly one-third of all losses – 200 million annually. Congress has blocked attempts to impose surcharges on the owners of these properties or to limit payouts. Now it wants to use tax dollars to put some of those houses on stilts, another subsidy." (G. M. Wood 2000)

Nationally 96% of the 35,000 repetitive loss properties still in the program remain subsidized [as of 2000].

. . .

The problem is particularly acute along the Jersey Shore. 3,887 properties account for half of all flood claims in the state's four coastal counties, totaling $131 million, involve buildings with two or more losses, nearly one-third of the $403 million in flood claims statewide. Sixteen beach towns in New Jersey rank among the top communities nationwide with multiple losses. Homeowners in those towns have made 7, 831 claims, totaling $88.2 million since 1978, an average claim of $11,262

. . .

Last summer [1999], lawmakers proposed spending $200 million more to elevate flood prone buildings. Owners who agree to elevate would have 75 percent of the cost paid by taxpayers. Those who refuse would be charged actuarial rates.

(G. M. Wood 2000)

Since 2000, Flood Insurance Rate Maps (FIRMs) were required, with those seeking federal flood insurance or disaster relief, required to participate in the Nation Flood insurance Program. These FIRMS were to be updated regularly to reflect ever increasing accuracy in flood modeling and to reflect flood plane changes. However, despite these improvements to the program, between 1978 and February 29, 2012, payouts to New Jersey totaled $1,578,747,828.22, ranking New Jersey fifth in the nation (behind four hurricane ravaged Gulf Coast states). Of this amount, Middletown received $5,761,667.19 and Highlands received $10,522,496.66. Interestingly Sea Bright received the highest amount of flood insurance payout subsidies, $14,903,193.01, despite being "protected" by a seawall. (FEMA 2012). On December 23, 2011, President Obama signed the Fiscal Year (FY) 2012 omnibus appropriations bill that includes a provision extending the NFIP through May 31, 2012. (FEMA 2012)

1972 Coastal Zone Management Act ("CZMA") 16 U.S.C. §1451, et seq.

In 1966 the Commission of Marine Science, Engineering and Resources ("Stratton Commission"), released a study on the conflict between development of coastal resources and coastal preservation, concluding that states were in the best position to manage coastal resources, with the federal government providing funds to help states bear the expenses of administration. These recommendations were essentially incorporated into the regulation of land and water uses in the CZMA. (Malone 1991)

Per §1451(c) Congress noted in 1972 "The increasing and competing demands upon the lands and waters of our coastal zone occasioned by population growth and economic development . . . [has led to] permanent and adverse changes to ecological systems, decreasing open space for public use, and shoreline erosion."

Congress enacted a law designed to persuade, in lieu of mandating the states to protect the resources of the coastal zone via coastal management plans. An elective contractual relationship is offered where the state can elect (or not) to enter into an agreement with the federal government and the federal government for its part, can reserve the right to deem the state's plan deficient. However, if the federal government does deem the state management plan in accordance with federal guidelines, the federal government will grant the state monies to effectuate the plan. (Duff 2001).

To qualify, a state's management program must satisfy each of the following required elements within the coastal zone subject to the program:

(A) Identify its boundaries;

(B) define permissible land and water uses, having a direct and significant impact on coastal waters;

(C) take and inventory and designate areas of particular

concern;

(D) identify the means by which the State will exert control over the land and water uses referred to in subparagraph (B), providing a list of relevant State constitutional provisions, laws, regulations, and judicial decisions;

(E) provide guidelines for use prioritization, specifiying lowest priority uses;

(F) describe the organizational structure proposed to implement the management program, including the responsibilities and interrelationships of local, area wide, state, regional, and interstate agencies in the management process.

(G) define "beach", establishing a planning process for the protection of, and access to, public beaches and other public coastal areas of environmental, recreational, historical, esthetic, ecological, or cultural value.

(H) A planning process for energy facilities likely to be located in, or which may significantly affect, the coastal zone, including a process for anticipating the management of the impacts resulting from such facilities.

(I) A planning process for assessing the effects of, and studying and evaluating ways to control, or lessen the impact of, shoreline erosion, and to restore areas adversely affected by such erosion.

16 U.S.C.A. § 1455(2)(A)-(I)

"One aspect of the CZMA, the consistency provision, allows states a voice in activities that are outside of the state territory, but which may affect the state's coastal zone. Critics of the CZMA argue that the federal government bargained badly in constructing the contractual nature of the relationship and that the CZMA, or at least certain features of the cooperative federalism relationship, including the consistency provision, ought to be abolished. . . . But in those circumstances where the federal activity may impact the state's coastal zone, the state must do more than merely object; it must articulate some rational basis for doing so. In fact, in 1984, the U.S. Supreme Court ruled against a state for failure to state a consistency objection within the meaning of the CZMA. This decision led to a congressional strengthening of the state's consistency scope. (Duff 2001)

In addition, the federal government has several exemptions from the state's consistency provision, such as federal lands (such as Sandy Hook); any the president may "exempt from compliance those elements of the federal agency activity . . . found . . . to be inconsistent with an approved State program, if the President determines that the activity is in the paramount interest of the United States." Further and perhaps most importantly, the CZMA may be amended to increase its requirements for states to remain in the program. (Duff 2001). In fact the CZMA has been amended multiple times, with perhaps the most significant amendments occurring in 1990. (Duff 2001)

1990 Amendments, Coastal Zone Management Act ("CZMA") 16 U.S.C. §1451, et seq

In 1990, in recognition of climate change, §1451(l) was added, which recognized that "[b]ecause global warming may result in a substantial sea level rise with serious adverse effects in the coastal zone, coastal states must anticipate and plan for such an occurrence."

In the next section dealing with policy declaration, Congress declared that "the study and development, in any case in which the Secretary considers it to be appropriate, of plans for addressing the adverse effects upon the coastal zone of land subsidence and of sea level rise." 16 U.S.C. §1452 (2)(K).

Further the amendments sought "to encourage the preparation of special area management plans which provide for increased specificity in protecting significant natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making." 16 U.S.C. §1452 (3)

Overall effects of Federal Insurance and Laws on Coastal Development

The CZMA's increased requirements have been helpful, but the sheer amount of development that has been occurring on the New Jersey Shore, in part attracted by NFIP subsidized loss payouts. Since 1978 FEMA's payouts have exceeded $1.5 billion in NJ (FEMA 2012). Granted, not all of the losses are in shore towns (many are near rivers), but it goes to show that the NFIA has attracted tremendously valuable development to coastal at risk areas, which would not have been built, and had not been built prior to the creation of the NFIP in 1968, given that private insurers refused to insure these properties from flood damage. Improved design requirements and flood plain mapping are helpful, but are no panacea in coastal areas where the land gradually shifts in form, and sometimes suddenly during major storms such as 1962 when inlets were suddenly carved out of barrier islands.

f. Mitigation Strategies and Best Practices

Municipalities and the built structures within them are not completely vulnerable to the forces of flooding, sea level rise, and damage brought forth by destructive storms and climate change. In fact, numerous strategies and practices have been proven to at least be partially effective in mitigating the negative effects from occurring or even preventing them altogether. These strategies range from altering the natural environment, altering the built environment, or implementing increasingly restrictive building or development codes, among others. Some geographic entities from both within the United States and abroad have already been implementing some of these best practices. The hope is that these strategies will aid in mitigating the destructive effects associated with major storms. This is not an issue unique to the Jersey Shore. While the New Jersey coastline is certainly highly vulnerable, there are similar coastal developments not only up and down the American east coast, but around the world as well.

There are numerous methods in which humans can alter the natural environment with the mission of mitigating negative effects of storms in vulnerable areas. Many of these methods have been widely practiced both in New Jersey and around the world. However, some practices have proven to be more environmentally conscious than others. For example, among the most prevalently used practices is beach replenishment. This method involves refilling the beach of lost amounts of sand in an effort to not only make a beach larger and more attractive but also creating more of a protective barrier against possible flooding threats. The method involves replacing sand that has been naturally lost due to erosion or drift and replacing it with sand from outside the beach area. It is a common mitigation method that has been funded by both public and private funds. While it creates a natural, soft protection, a number of environmental issues are concerning including the harming or alteration of natural habitats and processes and also questions

regarding where to take the sand from. Another similar method is the creation or protection of sand dunes along a coastline. Sand dunes act as a natural defense against the destructive effects of storms. They are often the first line of defense against things such as large waves or flooding as well as providing valuable space for vegetation and habitat. The creation of dunes where they do not naturally occur, or where they have been destroyed, has minimal negative impacts and therefore is often a favored approach.

Often the most costly effects of destructive storms occur at the property level. Often, waterfront properties within flood zones are the most directly affected by the storms. Therefore, a number of practices have been implemented in response to mitigating the effects and have become widely used as they have been determined to be an effective method. The elevation of property has become a popular practice and it involves physically raising the foundation of a property off the ground anywhere from a few feet to entire floors. This allows a property to be less directly affected by flooding. In some high flood-prone areas, this practice has become a requirement for properties within a flood zone. Many property owners have also taken it upon themselves to reduce the amount of impermeable surface on their respective properties. This allows a larger amount of water to be absorbed into the ground. A property with a large amount of paved surface is more susceptible to flooding, as water cannot be adequately absorbed naturally and has nowhere to go. Also, green building techniques have become more present as knowledge about the benefits of them has increased. These techniques often serve a dual beneficial purpose. For one thing, more modern materials can add strength and longevity to a building in the face of more powerful storms. Meanwhile, green, environmentally friendly techniques can lessen a building's carbon footprint and negative effect on the surrounding environment. As more buildings embrace these techniques, the cumulative effect will be less of a detrimental effect on the environment. This is incredibly important as scientists are increasingly pointing to human induced factors as a prime reason for climate change and the increased frequency of destructive storms.

Modifications made at the municipal level in response to hazard mitigation often closely parallel the ones made at the property level. However, responses at the municipal level have the effect of being more wide-reaching in scope. They are often regulations or codes that require implementation of mitigation practices. For example, a municipality could require the implementation of property elevation requirements or the reduction of impermeable surfaces in high-risk areas within its boundaries. They also have the potential to create a wider development strategy through zoning or other means of responsible practices in regards to flooding and storm events. As an example, a municipality may offer incentives to promote development in low flood-risk areas. This practice has the potential to redirect dense development away from highly vulnerable areas and discourage development from occurring in high flood-prone areas. A municipality also may also locate all newer development and critical facilities outside of a high-risk floodplain. This is a very restrictive measure, but it could become a more prevalent tactic as storms and floods continue to become more frequent and intense and the sea level continues to rise to higher levels as many predict. Another tactic that municipalities have used is dedicating land within the highest-risk floodplains to parks or other open space. This method allows the land to still be beneficial to the public without being built up. When flooding occurs, there is no substantial damage to physical property. Also, the modernization of stormwater drains and systems can help immensely in mitigating the effects of flooding. Outdated infrastructure that is without newer advances in technology can prove to be a liability in major storm events. Municipalities may also use overlay zoning and many of its variations, which allows for additional restrictions for flood protection without changing the use of the land.

A key aspect to producing best practices regarding the mitigation of destructive storm effects and climate change is the proper planning for it. The importance of this is becoming more widely realized, as not only many municipalities begin to draft plans specifically designed towards the issue, but it is also occurring at the county and even state level. Many municipalities in the United States that are particularly prone to the effects of major storms and climate change have taken the initiative to produce forward-thinking plans or included the issue within its comprehensive master plans. Cities of all sizes have taken the time to prepare detailed plans, with cities ranging from small municipalities such as Lewes, DE to major urban centers such as Virginia Beach, VA. One common thread throughout the various plans is the recognition that sea-level rise and, to a certain extent, climate change is an inevitable reality.

As an example, the city of Lewes, Delaware has enacted a Hazard Mitigation and Climate Change Adaptation Action Plan. Above all, the plan recommends incorporating climate change concerns into the comprehensive plan and into future reviews of the building and zoning codes. It also stresses the importance of mapping of future potential flood risks and including them in all planning processes and any future rewrites of the master plan. The city of Virginia Beach did exactly this and has included a section directly concerning sea-level rise due to climate change within its master plan. Its plan recommends a prohibition on construction in floodplains without acceptable mitigation while higher ground the prime focus of development. The town of Seabrook, New Hampshire has similar plans as it recommends that all future development and critical facilities be located outside coastal or flood-prone areas using future projections of sea-level rise as a guide. Furthermore, Seabrook recommends permanently protecting undeveloped coastal areas from development or human intrusion on the natural environment. Seabrook, along with its fellow New Hampshire municipality of Keene, wishes to renovate its transportation network and street grading in order to better handle expected changes in temperature and precipitation as well as flooding threats. Keene also wishes to incentivize infill development in low-risk areas while investigating and promoting building standards from other areas that have similar weather to what New England can expect in the future in order to adequately withstand the effects of storms. All of these towns that have been briefly mentioned are all looking to the future with the knowledge that planning for changing conditions is necessary.

g. Overview of Regulatory Framework in New Jersey

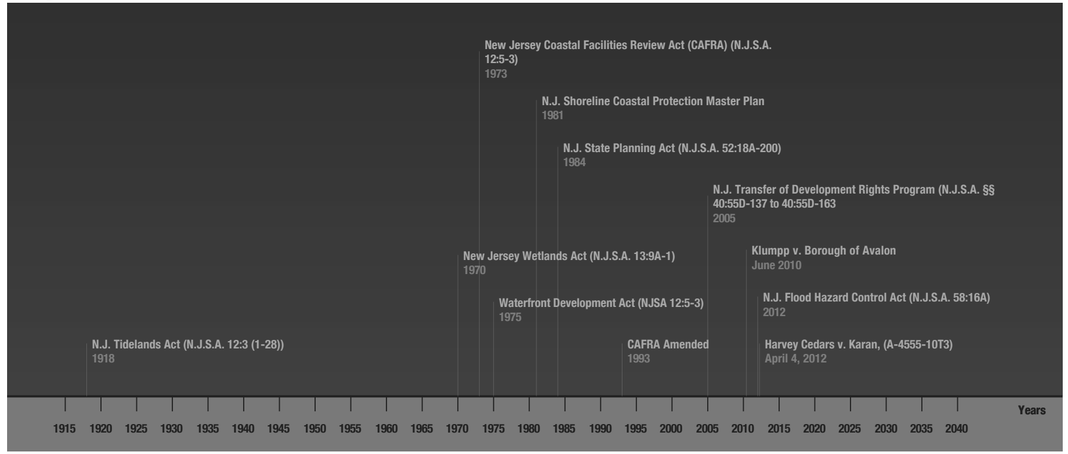
New Jersey has a history of passing some of the most extensive and complex regulatory schemes in the land use and environmental protection arena. It therefore does not come as much of a surprise that it has one of the most extensive coastal management programs as well. This complex system of regulation both constrains and empowers municipalities. State law, particularly the Coastal Area Facilities Review Act (CAFRA) requires extensive coordination with state agencies, since state oversight is strict. Conversely, New Jersey is also a fiercely home rule state, with many state laws empowering localities them to adopt innovative programs to protect their communities, such as the ability to enact Transfer of Development Rights (TDR) systems.

Although New Jersey must live with the historic legacy of intensive development up and down the Shore, many of the destructive trends of the past have slowed or stopped. As David N. Kinsey, former Coastal Management Program Director with the New Jersey Department of Environmental Protection (DEP) wrote, "New Jersey's coastal management efforts have reversed several destructive trends. Filling of wetlands have virtually stopped. . .[n]ew high-rises no longer mar scenic vistas. . . physical and visual access to beaches and waterfronts has increased for walking, fishing, swimming and enjoying the coast, through required public access paths, special beach shuttles to barrier islands, and local waterfront park development...critical natural habitats have been protected . . ." (Kinsey, 2007)

All of this achievement has certainly had a cost, but Kinsey also believes predictability in public decision-making has improved, and that development, while it may have slowed, has been instead directed to appropriate locations. High rises have only been built in areas where they previously existed and he even believes that "more than $1 billion in casino-inspired boomtown development has taken place in the Atlantic City region, but not at the expense of the coastal environment (Kinsey, 2007)."

New Jersey's first regulation pertaining exclusively to its coastal environment was the Waterfront Development Act, dating from 1914. It regulates new development and the

Legal Events Timeline



impact on navigation channels, marinas, moorings and other existing uses. The scope of its jurisdiction is tidal waters and adjacent areas, from the mean high water line to the first paved road, railroad, or surveyable property line, at least 100 feet inland from the tidal water body. Within this zone, the N.J. Department of Environmental Protection (NJDEP) reviews and issues permits for any construction or alteration activity, requiring a Waterfront Development Permit for any project in a tidal waterway anywhere in the state.

New Jersey Wetlands Act (1970) (N.J.S.A. 13:9A-1)

The latter half of the sixty years since the passage of the Waterfront Development Act was passed witnessed an enormous surge in coastal construction; particularly in the Post-World-War II years. In the 1960's over 1,500 acres of coastal wetlands were filled for coastal homes or industrial development. The Wetlands Act regulates development in coastal wetlands, and requires a permit from the DEP to excavate, dredge, fill or build in the regulated area. The law required the DEP to map 300,000 acres of coastal wetlands, notify property owners and hold hearings in each county before implementing the regulations. The process was time consuming, and led to dumping continuing in sensitive areas right up until the moment of implementation. The program has proved successful, however, as the annual rate of wetlands filling fell to less than one acre by the end of the 1970s.

New Jersey Coastal Area Facilities Review Act (CAFRA) (1973) (N.J.S.A. 12:5-3)

CAFRA is based on the principles and standards of the Federal Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.). It functions as the legal foundation for implementation of the state's Coastal Zone Management Program.

The Division of Coastal Resources within DEP administers the Wetlands Act. The challenges with mapping and enforcing it have spurred the legislature to pass the CAFRA. The law places prohibitions on development in erosion hazard areas, contains setback provisions and provides definition of conditions under which ocean front shore protection structures are allowed, and requires the issuance of a permit for certain types of construction within the zone. It applies to all coastal areas not regulated under the Tidal Wetlands Act (N.J.A.C. 13:19-19). The zone is set as by the 10-foot contour interval as the inland coastal boundary. 1,376 square miles, comprising 20% of N.J.'s land area is covered, and all or part of half of the state's 566 municipalities are under CAFRA's jurisdiction. It includes the 127-mile recreational waterfront, industrial tidal riverfront, and bayshores.

Regulated activity includes:

1) All development on a beach or dune

2) Development located within 150 feet of the mean high water line, in areas without development between the subject site and the high water line.

3) Development projects within 150 feet of the mean high water line, in areas where development already exists between the subject site and the high water line, if the development consists of 3 or more housing units, 5 or more parking spaces or public or industrial development.

4) Development projects beyond 150 feet of the mean high water line, if the development consists of 25 or more housing units, commercial projects with more than 50 parking

Figure 5. CAFRA Boundaries. Source: NJDEP

spaces, or public or industrial development.

5) Development projects beyond 150 feet from the mean high water line and a point 500 feet inland, located in qualifying municipalities (pursuant to N.J.A.C. 52:27D-178), if the development consists of 25 or more housing units, commercial projects with more than 50 parking spaces, or public or industrial development.

6) Development projects at locations greater than 500 feet from the high water line if the development consists of 75 or more housing units, commercial projects with more than 150 or more parking spaces or any public or industrial development.

CAFRA requires an Environmental Impact Statement (EIS) be drafted as a component of a development application in the applicable zone.

The eight policies that guide the state's coastal management program are:

1. Promote healthy coastal ecosystems
2. Promote effective management of ocean and estuarine resources
3. Promote meaningful public trust rights to tidal waterways and their shores
4. Promote sustained and revitalized water-dependent uses
5. Preserve and enhance coastal open space
6. Foster safe, healthy and well-planned coastal communities
7. Coordinate coastal decision-making, comprehensive planning, and research
8. Coordinate public education and outreach

Unlike the California and North Carolina coastal acts as well as N.J.'s Pinelands, Highlands and Meadowlands special areas, CAFRA does not supersede local zoning authority and permits are not integrated with local processes. Separate permits are required from local and state authorities for development projects in the CAFRA area.

CAFRA requires a DEP-issued permit for a development of more than 25 units. By the late 1970's it was clear that CAFRA's thresholds became significant loopholes. Legislation was proposed (the "Dune and Shorefront Protection Act, N.J. General Assembly A-1825, 1980) that would require a new coastal permit program for the shorefront area that would allow for dune migration. The bill proposed integrating state and local plans and development review in the coastal zone by authorizing the state to delegate the bill's enforcement to municipalities. The bill failed to pass the legislature, however, upon significant opposition from homeowners and developers. A provision that would have made existing structures non-conforming and prohibited their rebuilding if damaged greater than 50% was a particular lighting rod in the debates about the bill; a policy suggestion that persists as a potential solution to the greater risks associated with climate change and sea level rise.

The 1993 amendments to CAFRA required rules to be adopted that required CAFRA zones to be coordinated with the State Plan (N.J.S.A 13:19-1 et seq).

The state plan, more thoroughly discussed below, is a unique planning process that "aims to channel growth in to urban areas" and preserve remaining natural resources throughout the entire state. Municipalities are not officially required to participate in the process, although many other laws and rules create coercive incentives to do so.

N.J. Flood Hazard Control Act (N.J.S.A. 58:16A)

The N.J. Flood Hazard Control Act applies to construction or land disturbance near rivers, lakes, streams, and in floodplains.

The department recently adopted new Flood Hazard Area Control Act rules along with amendments to the coastal permit program rules and Coastal Zone Management Rules.

The new Flood Hazard Area Control Act Rules (N.J.A.C. 7:13), related amendments to the Coastal Permit Program rules (N.J.A.C. 7:7) and Coastal Zone Management Rules (N.J.A.C. 7:7E) were completed to "incorporate more stringent standards for development in flood hazard areas and riparian zones adjacent to surface waters throughout the State." A zero-percent net fill requirement was implemented statewide for all non-tidal flood hazard areas of New Jersey. The rules expand preservation of near stream vegetation to zones that are now 50, 150 or 300 feet in width (from a previous 25 or 50 feet) depending on the class of watercourse.

The new rules also incorporate the flood hazard and riparian zone standards in the review of CAFRA permits, so that tidal and non-tidal areas are now reviewed under the same standards.

N.J. Tidelands Act (N.J.S.A. 12:3 (1-28))

The N.J. Tidelands Act regulates the construction and land disturbance in areas that are below the highwater line; i.e. tidally flowed or formerly tidally flowed. This means land that is considered riparian area. Sections of the law cover issues such as surveying and reporting of riparian areas,

the establishment of bulkhead and pier lines of the Hudson River, filling of bulkhead lines, construction of bridges; rights of way; and the leasing, conveyance, sale or rental of land below the high-water mark.

All of these lands are owned in the public trust the people of the State of New Jersey. The Tidelands Resource Council was established as the public body responsible for the stewardship of the riparian lands. The Council determines whether applications for a lease, license or grant of such lands are in the public interest. The Bureau of Tidelands Management oversees the administration of the Tidelands Act. Prior to the enactment of the Tidelands Act, the state often sold its riparian rights, however that practice was terminated by the mid-1970's.

The state issues tidelands licenses and leases. Licenses are revocable consents to use the tidal lands for docks, bulkheads and moorings. They are for a finite term and expire at the end of their term. Leases are a long-term rental for up to twenty years. The license fees are set by the state according to the impact the use will have.

N.J. State Plan (N.J.S.A. 52:18A-200)

The state plan is a unique planning process that attempts to preserve natural resources and redevelop existing towns and cities throughout New Jersey.

The purpose of the state plan is to "coordinate planning activities and establish Statewide planning objectives in... land use, housing, economic development, transportation, natural resource conservation, recreation, urban and suburban redevelopment, historic preservation, public facilities and services, and intergovernmental coordination (N.J.S.A. 52:18A-200(f))." Municipalities are not officially required to participate in the process, although many other laws and rules create coercive incentives to do so.

The state plan divides all of the land in the state into zones, called "planning areas." The plan categorizes all land in the state into "areas for growth," "areas for limited growth" and "areas for conservation." Growth planning areas are numbered 1, 2, or 3, 4 or 5. Special areas are designated for the N.J. coastal zone. A number of benefits accrue to a municipality that voluntarily submits to the Plan Endorsement process. The benefits include higher priority for state funding, streamlined permit reviews, coordinated state agency service, approval or renewal of coastal center designations, and the ability to change center designations and/or state planning areas.

While voluntary, New Jersey law requires plan endorsement as a precursor for state approval of centers in New Jersey's coastal region. While there are benefits to designating areas in a town a center anywhere in the state, the stakes are significantly higher in the area regulated by Coastal Area Facilities Review Act (CAFRA). This is because, under state rules, the amount of impervious coverage permitted in the CAFRA zone is limited (N.J.A.C. 7:7E-5B.4). The 1993 amendments to CAFRA required rules to be adopted that required CAFRA zones to be coordinated with the State Plan (N.J.S.A 13:19-1 et seq.). The new rules set limits for impervious and vegetative coverage based on the designation of a parcel's location in a CAFRA zone - a center, core, node, Coastal Planning Area or Coastal Center. The highest densities and coverages were allowed in the coastal or CAFRA Centers. If a town wants to permit development, it often had to have its impervious coverage limits increased by applying the NJDEP and/or Pinelands Commission to change the designated CAFRA zone, which thus required that the town complete the process of Plan Endorsement.

Recommendations include the current regulatory framework to be updated to accommodate statewide climate change estimates. Regulations that impact Erosion Hazard Areas and Wetlands Buffer rules should be updated to account for Sea Level Rise.

N.J. Transfer of Development Rights Program (N.J.S.A. §§ 40:55D-137 to 40:55D-163 (2005))

Transfer of Development Rights (TDR) is an advanced system of land use regulation intended to balance the injustice of losses and gains due to land use regulation. TDR has been called "the most innovative, imaginative and potentially effective technique of land use control...since the introduction of zoning and subdivision regulations (Rose, 1974)." TDR has been used to protect farmland from development, to prevent development in floodplains, and to protect historic sites in cities. TDR can accomplish these goals "without any direct cost to government (Ibid)," making it perhaps one of the most cost-efficient transformational adaptations available.

TDR programs are designed to shift development from "sending" areas (where the community wants to preserve land) to "receiving" areas (where higher density development is appropriate). TDR programs have been tacitly endorsed by the U.S. Supreme Court as a possible means to avoid a "taking" of private property under the 5th Amendment of the U.S. Constitution, a major issue with any regulation that can potentially eliminate the right to develop coastal land (Penn Central Transp. Co. v. New York City, 438 U.S. 104).

New Jersey first passed legislation permitting towns to establish TDR programs for use in its special planning areas - first in the Pinelands in 1981, and later in the Meadowlands. In 2004 the state subsequently enacted the N.J. Transfer of Development Rights Act, which authorized all municipalities in the state to use TDRs (N.J. Stat. Ann. §§ 40:55D-137 to 40:55D-163 (2005)).

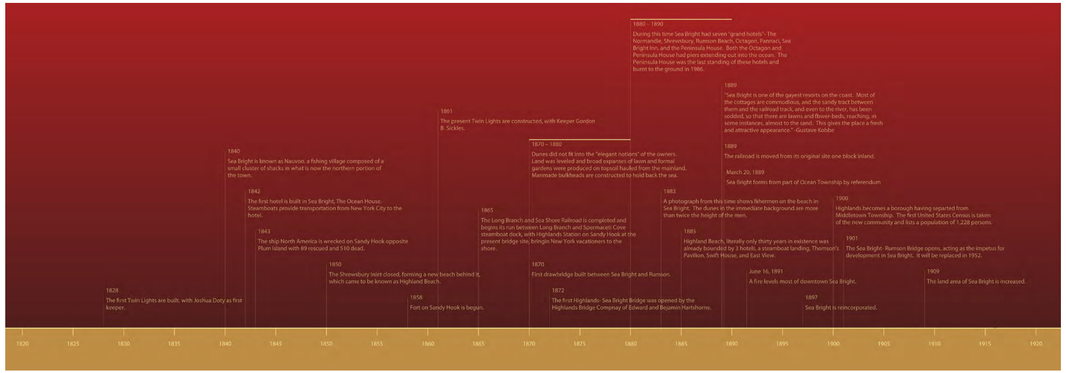
New Jersey's TDR program is often considered the most advanced and extensive in the country. One of the reasons is that the state established a TDR bank funded by a state bond act. In the Pinelands, the first area of the state that used TDR, over 19,000 acres have been preserved since 1981. Modifications were made to the program to overcome a slow start, including a $30 million bond act for infrastructure improvements in receiving areas.

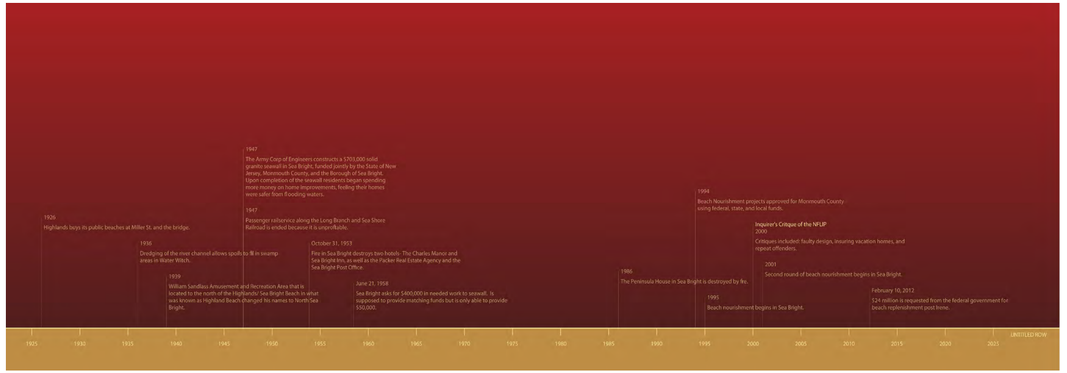
The TDR program supports the municipality's land use designations and master plan that are coordinated with the state plan.

Dune Preservation and Recent Case Law

The Superior Court of New Jersey, in Borough of Harvey Cedars v. Karan, (A-4555-10T3) recently affirmed a jury award of $375,000 for acquisition of an easement for blocking a shorefront homeowner's view of the ocean. The Borough of Harvey Cedars reconstructed a dune as part of a beach replenishment project. The court determined that protective benefits the dune provided were "general benefits" and not "specific benefits" conferred on plaintiffs. New Jersey law defines general benefits as those that all property owners share and cannot be deducted from a property owner's just compensation. The court refused to hear testimony by the Borough that the project did confer a specific benefit on the owner's property. Unfortunately this case has the potential to chill local government beach replenishment and dune protection programs, since it may spur a rash of

Historical Events Timeline





homeowners claiming that they too have a right to compensation. The Borough pledged to appeal, so if the New Jersey Supreme Court agrees to hear the case and affirms the Appellate Court's decision, it could spell a significant statewide setback for coastal protection programs in New Jersey. Municipalities will have to consider alternative means of paying for their dune protection and restoration programs; one possibility is through TDR.

The courts in New Jersey have also affirmed homeowners' rights to compensation even after a coastal storm substantially destroys the dwelling. In a 7-0 decision, the court in Klumpp v. Borough of Avalon, determined that "physical invasion and physical taking of real property" occurred when the Borough appropriated the Klumpp's land for a beach replenishment project. The Klumpps constructed a house in 1961 which was destroyed by a Nor'easter in 1962. 33 years later the Klumpps applied to build a house on the land, which they continued to own and pay taxes on that entire time. The Borough did not offer any compensation for the property, and the court found both a physical taking occurred in 1965 and a regulatory taking in 1995, contrary to the New Jersey and U.S. Constitutions.

Both of these cases highlight the challenge that the courts and constitutional law can present to a rational system of land use in the face of rising seas and climate change. Until a constitutional amendment is passed or courts begin to recognize the transient nature of private property rights in coastal locations where land is not permanent, these decisions will continue to present challenges to municipal and state coastal protection programs.

Methods

Middletown Dune Construction
Credit: Scot K. Bell

Middletown Dune Repair
Credit: Scot K. Bell

a. Case Studies

All three case study communities are located along the northern coastline of Monmouth County, New Jersey. Sea Bright is the northernmost community in New Jersey along the Atlantic Ocean, while Highlands and Middletown are located along the Raritan/ Sandy Hook Bayshore. The three case study communities were chosen based on a number of factors including their uniqueness and economic diversity. Middletown is a large municipality with an economically diverse population. The community is subject to bayshore and riverine flooding. Highlands is a much smaller community, and is geographically bisected by a steep slope, separating the community into a bayshore floodplain and a plateau, located at a much higher elevation. Traditionally, Highlands has been a community of working-class clam diggers, although its economic base has diversified in recent years. Sea Bright is located on an extremely narrow barrier spit and is prone to riverine flooding. Historically, Sea Bright has some of the oldest development along the coast, as well as the oldest history of coastal fortifications. In the late 1940's a seawall was built, running the entire length of the Borough. More recently, the community has undergone massive beach replenishment and dune planting projects.

b. Data Collection and Methods of GIS

In order to obtain the storm damage data necessary for illustrating financial loss to the Monmouth County municipalities from probabilistic future storm events, three specific sources of data were utilized. The first set of data used is the Monmouth County LiDAR Digital Elevation Model (DEM), which was put in to the HAZUS program to develop more accurate elevation modeling, resulting in higher accuracy flood representation and prediction. The LiDAR DEM is from a data collection that took place from December 2006 to

Table 1. Probibility of Storm Occurrence

Storm Return Period	Probability of Occurrence				Base Flood Elevation	Base Flood Elevation (30-yrs SLR)
	1 year	7 years	15 years	30 years		
10-Yr Storm	10.0%	52.2%	79.4%	95.8%	7.0 ft	7.6 ft
50-Yr Storm	2.0%	13.2%	26.1%	45.5%	9.6 ft	10.2 ft
100-Yr Storm	1.0%	6.8%	14.0%	26.0%	10.9 ft	11.5 ft
500-Yr Storm	0.2%	1.4%	3.0%	5.8%	13.4 ft	14.0 ft

February 2007. The DEM has a vertical accuracy of 0.6 feet and a horizontal accuracy of 1 meter. This is a great improvement over the standard HAZUS DEM, which uses the default USGS 30-meter DEM, which contains about a 2.44 meter vertical accuracy.

The second source of data that was utilized was the FEMA Flood Insurance Rate Maps. These are maps that FEMA produces that delineate "both special hazard areas and the risk premium zones applicable to the community." The data from these maps were used as a preliminary look into properties in the case study areas that are known to be at risk for flood hazards and how much financial support was provided through the NFIP to these properties. In addition, the map data was used to identify how many properties were considered to be severe repetitive loss (SRL) properties. These SRL's are by far the most expensive properties covered by the NFIP and concentrations of these properties could indicate zones where the subsidized coverage of properties was encouraging risky development along the shore.

The third source of data was data collected through the U.S. Census and was used by the HAZUS program. The HAZUS program's standard damage estimators use U.S. Census information such as general building stock to produce financial damages to a selected area. Specifically, HAZUS utilizes 2000 Census data for some of its estimations, which mainly encompasses the population data used to estimate population impacts such as displacement and shelter requirements. HAZUS also uses data from the Department of Energy's Housing Characteristics 1993, A Look at Residential Energy Consumption in 1997, and A Look at Commercial Buildings in 1995 to estimate residential and commercial building damages and impacts.

These three sources of data were used to first observe the historic impact of storm events along the New Jersey shoreline, and then used to estimate the impact of future storm events on the area. These future storm events were found using the HAZUS-MH program developed by FEMA. The three sources of data were used to find impacts of storm events on the study areas at a more accurate level than the standard HAZUS outputs. While much of the data used in the outputs is the same as the standard models in HAZUS, the use of the LiDAR-based DEM allowed the outputs for the study areas to be more accurate in terms of flood extents and damages than the standard model. Further refinement of the HAZUS model had proven extremely time consumptive, to the point that production of final flood models was questionable in the time frame available. As such, the use of partial Level 2 refinement in the HAZUS model was decided as the best course of action for producing usable figures and outputs for the project.

Within HAZUS there are multiple hazard scenarios that can be selected, Hurricane, Flood, Volcano, and Earthquake. The two applicable hazard events being Hurricane and Flood, the choice was made to use the Flood event as the model for estimation of losses in the study area. The decision was made based on multiple factors. The first of which being that the flood model was able to show damage impacts around a greater portion of the study area, where the hurricane event was more exclusive in where the hazard effects reached within the study area. For example, even when the flood and hurricane data were used to produce a storm surge estimate of a hurricane event, the resulting model tended toward damage concentration along the immediate shore, where the flood model alone was able to show damages along the coast as well as into riparian inlets along the study area. This would allow for a more in depth view of the damages inflicted by the storm events. A second point in favor of the flood model is that the flooding that occurs as a result of hurricanes is the more frequent and more costly storm event in the study area. The study area may experience hurricane events on occasion, but more often than not the hurricanes that make the trek up the eastern seaboard become downgraded to tropical depressions and produce a large amount of precipitation, resulting in extensive flooding along the coast, in contrast with the powerful winds and storm surges that are the most damaging factors of a full strength hurricane.

Within the flood model, there are options to estimate riparian and coastal flooding events. The coastal flooding events were chosen due to the limited extents of the LiDAR-based DEM. The riparian flood events required HAZUS to create hydrology models that required the inclusion of a DEM that greatly exceeded the available LiDAR data, which would result in diminished refinement of the flood model. That being the case, the coastal flooding was the only flood scenario used to estimate losses in the study area. It was also important to note that the study area included very little riparian area that was not considered a part of the coastal zone by the HAZUS program, so there was little data loss from the exclusion of riparian flooding. The coastal flooding events were then taken at the 10, 50, 100, and 500 year levels. The progressive levels of flooding were used to show the growing extent of damage of increasingly powerful events, as well as draw attention to the increasing frequency of such events with the rising sea levels.

Sea level rise is a result of climate change, which involves the displacement of the shoreline at all coastal margins, including those on the barrier islands, the baysides, and the mainland. This results in all coastal areas seeing the mean sea level rise, resulting in a loss in horizontal beach area. The sea level rise and climate change are also predicted to result in increased frequency of higher level storm events. To illustrate this, the increasing flood levels were shown with the additional sea level rise and the corresponding year. These estimates are based on IPCC estimates from 2007.

Storms can be measured by their return periods or average recurrence interval over an extended period of time. The table below lists the probability of occurrence, the base flood elevation and the base flood elevation after 30 years of projected sea level rise (6 mm/yr) for each of the 10-, 50-,100-, and 500-year storm return periods. The probability of occurrence for each storm event is given at the intervals of 1 year, 7 years (average time a person stays in a home before moving), 15 years and 30 years (standard lengths of home mortgages). It is interesting to note that the increase in the projected base flood elevation after 30
years of sea level rise is 0.6ft, which is equal to the vertical accuracy of the 1- meter LiDAR-based DEM.

In order for HAZUS to produce the outputs of damage estimates it utilizes standard damage functions. The damage functions are assigned to each building occupancy class and foundation type. These damage functions are then combined with the estimated water depths to determine percent damage to each building. HAZUS then takes the percent damage and multiplies it by the replacement value of the occupancy class to get the estimated dollar loss for the occupancy class, and the combined dollar loss gives the estimate for the study area.

The next step of estimating the financial impact of the storm events involved performing fiscal analysis on the individual case study municipalities. In order to produce the fiscal impacts, the HAZUS outputs were used as inputs in the fiscal analysis models. The outputs for HAZUS are given as different categories of dollar losses for each storm level event. So, the production of the data from the HAZUS models are the variable inputs in the fiscal analysis which help to determine the estimated fiscal impact of the different storm events on the case study municipalities.

c. Fiscal Impact Analysis Methods

Why do a Fiscal Impact Analysis?

Storms, sea level rise, and climate change impact communities in a variety of ways. These storms cause flooding, property damage, loss of business, and can even be life threatening. In this project, we considered the fiscal impacts of these storms on communities in order to better understand the mitigation-related decisions they are making currently and to use this as a basis for proposing recommendations for coastal management strategies that might better preserve the environment and property, while at the same time meeting both municipal and personal interests.

Fiscal impact analysis estimates the net financial effect of storm events on municipalities' budgets. This involves the evaluation of tax revenues and expenditures associated with storm events. Municipal revenues consist of such components as local property taxes, state aid, licenses, fees and permits. The expenditures side of towns' budgets consists of categories like public safety, administrative, parks, recreation, culture, and public works. As a result of storm events, municipalities face additional costs for debris disposal, the temporary relocation of residents, and additional capital costs for public infrastructure that was destroyed or damaged during the storm. At the same time, they are faced with decreased tax revenues because property was destroyed and residents could have moved away. HAZUS outputs were used to quantify the magnitude of these expenditures as well as the reduction in tax revenue.

Fiscal impact analysis is used in this report to determine the impact of storms on municipal budgets as well as in a series of "what if" analyses. Through these "what if" scenarios, we examine the impact of certain personal or policy-level decisions on municipal budgets to help municipalities understand the impacts such policies might have on their budgets. The scenarios we examine are Retreat, Rebuild, and Smaller Subsidy. These scenarios will be explained below.

Note that this model uses an average cost fiscal impact analysis. This implies linear reductions when there may be some instances in which changes in services, revenues or expenditures are no longer linear.

Expenditures

The purpose of the model is to analyze how flood events and adaptation strategies will affect municipalities' budgets via both expenditures and revenues. These elements must be equivalent for town to achieve a balanced budget. The following steps were taken to complete the expenditures side of the fiscal impact analysis.

The expenditures of each municipal budget were first broken up into service categories and the associated cost was listed according to the budget. Next, these expenditures were allocated based on residential and non-residential use categories. This allocation is based on an average of the percentage of residential and non-residential assessed values and the percentage of residential and non-residential parcels. Once these expenditures were allocated, the per capita costs were calculated based on the total population of the municipality and well as the total amount of workers from U.S. Census data.

Once the municipality's existing expenditures were allocated, it was determined which expenditures would be affected by flooding and adaptation strategies. Although

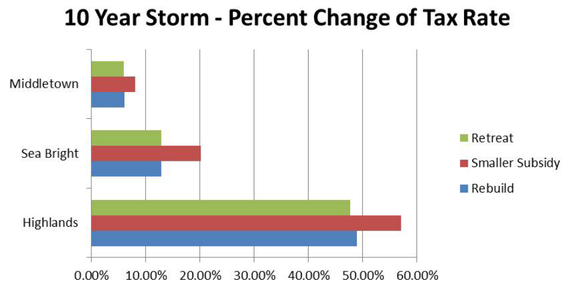


Figure 6. Percentage change in tax rates for each municipality after a 10 year storm event

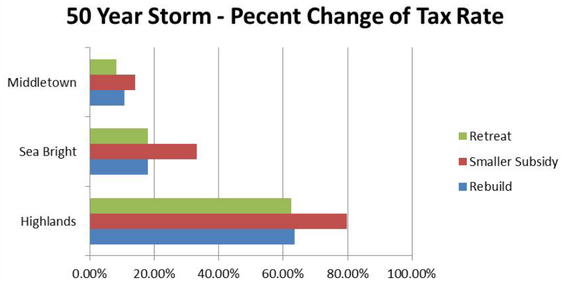


Figure 7. Percentage change in tax rates for each municipality after a 50 year storm event

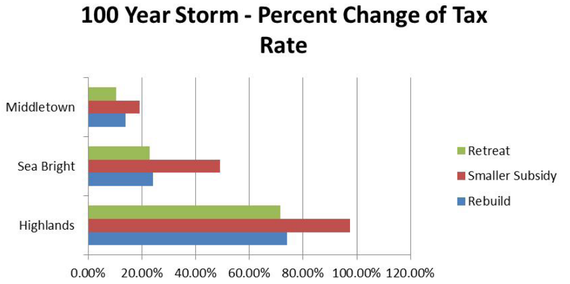


Figure 8. Percentage change in tax rates for each municipality after a 100 year storm event

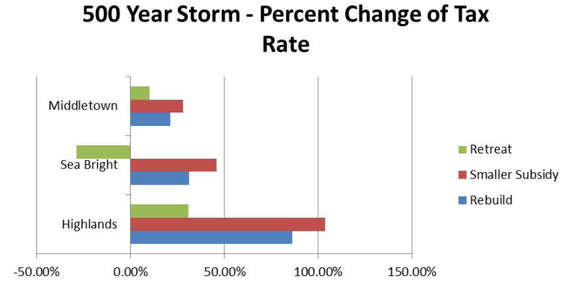


Figure 9. Percentage change in tax rates for each municipality after a 500 year storm event

the categories of expenditures were not all the same for each municipality, the most similar ones were chosen. For example in Sea Bright, the expenditures include Engineering Services, Police Department, Police Dispatch, Office of Emergency Management, Fire Department, Street and Road Maintenance, and Public Health Service. Expenditures also include the annual debt payment of any new infrastructure cost from storm damage like a new police station, fire station or hospital. The total amount of new expenditures was summed and calculated as an output.

In a flood event, expenditures are expected to increase in some areas and decrease in others. When a severe flood occurs certain houses may be destroyed or may be bought by the government. When this happens the population of the municipality decreases and the cost of certain services may be able to be reduced. However if a hospital is partially destroyed or a police station becomes severely damaged, the expenditures for these services will increase because of their critical nature. The increased and decreased costs of expenditures were chosen based on information gathered from interviews, municipal protocols, and research of past reactions to storm events by municipalities.

Revenues

To analyze the revenues section of the three municipal budgets, the revenues were broken into categories and the associated amount from the budget was listed. Next, these revenues were allocated based on residential and non-residential categories. The allocation is based on an average of percentage of residential and non-residential assessed values and the percentage of residential and non-residential parcels. Once these revenues were allocated, the per capita revenues were calculated based on the total population of the municipality and well as the total amount of workers from U.S. Census data.

Once the existing budgets' revenues were allocated, the revenues that would be affected by flooding and adaptation strategies were determined. Although the categories of revenues were not the same for each municipality, the source of funding most likely to be impacted, municipal receipts from property taxes, was calculated for each town. The total amount of new revenues, whether increased or decreased, was summed and calculated as an output.

In a flood event, municipal revenues are expected to decrease because buildings are destroyed, and people and businesses are displaced, thereby decreasing the tax base. However, intergovernmental transfers to municipalities might increase at the same time as the Federal, State or County governments step in to help towns suffering from these natural disasters. The increased and decreased revenues were chosen based on information gathered from interviews, municipal protocols, and research of past reactions to storm events by municipalities.

Data Sources

The fiscal impact analysis models were created using data from several sources including the 2011 County Abstract of Ratables, 2010 U.S. Census data, and the 2009 U.S. Census Longitudinal Employer-Household Dynamics dataset, as well as the user-friendly municipal (2011) budgets. These data were used in a series of steps to create outputs that could be used for the analysis of both flood events and various solutions to various adaptation strategies.

Key Assumptions and Scenarios

Fiscal impact analyses were conducted for a series of scenarios including Retreat, Rebuild, and the Federal Government Pays Less. Some assumptions, listed below, are common to all scenarios, while some are specific to each scenario.

All Scenarios

For all of the below scenarios, fiscal impacts were determined for 10, 50, 100, and 500 year storms for Sea Bright, Highlands, and Middletown. HAZUS outputs were used to aid the fiscal impact analysis.

Public Safety

To calculate the public safety cost associated with the storm, we divided the total police budget by 365 to determine the police budget for one normal day. We assumed that a typical police budget consisted of three shifts per day at 25%, 50%, and 25% respectively, for a total of 100% capacity. In the case of a disaster, the police department would need to deploy more officers for longer periods of time, generating a cost for the municipality. We assumed that the shifts would rise to 50% capacity for each of the three shifts, generating a total of 150% capacity for one day. Lastly, we assumed that police department costs would be raised for one day for a 10 year storm, four days for a 50 year storm, one week (seven days) for a 100 year storm, and two weeks (14 days) for a 500 year storm. This additional cost was added to the expenditures side of the municipal budgets.

Relocation and Debris

During storm events, residents must be relocated temporarily for their safety. These relocation costs were taken from HAZUS and added to the expenditures side of municipal budgets. Debris removal costs were also added to municipal expenditures as a result of storm events. We assumed that removing one truckload of debris employs three people for four hours at $50 per hour per person, for a total of $600 per truckload. HAZUS estimates were used to determine the number of truckloads required to remove debris from each storm.

Insurance Premiums

Insurance premiums were reported as separate from towns' budgets. This was equivalent to the building loss as reported by HAZUS divided by the number of years it would take to collect premiums to recoup the costs. For instance, the building loss would be divided by 10 in the case of a 10 year storm.

Infrastructure

In each storm event, municipal infrastructure is damaged. It is assumed that municipalities would replace these facilities, paying for them by purchasing bonds for their reconstruction. The amount of building and content loss are taken from HAZUS and reported here. Bonds were assumed to last 30 years and be available at 5% interest. Annual payments were calculated accordingly.

Change in Assessed Value

To calculate the change in assessed value, we began with the change in number of residential and commercial buildings. Next, we multiplied the change in residential buildings by the median assessed residential value for the town, found in the 2010 US Census. Then, we multiplied the change in commercial buildings by the total assessed value for commercial properties divided by the total number of

parcels, both of which were reported in the 2011 Monmouth County Abstract of Ratables. This average value per parcel amount was used for commercial properties because the US Census does not report mean, median, or mode assessed values for commercial properties. The two values were added together to generate the total change in assessed value for the town.

Change in Population and Workers

Changes in population were determined by multiplying the change in number of residential buildings by the average number of people per household. This average number of people per household was generated by dividing the total population of a town by the number of occupied housing units, both of which were reported in the 2010 US Census. The change in workers was determined by multiplying the change in number of commercial buildings by the total number of workers as reported in the 2009 U.S. Census Longitudinal Employer-Household Dynamics dataset divided by the total number of commercial parcels, reported in the Monmouth County Abstract of Ratables.

Expenditures Per-Capita and Per-Worker

Expenditures per capita and per worker were determined first by calculating the average of the percentage of residential and non-residential assessed values and the percentage of residential and non-residential parcels. This yielded an estimated percentage of residentially- and non-residentially-associated expenditures. These percentages were then applied to expenditures to yield a total estimated residential and non-residential expenditure for each scenario. These residential expenditures could then be divided by the total population to determine the per-capita expenditure, just as the non-residential expenditures could be divided by the total number of workers to yield the per-worker expenditures.

Total Expenditures

To begin, the increased public safety and debris removal expenditures associated with storms were added into the municipal expenditures. These expenditures were then allocated into residential and non-residential categories, as explained in the section entitled Expenditures Per-Capita and Per-Worker, and then calculated to yield a new per-capita and per-worker expenditure. The total residential expenditure, total non-residential expenditure, annual bond repayment amount to replace infrastructure, and relocation cost were added together. However, with a population loss, it was assumed that fewer governmental services would be necessary to serve that population. So the calculation did not end there. Added to this expenditure was change in population multiplied by the per-capita expense, as well as the change in workers multiplied by the per-worker expense. In this way, the reduced services necessary due to accommodate a reduced population resulted in a reduced municipal budget to serve that population.

Tax Rates and Local Purpose Tax Revenue

For the purposes of the analysis, we used the nominal tax rate as reported in the Monmouth County Abstract of Ratables for 2011. For historical comparisons of property tax rates, we used equalized rates calculated by multiplying the nominal rates in the Monmouth County Abstract of Ratables by the equalization ratios for each year. The tax rates reported in the scenarios are all equalized using the 2011 equalization ratio.

The new local purpose tax revenue (or property tax) was calculated by multiplying the nominal tax rate in 2011 divided by 100, by the new total assessed value. This calculation demonstrates the amount of money that could be raised based on the current tax rate by the new tax base (or assessed value) after the storm.

Total Revenue

The new total revenue was calculated by subtracting the change in local purpose tax revenue from the 2011 municipal revenues, as this is the only way in which revenues to the towns change.

Net Revenue

Net revenue was calculated by subtracting expenditures from revenues.

Adjusted Tax Rate

The adjusted tax rate was calculated by taking the new total expenditures and subtracting the sum of all revenues, excluding those revenues from property taxes. This amount was divided by the new assessed value divided by 100.

Rebuild

For the Rebuild scenario, we assumed that all properties damaged in storms would rebuild. This is supported by historic research, which demonstrates that property owners decide to either rebuild damaged buildings themselves or will sell or rent to people who will rebuild. This scenario also assumes that the Federal Emergency Management Agency (FEMA) would pick up 75% of debris removal costs, as they do now. This is considered the baseline scenario.

Retreat

In this scenario, we assumed that 100% of the properties that were substantially damaged in storms would not rebuild. This scenario represents a deliberate policy decision that could take place at the Federal, State or Local level that rebuilding in places that continue to be flooded and cost money on all levels of government is not in the interests of government, property owners, other stakeholders, or the environment. This scenario also assumes that the Federal Emergency Management Agency (FEMA) would pick up 75% of debris removal costs, as they do now. The hypothesis is that this scenario will result in a lower overall tax rate for municipalities, and will thus be an attractive flood management scenario. However, we understand that this scenario is emotionally charged and politically difficult, since peoples' communities would be at risk of changing and possibly shrinking. We suggest that this scenario be framed as creating more green, open spaces for this community and, indeed, all of New Jersey.

Federal Government Pays Less

In the Federal Government Pays Less scenario, we assumed that citizens around the country would grow tired of subsidizing wealthy people on the coasts, and would severely limit FEMA's ability to pay flood insurance premiums and contribute to escalating costs to rebuild and recover from disasters. Under this scenario, we assumed that reduced subsidies would lead only 50% of property owners to rebuild. We also flipped the FEMA and municipal contributions to debris removal costs, leaving towns with 75% of debris removal costs.

d. Interviews/Stakeholders

There were numerous interviews conducted for this study. Interviewees were selected based on their knowledge of

the area being studied. These included county government workers, municipal workers, political representatives, real estate agents, and residents. For any non-government worker waiver forms were signed or verbally agreed upon. These interviews helped support the creation of the fiscal impact analysis model, suggested adaptation strategies, and the historical analysis of the selected municipalities.

Methods for conducting interviews

To conduct interviews, a list of potential stakeholders was compiled including but not limited to municipal and county officials, homeowners, renters, emergency management personnel, municipal planners and real estate agents. A list of all identified stakeholders can be found in the appendix. Stakeholders were then contacted to determine their willingness to participate in interview sessions. Interviews were held in person, via telephone and email. Interview sessions lasted approximately 30- 45 minutes and were conducted following IRB protocol. Summaries of interviews can be found in the appendix.

Sea Bright Sea Wall
Credit:Scot K. Bell

Case Studies

Case Study 1: Sea Bright

Physical Setting

Sea Bright is located along the Atlantic Ocean in the northern portion of Monmouth County. It is bounded to the north by Gateway National Park at Sandy Hook, to the south by Monmouth Beach, to the east by the Atlantic Ocean and to the West by the Shrewsbury and Navesink Rivers. Sea Bright is 6/10th of a square mile in land mass. Although it is four miles long, it has an average width of less than ½ mile. Elevations within the Borough range from sea level to 15ft at the highest point, with an average elevation of 6 - 8 feet. Despite it's extensive coastline, all of the natural barrier beach vegetation has been removed due to the long history of development; making the town highly susceptible to damage from storm events. Due to its low elevations, lack of natural defenses, and the inherent nature of a barrier beach, Sea Bright is highly susceptible to flooding events. Most flooding events in Sea Bright occur due to high levels of water in the river due to the tide, wind, and lunar phase.

The Borough of Sea Bright formed from part of Ocean Township by referendum on March 20, 1889 and was re-incorporated in 1897. During the late 1800's and into the early part of the 20th century, Sea Bright had a number of "grand hotels" and a railroad line running to Long Branch. Today the Borough is a bedroom community, consisting of young professionals who commute to New York City via the easily accessibly ferry in Highlands, Atlantic Highlands, or Belford; and is host to a number of daily visitors all summer long, as residents from the more inland municipalities of Monmouth County flock to the town and it's seven private beach clubs.

The Sea Bright Borough Beach Management Plan For the Protection of Federally and State-Listed Species identifies three management zones of Sea Bright Beaches based on historical use and importance, existing human uses, and habitat conditions. The zones are as follows:

North Beach: Protected Zone- Sandy Hook border to the northern border of Ship Ahoy Beach Club

Central Beach: Recreational Zone- Northern border of the Ship Ahoy Beach Club to the southern border of the Driftwood Cabana Club

South Beach: Protected Zone- Southern border of the Driftwood Cabana Club to the Monmouth Beach Borough border.

Figure 10. Location of Sea Bright. Source: Google Maps

This plan designates the center of the town, including the downtown business area and the most built up section of Sea Bright to be the area of beach with the least amount of protection due to the high volume of visitors to this area year round. The outer portions of the town are less built out and are therefore designated as protected zones to allow for further growth in the future.

History

The area that is now Sea Bright and Monmouth Beach was granted to Eliakim Wardell in the 17th century. However, for most of the next two hundred years Sea Bright remained a fully developed barrier beach. In the 1840's the northern portion of the town was known as the small fishing village of Nauvoo. However, with completion of the Long Branch and Seashore Railroad in 1865, Sea Bright became a premier summer vacation destination for wealthy tourists from New York City. During the 1870's and 1880's many of the expansive beach dunes were leveled and covered with lawns and gardens to appeal to the wealthy clientele. Around this same time began the battle between man and the nature that still continues to this day as bulkheads were constructed to hold back the water and then consequently destroyed, along with rail-line, houses, and hotels in every storm and flooding event, with numerous brutal storm events occurring during the 1880's. However, development in Sea Bright seemingly could not be stopped, not even by a fire in 1891 that destroyed most of the downtown business area.

In December of 1913 and January of 1914 the Monmouth County area was hit was brutal storms, causing many houses to fall into the ocean and destroying the Octagon Hotel. After the January storm many of the remaining houses were moved across the river, where they would be better protected from the elements. However, Sea Bright continued to thrive as a vacation destination, with each decade bringing not only new development to the small borough, but all new methods of battling the forces of nature. The most recent storm to wreck havoc on the area was the Nor'easter of December 1992. This storm caused massive flooding throughout the borough, and along with hurricane force winds and large amounts of rain, caused massive erosion to the beaches, drastically altering the coastline. This storm served as the impetus for the federally and state funded beach replenishment projects that have been the most recent form of protection against the ever impending sea. While the additional sand has done much to aid tourism and increase the popularity of the beaches in the borough, Sea Bright is still susceptible to riverine flooding, which occurs a number of times each year.

Demographics

According to the 1989 Master Plan, seventy percent of the population of Sea Bright falls within the working age group of 18-64. Sea Bright has the smallest percentage of the population in school age groups out of any municipality in Monmouth County as well as the smallest average household size in Monmouth County. The1989 Master Plan also declares that 68% of the parcels within Sea Bright were zoned as residential, with 58% of the borough being utilized by housing.

Year	Population
1910	1,220
1920	856
1930	899
1940	779
1950	999
1960	1,138
1970	1,339
1980	1,812
1990	1,693
2000	1,818
2010	1,412

Table 2. Total Population of Sea Bright

Commercial uses account for 6.8% of the parcels in Sea Bright and 28.2% of the assessed valuation. Less than five acres in Sea Bright are vacant and developable although 23.8% of lots in Sea Bright are classified as vacant. This high percentage is deceptive because most of the vacant lots are located to the east of Ocean Avenue and are undevelopable. In

2010, the ACS 5 year survey estimates gave Sea Bright a per capita income of $82,535 and a median household income of $74,236.

In 1989,only Asbury Park and Shrewsbury contain higher percentages of multiple dwelling units within Monmouth County. 70.9% of the population within the Borough of Sea Bright is within the working age category, however, only 8.8% of those work within the borough, most commute at least 15 minutes.

Between January 24, 2011 and January 24, 2012, 71 properties were sold in Sea Bright, although 238 homes have been constructed since 2000 (tax records). Approximately 15-20% of Sea Bright residents are seasonal (Long and Keeler, 2012), although Sea Bright is home to seven members-only beach clubs, Ship Ahoy, Sands, Surfrider, The Sea Bright Beach Club, Chapel Beach Club, Driftwood, and Edgewater, which bring in beach patrons from the surrounding communities. Industry in Sea Bright is primarily service based, with more than 20 restaurants, 7 beach clubs, 10 marinas, and 30 service oriented and specialty shops located in the Borough (www.visitseabright.com).

The major road through Sea Bright is Route 36 (Ocean Ave), which runs north-south, parallel to the shoreline. Sea Bright is also accessible via the Rumson Road Bridge, which would bring travelers out of town and across the river into neighboring Rumson. The only public transportation accessible in Sea Bright in a NJ Transit Bus with service from Ocean Ave/ Church Street.

Master Plan Summary

The Master Plan for the Borough of Sea Bright was written in 1989 with re-examinations done in 1996 and 2003. Planning issues in the Borough include: shore protection, beach access, redevelopment for higher density multi-family housing, and the need for more parking in the central business district.

The goals and objectives of the 1989 Sea Bright Master Plan that are relevant to this study are as follows:

a. To encourage municipal action to guide the appropriate use or development of all land in this Borough in a manner which will promote the public health, safety, morals and general welfare;

b. To secure safety from fire, flood, panic and other natural and man-made disasters, specifically including the protection of life and property from coastal storms and flooding;

c. To insure that development within the municipality does not conflict with the development and general welfare of neighboring municipalities, the county and state as a whole, specifically to ensure development which is compatible with that of adjoining communities and the state's Coastal Areas Facilities Review Act;

d. To promote the establishment of appropriate population densities and concentrations that will contribute to the well-being of persons, neighborhoods, communities and regions, and preservation of the environment.

Zoning in the Borough of Sea Bright, as indicated by the 1989 Master Plan is as follows:

R-1- Residential- single family

R-2- Residential- one family dwelling and multi family development

B-1- Central Business Zone- permits multi- family as well as general and specialty retail

B-2- River Front Business Zone- water oriented business district

RR- Residence Restricted Zone (CP, Coastal Protection Zone)- all properties east of Ocean Ave in the northern portion of the borough adjacent to seawall- no structures permitted

The Master Plan also looks at the relation of Sea Bright's Master Plan to other planning documents. The Monmouth County Growth Management Plan has the following objectives that were decided to be relevant to planning exercises within the Borough of Sea Bright:

a. Restrict non-water-related development in coastal flooding and high-risk erosion areas.

b. Support non-structural maintenance of ocean beaches by means of a program of annual nourishment in conjunction with appropriate land use controls.

c. Encourage State and Federal governments to develop a coordinated, comprehensive coastal management program.

d. Establish a coastal development district to set density, location and use standards for areas adjacent to the Atlantic Ocean and to Sandy Hook and Raritan bays.

e. Prohibit shorelines land discourage high rise structures within 1,000 feet of the bay and ocean shorelines.

f. Allow ocean front development of beach-related commercial and recreational activities where such uses have been traditionally located.

g. Encourage new coastal development compatible with the surrounding environment.

h. Continue to protect tidal wetlands through State and Federal wetlands management program.

The New Jersey Shore Protection Master Plan, classified most of Sea Bright as Category 1, critically eroding. The Stormwater Management Plan identifies the Borough as being entirely in the PA5B- Environmentally Sensitive Barrier Island Planning Area in the New Jersey State Development and Redevelopment Plan and also falling in Watershed Management Area 12. The Stormwater Management Plan identifies both the Shrewsbury and Navesink Rivers as impaired waterways, requiring the NJDEP to develop a total maximum daily load for pollutants found in these waterways. In addition to water quality issues on the river side of the Borough, Sea Bright has sever flooding problems with flooding from the ocean and Shrewsbury river occurring throughout the entire borough, not only in extreme storm events, but also daily, as river flooding occurs during new and full moons as well as storm events.

The 1989 Master Plan suggest that some policy changes be made regarding land use in Sea Bright including that areas be rezoned to singles family residential due to the high potential for storm destruction within to borough to ensure that as few people as possible reside within the town. However, the plan also suggests that the resort character of the Borough should be strengthened and hotels should be encouraged to be built.

Historic and Current Mitigation Strategies

Sea Bright is affected by flooding events because it is a narrow peninsula just a few feet above sea level. The Shrewsbury River, from which most of the flooding occurs, is located to the west of the town and is a tidal river, approximately two hours behind the ocean. Flooding also occurs from the ocean during storm events. As a response to ongoing erosion issues, a $703,000 solid grand seawall was constructed in Sea Bright in 1947. The wall was paid for by the State of New Jersey, Monmouth County, and the Borough

of Sea Bright. As a direct result of the wall construction, residents began spending more on their homes, feeling they were safer from flooding issues.

During the 1970's and 1980's Sea Bright was in what is refered to as the "Crisis Period (Keeler, 2012)." During this time there was virtually no sand east of the seawall and routine events would bring flooding to the community. James Howard, one of New Jersey's representatives in Congress and a member of the Committee on Public Works and Transportation, pushed for funding for an Army Corp of Engineers sand replenishment project. Although the project was approved for federal funding, matching local funds were required, which the state was not willing to provide. In 1992, A Nor'easter devastated the area, causing more damage than any other storm in decades. At this time the State agreed to provide funding for beach replenishment, however there was a lot of local opposition. Many opponents of the replenishment argued that the sand would not stay on the beach for long and was a waste of money. In 1962 the Army Corp had pumped sand from the Shrewsbury onto the beach. This sand had a much smaller grain size than the ocean sand and was washed away in about six months. Campbell Engineering and Stevens Institute ran models and did many calculations to pick the proper sand size and ensure it would not wash away quickly. Regardless, the state of New Jersey signed a 50 year replenishment contract with the Army Corp that includes all of Monmouth County, and sand replenishment projects began in 1994 in Monmouth Beach, before heading to Sea Bright. After Sea Bright had been replenished, they continued north to Sandy Hook before heading elsewhere in Monmouth County. The first scheduled renourishment was in 2002 and the second should happen between 2012 and 2013.

In the following years, the beach has been monitored to determine their profile and size of sand granule, in order to measure the success of the renourishment program. After beach replenishment occurred, dunes were created and planted with plants and shrubs to prevent erosion from occurring. The dune management program in Sea Bright promotes more natural dune habitats, especially in the northern end of town. The replenishment projects have held up well at the north end of the town, where the dune systems are more intensive, but in the south end and into Monmouth Beach there has been a high level of erosion.

Sea Bright has undertaken a number of other measures to reduce flooding in the town. Submersed pumps have been placed at the end of three streets in the downtown area to remove water from the river and reduce flooding. Originally water was pumped out using hoses, but have since been replaced with more elaborate pumping systems with diesel back-ups in case of a power outage. Unfortunately, this has done more to displace the flooding than mitigate it, as streets that never flooded before have begun to flood. Another cause of riverine flooding in Sea Bright is the low bulkheads along the river. Sea Bright has received a grant from FEMA through the Hazard Management Grant Program to raise the publically owned bulkheads along the river to Army Corp with approximately a 25% local cost share. However, this does not affect bulkheads on private property. The Army Corp of Engineers has also done a flood plane study of the Shrewsbury River. Sea Bright has changed local ordinances to require that houses be built three feet above sea level. This change has been welcomed by most homeowners, as they use this opportunity to create a third floor. However, Sea Bright does not allow homes to be built on pilings to help preserve the local character of the community. Beach replenishment and dune plantings have done much to stop flooding from the ocean.

Sea Bright Budget Summary

Sea Bright's municipal budget is broken up into four different parts. The first part, which this analysis focused on, is the general budget. The other three are the water utility, sewer utility, and beach utility. The general budget for 2011 had a total expenditures and revenue of $5,192,018.16. Expenditures for the most part come from general appropriations for municipal services, such as the police department and insurance for employees. Around $700,000 is for the municipal debt service.

Most of the revenue comes from the local tax for municipal services, roughly 74% of the total revenues. The budget relies heavily on taxes on assessed value of land and improvement values, of which almost 89% is accounted for by residential properties. However the population of Sea Bright is fairly small with 1,412 persons. With the residential assessed value at $428,293,500, Sea Bright has a much higher rate of assessed value per capita versus the other case studies, Middletown and Highlands. This can be accounted for by the nearly 25% of the housing units being reported as seasonal units in the 2010 Census.

Seasonal homes provide a huge ratable for Sea Bright. This means that retreat is a realistic option for Sea Bright. Homes can be taken away from the assessed values and tax base and only slightly affect the tax rate.

Sea Bright School Budget

Because Sea Bright is so small, it does not have its own public school system. Instead it is part of two regional school systems, Oceanport from Kindergarten through eighth grade and Shore Regional High School from ninth grade to twelfth grade. However because of the large tax base relative to the small population, any diminishment of the tax base should not have serious consequences for the school budget.

Recent Tax Rate Trends

The historical trend of tax rates is an important component of the fiscal analysis for the municipalities. They are important in determining how volatile tax rates are for municipal budgets. A chart (Figure 13) displays the tax rates from 1995 to 2011. In order to account for reassessed values of land the tax rates were equalized with the county equalization ratio. The general tax rate was included as well to as a way to compare general trends to the municipal level. The chart shows mostly stable tax rates in the 1990s with a decline in the early 2000s (during the housing boom) and a sharp increase in the late 2000s as a result of the housing bust. However the housing bust, from 2007 to 2011, both the general and municipal tax rate have remained stable.

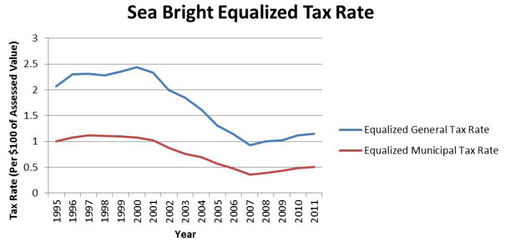
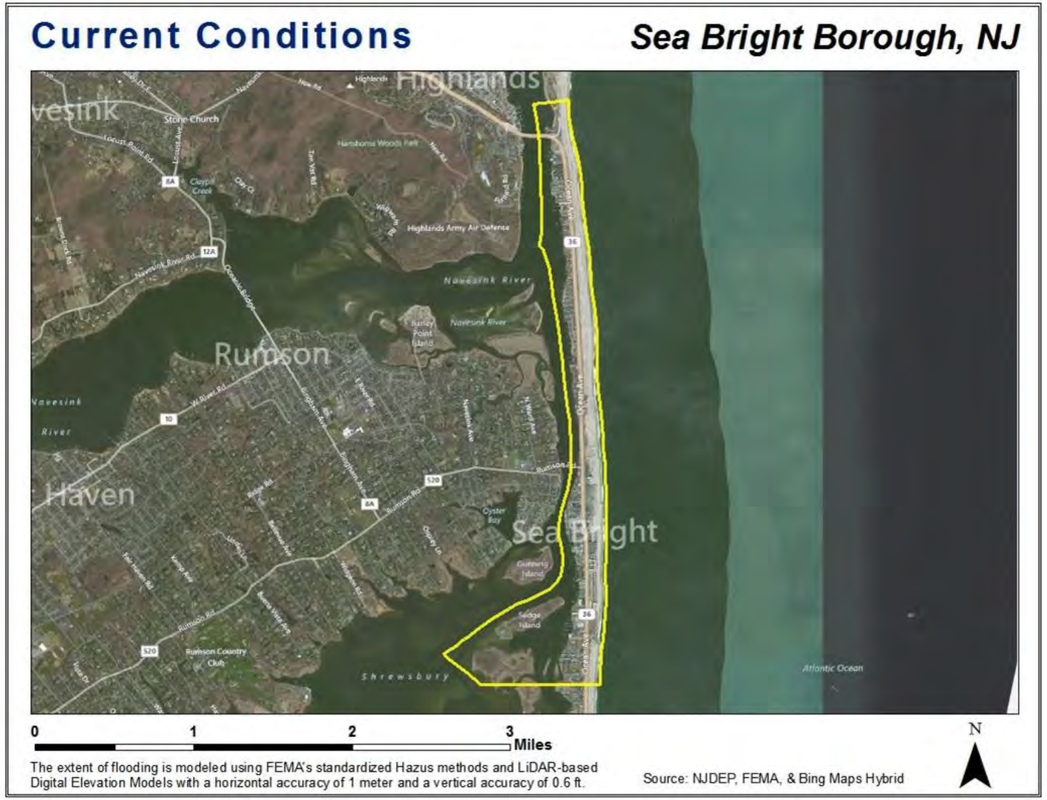
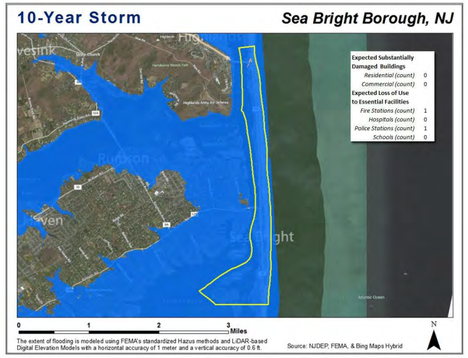


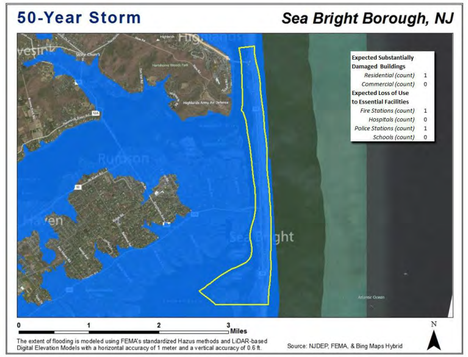
Figure 11. Equalized Tax Rate for Sea Bright



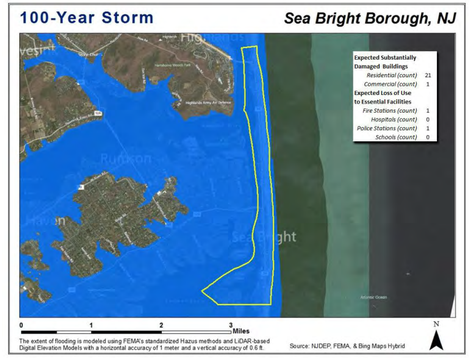
Map 1. Sea Bright Current Conditions Model



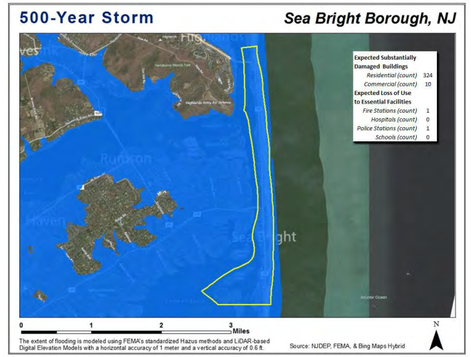
Map 2. Sea Bright 10 Year Storm Event Model



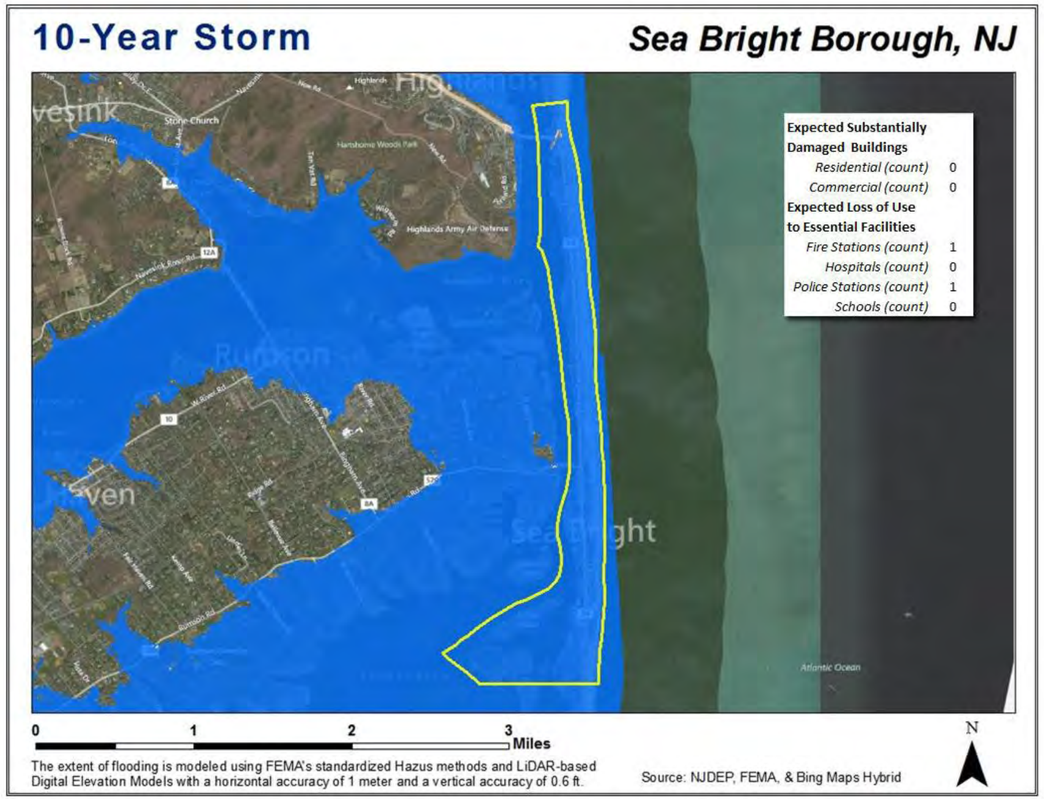
Map 3. Sea Bright 50 Year Storm Event Model



Map 4. Sea Bright 100 Year Storm Event Model



Map 5. Sea Bright 500 Year Storm Event Model



Map 2. Sea Bright 10 Year Storm Event Model

Sea Bright Model: 10 Year Storm Event

Rebuild

In the rebuild scenario for the 10 year storm, Sea Bright's tax rate increased from .739 to .834 per $100 of assessed value. Revenues stayed the same at $5,192,128.60 because no structures or population were lost. Expenditures increased however by $495,569.42 due to increases in public safety and police costs ($1,825), debris cleanup ($137,850), damages to the police station and fire station ($3.78 million amortized for a 30 year period), and relocation costs ($110,000). (Appendix Table 1). The insurance premium for

Sea Bright for a 10 year storm is $6,020,000 annually.

Retreat

In the retreat scenario for the 10 year storm, Sea Bright's tax rate increased from .739 to .834 per $100 of assessed value, same as the rebuild scenario. Revenues stayed the same at $5,192,128.60 because no structures or population were lost. Expenditures increased by $495,569.42 due to increases in public safety and police costs ($1,825), debris cleanup ($137,850), damages to the police station and fire station ($3.78 million amortized for a 30 year period), and relocation costs ($110,000) (Appendix Table 1). The insurance premium for Sea Bright for a 10 year storm is $6,020,000 annually.

Smaller Subsidy

In the smaller subsidy scenario for the 10 year storm, Sea Bright's tax rate increased from .739 to .888 per $100 of assessed value. Revenues stayed the same at $5,192,128.60 because no structures or population were lost. Expenditures increased by $771,269.42 due to increases in public safety and police costs ($1,825), debris cleanup ($413,550), damages to the police station and fire station ($3.78 million amortized for a 30 year period), and relocation costs ($110,000). The debris cleanup costs are the most significant factor for this scenario due to the increased responsibility of the municipality (75%) to pay for the cleanup versus the usual 25% local, 75% federal ratios (Appendix Table 1). The insurance premium for Sea Bright for a 10 year storm is $6,020,000 annually.

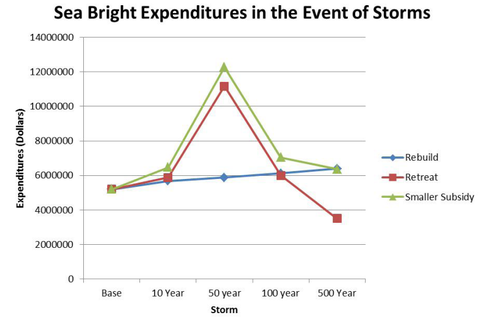
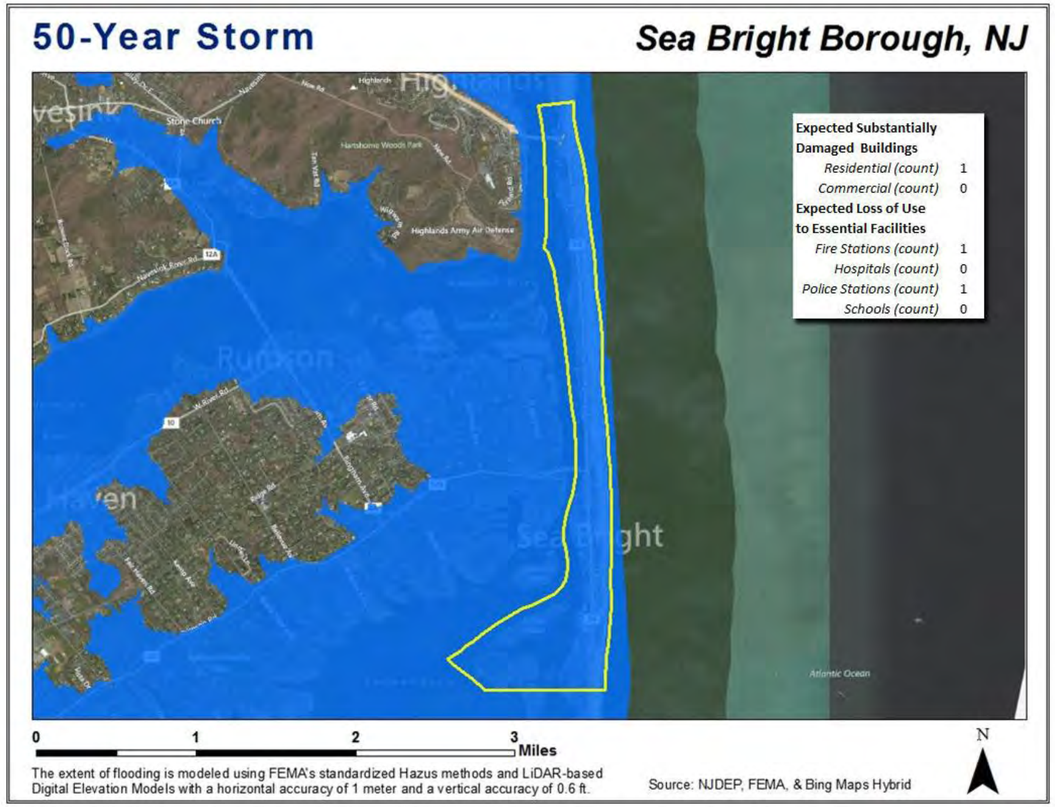


Figure 12. Sea Bright Change in Expenditures Due to Storm Events



Map 3. Sea Bright 50 Year Storm Event Model

Sea Bright Model: 50 Year Storm Event

Rebuild

In the rebuild scenario for the 50 year storm, Sea Bright's tax rate increased from .739 to .872 per $100 of assessed value. Revenues stayed the same at $5,192,128.60 because the one structure that was substantially damaged was rebuilt. Expenditures increased by $690,323.23 due to increases in public safety and police costs ($7,300), debris cleanup ($290,700), damages to the police station and fire station ($4.34 million amortized for a 30 year period), and relocation costs which remained the same as the 10 year storm ($110,000) (Appendix Table 1). The insurance premium for Sea Bright for a 50 year storm is $1,651,400 annually.

Retreat

In the retreat scenario for the 50 year storm, Sea Bright's tax rate increased from .739 to .872 per $100 of assessed value, the same as the rebuild scenario. Revenues decreased slightly due the loss of one home ($5,189,911.60). Expenditures increased by $686,886.57 due to increases in public safety and police costs ($7,300), debris cleanup ($290,700), damages to the police station and fire station ($4.34 million amortized for a 30 year period), and relocation costs which remained the same as the 10 year storm ($110,000) (Appendix Table 1). The loss of one resident also decreased expenditures slightly. The insurance premium for Sea Bright for a 50 year storm is $1,651,400 annually.

Smaller Subsidy

In the smaller subsidy scenario for the 50 year storm, Sea Bright's tax rate jumped increased from .739 to .984 per $100 of assessed value. Revenues stayed the same at $5,192,128.60 because the one structure that was substantially damaged was rebuilt. Expenditures increased by $1,271,723.23 due to increases in public safety and police costs ($7,300), debris cleanup ($872,100), damages to the police station and fire station ($4.34 million amortized for a 30 year period), and relocation costs which remained the same as the 10 year storm ($110,000) (Appendix Table 1). The insurance premium for Sea Bright for a 50 year storm is $1,651,400 annually.

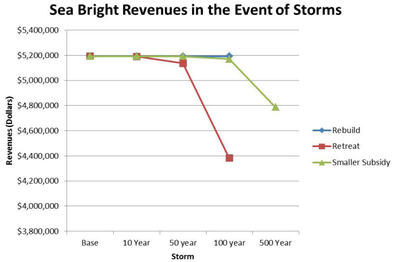


Figure 13. Sea Bright Change In Revenues Due to Storm Events

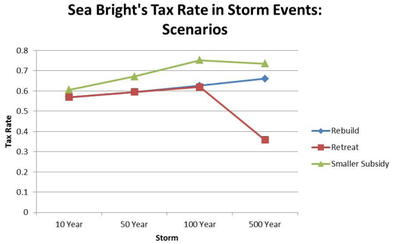
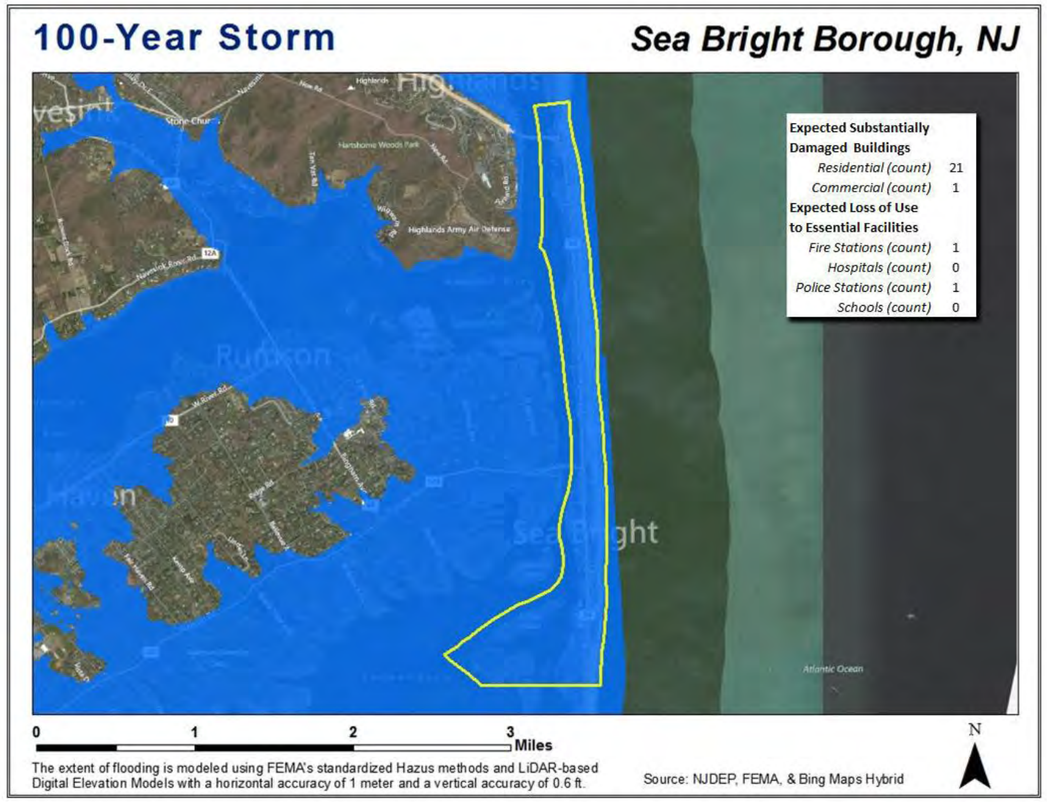


Figure 14. Sea Bright Change in Tax Rates Due to Storm Events



Map 4. Sea Bright 100 Year Storm Event Model

Sea Bright Model: 100 Year Storm Event

Rebuild

In the rebuild scenario for the 100 year storm, Sea Bright's tax rate increased from .739 to .918 per $100 of assessed value. Revenues stayed the same at $5,192,128.60 because the 22 structures that were substantially damaged were rebuilt. Expenditures increased by $928,164.17 due to increases in public safety and police costs ($12,775), debris cleanup ($492,900), damages to the police station and fire station ($4.65 million amortized for a 30 year period), and relocation costs which increased by $10,000 from the previous 50 year scenario ($120,000) (Appendix Table 1). The insurance premium for Sea Bright for a 100 year storm is $883,200 annually.

Retreat

In the retreat scenario for the 100 year storm, Sea Bright's tax rate increased from .739 to .908 per $100 of assessed value. Revenues decreased slightly by $55,725.78 due the loss of 22 structures (21 residential homes and 1 commercial building) that were substantially damaged. Expenditures increased by $806,591.53 due to increases in public safety and police costs ($12,775), debris cleanup ($492,900), damages to the police station and fire station ($4.65 million amortized for a 30 year period), and relocation costs ($120,000) (Appendix Table 1). However the expenditures loss is smaller than that in the rebuild scenario due to the population loss of 31 residents and 7 workers. The insurance premium for Sea Bright for a 100 year storm is $883,200 annually.

Smaller Subsidy

In the smaller subsidy scenario for the 100 year storm, Sea Bright's tax rate increased from .739 to 1.102 per $100 of assessed value. Revenues decreased slightly by $22,170.00 due the loss of 10 structures (all residential homes) that were substantially damaged. Expenditures increased by $1,850,600.27 due to increases in public safety and police costs ($12,775), debris cleanup ($1,478,700), damages to the police station and fire station ($4.65 million amortized for a 30 year period), and relocation costs ($120,000) (Appendix Table 1). The population loss of 15 residents slightly affects the expenditures as well. The most significant factor in this scenario is once again the cost of the debris cleanup, of which 75% is accounted for by the municipality. The insurance premium for Sea Bright for a 100 year storm is $883,200 annually.

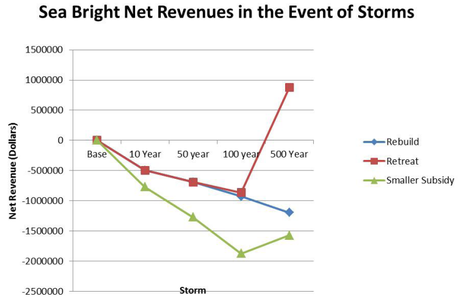
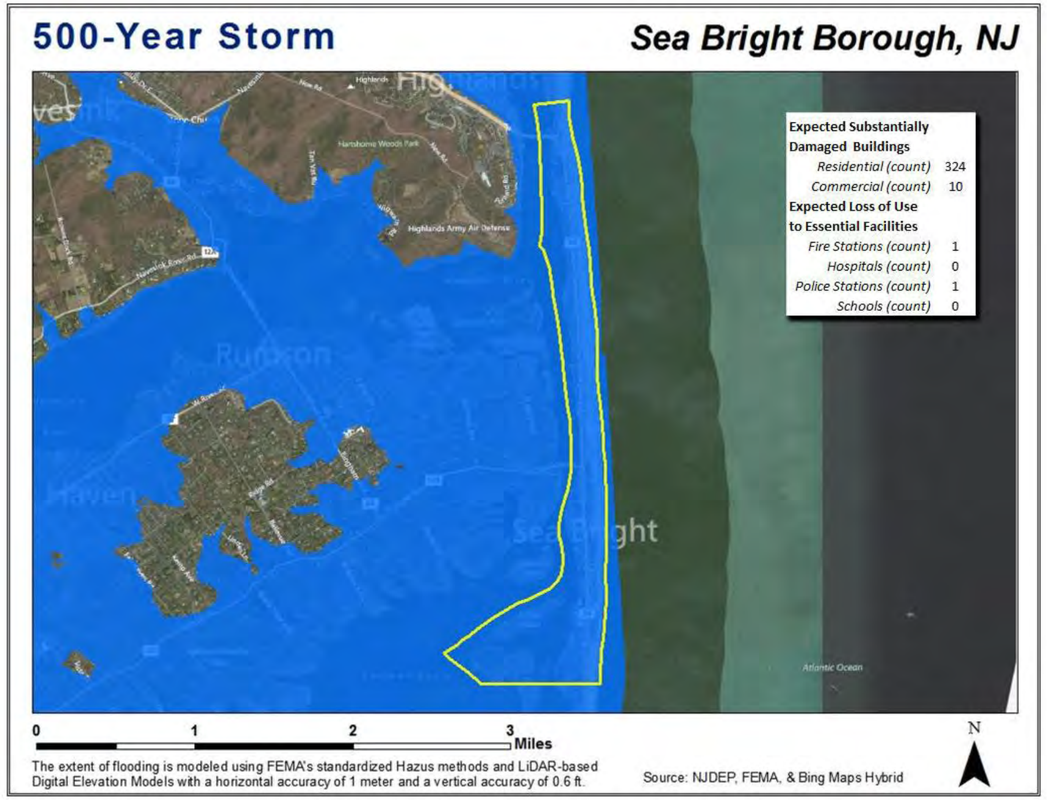


Figure 15. Sea Bright Net Change in Revenues Due to Storm Events

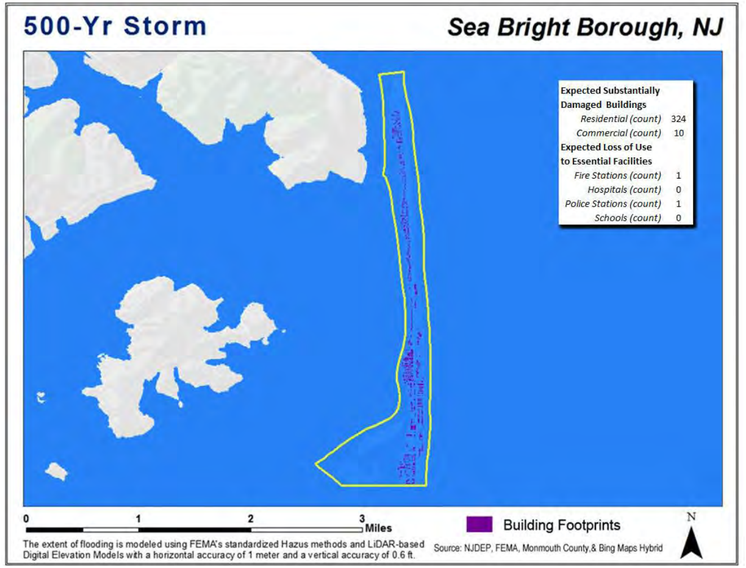


Map 5. Sea Bright 500 Year Storm Event Model

Sea Bright Model: 500 Year Storm Event

Rebuild

In the rebuild scenario for the 500 year storm, Sea Bright's tax rate increased from .739 to .969 per $100 of assessed value. Revenues stayed the same at $5,192,128.60 because the 334 structures that were substantially damaged were rebuilt. Expenditures increased by $1,194,575.18 due to increases in public safety and police costs ($25,500), debris cleanup ($691,050), damages to the police station and fire station ($5.35 million amortized for a 30 year period), and relocation costs which once again increased by $10,000 from the previous 100 scenario ($130,000) (Appendix Table 1). The insurance premium for Sea Bright for a 500 year storm is $196,980 annually.



Map 6. Sea Bright 500 Year Storm Event Model with Building Footprints

Retreat

In the retreat scenario for the 500 year storm, Sea Bright's tax rate decreased from .739 to .526 per $100 of assessed value. Revenues decreased by $809,995.84 because of the loss of 334 structures (324 residential homes and 10 commercial buildings). Expenditures also decreased by $1,684,556.04 even with increases in public safety and police costs ($25,500), debris cleanup ($691,050), damages to the police station and fire station ($5.35 million amortized for a 30 year period), and relocation costs which once again increased by $10,000 from the previous 100 scenario ($130,000) (Appendix Table 1). The population loss of 489 residents (nearly 35% of the population) and 78 workers significantly affected the amount of services needed by the municipality by $489,980.86. The insurance premium for Sea Bright for a 500 year storm is $196,980 annually.

Smaller Subsidy

In the smaller subsidy scenario for the 500 year storm, Sea Bright's tax rate increased from .739 to 1.077 per $100 of assessed value. Revenues decreased by $404,997.92 because only half of the 334 structures that were substantially damaged were rebuilt (162 residential homes and 5 commercial buildings were lost). Expenditures increased by $1,166,597.97 due to increases in public safety and police costs ($25,500), debris cleanup ($691,050), damages to the police station and fire station ($5.35 million amortized for a 30 year period), and relocation costs which once again increased by $10,000 from the previous 100 scenario ($130,000) (Appendix Table 1). The loss of 244 residents and 39 workers helped subsidize the increase of expenditures. The insurance premium for Sea Bright for a 500 year storm is $196,980 annually.

Mitigation Strategies and Recommendations

The scenario providing the most consistently low tax rates is the retreat scenario. This is due to the fairly large assessed value to relatively small residential population. Seasonal homes act as ratables and help subsidize any loss in assessed value. The large decreases in population of residents and workers also help to significantly decrease the amount of municipal services needed. The smaller subsidy scenario consistently produces the highest tax rates due to the high cost of debris removal. The rebuild scenario, most consistent with the type of activity seen today, produces increased tax rates linearly. Since it is not affected by loss of tax revenue, the revenue never increases or decreases. Instead the expenditures steadily increase by the amplified intensity and damage of the storms.

Middletown Docks
Credit: Scot K. Bell

Case Study 2: Highlands

Physical Setting

The Borough of Highlands sits along the very northern edge of the Jersey Shore, around the area where the waters of the Raritan Bay meet the Atlantic Ocean. The waters just off of its shore teem with life, and the Borough has long since been known as a community where "men lived off, by and for the clam," as described by author James W. Brydon in his 1975 description of the History of Highlands. The Borough sits on two very different types of land – a low-lying floodplain adjacent to the shore where much of the population (as well as the main business district along Bay Avenue) is located, and a bluff that sits high above the floodplain and the bay that gives the community its name. The high portion of the Borough is some of the highest terrain to be found along the entire Eastern Seaboard, and gives the community a very distinguishable characteristic amongst other places along the New Jersey shore.

The bisection of the Borough's geography by the bluffs defines the community in many ways. Unfortunately, the low elevation that much of Highlands sits on makes it very prone to flooding, and when nor'easters or hurricanes strike, the aftermath can be absolutely devastating. Throughout the last century (at least), the Borough has fallen victim to multiple storms that have brought several feet of water into the central business district.

The Borough has an area of 0.71 square miles and is adjacent to the Gateway National Recreation Area and Sandy Hook, Middletown Township, Atlantic Highlands Borough, Sea Bright Borough, and Raritan Bay. At its highest point in the high bluffs overlooking the bay, the Borough is 246 feet above sea level; at its lowest point in the floodplain, it has an elevation of 13 feet.

History

In 1524, Giovanni de Verrazano became the first European to see what is now the Borough of Highlands and nearby Sandy Hook. The Verrazano Narrows Bridge in New York City was later named for this famous explorer. Nearly a century later in 1609, Henry Hudson also saw the Highlands area. One of Hudson's crew members, John Coleman, became the first European to be killed in North America when a member of the Lenape tribe shot an arrow through his neck.

The oldest house still standing in the Borough was constructed in 1734 on Portland Road between Riker and Thompson Streets. The first hotel followed decades later in 1798, and ushered in the beginning of tourism in the Borough. The Twin Lights for which the Borough is known for were first constructed in 1828. The first fort was established at nearby Sandy Hook in 1858 and the first Highlands-Sea Bright Bridge was constructed in 1872. In 1900, the community split from Middletown and was formally incorporated under the Borough form of New Jersey municipal government in 1900 during a period when many other communities in the state were also being incorporated as boroughs.

At the 1900 Census, Highlands registered an official head count of 1,228 people. In 1926, the Borough bought its public beaches at Miller Street and the bridge. A fierce storm rocked Highlands in 1932, bringing 2 feet of flood water to Bay Avenue, the major thoroughfare in town. Four years later, a local river channel was dredged.

A powerful hurricane struck the Borough in September of 1944. Homes were swept off of their foundations and carried several blocks away during the '44 storm. Up until that point, it was the most destructive storm the Borough had ever witnessed, according to testimony from local residents and fishermen at the time.

Highlands suffered again in 1953 when a nor'easter flooded Bay Avenue with three feet of water. Hurricane Donna, a storm that achieved Category 5 status at one point, struck the Eastern Seaboard several years later; the storm reached Highlands on September 12, 1960. The Borough was devastated - more than a thousand people were without electricity and emergency crews could not access some parts of Highlands and Atlantic Highlands due to the high flood waters. That storm went down as one of the costliest hurricanes in U.S. history.

Only a year and a half later in March of 1962, a powerful nor'easter swept up the New Jersey coast, bringing with it 2 feet of water to the low-lying section of Highlands. The next major storm came in 1984, when a storm caused $3 million in damages and brought a whopping 4 feet of water to some parts of the Borough. Another nor'easter struck in 1992 and caused significant destruction, followed by Hurricane Irene in 2011.

Demographics and Land Use

Picture 2. View of Highlands with New York City in Background
Credit: Christine Bell

POPULATION GROWTH 2000 - 2008	
Year	No. of Persons
2000	5,097
2001	5,101
2002	5,132
2003	5,168
2004	5,174
2005	5,166
2006	5,174
2007	5,179
2008	5,195

Table 3. Highlands Population Growth 2000-2008
Source: US Census/Monmouth County Planning Board annual estimate, 2008

According to the 2010 decennial census, 75.5% of the Borough's population is between 15 and 64 years old, which we define as the working age population. According to the 2006-2010 American Community Survey 5-year estimate, the Borough's median house-

hold income is $75,291, compared to $69,811 for the state of New Jersey as a whole during the same time period.

The population of the Borough in 2010 was 93.0% white, 1.6% black, and 1.3% Asian. 1.9% of the population reported two or more races and Hispanics, who may be of any race, comprised 6.5% of the total population.

The population remained fairly stable from 2000 to 2010, most likely due to the fact that the Borough is more or less a built-out community with little, if any, room for expansion or development on unimproved land or open space.

The official population count in the 2010 decennial census for Highlands was 5,005, only slightly smaller than the figure that the Borough apparently maintained throughout the 2000s.

In the Borough's Re-Examination of the Master Plan, which was adopted in 2009, the following table is provided which provides calculations that show that the Borough averaged about 11.6 new units per year. Thus, there is very little growth in the Borough, but growth nonetheless. It is important to note that these figures were compiled and released in the summer of 2008, just before the economic collapse that happened the following autumn. Based on nationwide trends, it is reasonable to conclude that building permits and residential construction in the Borough has all but come to a halt in the years since the economic collapse of 2008.

TOTAL RESIDENTIAL BUILDING PERMITS
2000 – 2007
HIGHLANDS BOROUGH

Year	# Dwelling Units	Single-Family	Multi-Family
2000	14	14	0
2001	25	23	2
2002	6	6	0
2003	13	9	4
2004	13	13	0
2005	11	11	0
2006	10	10	0
2007	1	1	0
Average:	**11.6 units/year (Total Units)**		

Table 4. Highlands Residential Building Permits
Source: Monmouth County Planning Board, 2008

LAND USE
PROPERTY CLASS OF TAX PARCELS
HIGHLANDS BOROUGH
2004, 2008

Land Use Class	Land Use Type	2004 # %	2008 # %	# Change
1	Vacant	159	149	-10
2	Residential	2,237	2,262	+25
3A	Farm, House	0	0	0
3B	Farm, Qualif.	0	0	0
4A	Commercial	103	99	-4
4B	Industrial	0	0	0
4C	Apartment	10	9	-1
Subtotal		113	108	-5
Total		2,509	2,519	+10

Table 5. Highlands Land Use
Source: Monmouth County Board of Taxation

Table 5 displays data regarding the land use associated with all of the parcels in the Borough. According to this table, in 2008, 5.9% of the parcels in the Borough were vacant; 89.8% of the parcels were classified as residential (presumably single-family dwellings since "apartment" is listed as a separate land use category); 3.9% were classified as commercial and 0.4% were apartments. Upon examining this data, it is quite easy to see that Highlands is an overwhelmingly residential community.

The Borough of Highlands current Master Plan was drafted in 2004 and adopted in early 2005. It was succeeded by a re-examination in 2009. The 2004 plan is divided into several smaller parts, in some cases referred to as plans or elements. They are as follows:

- Action Plan
- Circulation Plan
- Conservation and Community Facilities Plan
- Demographics Plan Element
- Economic Development Plan
- Goals and Objectives
- Historic Preservation Plan
- Housing Plan Element
- Land Use Plan Element
- Recycling Plan Element
- Statement of Consistency
- Utilities Plan Element

The process of drafting the Master Plan began in February 2002. The Plan outlines a vision for 2020: "a thriving village with a more diversified economy, significant employment, modern infrastructure, and an expanding tax base." Revitalization efforts were to focus on the Bay Avenue corridor, though the plan fully acknowledges that that particular corridor historically has a high turnover rate among small businesses due to frequent flooding that makes rebuilding too expensive or other not feasible.

General goals for the Borough outlined in the Plan include:

- To meet the demands of the Borough with the creation of mixed use development of exceptional design quality, a waterfront designation for activity and relaxation
- A redeveloped community offering homes, employment, services, civic spaces, and leisure in a quality of environment which will form part of the established communities of the Bayshore Region
- To protect the existing resource base through sensitive design, energy efficiency, sustainable waste management and to minimize the impact on the local environment
- To create a balanced Borough – residential, business/employment, retail, community, and leisure
- Strive to increase the percentage of owner-occupied housing in the Borough

The Land Use Plan Element portion of the plan discusses several points. First, it identifies parking as a problem in the Borough – i.e. the Borough is unable to meet the demand for parking in residential and commercial districts in the community. Second, non-conforming land uses were mentioned as a problem in the Borough. Third, the aforementioned frequent flooding of the Bay Avenue corridor and the subsequent difficulty in maintaining long-term small business occupancy along the street. Flooding was identified as a major barrier to downtown business growth and development in this portion of the 2004 Plan. Fourth, the Borough identified development of its waterfront for recreational purposes as an important goal. Fifth, the Plan describes Federal Emergency Management Agency (FEMA) mandates regarding how high new or significantly improved structures in the Borough must be in order to minimize flood damage in the event of a major storm, and provides a guideline for how development in the floodplain should occur.

Lastly, the Plan discusses a desire for the Borough to seek a "Transit Village" designation from the New Jersey Department of Transportation (NJDOT) centered around its ferry terminal, where commuters can catch a ferry ride to Manhattan. This would be an interesting proposition since the Transit Village designation is designed to help aid development around rail stations, though ferry service is a form of

mass transit.

The Housing Plan Element begins by acknowledging the plentiful regulations on housing and land use already in existence that are applicable to the Borough, including the Coastal Area Facility Review Act (CAFRA), a state law dating back to the early 1970s.

This portion of the Plan also discusses the Borough's housing stock – it states that the median year of construction for housing in the Borough is 1962 – at the time, half of all homes in the Borough were constructed in or before that year, and half were constructed in or after that year. About a quarter of housing (23 percent) was constructed before 1940. New housing construction boomed after 1940, but petered out after about 1990 or so as the Borough approached maximum build-out.

The 2004 Plan expressed a desire for all new housing in the Borough to be consistent with the existing housing stock.

The Economic Plan Element discussed the Borough's intention to actively seek economic development and growth. According to the Plan, 92% of the Borough's labor force works in New Jersey; 65% work in Monmouth County. Six percent of Borough residents work from home, much lower than the countywide figure of 13.5% and 19.1% statewide.

In 2004, 8.6% of the Borough's residents walked to work or worked at home, 8.5% used public transportation, 6.7% carpooled and over 75% commuted alone by car. The Borough expressed a desire to investigate why more Borough residents don't take advantage of the ferry located on the waterfront, but also acknowledged that monthly ferry service from Highlands is considerably more expensive than monthly bus or rail service into Manhattan. This portion of the plan also outlined the steps in the redevelopment process with regards to the Local Redevelopment and Housing Law (LRHL). Downtown waterfront redevelopment was listed as an important goal for the community.

The Circulation Plan described all of the transportation networks (road, rail, bus, etc.) in or near the Borough, while also discussing plans for traffic calming and bicycle-pedestrian initiatives.

The Conservation and Community Facilities Plan Element gave a list of existing community facilities, such as the convention center, parks, etc. It also talks about how development along the steep cliffs that give the Borough its name has caused erosion and disturbed the soil. This part of the Plan suggests forming a partnership with the New Jersey Office of Coastal Planning in order to help the Borough realize its conservation and environmental protection goals.

The Utilities Plan describes the Borough's utility and infrastructure providers as well as its lack of a Stormwater Management Plan, which was eventually adopted in 2005 and amended in 2007.

The Historic Plan Element outlines much of the history previously mentioned in this document, and the Borough's pride in its unique and rich history. The Recycling Plan Element provides a guideline for handling, reducing, and recycling solid waste. The Statement of Consistency section describes how the Master Plan is consistent with the Master Plans of surrounding communities as well as the State Development and Redevelopment Plan.

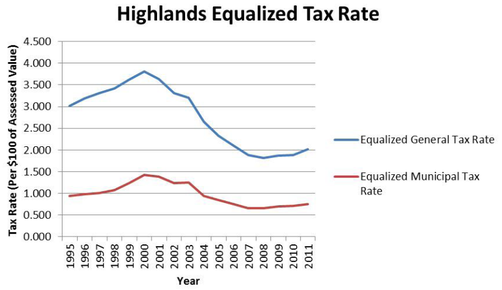


Figure 16. Highlands Equalized Tax Rate1995-2011

Highlands Fiscal Impact Analysis

Highlands Budget Summary

Highlands is a small community with 5,005 residents (US Census, 2010) and 900 jobs (US Census Longitudinal Household-Employer Dynamics Dataset, 2009). The total municipal budget in 2011 was $8,099,675. In terms of expenditures, the largest spending categories were public safety at 26% of the municipal budget, insurance at 17%, and general government at 11%. Of the total budget expenditures, 93% of costs ($7,512,653) were associated with residential uses, while just 7% of costs ($587,023) were associated with nonresidential uses. This amounts to a per-capita expense of $1,501 and a per-worker expense of $652. In terms of revenues, 70% of the municipal budget is comprised of local property taxes. The equalized tax rate in Highlands is .757, while the nominal rate is .916 (Monmouth County Abstract of Ratables, 2011). Based on the 2011 County Abstract of Ratables, Highlands is highly residential, with 89% of the town's assessed value found in residential property; a small portion of the town (10%) of the town is commercial, just 1% is vacant, and 0% is industrial. Furthermore, Highlands is a shore community that has a relatively low percentage of seasonal or vacation homes, at just 9% of the housing stock (US Census, 2010).

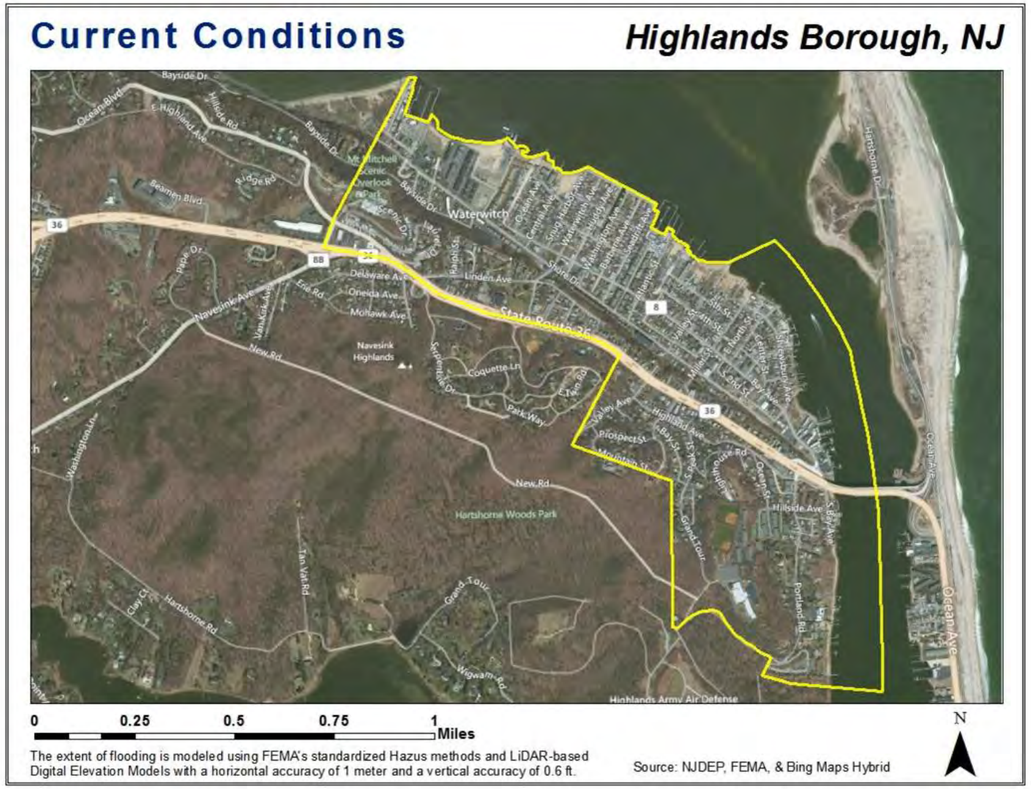
Highlands School Budget

Highlands has its own elementary school, called the Highlands Elementary School, for students in Kindergarten to sixth grade. Students in seventh through twelfth grades in Highlands go to a regional school, called Henry Hudson Regional School, with students from Atlantic Highlands. In the scenarios we examined, the schools to which Highlands sends its students were not damaged. Furthermore, because of the large amount of regional schools in this area, we project that if the number of students in primary grades decreases beyond a critical point, Highlands would elect to send their students to a regional school rather than keep Highlands Elementary School open for a small number of students.

Recent Tax Rate Trends

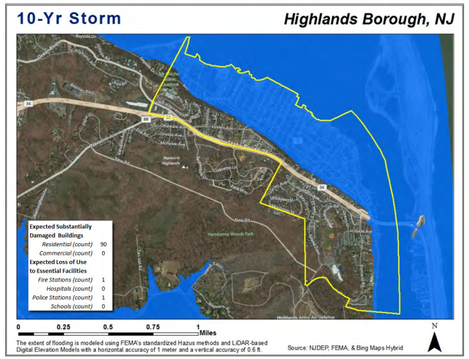
Highlands' equalized general and municipal tax rates were volatile between 1995 and 2011. The equalized general rate ranged from a high of 3.810 per $100 of assessed value in 2000 to a low of 1.815 in 2008. The equalized municipal rate ranged from high of 1.424 per $100 of assessed value in 2000 to a low of 0.654 in 2008 (Figure 18). In this case the high is more than twice the rate of the low.

Highlands Flood Models

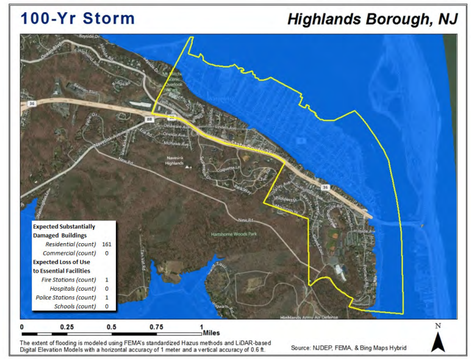


Map 7. Highlands Current Conditions Model

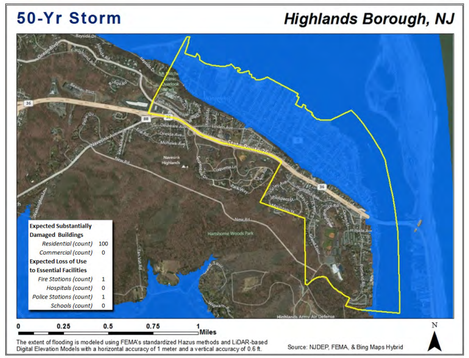
Highlands Model: All Flood Events



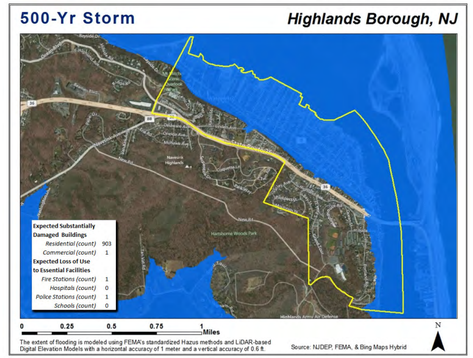
Map 8. Highlands 10 Year Storm Event Model



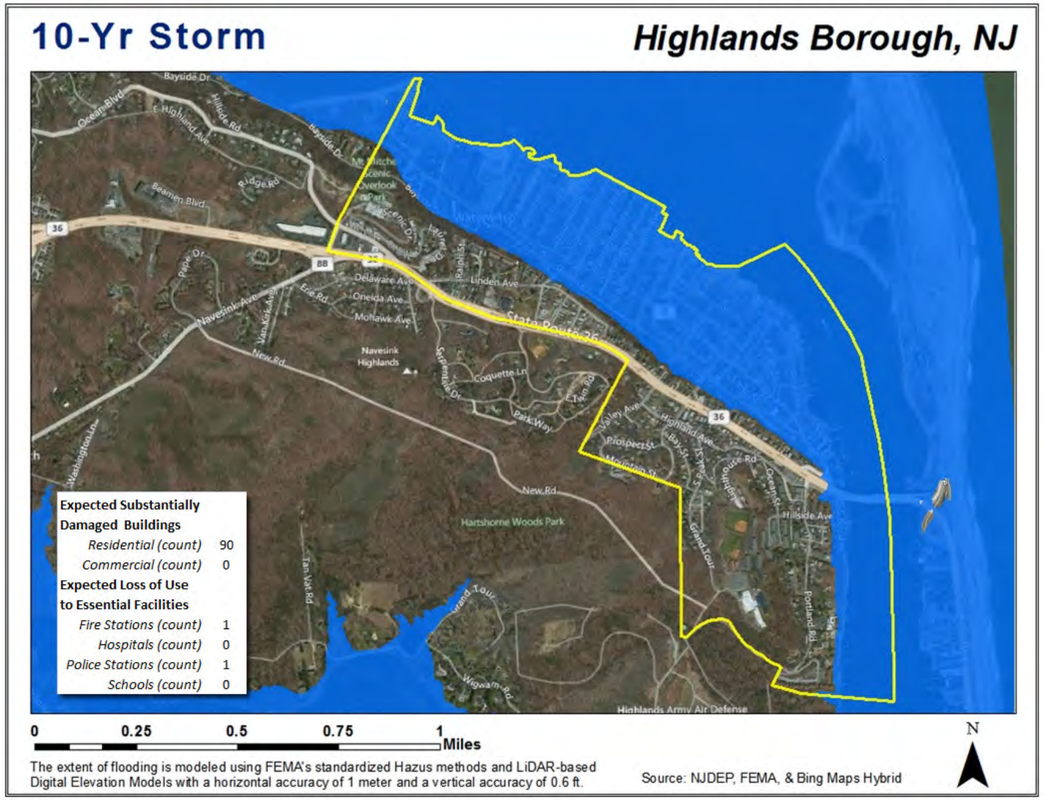
Map 10. Highlands 100 Year Storm Event Model



Map 9. Highlands 50 Year Storm Event Model



Map 11. Highlands 500 Year Storm Event Model



Map 8. Highlands 10 Year Storm Event Model

Highlands Model: 10 Year Storm Event

Rebuild

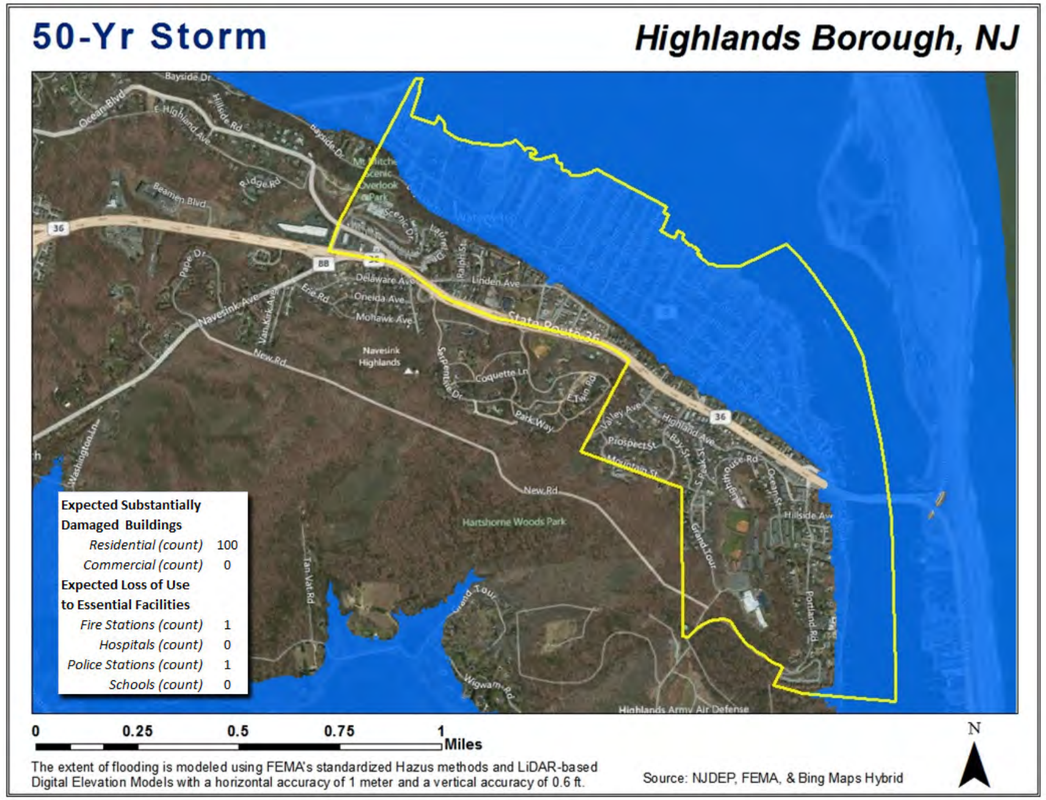
In the rebuild scenario for the 10 year storm, Highlands' tax rate jumped 49% from 0.757 to 1.127 per $100 of assessed value. Revenues stayed the same at $8,099,675 because no structures or population was lost. However, expenditures grew 32% from $8,099,675 to $10,721,412 because of additional police expenditures ($2,937); costs to temporarily relocate displaced people ($100,000); debris removal ($243,300); and the cost of replacing infrastructure (a total of $17,490,000, for an annual payment of $1,137,750) (Appendix Table 2). The insurance premium for Highlands for a 10 year storm is $10,302,000.

Retreat

In the retreat scenario for the 10 year storm, Highlands' tax rate jumped 48% from 0.757 to 1.118 per $100 of assessed value. Local Purpose Tax Revenues (or revenues from property taxes) declined 3% because 90 homes were not rebuilt. This represents a loss of $17,676,720 in assessed value for the town, and a loss of 171 residents. Total revenues shrank from $8,099,675 to $7,937,757. No commercial properties were lost in the 10 year storm. At the same time, expenditures grew 29% from $8,099,675 to $10,412,460 because of additional police expenditures ($2,937), costs to temporarily relocate displaced people ($100,000); debris removal ($243,300); and costs to replace existing infrastructure (a total of $17,490,000, for an annual payment of $1,137,750) (Appendix Table 2). The insurance premium for Highlands for a 10 year storm is $10,302,000.

Smaller Subsidy

In the Smaller Subsidy scenario for the 10 year storm, Highlands' tax rate grew 57% from 0.757 to 1.189 per $100 of assessed value. Local Purpose Tax Revenues declined 1% because 45 homes were destroyed in the storm and not rebuilt. This represents a loss of $8,838,360 in assessed value for the town, and a loss of 86 residents. Total revenues shrank from $8,099,675 to $8,018,716. No commercial properties were lost in the 10 year storm. At the same time, expenditures grew 36% from $8,099,675 to $11,048,432 due to additional police expenditures ($2,937); costs to temporarily relocate displaced people ($100,000); debris removal ($729,900); and costs to existing infrastructure (a total of $17,490,000, for an annual payment of $1,137,750) (Appendix Table 2). The insurance premium for Highlands for a 10 year storm is $10,302,000.



Map 9. Highlands 50 Year Storm Event Model

Highlands Model: 50 Year Storm Event

Rebuild

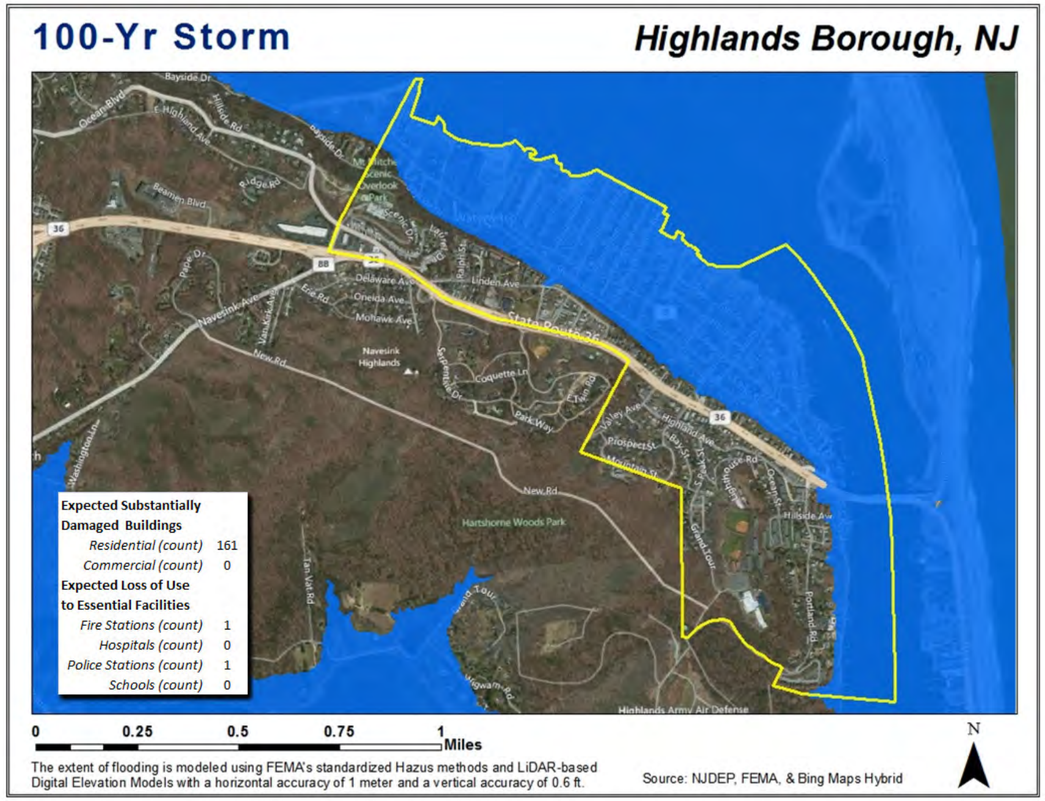
In the rebuild scenario for the 50 year storm, Highlands' tax rate jumped 64% from 0.757 to 1.238 per $100 of assessed value. Revenues stayed the same at $8,099,675 because no structures or population was lost. However, expenditures grew 9% from $8,099,675 to $11,541,115 because of additional police expenditures ($11,749); costs to temporarily relocate displaced people ($130,000); debris removal ($466,050); and costs to replace existing infrastructure (a total of $21,780,000, for an annual payment of $1,416,820) (Appendix Table 2). The insurance premium for Highlands for a 50 year storm is $2,645,200.

Retreat

In the retreat scenario for the 50 year storm, Highlands' tax rate jumped 62% from 0.757 to 1.229 per $100 of assessed value. Local Purpose Tax Revenues (or revenues from property taxes) declined 3% because 100 homes were not rebuilt. This represents a loss of $19,640,800 in assessed value for the town, and a loss of 190 residents. Total revenues shrank from $8,099,675 to $7,919,766. No commercial properties were lost in the 50 year storm. At the same time, expenditures grew 38% from $8,099,675 to $11,177,924 because of additional police expenditures ($11,749); costs to temporarily relocate displaced people ($130,000); debris removal ($466,050); and costs to replace existing infrastructure (a total of $21,780,000, for an annual payment of $1,416,820) (Appendix Table 2). The insurance premium for Highlands for a 50 year storm is $2,645,200.

Smaller Subsidy

In the Smaller Subsidy scenario for the 50 year storm, Highlands' tax rate grew 80% from 0.757 to 1.361 per $100 of assessed value. Local Purpose Tax Revenues declined 2% because 50 homes were destroyed in the storm and not rebuilt. This represents a loss of $9,820,400 in assessed value for the town, and a loss of 95 residents. Total revenues shrank from $8,099,675 to $8,009,721. No commercial properties were lost in the 50 year storm. At the same time, expenditures grew 52% from $8,099,675 to $12,278,524 due to additional police expenditures ($11,749); costs to temporarily relocate displaced people ($130,000); debris removal ($1,398,150); and costs to replace existing infrastructure (a total of $21,780,000, for an annual payment of $1,416,820) (Appendix Table 2). The insurance premium for Highlands for a 50 year storm is $2,645,200.



Map 10. Highlands 100 Year Storm Event Model

Highlands Model: 100 Year Storm Event

Rebuild

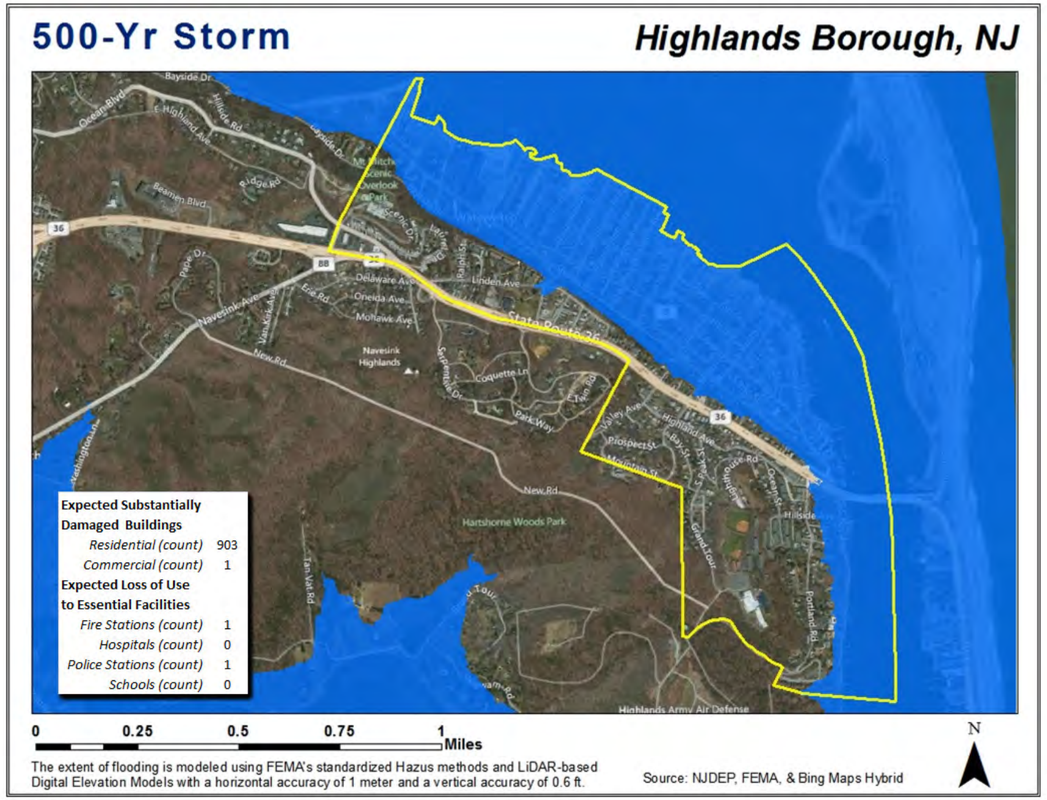
In the rebuild scenario for the 100 year storm, Highlands' tax rate jumped 74% from 0.757 to 1.316 per $100 of assessed value. Revenues stayed the same at $8,099,675 because no structures or population was lost. However, expenditures grew 49% from $8,099,675 to $12,107,980 because of additional police expenditures ($20,561); costs to temporarily relocate displaced people ($140,000); debris removal ($681,300); and costs to replace existing infrastructure (a total of $24,388,000, for an annual payment of $1,583,222) (Appendix Table 2). The insurance premium for Highlands for a 100 year storm is $1,437,900.

Retreat

In the retreat scenario for the 100 year storm, Highlands' tax rate jumped 72% from 0.757 to 1.299 per $100 of assessed value. Local Purpose Tax Revenues (or revenues from property taxes) declined 5% because 161 homes were not rebuilt. This represents a loss of $31,621,688 in assessed value for the town, and a loss of 306 residents. Total revenues declined from $8,099,675 to $7,810,021. No commercial properties were lost in the 100 year storm. At the same time, expenditures grew 42% from $8,099,675 to $11,485,413 because of additional police expenditures ($20,561); costs to temporarily relocate displaced people ($140,000); debris removal ($681,300); and costs to replace existing infrastructure (a total of $24,388,000, for an annual payment of $1,583,222) (Appendix Table 2). The insurance premium for Highlands for a 100 year storm is $1,437,900.

Smaller Subsidy

In the Smaller Subsidy scenario for the 100 year storm, Highlands' tax rate grew 97% from 0.757 to 1.494 per $100 of assessed value. Local Purpose Tax Revenues declined 3% because 81 homes were destroyed in the storm and not rebuilt. This represents a loss of $15,810,844 in assessed value for the town, and a loss of 153 residents. Total revenues declined from $8,099,675 to $7,954,848. No commercial properties were lost in the 100 year storm. At the same time, expenditures grew 62% from $8,099,675 to $13,135,963 due to additional police expenditures ($20,561); costs to temporarily relocate displaced people ($140,000); debris removal ($2,043,900); and costs to replace existing infrastructure (a total of $24,388,000, for an annual payment of $1,583,222) (Appendix Table 2). The insurance premium for Highlands for a 100 year storm is $1,437,900.



Map 11. Highlands 500 Year Storm Event Model

Highlands Model: 500 Year Storm Event

Rebuild

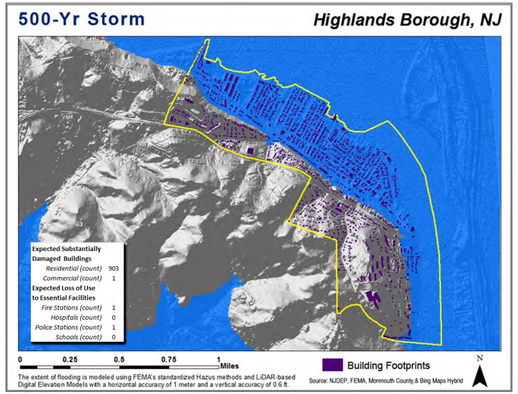
In the rebuild scenario for the 500 year storm, Highlands' tax rate jumped 86% from 0.757 to 1.409 per $100 of assessed value. Revenues stayed the same at $8,099,675 because no structures or population was lost. However, expenditures grew 58% from $8,099,675 to $12,789,486 because of additional police expenditures ($41,122); costs to temporarily relocate displaced people ($140,000); debris removal ($854,100); and costs to replace existing infrastructure (a total of $28,090,000, for an annual payment of $1,827,486) (Appendix Table 2). The insurance premium for Highlands for a 500 year storm is $322,280.

Retreat

In the retreat scenario for the 500 year storm, Highlands' tax rate jumped 31% from 0.757 to 0.990 per $100 of assessed value. Local Purpose Tax Revenues (or revenues from property taxes) declined 29% because 903 homes and one commercial property were not rebuilt. This represents a loss of $177,938,063 in assessed value for the town, and a loss of 1,716 residents and 9 workers. Total revenues declined from $8,099,675 to $6,469,763. At the same time, expenditures declined 6% from $8,099,675 to $7,582,679. Some expenditure categories increased, including police expenditures ($41,122); debris removal ($854,100); and costs to replace existing infrastructure (a total of $28,090,000, for an annual payment of $1,827,486). However, because the population loss was so large at just over a third, general town expenditures declined in total (Appendix Table 2). The insurance premium for Highlands for a 500 year storm is $322,280.

Smaller Subsidy

In the Smaller Subsidy scenario for the 500 year storm, Highlands' tax rate grew 104% from 0.757 to 1.541 per $100 of assessed value. Local Purpose Tax Revenues declined 15% because 452 homes and one commercial property were destroyed in the storm and not rebuilt. This represents a loss of $88,969,032 in assessed value for the town, and a loss of 858 residents and 4 workers. Total revenues declined from $8,099,675 to $7,284,719. At the same time, expenditures grew 49% from $8,099,675 to $12,105,907 due to additional police expenditures ($41,122); costs to temporarily relocate displaced people ($140,000); debris removal ($2,562,300); and costs to replace existing infrastructure (a total of $28,090,000, for an annual payment of $1,827,486) (Appendix Table 2). The insurance premium for Highlands for a 500 year storm is $322,280.



Map 12. Highlands 500 Year Storm Event Model with Building Footprints

Based on the fiscal impact analysis of 10, 50, 100, and 500 year storms for the Rebuild, Retreat, and Smaller Subsidy scenarios, Highlands consistently performs best in a retreat scenario. The equalized tax rate is lowest for the retreat scenario for each storm considered, at 1.118 for the 10 year storm, 1.229 for the 50 year storm, 1.299 for the 100 year storm, and .990 for the 500 year storm (see Figure 19). Furthermore, the more severe the storm, the better the retreat scenario performs in terms of tax rate for Highlands. In the 500 year storm, the worst storm tested in this model, the Retreat scenario's tax rate was .418 lower than the Rebuild scenario, and .550 lower than the Smaller Subsidy scenario. The tax rate drops substantially in the Retreat scenario for the 500 year storm because of the large loss of population,

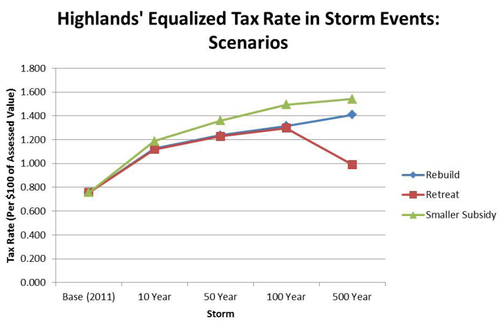


Figure 17. Highlands Change in Tax Rates Due to Storm Events

in proportion to the size of the town. More than one third of people (34%) are lost in that scenario. This means that a far smaller amount of people would be left to receive governmental services, thereby lowering the tax rate significantly. The Smaller Subsidy scenario represents the worst option for Highlands, as it consistently has the highest tax rates for all storms at 1.189 for the 10 year storm, 1.361 for the 50 year storm, 1.494 for the 100 year storm, and 1.541 for the 500 year storm.

When compared with the past sixteen years of tax data, from 1995 to 2011, it becomes clear that these storm scenarios do cause the municipal tax rate to exceed recent trends. The highest reported equalized municipal tax rate between 1995 and 2011 was 1.424; this rate is exceeded in all but three scenarios examined here (Appendix Table 2). In light of the historic volatility in tax rates, as well as the high tax rates that municipalities could experience in these scenarios, indicate that Highlands may want to consider scenarios that give residents the best chance of having a more predictable and low tax rate, as is found in the Retreat scenario.

In terms of net revenues, as well, the Retreat scenario performs best (Figure 20). For all three scenarios, there is a negative net result from storms, but the Retreat scenario is consistently the least negative of all scenarios. In fact, the more severe the storm, the better Retreat performs. For the 500 year storm, the net revenue for the Retreat scenario is -$1,112,916, while it is -$4,689,811 for the Rebuild scenario, and -$4,821,188 for the Smaller Subsidy Scenario.

In terms of population, the greatest numbers of people are lost with the Retreat Scenario (Figure _6_). This is by design, since 0% of residential structures are lost in the

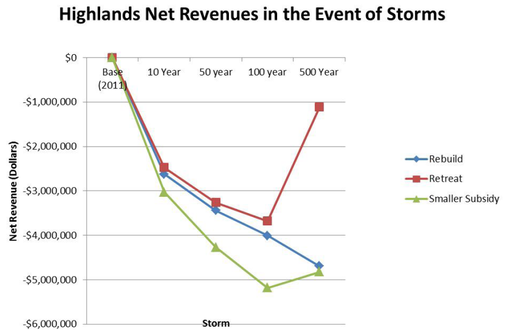


Figure 18. Highlands Change in Net Revenues Due to Storm Events

Rebuild scenario, 50% of substantially damaged residential structures are lost in the Smaller Subsidy Scenario, and 100% of the substantially damaged residential structures are lost in the Retreat scenario. The population losses follow proportionally, with the 500 year storm being the most demonstrative of these assumptions. During that storm, 0 people are lost in the Rebuild scenario, 858 are lost in the Smaller Subsidy scenario, and 1,716 are lost in the Retreat Scenario.

While the Smaller Subsidy scenario is not the most attractive for Highlands in terms of their budgets, Highlands should prepare for this to become reality. The amounts FEMA is paying to flood victims in areas where such flooding is predictable and preventable may be unattractive in tight fiscal times. Furthermore, the large numbers of vacation homes on the Jersey shore (and the fact that these second homes are often owned by wealthy people) may become a liability, as the less well-off around the country decline to subsidize the largess of the very wealthy. Furthermore, in preparing for a smaller subsidy world, Highlands may want to consider the Retreat scenario, as this scenario gives them more control over their own fiscal fates by allowing them to choose which areas should and should not be rebuilt, thereby giving them more control over their fiscal futures. Highlands should also understand that debris cleanup is a large portion of the cost they will have to pick up in a smaller subsidy world, and it is a large number in each storm scenario. By retreating, Highlands could avoid massive clean-up costs with which they will otherwise be shackled.

Case Study 3: Middletown

Physical Setting

Middletown, "New Jersey's Oldest Settlement" was settled beginning 1613. The Shrewsbury River, forming Middletown's South Eastern boundary, was an essential transportation hub in the 17th and 18th centuries, usable by ships because the then navigable depths and the existence of inlets. Farm goods, such as strawberries, and seafood, including oysters and clams were shipped in 60-85' boats known as Shrewsbury Packets, which featured flat bottoms and centerboards, making possible river navigation and the ability to carry goods to markets in northern New Jersey and New York. In 1825, steamboats began navigating the river. The cutting down of dunes, building of bulkheads, jetties and seawalls likely impacted the natural shifting of sands, and in turn likely affected the flow and depth of the Shrewsbury river, creating shoals cursed by the sailors, as well as the altering the evolution of the outlying barrier island. To prevent ship groundings along the River, Congress allocated $47,000 in 1880 to dredge a channel in the River that quickly refilled, making navigation as difficult as before. This was repeated in 1893, 1897, 1901, 1907, 1910, 1919, each time for the purpose of making the channel deeper and wider for ships to pass--only to have the river silt up again(Methot, Up & Down the River, 1980).

Through the end of the nineteenth century, the Middletown's growth was modest, relying on the export of agricultural and maritime goods, in addition to some industry in the form of carriage and farm wagon production, a hat factory and a tannery. The primary outlet for goods was via sailboats stationed Port Monmouth until a steamboat called the Eagle began taking freight from Compton's Creek and since 1859 from the New Jersey Southern Railway's wharf to New York. In 1875 the New York and Long Branch Railroad was built, around which housing units and a telegraph station were built, the latter increasing Middletown's connection with the rest of the world. (Mandeville, 1972). More recently, dredging has been an issue in Compton's Creek on the Bayshore where the still viable Belford commercial fishing fleet is stationed—which remains a critical part of Middletown's economy.

Year	Population	% Change
1910	6,653	—
1920	5,917	-11.10%
1930	9,209	55.60%
1940	11,018	19.60%
1950	16,203	47.10%
1960	39,675	144.90%
1970	54,623	37.70%
1980	62,574	14.60%
1990	68,183	9.00%
*2000	67,479	-1.00%
2010	66,522	-1.40%

Table 6.
Middletown Population Growth
US Census Bureau

Automobiles dramatically accelerated the growth of the region after 1920, when the town's population remained a modest 5,917 persons. In 1910, the automobile started bringing in the summer crowds, when it was noted that "The road from Keyport to Red Bank, leading through Middletown village, is one of the most used roads in the state by automobiles in going to the shore. The road is in fine condition, Sunday afternoon 335 machines went through the place within forty minutes." (The Red Bank Register, 1910).

However, with the age of the automobile United States Census data confirms rapid population growth in Middletown: 1920-1930 (55.6%), 1930-1940 (19.6%) and 1940-1950 (47.1%). During this time, development continued in Middletown flood prone areas, in the face of ongoing storms. In 1930 Shadow Lake Dam was built across Quigley (a.k.a. Nut Swamp) Creek in Middletown to create attractive waterfront property, only to be washed out by a storm in 1934 (Gabriellan, 1994), rebuilt shortly thereafter only to be destroyed again by a September 1938 hurricane (Gabrielan, 1995). The upkeep of this dam is an issue that persists with each major passing storm.

During the 1944 Hurricane, June Methot personally observed shrieking winds reaching speeds of 100 m.p.h. sustained over a twelve hours period. The author, from her house on the northern bank of The North Shrewsbury River saw that the river was 30' above the normal high tide line, stating "Not until morning did we discover that a sturdy 100—foot dock, 50 to 60 feet of solid concrete bulkhead and one-third of our riverbank had vanished" (Methot, Up & Down the Beach, 1988, p. 177). Similarly, this storm is one of the first flooding recollections of the now 74-year-old Charles Rogers, Middletown's Office of Emergency Management ("OEM") Coordinator. This was the first of several times where he had to be carried out his house by his father. In the 1950's his parents elevated the house approximately 7' off the ground (Rogers, 2012).

The opening of the Garden State Parkway in 1955 greatly accelerated the population growth trend: "The [federally funded] Garden State Parkway had opened only seven years earlier, speeding access to shore points from major population centers to the north and west,'' [The Chief of Coastal Planning for the U.S. Army Corps of Engineers, Philadelphia Division, Jeffrey A.] Gebert said. "The coastal counties of New Jersey were in the midst of a boom in population, development and day-tripper recreational demand.''(APP.com, 2012). Census figures reflect that the population exploded by 144.9% from 1950 to 1960, the decade the Parkway opened. Charles Rogers agreed that installation of the Parkway, with a Middletown Exit, plus the expansion of the state roads such as the widening of Rt. 35 and addition of clover leafs in the 1970's (Gabriellan, Vol. II 1995) contributed greatly to Middletown's growth. Interestingly, the population growth in Middletown tended to be inland, away from the flooded areas, due to the availability of inexpensive agricultural land near the Parkway entrance—to access the Northern Jersey/New York employment markets (Rogers, 2012). The decennial Census figures reflect that for the next thirty years, Middletown's population continued to grow at a rapid but steadily declining rate through 1990 (37.7% from 1960-70; 14.6% from 1970-80, and 9% from 1980-90). In the past two decades, population growth has ceased, with slight 1% and 1.4% population declines from 1990-00 and 2000-10, respectively). This leveling off of the population represents an opportunity to redirect development, away from flood plains and environmentally sensitive areas.

Per the recollection of Charles Rogers, Middletown fared reasonably well through the Great Ash Wednesday Storm of 1962: There was a lot of vehicular damage because there was insufficient advanced warning of the storm's arrival to move vehicles from the low lying areas. Although he was evacuated via a Coastguard duck from his home in Fort Monmouth, by then many homes like his were already raised and did not sustain significant damage. The summer bungalows suffered from three to four feet of flooding, but none were wiped out (Rogers, 2012). Following the storm, the Federal government spent $300,000 on sand pumping in Middletown (Special to The New York Times, 1963). In September 1963, NJ provided an $119,500 grant for 340,000 cubic yards of beach fill to raise the beach from Pew's Creek

eastward to the fish factory, by twelve feet above the mean high water line. This represented 50% of the project's cost, with Middletown to pay 40% and Monmouth County to pay the remaining 10%, with complete reimbursement sought by the federal government if the project is considered part of the Army Corp of Engineer's hurricane protection work that was taking place on the western side of Pew's Creek. In addition, funding to build a bulkhead at Compton's Creek in Belford was sought. (The Red Bank Register, 1963)

In 1968, a massive nor'easter again forced the evacuation of 100 people from the Port Monmouth section of Middletown (Bigart, 1968). Following the storms of the 1960's, the Army Corps of Engineers built a dike extending from Hazlet to Middletown; along the Keansburg and Middletown bay front to Pews Creek, and several closure devices (floodgates) in all three towns (The Daily Register, 1974). In December of 1968 Middletown requested that the state provide $704,000 for beach fill along the bay, "completing" work on township property fronting the bay which had already included beach fill and sloping dikes in Port Monmouth and Belford, as well as an Army Corps of Engineer's project under contract at East Keansburg (now North Middletown). The request was for the construction of a new jetty and related bulkhead extensions on the west side of Pew's creek, backfill in Leonardo and dune grass plantings on the back slope of the Port Monmouth beach work already completed. This was in addition to $30,000 in shore preservation funding provided by the state to Middletown, the prior year. (The Daily Register, 1968). From the observations of longtime resident and current Middletown OEM Administrator, Charles Rogers, the dike system has done well to protect East Keansburg from Pew's Creek, but may have worsened flooding in the Fort Monmouth and Belford areas—since the water has to go somewhere. (Rogers, 2012).

Picture 2. Beach Construction
Credit: Scot K. Bell

Of course, this infrastructure has to be maintained. In 1974, an agreement was brokered to split the $150,000 cost maintaining the dike between the state, who agreed to pay for half the cost, and the three towns, Middletown, Hazlet and Keansburg agreeing to split the other half (The Daily Register, 1974). Compton's Creek has long been the staging ground for fishermen from Middletown's Belford village. To protect this asset, in 1982, a bond was issued to build a seawall, 50' wide at its base and 20' wide at the peak, to prevent from silting up as a result of north-easterly winds and storms. Of the $1 Million project costs, Middletown's share was $200,000 with the remainder to be paid for by the state and federal governments. In addition, the $550,000 in estimated costs to dredge the creek was paid in entirety by the Army Corps of Engineers (Breen, 1983). This investment helped maintain the viability of a longstanding commercial fishing enclave. As of 1994, the Belford fleet of 70 vessels was the last remaining major New Jersey commercial fishing enclave in the Bayshore region—generating about 300 jobs and $10 million of revenue into the local economy. At the time, the Belford Cooperative was fretting a plan by the state to introduce ferry commuter service from Compton's Creek to Lower Manhattan, alleging that larger ferryboats sharing the creek constituted a safety Hazard (Kamin 1994). The ferry birth was eventually built and has largely coexisted peaceably with the fishing boats (Rogers, 2012). From a stormwater management perspective, however, the 1,600 space impermeable parking lot sited near the Creek was and remains problematic.

As a result of the 1992 Nor'easter, Charles Rogers estimates that four feet of water suddenly overtopped the Belford Docks in beginning, with little warning. Eventually, the water level sat at six feet at the docks, with water coverage that extended between half of a mile to three quarters of a mile inland (Rogers, 2012). The hardest hit sections of Middletown were Leonardo, Belford and Port Monmouth. In Port Monmouth, the Township's new fishing pier, completed that August with state Green Acres funds August, suffered severe damage. The Township's beaches suffered severe erosion and the dunes were destroyed (Sherman 1992). However, there was not too much structural damage because of better building codes, although some buildings suffered floor and/or wall damage, no homes were knocked off their foundations or swept away (Rogers, 2012)

As a result of a nor'easter storm that passed through on March 13, 2010, the dunes in the Port Monmouth, North Middletown and Leonardo sections were undermined, causing heavy flooding in some residential areas (Spoto, Dredge Silt Proposed to Fix Bayshore Dunes, 2010) and left the township's 9/11 memorial in the Leonardo section a pile of rubble (Spoto, After Weathering the Storm, Towns Assess its Damage, 2010).

Picture 3. Middletown Docks
Credit: Scot K. Bell

Hurricane Irene in August 2011 caused severe flooding that crested perhaps a foot below the peak of the 1992 nor'easter, according to Charles Rogers. He felt that Irene did not hit quite as hard or as long as the other two because it overtopped them, instead of over the ocean and wind speeds only reached 45 mph. Due to advanced notice and there was a mandatory evacuation declared by the state that was coordinated locally through his office. Most citizens complied. There was no equivalent warning in 1962, so more people were trapped in their houses then. Irene caused some road, dune, and property damage. Notably, a couple of river dams in the Shadow Lake area broke loose, with the water flow taking a house off

of its foundation. The dams were repaired by the county. The house is for sale and FEMA is contemplating purchasing it. (Rogers, 2012). Despite improved building codes, FEMA records indicate that from 1978 through February 2009, Middletown has received $5,761,667 in flood insurance payments, which compares favorably to Sea Bright ($14,903,193) and Highlands ($10,522,496.66), but is still substantial when compared to the payouts received by entire state of Delaware ($57,983,629) for the same period of time.(FEMA, 2012)

Current Demographics

In Middletown, median income is $34,196 per capita, $85,049 per household and $99,862 per family, respectively, per the 2007 American Community Survey ("ACS") estimates. In terms of income inequality, in 2000 the United States Census notes that Middletown males had a median income of $60,755 when compared to only $36,229 for females. About 1.9% of families and 3.1% of the overall population is below the poverty line, including 3.2% of those under age 18 and 5.7% of those 65 years or over.

Per the 2010 Census, there were 24,959 housing units, of which 23,962 were occupied and 997 were vacant. 20,304 were owner occupied, 3,658 were renter-occupied and 997 were vacant. Unlike most shore communities, in Middletown, only 188 units or .8% were occasional/seasonal use properties. Interestingly, despite a slight 1% population decline, a net 1,099 new dwelling units were constructed in the Township between 2001 and 2010. The September 12, 2011 update to the Middletown Master Plan speculates that this can be attributed to a number of factors such as increased housing vacancy rates and/or decreasing household sizes.

Middletown Master Plan

In 2004, Middletown issued a new Mmaster plan which has since been updated twice. Stormwater management issues are addressed directly and indirectly throughout the plan and its updates. In the policy section of the report, it calls for future land development to "protect and enhance the environmental quality of the Township, and preserve and protect valuable open spaces and natural resources " (pg. 4)." The plan recognizes that the Bayshore areas of the Township, predominantly north of Route 36 in North Monmouth, Port Monmouth and Belford, contain high densityhigh-density residential development, with very little developable land extant in those areas. North Middletown, historically a summer resort characterized by bungalows, also features little developable land (pg. 8). On pp. 16-18 the plan encourages, where appropriate, that clustered development, lot averaging (regardless of minimum tract size), increased floor area and building height (but not to exceed 35') may be employed to reduce impervious coverage, allow for more contiguous open areas, preserve natural features, reduce site disturbance and directing growth to village centers and minimizing suburban sprawl. In addition, TTransfer of Development Rights (TDR) in non-contiguous parcels, away from certain critical areas was identified as an effective tool for open space preservation.

The Circulation Element of the plan recommends new paving, curbs sidewalks in street trees in older sections of the Township. However, the recommendations could have gone further to stress the potential environmental and stormwater management benefits of those proposals, particularly in the context of a full "green streets" effort where significant portions of sidewalks and curb bump-outs are converted into vegetative areas.

The Master Plan notes that the Middletown train station has parking for 1,600 vehicles—but there is no mention of how the rainwater runoff from these lots was mitigated during renovations in 2002, or would be in the future, if at all. The Stormwater Management element of the plan talks about establishing stormwater management design and performance standards for new (but not existing development), emphasizing the use of non-structural stormwater management techniques such as minimizing disturbance, impervious surfaces, the use of stormwater pipes and preserving natural drainage features. Requirements for groundwater recharge, stormwater runoff quantity control, and buffers for "Category One" waterways The Navesink River, Shrewsbury River, Swimming River and their immediate tributaries) were recommended. McClees and Claypit Creek drainage basins were designated as Environmentally Sensitive Planning Areas due to their coastal and freshwater wetlands, steep slopes and other natural landscapes. These waterways, Poriicy Brook and Hartshorne Woods Pond and other streams were recommended by the plan's authors to be the starting point for coordinated usage of overlay zones by which Middletown may pursue land acquisition and conversion to "Conservation Areas" which are defined in the plan as ". . . containing natural features such as woodlands, tidal wetlands, ponds, streams, etc. They are to be preserved and their use shall be limited only to passive recreation activities. The Master Plan notes that substantial portions of the town are in CAFRA zones, which are therefore subject to CAFRA's development restrictions. The plan calls for either preservation or careful management of natural resources.

We recommend a policy of active stewardship over these areas, as there are few natural resources that are not adversely affected by human's activities and which therefore require some level of active management to repair. Among the protectable natural resources listed in the plan are beaches

Existing Land Use, Middletown, NJ	Area (acreage)	% of Township
Vacant/Undeveloped	1,419	6%
Residential	9,516	39%
Multi-Family Residential	563	2%
Commercial	1,561	6%
Industrial	5	0%
Farmland	1,927	8%
Military Land	705	3%
Public Parks/Open Space	3,671	15%
Public Schools	587	2%
Other Land Uses	2,076	8%
Streets, Highways & Railroads	2,418	10%
Total	24,448	100%

Table 7. Middletown Land Use
Middletown, NJ Master Plan 2003

and dunes; fresh and saltwater wetlands and floodplains (which absorb and filter stormwater); steep slopes (vegetation reduces erosion), etc.

The September 12, 2011 Amendment and Re-examination Report noted the continuing need to lower residential dwelling unit densities in areas where significant environmental constraints exist, such as the McClees Creek and Navesink River watersheds. Although the amendment report acknowledged the ongoing issue, its only recommendation was to diverting development to other developable areas of Middletown that do not suffer from the same constraints.

The need to adopt regulations that would establish minimum dimensions for the buildable area of lots for single familysingle-family dwellings was considered an objective. Zoning regulations were further refined in March 2010 providing flexibility in Performance Residential Development (aka. "clustering") provisions that allow reduced lot sizes in exchange for critical area preservation regardless of tract size. Density provisions were altered slightly in order to encourage the preservation of natural features while maintaining certain standards for minimum dimensions for buildable lot area. Accordingly, the issue of adopting regulations to establish minimum dimensions for the buildable area of lots has been sufficiently addressed.

The 2011 Reexamination Report noted that updated regulations were adopted by the Township on September 21, 2009. Just prior to the September 25, 2009, effective date of the Federal Emergency Management Agency's (FEMA) updated Flood Insurance Rate Maps (FIRM). Middletown's adoption of significant elements of New Jersey's the Model Flood Damage Prevention Ordinance prepared by the NJDEP has permitted the Township to continue participation in the National Flood Insurance Program (NFIP) as administered through FEMA. Some enhancements to the Model Ordinance have allowed the Township to obtain a rating of "8" in FEMA's Community Rating System (CRS), which the plan noted would likely result in substantial flood insurance policy savings to Middletown property owners for exceeding NFIP's minimum requirements by two categories (class ten represents the minimum clearance and one representing the highest achievable clearance categprucategory) . According to FEMA's 2007 National Flood Insurance Program Community Rating System Coordinator's Manual, Middletown's "Class 8" rating qualifies residents for a 10% discount of a maximum possible 45% discount obtained by Class 1 communities (FEMA, 2007).

The "Stormwater Management Ordinance of the Township of Middletown." (Ord. No. 2006-2872 § 1)

This Middletown Ordinance properly seeks to control flooding and groundwater recharge and low impact techniques, such as environmentally sensitive site design and source controls as a matter of first resort, before resorting structural best management practices (BMPs). 16-1001.1A

However, the ordinance only applies to "Major Developments" that are residential or non-residential, involving an acre or more of land disturbance through ". . . the placement of impervious surface and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.

To the maximum extent practicable, nonstructural stormwater management measures shall be incorporated and identified in the application and shall include: protection of areas susceptible to erosion, provide water quality benefits; minimization of soil compaction, land disturbance and impervious surfaces; maximize protection and use of native vegetation and natural drainage features that discharge into stable vegetated areas and apply fertilizers in accordance with the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39, et seq.

Given that Middletown's smallest and densest lots are along the Bayshore, these less-onerous, nonstructural BMPs of the ordinance should apply to land disturbances that are a half acre or more, to increase their application where needed most.

Figure 19.
Middletown Municipal Code Carve Out
Source: Middletown, NJ Master Plan 2003

Middletown Fiscal Impact Analysis

Middletown Budget Summary

Middletown is the 16th largest municipality of New Jersey, with a total population of 66,522 (US Census 2010), and 20,093 workers (US Census Longitudinal Household-Employer Dynamics Dataset, 2009). The general budget for 2011 had a total expenditure and revenue of $61,868,799.57. The largest spending categories were public safety at 24% of the municipal budget, General Government at 22%, and municipal debt service at 12%. Of the budget expenditures, about 89% of costs were associated with residential uses, while 11% associated with nonresidential uses.

Most of the revenue comes from the local tax for municipal services, roughly 74% of the total revenues. About 10% of the revenues are comprised of State aid. The property tax rate in Middletown is 0.471 per $100 of assessed value for year 2011. Average homeowner annul at $1791 and $149 per month. Compare with the two other studied municipalities, Highlands and Sea Bright, Middletown is much larger in area with much lower tax rates.

Based on the 2011 County Abstract of Ratables, Middletown is highly residential, with 86% of the town's assessed value found in residential property; 12 % percent of the town is commercial, just 1% is vacant, and 0% is industrial.

Recent Tax Rate Trends

The historical trend of tax rates is an important component of the fiscal analysis for the municipalities. They are important in determining how volatile tax rates are for municipal budgets. A chart (Figure 23) displays the tax rates from 1995 to 2011. In order to account for reassessed values of land the tax rates were equalized with the county equalization ratio. The general tax rate was included as well, as a way to compare general trends to the municipal level. The chart shows mostly stable tax rates in the 1990's until the early 2000's, since when the trend began to decline during the housing boom. The decreasing trend of tax rate touched its bottom at the year of 2008. It then grew up back rapidly in the late 2000's, and continued to increases through 2011.

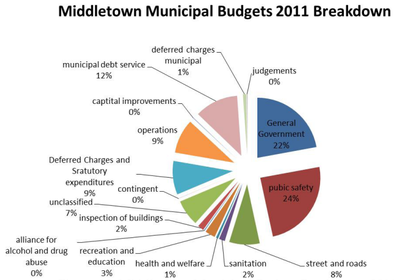


Figure 20. Middletown Municipal Budget Breakdown 2011
Source: Municipal Budgets 2011

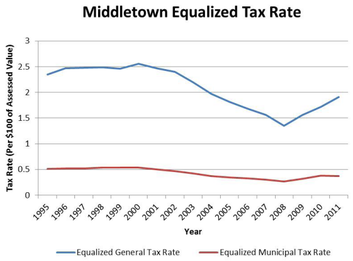
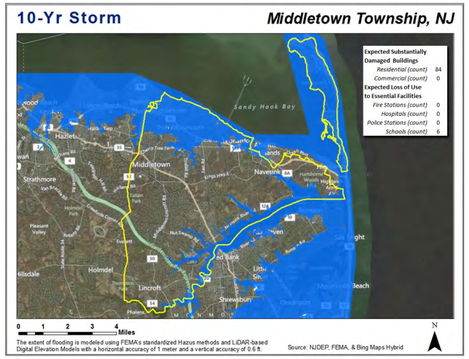
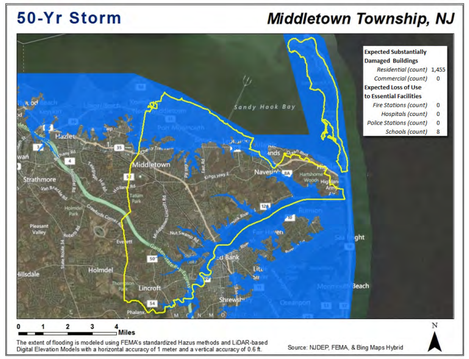


Figure 21. Middletown Equalized Tax Rates 1995-2011
Source: County Abstract of Ratables

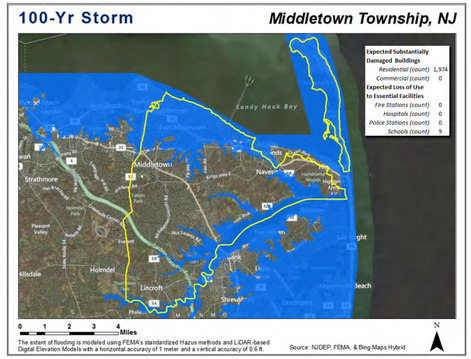
Map 13. Middletown Current Conditions Model



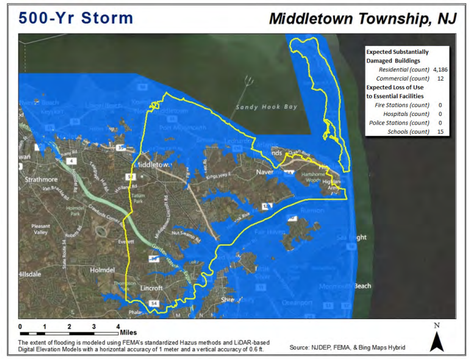
Map 14. Middletown 10 Year Storm Event Model



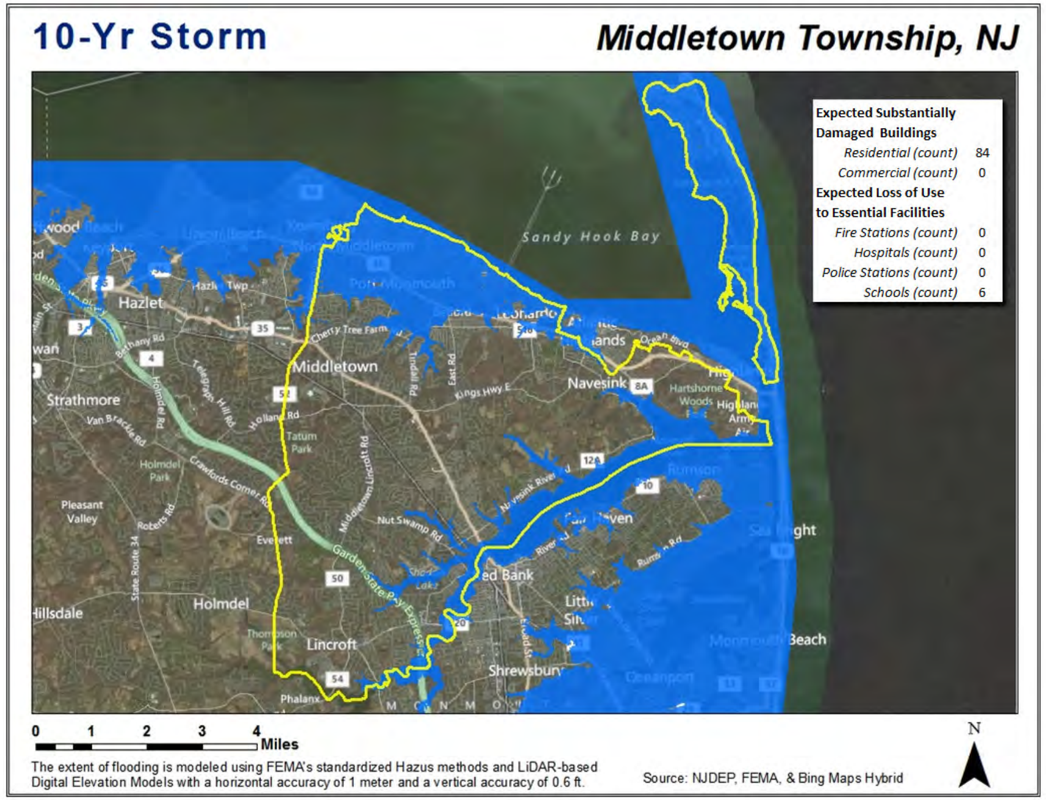
Map 15. Middletown 50 Year Storm Event Model



Map 16. Middletown 100 Year Storm Event Model



Map 17. Middletown 500 Year Storm Event Model



Map 14. Middletown 10 Year Storm Event Model

Middletown Model: 10 Year Storm Event

Rebuild

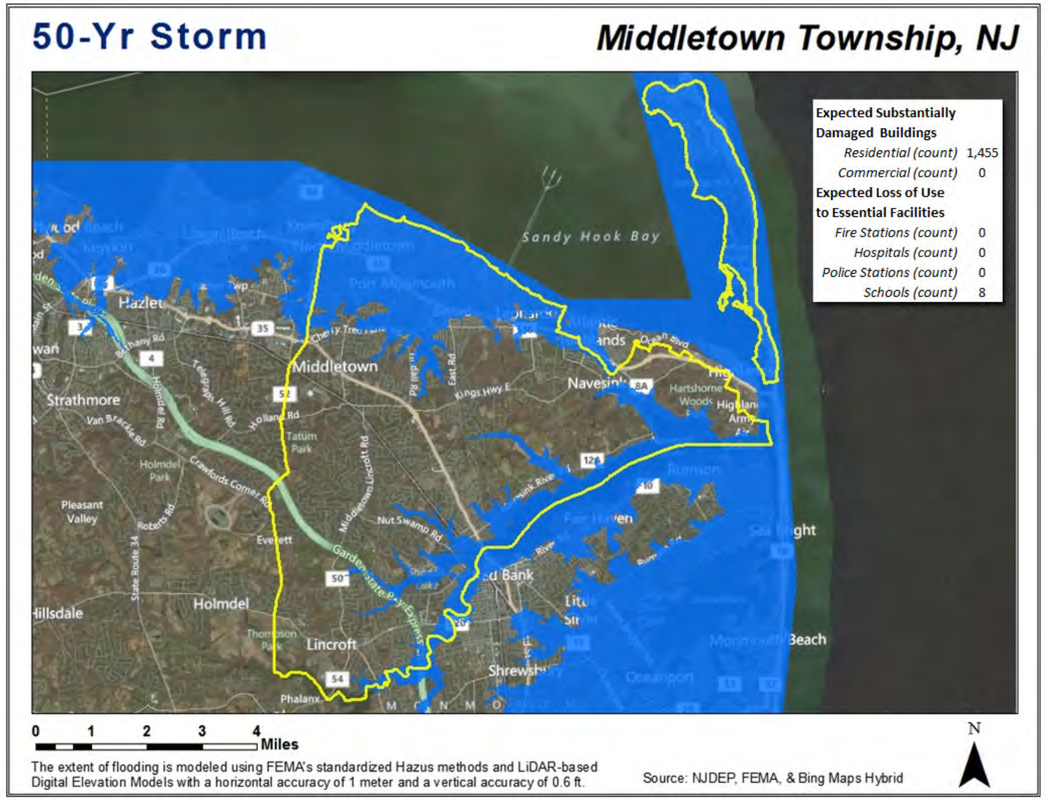
In the rebuild scenario for the 10 year storm, Middletown's tax increased from 0.471 to 0.5 per $100 of assessed value. Revenues stayed the same at $61,868,799.57 because no structures or population were lost. However, expenditures grew 4.58% from $ $61,868,799.57 to $ $64,703,998.46 because of additional police expenditures ($54,155), costs to temporarily relocate displaced people ($580,000), debris removal ($438,150), and the cost of replacing infrastructure (a total of $27,100,000 for an annual payment of $1,762,894) (Appendix Table 3). The insurance premium for Middletown for a 10 year storm is $40.714 million.

Retreat

In the retreat scenario for the 10 year storm, Middletown's tax rate increased from 0.471 to 0.499 per $100 of assessed value, very slightly lower than rebuild scenario. 84 homes were substantially damaged and were not rebuilt, which represents a loss of $$28,892,556 in assessed value for the town, and a loss of 233 residents. Total revenues shrank from $61,868,799 to $61,695,488. No commercial properties were lost in the 10 year storm. At the same time, expenditures grew 4.26% from $61,868,799 to $64,505,736 because of additional police expenditures ($54,155), costs to temporarily relocate displaced people ($580,000), debris removal ($438,150), and the cost of replacing infrastructure (a total of $27,100,000 for an annual payment of $1,762,894) (Appendix Table 3). The insurance premium for Middletown for a 10 year storm is $40.714 million.

Smaller Subsidy

In the Smaller Subsidy scenario for the 10 year storm, Middletown' tax rate grew 7.98% from 0.471 to 0.509 per $100 of assessed value. Local Purpose Tax Revenues declined 0.15 % because 42 homes were destroyed in the storm and not rebuilt. This represents a loss of $14,446,278 in assessed value for the town, and a loss of 177 residents. Total revenues shrank from $61,868,799 to $$61,763,530. No commercial properties were lost in the 10 year storm. At the same time, expenditures grew 5.84% due to additional police expenditures ($54,155), costs to temporarily relocate displaced people ($580,000), debris removal ($1,314,450), and the cost of replacing infrastructure (a total of $27,100,000 for an annual payment of $1,762,894) (Appendix Table 3). The insurance premium for Middletown for a 10 year storm is $40.714 million.



Map 15. Middletown 50 Year Storm Event Model

Middletown Model: 50 Year Storm Event

Rebuild

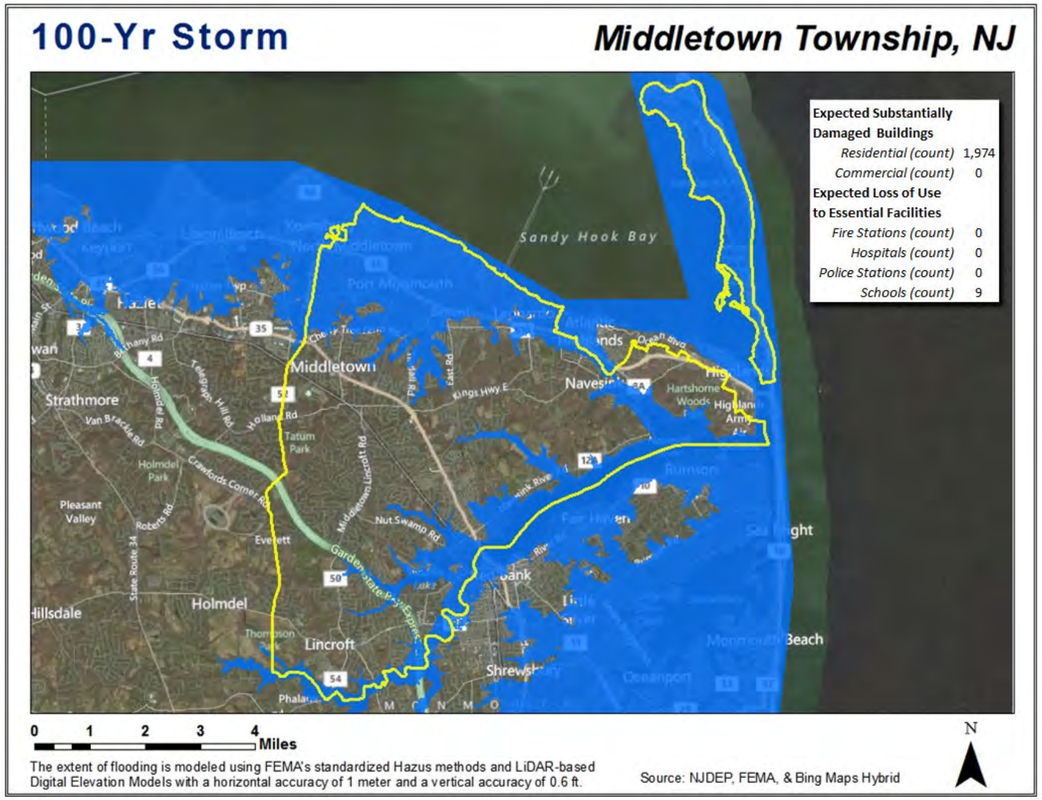
In the rebuild scenario for the 50 year storm, Middletown's tax rate increased 10.76% from 0.471 to 0.522 per $100 of assessed value. Revenues stayed the same at $61,868,799 because no structures or population were lost. However, expenditures grew 8% from $61,868,799 to $$66,849,010 because of additional police expenditures ($216,620), costs to temporarily relocate displaced people ($920,000), debris removal ($1,009,950), and costs to replace existing infrastructure (a total of $21,780,000, for an annual payment of $1,416,820) (Appendix Table 3). The insurance premium for Middletown for a 50 year storm is $13,059,400.

Retreat

In the retreat scenario for the 50 year storm, Middletown's tax rate increased 8.29% from 0.471 to 0.510 per $100 of assessed value. Local Purpose Tax Revenues (or revenues from property taxes) declined 5.12 % because 1453 homes were not rebuilt. This represents a loss of $$499,772,427 in assessed value for the town, and a loss of 4034 residents. Total revenues shrank 3.86% from $61,868,799 to $59,477,644. No commercial properties were lost in the 50 year storm. At the same time, expenditures grew 2.07% from $61,868,799 to $63,149,129 because of additional police expenditures ($216,620), costs to temporarily relocate displaced people ($920,000), debris removal ($1,009,950), and costs to replace existing infrastructure (a total of $21,780,000, for an annual payment of $1,416,820) (Appendix Table 3). The insurance premium for Middletown for a 50 year storm is $13,059,400.

Smaller Subsidy

In the Smaller Subsidy scenario for the 50 year storm, Middletown's tax rate grew 14% from 0.471 to 0.537 per $100 of assessed value. Local Purpose Tax Revenues declined 2.6% because 1453 homes were destroyed in the storm and 726 were not rebuilt. This represents a loss of $249,886,213 in assessed value for the town, and a loss of 2017 residents. Total revenues shrank from $61,868,799 to $60,654,608. No commercial properties were lost in the 50 year storm. At the same time, expenditures grew 8.33% due to additional police expenditures ($216,620), costs to temporarily relocate displaced people ($920,000), debris removal ($3,029,850), and costs to replace existing infrastructure (a total of $21,780,000, for an annual payment of $1,416,820) (Appendix Table 3). The insurance premium for Middletown for a 50 year storm is $13,059,400.



Map 16. Middletown 100 Year Storm Event Model

Middletown Model: 100 Year Storm Event

Rebuild

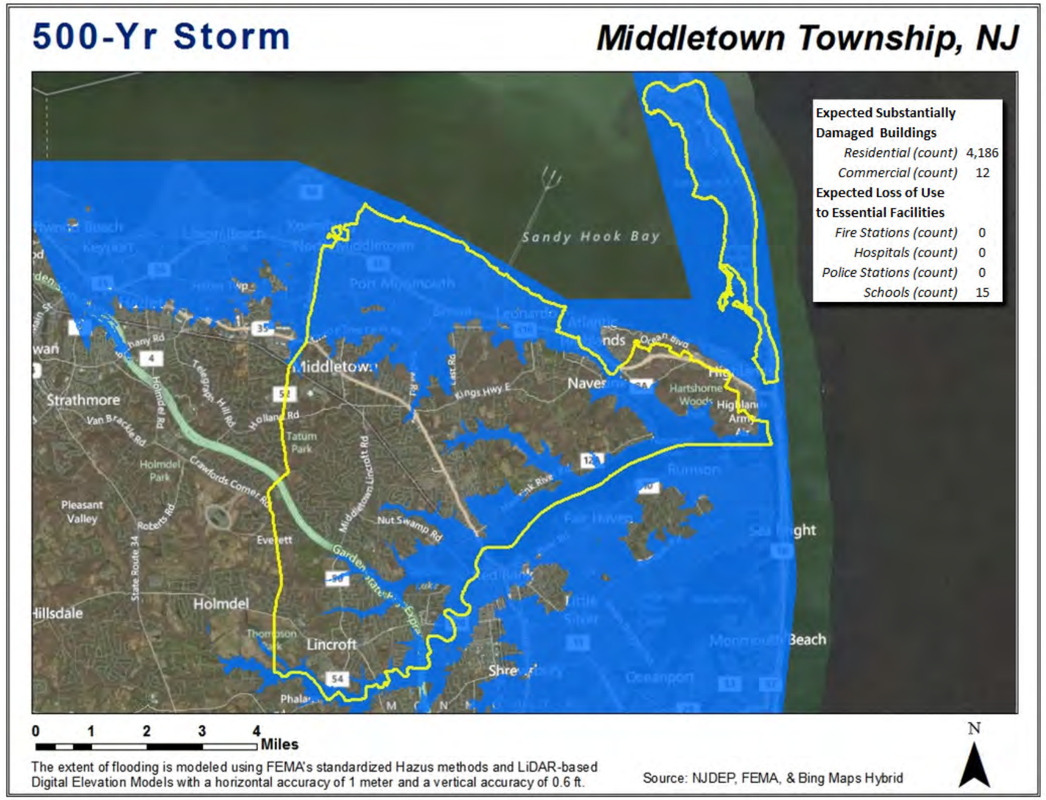
In the rebuild scenario for the 100 year storm, Middletown's tax rate increased 14 % from 0.471 to 0.537 per $100 of assessed value. Revenues stayed the same at $61,868,799 because no structures or population were lost. However, expenditures grew 10.5% about 6,5million because of additional police expenditures ($379,085), costs to temporarily relocate displaced people ($1,080,000), debris removal ($1,524,600), and costs to replace existing infrastructure (a total of $53,780,000, for an annual payment of $3,498,466) (Appendix Table 3). The insurance premium for Middletown for a 100 year storm is $7,995,600.

Retreat

In the retreat scenario for the 100 year storm, Middletown's tax rate grew 19% from 0.471 to 0.520 per $100 of assessed value. Local Purpose Tax Revenues (or revenues from property taxes) declined roughly 7% because 1974 homes were not rebuilt. This represents a loss of $678,975,066 in assessed value for the town, and a loss of 5480 residents. Total revenues declined from $61,868,799 to $58,633,599. No commercial properties were lost in the 100 year storm. At the same time, expenditures grew 2% because of additional police expenditures ($379,085), costs to temporarily relocate displaced people ($1,080,000), debris removal ($1,524,600), and costs to replace existing infrastructure (a total of $53,780,000, for an annual payment of $3,498,466) (Appendix Table 3). However, while the expenditure grew, the needs of public service reduced due to the loss of population, and the expenditure on those services decreased. The insurance premium for Middletown for a 100 year storm is $7,995,600.

Smaller Subsidy

In the Smaller Subsidy scenario for the 100 year storm, Middletown's tax rate grew 19 from 0.471 to 0.561 per $100 of assessed value. Local Purpose Tax Revenues declined 3.4 % because 1974 homes were substantially destroyed in the storm and 987 of them were not rebuilt. This represents a loss of $339,487,533 in assessed value for the town and a loss of 2740 residents. Total revenues declined from $61,868,799 to $60,232,585. No commercial properties were lost in the 100 year storm. At the same time, expenditures grew 11.19% due to additional police expenditures ($379,085), costs to temporarily relocate displaced people ($1,080,000), debris removal ($4,573,800), and costs to replace existing infrastructure (a total of $53,780,000, for an annual payment of $3,498,466) (Appendix Table 3). The insurance premium for Middletown for a 100 year storm is $7,995,600.



Map 17. Middletown 500 Year Storm Event Model

Middletown Model: 500 Year Storm Event

Rebuild

In the rebuild scenario for the 500 year storm, Middletown's tax rate increased 21.25% from 0.471 to 0.571 per $100 of assessed value. Revenues stayed the same at $61,868,799 because no structures or population were lost. However, expenditures grew $9,871,52, which is roughly 16%, because of additional police expenditures ($758,170), costs to temporarily relocate displaced people ($1,390,000), debris removal ($2,473,050), and costs to replace existing infrastructure (a total of $80,710,000, for an annual payment of $5,250,301) (Appendix Table 3). The insurance premium for Middletown for a 500 year storm is $2,197,400.

Retreat

In the retreat scenario for the 500 year storm, Middletown's tax rate grew 10.22% from 0.471 to 0.519 per $100 of assessed value. Local Purpose Tax Revenues (or revenues from property taxes) declined 14.8% because 4186 homes and 12 commercial properties were substantially destroyed and were not rebuilt. This represents a loss of $1,463,346,328 in assessed value for the town, and a loss of 11620 residents and 404 workers. Total revenues declined about 11% from $61,868,799 to $54,939,210. At the same time, expenditures declined 4.64 % to $58,998,218. Some expenditure categories increased, including police expenditures ($758,170), costs to temporarily relocate displaced people ($1,390,000), debris removal ($2,473,050), and costs to replace existing infrastructure (a total of $80,710,000, for an annual payment of $5,250,301) (Appendix Table 3) However, because the population loss was so large at just over a third, general town expenditures declined in total (Appendix Table 3). The insurance premium for Middletown for a 500 year storm is $2,197,400.

Smaller Subsidy

In the Smaller Subsidy scenario for the 500 year storm, Middletown's tax rate jumped 28% from 0.471to 0.603 per $100 of assessed value. Local Purpose Tax Revenues declined 7.4% because of 2093 homes and 6 commercial properties that were destroyed in the storm and not rebuilt. This represents a loss of $731,673,164 in assessed value for the town, and a loss of 5810 residents and 202 workers. Total revenues declined from $61,868,799 to $58,385,391. At the same time, expenditures grew 14% from $61,868,799 to $70,491,357 due to additional police expenditures ($758,170); costs to temporarily relocate displaced people ($1,390,000); debris removal ($2,473,050); and costs to replace existing infrastructure (a total of $80,710,000, for an annual payment of $5,250,301) (Appendix Table 3). The insurance premium for Middletown for a 500 year storm is $2,197,400.

Mitigation Strategies and Recommendations

Conclusion

In general, Based on the fiscal impact analysis of 10, 50, 100, and 500 year storms for the Rebuild, Retreat, and Smaller Subsidy scenarios, the tax rate increased in all scenarios, and the worse the storm is, the higher the tax rate grows. The Township of Middletown consistently performs best in a retreat scenario. The lowest for the retreat scenario for each storm considered, with an increase of 6% for 10 year Storm, 8% for 50 year Storm, and roughly 10% for 100 year and 500 year Strom (see figure _3_). Furthermore, the more severe the storm, the better the retreat scenario performs in terms of tax rate for Middletown.

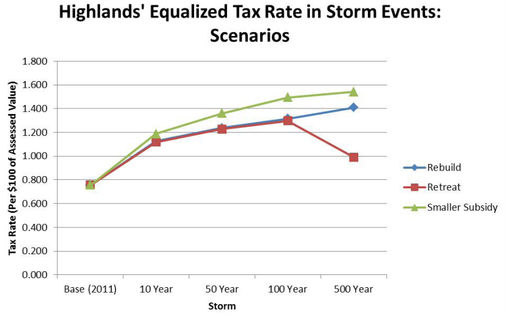


Figure 22. Highlands Change in Tax Rates Due to Storm Events

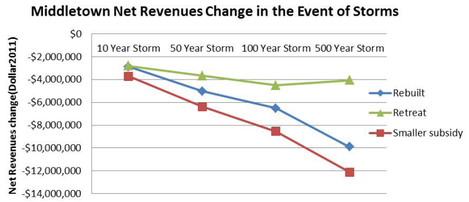


Figure 23. Middletown Net Revenues in the Event of Storms

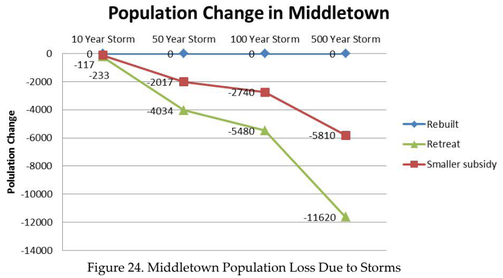


Figure 24. Middletown Population Loss Due to Storms

The Smaller Subsidy scenario represents the worst option for Middletown, as it consistently has the highest tax rates for all storms. This is basically due to the high cost of debris removal. The most significant jump of tax rate occurs on the 500 year storm, which is about 28% tax rate increase. This is also the only one that exceeds 0.6 in all scenarios for all storms.

In terms of revenues, the retreat scenario performs best (Figure _4_). For all three scenarios, there is a negative net result from storms, but the retreat scenario is consistently the least negative of all scenarios. In fact, the more severe the storm, the better retreat scenario performs.

In terms of expenditure, the large decreases in the population of residents and workers also helps significantly decrease the amount of municipal services needed (Figure 5). That is the reason why the total municipal expenditure decreased 5% in the retreat scenario of 500 year Storm (Figure_6_).The rebuild scenario, most consistent with the type of activity seen today, produces increased tax rates linearly. Since it is not affected by loss of tax revenue, the revenue never increases or decreases. Instead the expenditures steadily increase by the amplified intensity and damage of the storms.

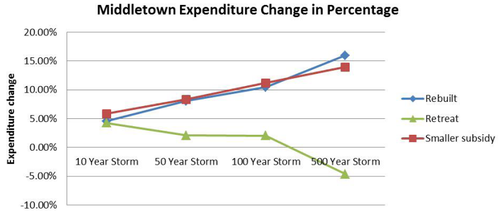


Figure 25. Middletown Expenditure Change in Percentage Due to Storm Events

View of Highlands from Sandy hook
Credit: Christin Bell

Conclusions

Mitigation SWOT Analysis:

A SWOT (Strengths, Weaknesses, Opportunities, and Threats) Analysis was used to compare different mitigation strategies and their performance level. Strategies were compared on a variety of levels including: property level modifications, municipal level modifications, market/ management responses, as well as different methods of retreat and rated as high performing, medium performance, and low performance. Ratings were determined by group consensus, taking into account a variety of factors and stakeholders for each strategy. The results of our analysis can be viewed in figure 28 below.

● High Performance ◒ Medium Performance ○ Low Performance

H = Highlands S = Sea Bright M = Middletown

Mitigation Strategies	Incrementalism	Cost	Fairness	Economy	Environment	Flood Mitigation	Implemented
	Performance						
Community Rating System Program	●	●	◒	◒	●	●	H,S,M
TDR	◒	◒	●	●	●	●	-
Abandon Property	●	●	○	◒	●	●	-
Buyouts	●	○	●	◒	●	●	-
Reduction Of Impermeable Surfaces	●	◒	◒	◒	●	●	M
Park Space In Flood Plains	●	◒	◒	◒	●	●	H,S,M
Mapping	●	◒	●	◒	◒	◒	H,S,M
Dunes	●	◒	◒	◒	●	◒	S,M
Overlay Zones/Rolling Easements	●	◒	◒	◒	●	◒	M?
No New Development Or	●	●	○	○	◒	◒	-
Beach Replenishment	◒	○	◒	◒	◒	●	H,S,M
Zoning/ Building Code Changes	●	○	◒	◒	◒	◒	H,S,M
Canal System	◒	○	◒	●	○	◒	H
Flood Insurance	◒	○	◒	◒	◒	○	H,S,M
Levees & Bulkheads	○	○	●	◒	○	◒	H,S,M

Figure 26. SWOT Analysis of Mitigation Strategies

Fiscal Conclusions

The three case studies for the most part show similar trends. However certain municipalities are more affected by the storms. Highlands' budget and tax rate is the most vulnerable with largest percent changes in the tax rate after all four storm scenarios. This is due to the vulnerability of homes in Highlands as well as the small population. Sea Bright is the second most vulnerable due to its small population. However there are slightly smaller percent changes in tax rates due its larger amount of seasonal homes than the other case study communities. Middletown is least affected by the storms because of its size and smaller percentage of homes and buildings being located on the coast. Figures 7 through 10 on page 35 show the percent changes in tax rates for each storm and scenario.

The scenario providing the most consistently low tax rates for all three of the municipalities was the same, the retreat scenario. This is because although the revenues decrease the loss of residents and workers in the retreat scenarios subsidize the loss of revenue and help to significantly reduce the amount of expenditures. The smaller subsidy scenario in every town consistently produces the highest tax rates due to the high cost of debris removal with the 75% local and 25% federal removal cost ratios. A possible outcome out of this, in preparation for the possibility of less funding from the government for debris removal, would be for the municipalities to establish rotating funds devoted to municipal debris removal in the event a storm occurs. Finally the rebuild scenario, most consistent with the type of activity seen today, produces increased tax rates linearly in all towns. Because it is not affected by loss of tax revenue, the revenue never increases or decreases. Instead the expenditures steadily increase by the amplified intensity and damage of the storms. Therefore retreat should seriously be considered as a way to cope with climate change and the increasing intensity of storms.

It is also advisable to further examine the fiscal impact of the storms. This involves examining the municipal budgets further in a non per capita basis. This means that municipal services are not allocated based on population but instead have thresholds. There are minimum costs of certain services and they will not be affected by a certain loss of the population.

Specific Policy Objectives/Recommendations:

Conclusion of Analysis

The case study municipalities of Sea Bright, Middletown, and Highlands have been and will continue to be highly susceptible to threats associated with flooding and sea level rise due to climate change. Physical threats in the way of severe damages and losses will increase s storm events continue to worsen these municipalities. Through careful research and analysis we have determined that the most cost- effective way of dealing with the impacts of climate change in these communities is through a policy of incremental retreat.

We recommended the following the following policy recommendations for the American Littoral Society to adopt to better inform local policies on coastal climate change adaptations and mitigations:

- Generate tools and information to aid coastal municipalities in preparing for the impacts of climate change.
- Encourage government officials to adopt the policies we have laid out below.
- Aid municipalities in better adapting to coastal climate change.

We recommended the following the following policy recommendations for government officials, at the municipal, state, and federal level, to adopt to better inform local policies on coastal climate change adaptations and mitigations:

- Stop federal incentives that allow homeowners to rebuild after massive flooding and storm destruction.
- Implement policies of gradual retreat. Once a building in a flood prone area is destroyed, it should be abandoned and homeowners should be relocated to less flood prone areas.
- Prepare for more severe storms to be the new norm. Take this into account when implementing local ordinances and zoning changes, as well as when planning for emergency management.

We recommended the following the following policy recommendations for those in the planning profession to adopt to better inform local policies on coastal climate change adaptations and mitigations:

- Encourage development away from coastal areas that are at the greatest risk for being impacted by sea level rise due to climate change.
- Encourage the implementation of more natural mitigation techniques along the coat such as dune stabilization, while discourages the use of, or designing ways to phase out the use of hard structures that ultimately increase beach erosion such as jetties, groins, and seawalls.
- Encourage the use of permeable ground cover and stormwater management in planning designs.

Additional Points of Research

As a final note to this report there are other subjects and areas of focus we were unable to cover in our time frame but are worth researching as future additions to this research to provide an even more accurate picture of the threat along the shorelines of New Jersey. These research topics include the following:

- Future costs of beach replenishment, buyouts and other strategies in fiscal impact assessments
- Breakdown of flood losses by census block, specifically identifying which individual properties would be affected by flood events
- Accurate breakdown of shore tourism, most importantly filtering out what part of that is from Atlantic City
- Equity issue of buyouts becoming a transfer of money from average residents to waterfront homeowners
- Effects of flood insurance on at risk property values
- Analysis investigating to what extent local risky development is influenced by bad planning, sea level rise, and NFIP distributions
- What ecological services would be created by a retreat (or “greening”) strategy compared to the ecological services lost due to sea level rise or adoption of a rebuild strategy
- More detailed analysis of who is affected by the policy changes in terms of costs and equity
- Comparison of Buffalo Commons approach to this retreat strategy

Appendices

Works Cited

1. APP.com. “Killer nor easter devastated Jersey Shore March 1962 transformed approach to building along coast.” APP.com. 3 3, 2012.

2. Associated Press. “Storm Briefs.” The Red Bank Register, 3 14, 1962: 1-2.

3. Bartnett, Edmond J. “Man Battles Sea For Area’s Shore.” The New York Times, September 3, 1956.

4. Bigart, Homer. “East is Battered in Coastal Storm; Many Evacuated.” The New York Times, November 13, 1968: 1, 28.

5. Blair, William M. “Vast Storm Plan Urged For Coasts.” The New York Times, March 24, 1962.

6. Breen, Dan. “Compton’s Seawall Permit Issued.” The Daily Register, April 27, 1983: B2.

7. Cheslow, Jerry. “If you’re thing of living in Middletown Township.” The New York Times, 12 24, 1995.

8. Darnton, John. “Shore Rights: Do the Beaches Belong to The People?” The New York Times, July 30, 1972.

9. Eder, Katie. “$24 M beach rescue funding critical to aid N.J. tourism, say stakeholders.” NJBIZ, February 10, 2012.

10. FEMA. FEMA: NFIP Reauthorization. January 3, 2012. http://www.fema.gov/business/nfip/nfip-reauth.shtm(accessed May 2, 2012).

11. FEMA. National Flood Insurance Program Community Rating System Coordinator’s Manual. Washington, DC, July 2007.

—. National Flood Insurance Program Loss Statistics. February 29, 2012. http://bsa.nfipstat.com/reports/1040.htm#34 (accessed 4 29, 2012).

12. Gabrielan, Randall. Images of America: Middletown Township. Vol. I. II vols. Dover, NH: Arcadia, 1994 (reprinted 1995).
—. Images of America: Middletown Township. Vol. II. II vols. Dover, NH: Arcadia, 1995.

13. Gansberg, Martin."Inland Sites Are Threatened by the Loss of Grassland." The New York Times, December 8, 1974

14. Hanley, Robert. "The Wall Saved Sea Bright This Time, but Residents Worry." The New York Times, February 11, 1978.

15. IPCC, 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability . Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, Martin L., Canziani, Osvaldo F., Palutikof, Jean P., van der Linden, Paul J., and Hanson, Clair E. (eds.)]. Cambridge University Press, Cambridge, United Kingdom: 1000.

16. IPCC, 2012: Glossary of terms. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 555-564.

17. Kamin, Arthur Z. "Fishermen and Other Residents Rally to Fight Ferryboats as Threat to Way of Life." The New York Times, March 13, 1994.

18. Kinsey, David. "Lessons from the New Jersey Coastal Management Program." Journal of the American Planning Association, November 26, 2007: 330.

19. Klett, Joseph R. Using the Records of the East and West Jersey Proprietors. Presentation, Trenton: New Jersey State Archives, 2008.

20. Mandeville, Earnest W. The Story of Middletown The Oldest Settlement in New Jersey.2nd. Edited by Thelma K. Jelliffe. Middletown, NJ: Christ Church, 1972.

21. Methot, June. Up & Down the Beach. Navesink, NJ: Whip Publishers, 1988.
—. Up & Down the River. Navesink, NJ: Whip Publishers, 1980.

22. Nee, Daniel. "Irene Wasn't a Hurricane When It Hit." Little Silver Patch, December 19, 2011.

23. Savadove, Larry and Buchholz, Margaret Thomas. Great Storms of the Jersey Shore. Harvey Cedars, NJ: Down the Shore Publishing, 1993.

24. Special Dispatch to The North American. "Much Damage Done to Property at Long Branch, Asbury Park and other Seaside Resorts." The North American, January 7, 1889: 1.

25. Psuty, Norbert P., and Tanya M. Silveira. Sea-Level Rise: Past and Future in New Jersey. Institute of Marine and Coastal Sciences. Rutgers University, New Brunswick, NJ, 2007.

26. Rose, Jerome, G. "Psychological, Legal and Administrative Problems to the Proposal to Use the Transfer of Development Rights (TDR) as a Technique to Preserve Open Space." 6 Urb. Law 919 (1974).

27. Sea Bright Borough Beach Management Plan For the Protection of Federally and State-Listed Species. June 2006. In cooperation with NJDEP division of Fish and Wildlife Endangered and Nongame Species Program and the United States Department of the Interior Fish and Wildlife Service New Jersey Field Office.

28. Sherman, T. "Federal Teams Trek State to Tally Storm Damages." The Star-Ledger, December 16, 1992.

29. Smit, Barry; Burton, Ian; Klein, Richard, JT; and Wandel, J. "An Anatomy of Adaptation to Climate Change and Variability." Climactic Change, Vol. 45, No. 1. 223-251

30. The Daily Register. "Bayshore Asks for $1.5 Million of State for Erosion Control." The Daily Register, December 12, 1968: 1.
—. "Meeting Set to Apportion Cost of Beach Protection." The Daily Register, October 3, 1974: 16.

31. The New York Times. "Jersey Shoreline Gets a New Look." The New York Times, May 14, 1963: 41, 61.
—. "Jersey Towns Ask 1.5 Million from State for Beach Erosion." The New York Times, June 21, 1958.
—. "2 Groups Moving to Open Beaches." The New York Times, June 25, 1972.
—. "Shorefront Damage Ended By Jersey Resort's Granite Wall." The New York TImes, August 17, 1949.
—. "Six Jersey Beaches Reported Polluted." The New York Times, August 7, 1948.
Sullivan, Joseph F. "Jersey Shore Battered as Winds Whip Tides 7 Feet Above Normal." The New York Times, February 8, 1978.

—. “Residents of Sea Bright Pull Out.” The New York TImes, August 10, 1976.
—.”$1,000,000 in Damage to Jersey Coast.” The New York Times, November 18, 1935.
—. “Storm Rakes Coast: Strewing Wreckage and Menacing Ships.” The New York Times, April 17, 1929: 1, 14.
—. “Jersey Beach Aid Set.” The New York Times, January 16, 1955.
—. “Ice is Crushing Piers Along Jersey Coastal Waters.” The New York Times, January 31, 1977.
—. “Gale- Driven Storm Lashes City Area.” The New York TImes, October 27, 1943.
—. “High Winds, Tides Lash The City Area.” The New York Times, December 1, 1944.

32. Special Dispatch to The North American. “Much Damage Done to Property at Long Branch, Asbury Park and other Seaside Resorts.” The North American, January 7, 1889: 1.

33. Spoto, MaryAnn. “After Weathering the Storm, Towns Assess its Damage.” The Star Ledger, March 10, 2010: 17.
—. “Dredge Silt Proposed to Fix Bayshore Dunes.” The Star Ledger, April 20, 2010.

34. The Red Bank Register. “Announce $119,500 Grant for Beach Protection Work.” The Red Bank Register, September 17, 1963: 2.
—. “Automobiles Peak Through Here on Their Way to the Shore.” The Red Bank Register, June 22, 1910: 12.
—. “Officials View Damage, Map Appeal for Prompt Federal Storm Aid.” The Red Bank Register, 3 14, 1962: 1-2.

35. URS and PBS&J. “Draft Multijursidictional Hazard Mitigation Plan - Monmouth County, NJ Risk Assessment Deliverable.” January 2008.

36. Villane, Anthony M. “Battered Shore: Official Neglect?” The New York Times, July 23, 1978.

37. White Jr., Gordon S. “New Jersey Sports: Help for Sea Bright.” The New York Times, October 31, 1972.

38. Wood, Gilbert M. Gaul and Anthony R. “In Defense of Jersey’s Shores.” The Philadelphia Inquirer, 3 9, 2000: 14-15.

39. Wood, Gilbert M. Gaul and Anthony R. “A Flawed Program Facilitates Building in Hazardous Areas.” The Philadelphia Inquirer, 3 8, 2000: 11-13, 12.

40. Wood, Jacqueline L. Urgo and Anthony R. “Jersey Shore, Forever Redefined.” The Philadelphia Inquirer, 3 4, 2012: A1, A18.

41. Wright, George Cable. “Jersey May Buy Storm-Hit Lands.” The New York Times, March 16, 1962.
Technical Manual for HAZUS MR4 Flood Model. 2009.USA. Department of Homeland Security. Federal Emergency Management Agency.

Interviews:

1. Barnett, Gabrielle (April 20, 2012)

2. Bell, Scot (April 7, 2012)

3. Catherine Folio (April 5, 2012)

4. Keeler, William Councilman (April 19, 2012).

5. Long, Dina, Mayor (April 19, 2012)
6. Rinaldi, Stephanie (April 7, 2012)

7. Rogers, Charles, interview by Marcus Ferreira. (April 17, 2012).

8. Thomas, Tom, PP. (April 4, 2012)

Regulations

1. 44 C.F.R. 206:401.

Statutes

1. 16 U.S.C. 1451 et seq.

2. N.J.S.A. 7:7E-5B.4

3. N.J.S.A. 13:19-1 et seq.

4. N.J.S.A. §§ 40:55D-137 to 40:55D-163 (2005)

5. N.J.S.A. 52:18A-200(f)

Case Law

1. Penn Central Transp. Co. v. New York City, 438 U.S. 104 (1978)

Appendix of Reference Tables

Sea Bright Fiscal Impact Assessment						
	10 Year Storm			50 Year Storm		
Inputs	Rebuild	Retreat	Smaller Subsidy	Rebuild	Retreat	Smaller Subsidy
Number of Homes that Will Not Be Rebuilt	0	0	0	0	-1	0
Number of Commercial Properties that Will Not Be Rebuilt	0	0	0	0	0	0
Median Household Assessed Value	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000
Average Commercial Assessed Value	$1,240,701	$1,240,701	$1,240,701	$1,240,701	$1,240,701	$1,240,701
Total Assessed Value Change	$0	$0	$0	$0	($300,000)	$0
Population Change	0	0	0	0	-1	0
Worker Change	0	0	0	0	0	0
Public Safety Change	$1,825	$1,825	$1,825	$7,300	$7,300	$7,300
Public Works Change (Debris Removal)	$137,850	$137,850	$413,550	$290,700	$290,700	$872,100
New Infrastructure Need	$3,780,000	$3,780,000	$3,780,000	$4,340,000	$4,340,000	$4,340,000
Relocation Costs	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000
Output						
Expenditures						
New Assessed Value	$519,254,000	$519,254,000	$519,254,000	$519,254,000	$518,954,000	$519,254,000
New Expenditures per Capita	$3,335	$3,335	$3,508	$3,434	$3,437	$3,797
New Expenditures per Worker	$1,136	$1,136	$1,195	$1,170	$1,170	$1,295
New Infrastructure Total Annual Debt Payment	$245,894	$245,894	$245,894	$282,323	$282,323	$282,323
New Total Expenditures	$5,687,698	$5,687,698	$5,963,398	$5,882,452	$5,879,015	$6,463,852
Difference in Expenditures	($495,680)	($495,680)	($771,380)	($690,434)	($686,997)	($1,271,834)
% Change in Expenditures	-10%	-10%	-15%	-13%	-13%	24%
Revenue						
New Local Purpose Tax Revenue	$3,837,287	$3,837,287	$3,837,287	$3,837,287	$3,835,070	$3,837,287
Change in Local Purpose Tax Revenue	$0	$0	$0	$0	($2,217)	$0
% Change in Local Purpose Tax Revenue	0%	0%	0%	0%	0%	0%
New Total Revenue	$5,192,129	$5,192,129	$5,192,129	$5,192,129	$5,189,912	$5,192,129
Net Revenue	($495,569)	($495,569)	($771,269)	($690,323)	($689,104)	($1,271,723)
Adjusted Tax Rate	0.569	0.569	0.606	0.595	0.595	0.671
% Change in Tax Rate	13%	13%	20%	18%	18%	33%

Appendix Table 1. Sea Bright Fiscal Impact Assessment Results
Source: Monmouth County Abstract of Ratables. Sea Bright Municipal Budget, 2011. US Census. 2009 U.S. Census Longitudinal Employer-Household Dynamics dataset. HAZUS.

Sea Bright Fiscal Impact Assessment						
	100 Year Storm			500 Year Storm		
Inputs	Rebuild	Retreat	Smaller Subsidy	Rebuild	Retreat	Smaller Subsidy
Number of Homes that Will Not Be Rebuilt	0	-21	-10	0	-324	-162
Number of Commercial Properties that Will Not Be Rebuilt	0	-1	0	0	-10	-5
Median Household Assessed Value	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000
Average Commercial Assessed Value	$1,240,701	$1,240,701	$1,240,701	$1,240,701	$1,240,701	$1,240,701
Total Assessed Value Change	$0	($7,540,701)	($3,000,000)	$0	($109,607,014)	($54,803,507)
Population Change	0	-31	-15	0	-489	-244
Worker Change	0	-7	0	0	-78	-39
Public Safety Change	$12,775	$12,775	$12,775	$25,500	$25,500	$25,500
Public Works Change (Debris Removal)	$492,900	$492,900	$1,478,700	$691,050	$691,050	$2,562,300
New Infrastructure Need	$4,650,000	$4,650,000	$4,650,000	$5,350,000	$5,350,000	$5,350,000
Relocation Costs	$120,000	$120,000	$120,000	$130,000	$130,000	$130,000
Output						
Expenditures						
New Assessed Value	$519,254,000	$511,713,299	$522,254,000	$519,254,000	$409,646,986	$464,450,493
New Expenditures per Capita	$3,564	$2,035	$4,224	$3,696	$5,653	$5,511
New Expenditures per Worker	$1,215	$1,230	$1,428	$1,105	$1,105	$1,792
New Infrastructure Total Annual Debt Payment	$302,489	$302,489	$302,489	$348,025	$348,025	$348,025
New Total Expenditures	$6,120,293	$5,998,720	$7,042,729	$6,386,704	$3,507,573	$6,358,727
Difference in Expenditures	($422,489)	($300,917)	($1,850,711)	$478,025	($2,401,106)	$1,561,334
% Change in Expenditures	-8%	-6%	-36%	9%	-46%	30%
Revenue						
New Local Purpose Tax Revenue	$3,837,287	$3,781,561	$3,859,457	$3,837,287	$3,937,223	$3,432,289
Change in Local Purpose Tax Revenue	$0	($55,726)	($22,170)	$0	($809,996)	($404,998)
% Change in Local Purpose Tax Revenue	0%	1%	-1%	0%	-21%	-11%
New Total Revenue	$5,192,129	$5,136,403	$5,214,299	$5,192,129	$3,027,291	$4,787,131
Net Revenue	($928,164)	($862,317)	($1,828,430)	($1,194,575)	$874,560	($1,571,596)
Adjusted Tax Rate	0.626	0.619	0.752	0.661	0.359	0.735
% Change in Tax Rate	24%	23%	49%	31%	-29%	46%

Appendix Table 1. Sea Bright Fiscal Impact Assessment Results
Source:MonmouthCountyAbstractofRatables.SeaBrightMunicipalBudget,2011.USCensus.2009U.S.CensusLongitudinalEmployer-HouseholdDynamicsdataset.HAZUS.

Highlands Fiscal Impact Assessment						
	10 Year Storm			50 Year Storm		
Inputs	Rebuild	Retreat	Smaller Subsidy	Rebuild	Retreat	Smaller Subsidy
Number of Homes that Will Not Be Rebuilt	0	-90	-45	0	-100	-50
Number of Commercial Properties that Will Not Be Rebuilt	0	0	0	0	0	0
Median Household Assessed Value	$196,408	$196,408	$196,408	$196,408	$196,408	$196,408
Average Commercial Assessed Value	$581,639	$581,639	$581,639	$581,639	$581,639	$581,639
Total Assessed Value Change	$0	($17,676,720)	($8,838,360)	$0	($19,640,800)	($9,820,400)
Population Change	0	-171	-86	0	-190	-95
Worker Change	0	0	0	0	0	0
Public Safety Change	$2,937	$2,937	$2,937	$11,749	$11,749	$11,749
Public Works Change (Debris Removal)	$243,300	$243,300	$729,900	$466,050	$466,050	$1,398,150
New Infrastructure Need	$17,490,000	$17,490,000	$17,490,000	$21,780,000	$21,780,000	$21,780,000
Relocation Costs	$100,000	$100,000	$100,000	$130,000	$130,000	$130,000
Output						
Expenditures						
New Assessed Value	$607,765,927	$590,089,207	$598,927,567	$607,765,927	$588,125,127	$597,945,527
New Expenditures per Capita	$1,745	$1,807	$1,866	$1,839	$1,912	$2,049
New Expenditures per Worker	$833	$1,029	$968	$878	$1,113	$1,073
New Infrastructure Total Annual Debt Payment	$1,137,750	$1,137,750	$1,137,750	$1,416,820	$1,416,820	$1,416,820
New Total Expenditures	$10,721,412	$10,412,460	$11,048,432	$11,541,115	$11,177,924	$12,278,524
Difference in Expenditures	$2,621,737	$2,312,785	$2,948,757	$3,441,440	$3,078,249	$4,178,849
% Change in Expenditures	32%	29%	36%	42%	38%	52%
Revenue						
New Local Purpose Tax Revenue	$5,567,136	$5,405,217	$5,486,177	$5,567,136	$5,387,226	$5,477,181
Change in Local Purpose Tax Revenue	$0	($161,919)	($80,959)	$0	($179,910)	($89,955)
% Change in Local Purpose Tax Revenue	0%	-3%	-1%	0%	-3%	-2%
New Total Revenue	$8,099,675	$7,937,757	$8,018,716	$8,099,675	$7,919,766	$8,009,721
Net Revenue	($2,621,736)	($2,474,703)	($3,029,716)	($3,441,439)	($3,258,159)	($4,268,804)
Adjusted Equalized Tax Rate	1.127	1.118	1.189	1.238	1.229	1.361
% Change in Tax Rate	49%	48%	57%	64%	62%	80%

Appendix Table 2. Highlands Fiscal Assesment Results
Source: Monmouth County Abstract of Ratables. Highalnds Municipal Budget, 2011. US Census. 2009 U.S. Census Longitudinal Employer-Household Dynamics Dataset. HAZUS.

Highlands Fiscal Impact Assessment						
	100 Year Storm			500 Year Storm		
Inputs	Rebuild	Retreat	Smaller Subsidy	Rebuild	Retreat	Smaller Subsidy
Number of Homes that Will Not Be Rebuilt	0	-161	-81	0	-903	-452
Number of Commercial Properties that Will Not Be Rebuilt	0	0	0	0	-1	-1
Median Household Assessed Value	$196,408	$196,408	$196,408	$196,408	$196,408	$196,408
Average Commercial Assessed Value	$581,639	$581,639	$581,639	$581,639	$581,639	$581,639
Total Assessed Value Change	$0	($31,621,688)	($15,810,844)	$0	($177,938,063)	($88,969,032)
Population Change	0	-306	-153	0	-1716	-858
Worker Change	0	0	0	0	-9	-4
Public Safety Change	$20,561	$20,561	$20,561	$41,122	$41,122	$41,122
Public Works Change (Debris Removal)	$681,300	$681,300	$2,043,900	$854,100	$854,100	$2,562,300
New Infrastructure Need	$24,338,000	$24,338,000	$24,338,000	$28,090,000	$28,090,000	$28,090,000
Relocation Costs	$140,000	$140,000	$140,000	$140,000	$140,000	$140,000
Output						
Expenditures						
New Assessed Value	$607,765,927	$576,144,239	$591,955,083	$607,765,927	$429,827,864	$518,796,895
New Expenditures per Capita	$1,911	$2,035	$2,230	$1,991	$3,030	$2,783
New Expenditures per Worker	$912	$1,382	$1,244	$951	$960	$1,106
New Infrastructure Total Annual Debt Payment	$1,583,222	$1,583,222	$1,586,474	$1,827,295	$1,827,295	$1,827,295
New Total Expenditures	$12,107,980	$11,485,413	$13,135,963	$12,789,486	$7,582,679	$12,105,907
Difference in Expenditures	$4,008,305	$3,385,738	$5,036,288	$4,689,811	($516,996)	$4,006,232
% Change in Expenditures	49%	42%	62%	58%	-6%	49%
Revenue						
New Local Purpose Tax Revenue	$5,567,136	$5,277,481	$5,422,309	$5,567,136	$3,937,223	$4,752,180
Change in Local Purpose Tax Revenue	$0	($289,655)	($144,827)	$0	($1,629,913)	($814,956)
% Change in Local Purpose Tax Revenue	0%	-5%	-3%	0%	-29%	-15%
New Total Revenue	$8,099,675	$7,810,021	$7,954,848	$8,099,675	$6,469,763	$7,284,719
Net Revenue	($4,008,304)	($3,675,392)	($5,181,115)	($4,689,811)	($1,112,916)	($4,821,188)
Adjusted Equalized Tax Rate	1.316	1.299	1.494	1.409	0.99	1.541
% Change in Tax Rate	74%	72%	97%	86%	31%	104%

Appendix Table 2. Highlands Fiscal Assessment Results
Source: Monmouth County Abstract of Ratables. Highlands Municipal Budget, 2011. US Census. 2009 U.S. Census Longitudinal Employer-Household Dynamics dataset. HAZUS.

Middletown Fiscal Impact Assesment						
	10 YEAR STORM			50 YEAR STORM		
	Rebuild	Retreat	Smaller Subsidy	Rebuild	Retreat	Smaller Subsidy
Substantially Damaged Residential Homes	84	84	84	1453	1453	1453
Substantially Damaged Commercial Properties	0	0	0	0	0	0
Rebuild Residential Homes	84	0	42	1453	0	726.5
Rebuild Commercial Properties	0	0	0	0	0	0
Median Household Assessed Value	343959	343959	343959	343959	343959	343959
Median Commercial Assessed Value	1961162.814	1961162.814	1961162.814	1961162.814	1961162.814	1961162.814
Total Assessed Value loss	0	28892556	14446278	0	499772427	249886213.5
Tax Rate Per $100	0.471	0.471	0.471	0.471	0.471	0.471
Population Change	0	-233	-117	0	-4034	-2017
Worker Change	0	0	0	0	0	0
Public Safety						
• police department change	54155	54155	54155	216620	216620	216620
• Energency Management Services	580000	580000	580000	920000	920000	920000
street and roads change	438150	438150	1314450	1009950	1009950	3029850
New Infrastructure Need	-27100000	-27100000	-27100000	-43560000	-43560000	-43560000
Outputs						
Expenditure						
New Assessed Value	$9,898,964,581	$9,870,072,025	$9,884,518,303	$9,898,964,581	$9,399,192,154	$9,649,078,367
New Expenditures Per Capita	$847.26	$850.24	$860.52	$861.66	$917.28	$916.53
Change in Expenditures Per Capita	$14.38	$17.36	$27.64	$28.78	$84.40	$83.65
New Expenditures Per Worker	$327.46	$327.46	$332.18	$333.24	$333.24	$344.11
Change in Expenditures Per Worker	$5.76	$5.76	$10.48	$11.54	$11.54	$22.41
New infrasturcture annul Debt Payment	$1,762,893.89	$1,762,893.89	$1,762,893.89	$2,833,640.51	$2,833,640.51	$2,833,640.51
New Total Expenditures	$64,703,998.46	$64,505,736.26	$65,479,969.11	$66,849,010.08	$63,149,129.20	$67,020,480.80
Difference in Expenditures	$2,835,198.89	$2,636,936.69	$3,611,169.54	$4,980,210.51	$1,280,329.63	$5,151,681.23
% Change in Expenditure	4.58%	4.26%	5.84%	8.05%	2.07%	8.33%
Resources						
New Local Purpose Tax Revenue	$46,661,350.59	$46,488,039.24	$46,556,081.21	$46,661,350.59	$44,270,195.05	$45,447,159.11
Change in Local Purpose Tax Revenue	$0.00	$136,083.94	$68,041.97	$0.00	$2,353,928.13	$1,176,964.07
% Change in Local Purpose Tax Revenue	0.00%	0.29%	0.15%	0.00%	5.04%	2.52%
New Total Revenues	$61,868,799.57	$61,695,488.22	$61,763,530.19	$61,868,799.57	$59,477,644.03	$60,654,608.09
Net Revenue	($2,872,426.30)	($2,810,248.04)	($3,716,438.93)	($5,017,437.93)	($3,671,485.17)	($6,365,872.71)
Adjusted Tax Rate	**0.5**	**0.499**	**0.509**	**0.522**	**0.51**	**0.537**
Change in Adjusted Tax Rate	6.16%	6.05%	7.98%	10.76%	8.29%	14.01%

Appendix Table 3. Middletown Fiscal Assessment Results
Source:MonmouthCountyAbstractofRatables.MiddletownMunicipalBudget,2011.USCensus.2009U.S.CensusLongitudinalEmployer-HouseholdDynamicsdataset.HAZUS.

	Middletown Fiscal Impact Assesment					
	100YEAR STORM			500 YEAR STORM		
	Rebuild	Retreat	Smaller Subsidy	Rebuild	Retreat	Smaller Subsidy
Substantially Damaged Residential Homes	1974	1974	1974	4186	4186	4186
Substantially Damaged Commercial Properties	0	0	0	12	12	12
Rebuild Residential Homes	1974	0	987	4186	0	2093
Rebuild Commercial Properties	0	0	0	12	0	6
Median Household Assessed Value	343959	343959	343959	343959	343959	343959
Median Commercial Assessed Value	1961162.814	1961162.814	1961162.814	1961162.814	1961162.814	1961162.814
Total Assessed Value loss	0	678975066	339487533	0	1463346328	731673163.9
Tax Rate Per $100	0.471	0.471	0.471	0.471	0.471	0.471
Population Change	0	-5480	-2740	0	-11620	-5810
Worker Change	0	0	0	0	-404	-202
Public Safety						
• police department change	379085	379085	379085	758170	758170	758170
• Energency Management Services	1080000	1080000	1080000	1390000	1390000	1390000
street and roads change	1524600	1524600	4573800	2473050	2473050	7419150
New Infrastructure Need	-53780000	-53780000	-53780000	-80710000	-80710000	-80710000
Outputs						
Expenditure						
New Assessed Value	$9,898,964,581	$9,219,989,515	$9,559,477,048	$9,898,964,581	$8,435,618,253	$9,167,291,417
New Expenditures Per Capita	$872.89	$951.25	$953.02	$894.84	$1,084.24	$1,053.14
Change in Expenditures Per Capita	$40.01	$118.37	$120.14	$61.96	$251.36	$220.26
New Expenditures Per Worker	$337.75	$337.75	$354.15	$346.55	$353.66	$376.94
Change in Expenditures Per Worker	$16.05	$16.05	$32.45	$24.85	$31.96	$55.24
New infrasturcture annul Debt Payment	$3,498,466.18	$3,498,466.18	$3,498,466.18	$5,250,301.33	$5,250,301.33	$5,250,301.33
New Total Expenditures	$68,350,950.75	$63,138,286.08	$68,788,949.76	$71,740,320.90	$58,998,218.43	$70,491,357.18
Difference in Expenditures	$6,482,151.18	$1,269,486.51	$6,920,150.19	$9,871,521.33	($2,870,581.14)	$8,622,557.61
% Change in Expenditure	10.48%	2.05%	11.19%	15.96%	-4.64%	13.94%
Resources						
New Local Purpose Tax Revenue	$46,661,350.59	$43,426,150.62	$45,025,136.90	$46,661,350.59	$39,731,761.97	$43,177,942.57
Change in Local Purpose Tax Revenue	$0.00	$3,197,972.56	$1,598,986.28	$0.00	$6,892,361.20	$3,446,180.60
% Change in Local Purpose Tax Revenue	0.00%	6.85%	3.43%	0.00%	14.77%	7.39%
New Total Revenues	$61,868,799.57	$58,633,599.60	$60,232,585.88	$61,868,799.57	$54,939,210.95	$58,385,391.55
Net Revenue	($6,519,378.59)	($4,504,686.48)	($8,556,363.89)	($9,908,748.74)	($4,059,007.48)	($12,105,965.63)
Adjusted Tax Rate	**0.537**	**0.52**	**0.561**	**0.571**	**0.519**	**0.603**
Change in Adjusted Tax Rate	13.98%	10.37%	19.00%	21.25%	10.22%	28.04%

Appendix Table 3. Middletown Fiscal Assessment Results
Source:MonmouthCountyAbstractofRatables.MiddletownMunicipalBudget,2011.USCensus.2009U.S.CensusLongitudinalEmployer-HouseholdDynamicsdataset.HAZUS.

Appendix: Example of Fiscal Calculations Middlteown 10 Year Storm Event

1. Disaggregated municipal expenditures into categories of service expenditures

MIDDLETOWN EXPENDITURES 2011		
EXPENDITURE	AMOUNT	PERCENTAGE
OPERATION WITHIN CAPS		
GENERAL GOVERNMENT	13,570,952.34	21.94%
PUBIC SAFETY		24.29%
FIRE	1,499,456.64	2.42%
POLICE	13,177,718.28	21.30%
JAIL MANAGEMENT	5,000.00	0.01%
SAFETY COUNCIL	850	0.00%
FIRST AID ORGANIZATION	345,548.00	0.56%
STREET AND ROADS	5,023,069.00	8.12%
SANITATION	983,005.00	1.59%
HEALTH AND WELFARE	365,893.99	0.59%
RECREATION AND EDUCATION	1,691,798.50	2.73%
ALLIANCE FOR ALCOHOL AND DRUG ABUSE	121,345.57	0.20%
INSPECTION OF BUILDINGS	1,016,005.00	1.64%
UNCLASSIFIED	4,330,447.40	7.00%
CONTINGENT	20,000.00	0.03%
DEFERRED CHARGES AND STATUTORY EXPENDITURES	5,544,606.00	8.96%
JUDEGEMENTS	0	0.00%
TOTAL WITHIN CAPS	**47,695,695.72**	
EXCLUDED FROM CAPS		
OPERATIONS	5,656,205.75	9.14%
CAPITAL IMPROVEMENTS	150,000.00	0.24%
MUNICIPAL DEBT SERVICE	7,176,898.10	11.60%
DEFERRED CHARGES MUNICIPAL	580,000.00	0.94%
JUDGMENTS	110,000.00	0.18%
TRANSFERRED TO BOARD OF EDUCATION FOR USE OF LOCAL SCHOOL		
CASH DEFICIT		
FOR LOCAL DISTRICT SCHOOL PURPOSES		
RESERVE FR UNCOLLECTED TAXES	500,000.00	
TOTAL EXCLUDED FROM CAPS	**14,173,103.85**	
TOTAL APPROPRIATIONS	**61,868,799.57**	

2. Calculate the Share of Residentially and Non Residentially Associated Costs and Revenues

MIDDLETOWN: 2011 ASSESSED VALUE AND NUMBER OF PARCELS	
ASSESSED VALUE	
TOTAL ASSESSED VALUE	9,898,964,581
RESIDENTIAL ASSESSED VALUE	8,513,497,900
RESIDENTIAL VALUE PERCENTAGE	86.00%
PARCELS	
TOTAL PARCELS	24,179
RESIDENTIAL PARCELS	22,337
RESIDENTIAL PARCELS PERCENTAGE	92.38%
ESTIMATED SHARE OF RESIDENTIALLY-ASSOCIATED COS	89.19%
NON RESIDENTIALLY ASSOCIATED	10.81%

3. Allocated expenditures to residential and non-residential land uses& per Capita and Per Worker

MIDDLETOWN: 2011 RESIDENTIAL V. NON-RESIDENTIAL COSTS AND PER CAPITA V. PER WORKER					
EXPENDITURE	TOTAL	RESIDENTIAL	NON-RESIDENTIAL	PER-CAPITA	PER-WORKER
GENERAL GOVERNMENT	13,570,952.34	12,104,322.03	1,466,630.31	181.96	72.99
PUBIC SAFETY					
FIRE	1,499,456.64	1,337,408.43	162,048.21	20.1	8.06
POLICE	13,177,718.28	11,753,585.28	1,424,133.00	176.69	70.88
JAIL MANAGEMENT	5,000.00	4,459.64	540.36	0.07	0.03
SAFETY COUNCIL	850	758.14	91.86	0.01	0
FIRST AID ORGANIZATION	345,548.00	308,204.18	37,343.82	4.63	1.86
STREET AND ROADS	5,023,069.00	4,480,219.46	542,849.54	67.35	27.02
SANITATION	983,005.00	876,770.38	106,234.62	13.18	5.29
HEALTH AND WELFARE	365,893.99	365,893.99	0	5.5	0
RECREATION AND EDUCATION	1,691,798.50	1,691,798.50	0	25.43	0
ALLIANCE FOR ALCOHOL AND DRUG ABUSE	121,345.57	108,231.60	13,113.97	1.63	0.65
INSPECTION OF BUILDINGS	1,016,005.00	906,204.03	109,800.97	13.62	5.46
UNCLASSIFIED	4,330,447.40	3,862,450.37	467,997.03	58.06	23.29
CONTINGENT	20,000.00	17,838.57	2,161.43	0.27	0.11
DEFERRED CHARGES AND STATUTORY EXPENDITURES	5,544,606.00	4,945,393.28	599,212.72	74.34	29.82
JUDGMENTS					
TOTAL WITHIN CAPS	**47,695,695.72**				
OPERATIONS	5,656,205.75	5,044,932.30	611,273.45	75.84	30.42
CAPITAL IMPROVEMENTS	150,000.00	133,789.31	16,210.69	2.01	0.81
MUNICIPAL DEBT SERVICE	7,176,898.10	6,401,281.47	775,616.63	96.23	38.6
DEFERRED CHARGES MUNICIPAL	580,000.00	517,318.65	62,681.35	7.78	3.12
JUDGMENTS	110,000.00	98,112.16	11,887.84	1.47	0.59
RESERVE FR UNCOLLECTED TAXES	500,000.00	445,964.36	54,035.64	6.7	2.69
TOTAL EXCLUDED FROM CAPS	**14,173,103.85**				
TOTAL APPROPRIATIONS	**61,868,799.57**	55,404,936.12	6,463,863.45	832.88	321.7
POPULATION	66,522				
WORKER	20,093				

4. Disaggregate budgets into categories of revenue and Calculate per Capita & per Worker

MIDDLETOWN: 2011 RESIDENTIAL V. NON-RESIDENTIAL REVENUES						
SOURCE OF REVENUE	AMOUNT	RESIDENTIAL	NON-RESIDENTIAL	PER-CAPITA	PER-WORKER	PERCENTAGE
SURPLUS OF ANTICIPATED REVENUES	600,000.00	535,157.23	64,842.77	8.04	3.23	0.97%
LOCAL REVENUES	3,430,980.74	3,060,190.23	370,790.51	46	18.45	5.55%
STATE AID WITHOUT OFFSETTING APPROPRIATIONS	6,052,688.00	6,052,688.00	0	90.99	0	9.78%
DEDICATED UNIFORM CONSTRUNCTION CODE FEES OFFSET WITH APPROPRIATIONS	1,183,498.00	1,055,595.85	127,902.15	15.87	6.37	1.91%
SPECIAL ITEMS OF GENERAL REVENUE ANTICIPATED WITH PRIOR WRITTEN CONSENT OF DIRECTOR OF LOCAL GOBERNMENT SERVICES	3,854,282.24	3,437,744.99	416,537.25	51.68	20.73	6.23%
RECEIPTS FROM DELINQUENT TAXES	86,000.00	76,705.87	9,294.13	1.15	0.46	0.14%
AMOUNT TO BE RAIRSED BY TAXES FOR SUPPORT OF MUNICIPAL BUDGET	46,661,350.59	41,618,598.28	5,042,752.31	625.64	250.97	75.42%
LOCAL TAX FOR MUNICIPAL PURPSES INCLUDING RESERVE FOR UNCOLLECTED TAXES	42,867,627.59	38,234,867.81	4,632,759.78	574.77	230.57	69.29%
MINIMUN LIVRARY TAX	3,793,723.00	3,383,730.46	409,992.54	50.87	20.4	6.13%
TOTAL GENERAL REVENUES	61,868,799.57	55,836,680.44	6,032,119.13	839.37	300.21	

5. Make assumptions based on available data sources

- Public safety police department: total police budget/365=police budget for 1 normal day. In case of disaster, assume a total of 150% capacity for 1 day. Therefore new police budget = police budget /365*150%*no. of disaster days. So 13177718.28/365*150%= $54155 per day
- Public safety Emergency Management Service= Relocation cost
- Debris Cleanup: removing 1 truckload employs 3 people for half a day (4 hours), $50/person/hour for a total of $600/truckload. (Goes to Street and Roads)
- Median Residential Assessed Value=$343,959
- Median Commercial Assessed Value=$1170814200 assessed value/597 parcels=$1,961,163
- Persons per Household=66522population /23962 occupied housing units=2.776
- Workers per Commercial Building=20093 workers/597 parcels=33.657

6. Input data from assumption for 10 Year Storm

Adjusted Tax Rate(per $100)	0.5
New Total Expenditure	$64,703,998.46
New Expenditure per Capita	$847.26
New Total Revenues	$61,868,799.57
New net Revenues	($2,872,426.30)

Scenario 1- 100% Rebuild

- 1day for 10 years flood.
- Relocation cost= $ 0.58 million
- Police cost= $54155* 1day= $ 54155
- Insurance premium=Building loss/10 year = 407.14 million/10=40.714 million
- Debris: The model estimates that a total of 73,030 tons of debris will be generated. It will require 2921 truckloads: 600*2921=$1752600.

Assume that 25% is paid by municipality: 25% *1752600=$438,150

- Government loss=new infrastructure need=building loss +content loss=4.04+23.06=27.1 million
- 84 residential building substantially damaged, all are rebuilt
- 0 commercial building substantially damaged

Adjusted Tax Rate(per $100)	0.537
New Total Expenditure	$67,020,480.80
New Expenditure per Capita	$916.53
New Total Revenues	$60,654,608.09
New net Revenues	($6,365,872.71)

Scenario 2 – Smaller Subsidies

- 4days for 50 years flood.
- Relocation cost= 0.92 million
- Police cost=54155* 4days=$216,620
- Insurance premium=652.97m/50=$13,059,400
- Debris=$600*6733*75%=$3029850
- Government loss=new infrastructure need=building loss +content loss=7.04+36.52=43.56 million
- 1453 residential building substantially damaged, 50% rebuilt, population loss=2017
- 0 Commercial substantially damaged

Scenario 3 – Retreat

- 4days for 50 years flood.
- Relocation cost= 0.92 million
- Police cost=54155* 4days=$216,620
- Insurance premium=652.97m/50=$13,059,400
- Debris=$600*6733*25%=$1009950
- Government loss=new infrastructure need=building loss +content loss=7.04+36.52=43.56 million
- 1453 residential building substantially damaged, no rebuilt, population loss=4034
- 0 Commercial substantially damaged

Adjusted Tax Rate(per $100)	0.51
New Total Expenditure	$63,149,129.20
New Expenditure per Capita	$917.28
New Total Revenues	$59,477,644.03
New net Revenues	($3,671,485.17)

Appendix: Interviews

Interview with Sea Bright Mayor Dina Long and Councilman William Keeler:

The following is a summary of an interview with Mayor Dina Long and Councilman William Keeler that occurred on Thursday, April 19, 2012.

Sea Bright is affected by flooding events because it is a narrow peninsula just a couple of feet above sea level. The Shrewsbury River, from which most of the flooding occurs, is located to the west of the town and is a tidal river, approximately two hours behind the ocean.

During the 1970's and 1980's Sea Bright was in what Councilman Keeler refers to as the "Crisis Period." During this time there was virtually no sand east of the seawall and routine events would bring flooding to the community. Due to Sea Bright's close proximity to New York City, major News Outlets would often come in to cover the flooding episodes, greatly hindering the ability to sell real estate within the Borough. Although Councilman Keeler had lived in Sea Bright since the 1950's he thought about moving out during the 1970's when his home flooded six times in one year. James Howard, one of New Jersey's representatives in Congress and a member of the Committee on Public Works and Transportation, pushed for funding for an Army Corp of Engineers sand replenishment project. Although the project was approved for federal funding, matching local funds were required, which the state was not willing to provide.

In 1992, A Nor'easter devastated the area, causing more damage than any other storm in decades. At this time the State agreed to provide funding for beach replenishment, however there was a lot of local opposition. Many opponents of the replenishment argued that the sand would not stay on the beach for long and was a waste of money. In 1962 the Army Corp had pumped sand from the Shrewsbury onto the beach. This sand had a much smaller grain size than the ocean sand and was washed away in about six months. Campbell Engineering and Stevens Institute ran models and did many calculations to pick the proper sand size and ensure it would not wash away quickly. Regardless, the state of New Jersey signed a 50 year replenishment contract with the Army Corp, and sand replenishment projects began in 1994 in Monmouth Beach, before heading to Sea Bright. After Sea Bright had been replenished, they continued north to Sandy Hook before heading elsewhere in Monmouth County.

In the following years, the beach has been monitored to determine their profile and size of sand granule, to measure the success of the renourishment program. In 2001 the first round of renourishment began, followed again in 2012. According to Councilman Keeler, the replenishment projects have held up well at the north end of the town, but in the south end and into Monmouth Beach there has been a high level of erosion. Soon after the first replenishment in 1995, dunes were planted on the beaches to prevent wind from blowing sand up, over the seawall, and onto Ocean Ave.

Sea Bright has undertaken a number of other measures to reduce flooding in the town. Submersed pumps have been placed at the end of three streets in the downtown area to remove water and reduce flooding. Originally water was pumped out using hoses, but since have been replaced with

more elaborate pumping systems with diesel back-ups in case of a power outage. Unfortunately, this has done more to displace the flooding than mitigate it, as streets that never flooded before have begun to flood. Another cause of riverine flooding in Sea Bright is the low bulkheads along the river. Sea Bright has received a grant from FEMA through the Hazard Management Grant Program to raise the publically owned bulkheads along the river to Army Corp with approximately a 25% local cost share. However, this does not affect bulkheads on private property. The Army Corp of Engineers has also done a flood plane study of the Shrewsbury River. Sea Bright has changed local ordinances to require that houses be built three feet above sea level. This change has been welcomed by most homeowners, as they use this opportunity to create a third floor. However, Sea Bright does not allow homes to be built on pilings to help preserve the local character of the community. Beach replenishment and dune plantings have done much to stop flooding from the ocean.

Despite these measures to prevent flooding, Mayor Long and Councilman Keeler agreed that flooding still occurs in the town approximately six times a year during spring tide, high tides. Often the flooding occurs from the river backing up through storm drains. Routine flood events often call for clean-ups to remove debris afterwards and can result in flood insurance claims. There are a few homes in Sea Bright that have been dropped from the National Flood Insurance program due to their high number of repetitive claims. The office of emergency management plans for more sever flood events and has begun to place tide gauges in the river to accumulate statistical data in hopes of being able to better predict major events in the future.

When flooding occurs, Sea Bright residents often get angry. To help residents deal with these issues elected officials try to give advice regarding flood issues in the town newsletter and website. A flood siren has been put in place in the downtown area where the primary flooding occurs. The system is resident activated and alerts residents to move their cars to higher ground. Sea Bright has also implemented a code red/ reverse 911 system that alerts targeted residents about expected high tides and reminds them to tie down their garbage. Unfortunately, Sea Bright has a large number of rental properties and is predominately a bedroom community. These transient residents are often the ones that are unaware and therefore most harmed by flooding issues in the town.

Interview with Gabrielle Barnett, former Sea Bright renter:
The following is a summary of an interview with Gabrielle Barnett that occurred on Friday, April 20, 2012.

After being a lifelong visitor to the beaches of Sea Bright, Gabrielle rented an apartment in the downtown portion of Sea Bright from August of 2009 to February of 2011. Around Saint Patrick's Day 2010, a nor'easter struck, flooding her first floor apartment with 2- 8 inches of water. Luckily, Gabrielle did not lose anything important in the flood. However, she was forced to move out of her apartment for one month while the flooring was replaced. The apartment also needed to be sprayed for black mold two times after the flooding occurred.

Gabrielle's apartment had an absentee landlord, however the superintendent lived above her. She did not have flood insurance because she had been told that she lived in such a high risk area, coverage would not be available and although there was one insurance place in town, wouldn't give coverage to anyone in town.

Having her home flooded terrified Gabrielle, especially as her street kept on flooding during high tide events. Paying attention to the river level and water in the streets was a way of life in Sea Bright, and you were often unable to park at the end of Gabrielle's street because of water in the street. Due to the nature of flooding in Sea Bright, from the river not the ocean, Gabrielle felt that it was always surprising when the flooding occurred. She stayed the summer to take advantage of the beach season, and then moved out the following winter before spring flood season.

Gabrielle felt that the government officials in Sea Bright didn't really do anything to help mitigate flooding issues. Anything residents knew about flooding, they knew by living there. However, climate change is more noticeable in Sea Bright with erosion issues than with flooding. If not for the pilings and beach replenishment, Sea Bright would be long gone.

Interview with Scot Bell, Commercial Building Owner, Former Sea Bright Business Owner:

The following is a summary of an interview with Scot Bell that occurred on April 7, 2012:

Scot Bell was the owner of the Foodtown Grocery Store located in the center of the downtown business district, which is also one of the lowest areas in the town. After the 1992 Storm flooded and devastated his building, he closed shop. Today he still owns the building, renting it out to other businesses. His building is four feet above street level and had water inside of it in 1984, 1992, and in 2012 water came within inches of the building.

During the 1992 storm the river rose up into the side streets and met itself on Ocean Avenue. Center and Beach streets were flooded, along with a few others. Everything on each block was affected, with access to houses and businesses cut off even if the location was elevated and remained dry. The water flooded Scot's business. Fortunately, Scot had insurance from a private insurer that covered all damage to structures, and other insurance that covered inventory damages. He says "the premiums are expensive only when it is dry." Unfortunately, after the 1992 storm, Scot made the decision to close his business due to the cost of operating with lost time, sales, and merchandise (during the interview with Councilman Keeler, he said the biggest lost to the town of Sea Bright during the '92 storm was that of the Foodtown Grocery Store).

According to Scot, flood events in Sea Bright occur approximately 2- 4 times a year, based on the lunar phase. He's observed that the severity of flooding events seems to in cycles, with a few bag years and then a few good years. However, the frequency always seems to be about the same with flooding events occurring during the spring and fall full or new moons and a summer or winter storm. Scot does not think that flooding events in Sea Bright have influenced property values to a large degree, as the lure of the ocean keeps them from dropping too much. He noted that while some people move out, others have raised their houses. Some businesses, however relocate to locations that do not lose time due to flooding.

To help with flooding issues in Sea Bright, Scot mentioned that the local government is working on bulkhead improvements, but their primary responses to manage problems has been putting in warning lights and making evacuations when flood events occur. In addition, the state and federal governments have helped people raise their houses to prevent damage during a flood. Scot does not feel that any of these responses have made a positive difference yet, as the main issue affecting Sea Bright is the lack of access when

flooding occurs, because there are only a few ways in and out of town and they get flooded as well.

When asked if rising sea levels or more rain due to climate change are seen as emerging issues for the Borough of Sea Bright, Scot indicated the because the town in not very high above the mean high tide level, any rise in Sea Bright is a concern. He quickly pointed out that the river level is far more of a concern in this area, because it is the main cause of flooding. If it rains heavily during high tide, or the wind is blowing to keep the tide in the back bays then there is nowhere for the water to go but onto the streets, making any increase in rain a huge concern for this community.

Tom Thomas, Former Planner for Sea Bright and Middletown

Time frame you were planning consultant?

Sea Bright- late 1970s early 80's- housing plan update- through the years have him come back for some part of the master plan

Worked at T & M Associates for 25 years- mid 1980's prepared Middletown MP, created zoning ordinance- same for Highlands

Had staff several worked with middletown Richard Kramer- full tiem planner for Middletown- 2001/ 2002 for Navesink River Area

When politics change in and out

To what extent do this municipality's comprehensive plan, zoning ordinance, and capital improvement plan reflect current understandings of flood risks? How have storm events changed these plans?

All munis- flood plain study in Sea Bright, firm has done them for all munis involved in- mid 1990's- started using GIS prepared FEMA submission to delineate and designate flood plain areas within Sea Bright- helped reduce flood insurance for all town residents

Federal Law and NJ state law- construction of inhabited buildings has to be 2ft above flood plain level- first floor has to be approx 12 ft in Sea Bright

If a muni is going to conform with FEMA must adopt zoning or building code in conformance

NJ is process of changing regulations- in past rule was you could not build in designated flood plain period- started utilizing GIS mapping to designate limits of 100 and 500 year flood plains- you can build up to edge of flood plain- if you build in 500 you have to raise house

Regulations along coast are much different in rivers and streams vs the ocean

"As far as global warming and all that stuff- I'm going to tell you that nobody pays attention to that." -Nobody pays attention to global warming

FEMA insurance is 10% a year so people don't pay it anymore- new houses get annoyed because they pay high premiums and neighbors don't

Most towns take regulations and FEMA conformance pretty seriously

MC planning board encourages towns to delinate riparian buffer along rivers- most have not

What is the nature of the interactions between disaster management people—first responders—and the planning bodies in this municipality regarding flooding issues?

Interacts with OEM and disaster management- they review proposed regulations, make comments if they have any- have their own disaster plans- he provided with GIS mapping when planning plans

Highlands is an unusual town- beachfront limited- different problem- steep slopes and hills- lots of restrictions on development of hillsides

If slopes steep and going to use retaining walls needed a geophysical engineer to certify wall would last 50 years

Richard Kramer- T &M Associates

Planner for Middletown- 732- 671- 6411

Administrator for Middletown was former township planner

Middletown Interviews:

Charles Roger, Middletown OEM:

Charles Rogers Office of Emergency Management ("OEM") - Middletown, NJ

732-615-2129 (office phone) Crogers@middletownnj.org

Has been a resident of a flooded area for 74 yrs (born in 1937)

Born in Fort Monmouth while he was growing up, 3-4 times when growing up, he was taken by father out of the house to higher ground as a result of Fort Monmouth house getting flooded out.

He has been with Middletown's OEM for 10 yrs. State and county has OEM offices, as does each individual town has some sort of coordinator. Middletown actually has an office while some smaller

towns just have their chief of police or other official handle the duties of the OEM.

The storm of 44, he barely remembers it except that he was carried out of the house by his father.

He recalls, people started to learn to build a couple of feet o ff the ground. His grandparents built 3'4' off the ground. In the 50's his parents raised the house 7' off the ground.

In the past 10' yrs most houses have been built 6'-10' to build above the ground.

Lots of cases you can't even have heating systems or utilities below the house. Now those are in the attic. First level is for carport, storage, etc.

Newer houses are 3-4 bedrooms, approx. 2X size of homes in the 50's, which started to elevate.

Back in the day, you didn't look to FEMA.

1962 Storm was still in Fort Monmouth, evacuated via a coast guard Duck. Little advancedw arning. After the 1962 storm there was better advanced warning. The Federal Bureau, got better after '62, but still the 1992 storm was still somewhat of a surprise. 1962 storm was a three day event. They usually get 1 day events, but this was 3 days. Lots of vehicular damage, because no prior warning to move cars. Lots of homes were already raised. The bungalows were flooded 3-4' but none were wiped out.

Sea Bright often gets hit the hardest because of the Shrewsbury River and Navesink rivers which empty into the bay to the west of Seabright and from the coastal flooding from

the east.
Highlands gets flooded by rain coming down from the hill and also from Raritan Bay.

Following the highways, farmland became a good place to build, Middletown's expansion has gone inland where the land is cheaper and has easy access towards Manhattan. Some condos have come in, mostly in open space areas near the shore (for the most part not replacing existing structures).

In approximately 1974-75 the feds built compacted 10' dirt levee, seeded and grew grass on it, which has protected East Keansburg from Pew's Creek, but that water is now funneled towards to Fort Monmouth and Belford areas. There have been discussions of adding another 1-2 feet to the levee, last time it was discussed, with FEMA and army Corp was about 3-4 yrs ago. Not too much new development attracted behind the levee in the intervening decades.
Middletown has historically tried to do soften the blow.

1992-Storm
He thinks 1992 was marginally worse than '62 in terms of amount of water but less damage
4'ft of water suddenly overtopped the Belford Docks in beginning, with little warning. Only after 1992, had the federal warning systems have gotten much better. By the time the storm had lingered there was 6' of water at the docs, with water coverage that extended ½ to ¾ of a mile inland.
Not too much structural damage because of better building codes, some floor/wall damage, but no buildings knocked off their foundations or swept away.

FEMA instituted "Project Impact" in the 1990's as a result of the 1992 Noreaster which resulted in the buying out of repetitive loss properties (3-4)x in the flood l plainn.

Since 1992, there were no evacuations until Irene. Some damage to streets.

2012 – Irene was about a 1' less than the 1992 storm. Didn't hit as hard or as long as the other two because it overtopped them, instead of over the ocean. The wind was only 45 mph. There was a mandatory evacuation from the state most got out of town did so. There was no equivalent warning in 1962, so more people were trapped in their houses. Road damage, dune damage, some property damage. A couple of river dams (repaired by the county) in the shadow lake area breaking loose, took a house off of it foundation. The dams were repaired. The house is for sale. FEMA is contemplated buying the house (Sebastian Bach's property)

Town OEM coordinates with County who then reaches out to state and then to FEMA.
His job is to notify the people, local coordinators can make determination to evacuate. If so, locality is to evacuate. Lots of deference to the locals. Most OEMs locally work fairly work consistently and in concert. They usually meet amongst each other and with county and state
He feels that the general population isn't too concern about climate change. Especially the new residents. It is difficult to get anyone to listen to anything. Where new homes have been built in the Bayshore area, no-one shows up to the education sessions, which have 15 people in the meeting, 10 of whom are OEM staffers.

There were more summertime folks in Middletown, in the past . However, The summer bungalows were bought out a few years back (late 70's). Since then most of housing has been year round. County installed a fishing pier and a park area. They bought all property from the Leonardo Marina to Pew Creek creating a 300-400' buffer.

As Middletown's OEM Coordinator, he is reluctant to call the evacuation, because he doesn't want to be the guy who "called wolf"

Most of Middletown's flooding comes in from the Ocean into Raritan Bay, into Comptom's Creek and Pew's Creek. Water flows into meadows in southeasterly direction, onto the streets. Repairs after flood events to streets.

Threefold growth due to Garden State Parkway and widening of Rts 35 and 36 (state rds) 1960's As a result they went to 25,000 to almost 75,000 today. Garden State Parkway goes through Lincroft section, of Middletown. By exit 105 the parkway crosses a creek.
Over the years because of the building codes,r ruiring elevation most of the damages to individual houses has been relatively modest.

Today the coast line is mostly beaches and dunes, built by the Army Corps.
Ferry service was instituted, large blacktop parking lot, east of Belford Creek. There is beachfront in front of the parking lot. Big rock jetty/wall extends into the Bay there, which has been there for tong time. The ferry service is behind the wall. It has been dredged. No significant conflict between the ferrys and the fishing boats (as predicted by the fishermen in the late 1990's

Middletown, pretty much sticks to the master plan.
The dunes are not high enough in Middletown to block any views that were the subject of 2012 takings case in Sea Girt not too much of an issue.

Stephanie Rinaldi, Port Monmouth (Middletown) Resident and Homeowner:

The following interview took place on April 7, 2012:

Have flooding events affected this community in recent years? If so, please tell me what happened.

Mandatory Evacuation during Irene
Full Moon High Tide- Flood because of location in back bay on "wet side" of 36 (over this past weekend- 4/5-4/7)
Who was affected? Which neighborhoods, which types of homes, businesses, public infrastructures?
Irene- wet side of 36 to water- mandatory evacuation from Saturday at noon to Monday at 9am
Challenging because everything was shut down
Regular High Tide/ Full Moon Flooding
Homes are always underwater
Frequent road closures
The entire area is a FEMA Flood Zoone- need flood insurance- has recently been reclassified as such and this is a challenge for the working class people that live there and who never needed it before
Bayfront beach erosion
Stephanie lives in condos- 16ft above sea level and built back, the homes around these condo units are not- they get flooded every time the marshes build up

Do flooding events happen very often? How frequently? Has the pattern changed over time, in terms of

either frequency or severity?

Every Full and New Moon High Tides
Road closures
Road closures near Belford Ferry access
People drive through the flooded roadways because they need to
The fire department often wants to close the road, but that's how people get to work (in NYC) and the ferry is a business
Have flooding events influenced property values in affected neighborhoods? Have there been any long-term effects? Who has moved out and who has stayed?

I don't know
People like to live near water and forget easily
Sellers wouldn't mention their homes get flooded regularly
Noticed more for sale signs after Irene

What have been the governmental responses to these flooding events? Emergency responses to help manage problems in the short term? Planning and policy responses to better prepare the community to weather future events?

Looking to do dredging and drainage work in marshes and creeks
Planned beach replenishment of bayshore
After Irene
FEMA stations set up to get assistance if needed- emergency disaster assistance

Which of these responses have made a positive difference, in your opinion? Short-term? Long-term?

Just secured funding for dredging, drainage, and beach replenishment- projects will start in late 2012 or 2013- people feel better knowing that funding has been secured

Both state and federal government play large roles in helping communities and individuals cope with disasters. How has that played out here? Please give specific examples of what has worked well and not so well.

See #5
Are rising sea levels or more rain due to climate change seen as an emerging problem for this community? Is it something that you personally worry about? Please elaborate.

Stephanie notices a difference, however she does not think the community does
Historians have pictures from apple orchards in front of the spy house- now this is very close to the water from
People are more focused on water quality and how this has improved- the bay used to be dirtier- now its cleaner
Who else should I talk to in order to understand more about flooding and responses to this problem in this community?
Middletown OEM- Emergency Management Response Team- they were very good during Irene- sent constant updates via text and email
Community responses- one of Steph's neighbor's stayed during Irene- he is a retired cop- he said people from outside of the community came in and were trying to case all the empty homes- he sat on his front porch with a gun.- neighbors not built up like the condos were totally under water

Homeowners
Has your house ever been flooded? If so, when did it happen? What caused the flood? Was the damage bad?
No, it is 16 feet above sea level

Did you have flood insurance? From whom (private insurer, federal government)? How much of your damage did it cover? Are the premiums expensive?

It is in the flood zone, the condo community has a master flood policy, but they advise individual owners to buy their own policy as well- she did.

Did you consider moving after the flood occurred? Did you move? From where to where? What factors went into that decision?

When you bought your house, what information did the realtor provide about flood risks? Did you ask any local government officials about these issues? Your insurer?

About flooding in Port Monmouth:
It happens a lot- you are often unable to get from 36 to the bay whenever it rains- you have to take detours, it becomes a way of life
Wilson and Braynard Street flood often
When The Dunes (the condo complex Steph lives in) was built (around 2004), they were required to build up Broadway (road)
Main St. in Belford often floods
In the morning steph watches the marshes to see whats happening
Living in Port Monmouth you learn a lot about wind direction and how wind direction and speed impact flooding
If NE wind- the water gets pushed into the marshes
If NW wind- the water pushed out into the ocean
Thinks its smart Middletown evacuated during Irene- the flooding was bad, would not be able to get anyone in if they needed help- if the same thing were to occur, the twp. should do it again
the worst part about the mandatory evacuation and the flooding during Irene was feeling homeless and trapped.

Dr. Cathy Folio- North Middletown Homeowner

The following interview took place on April 2, 2012:

Have flooding events affected this community in recent years? If so, please tell me what happened.

No flooding events in my neighborhood in recent years.
Who was affected? Which neighborhoods, which types of homes, businesses, public infrastructures?
NA
Do flooding events happen very often? How frequently? Has the pattern changed over time, in terms of either frequency or severity?

Our flooding has been avoided for the last 25 years by a levee built across the salt marsh ½ mile away, and by a storm sewer pumping station on Raritan Bay. Prior to that, mod-

erate flooding was in the street frequently with heavy rains during high tides.

Have flooding events influenced property values in affected neighborhoods? Have there been any long-term effects? Who has moved out and who has stayed?

I believe that the property values went up a bit after the levee was built by the Army Corps of Engineers and the pumping station was put in. Property values are mostly down now because of the recession. I don't know if potential buyers are being influenced by the strict new FEMA 100-year flood maps, or whether people have moved out because of it. My immediate neighbors, and our local businesses, have remained either because they trust the mitigation efforts (I do) and/or they were grandfathered into the initial low flood insurance rate ($350/yr) rather than having to pay the new rate ($1600/yr) when we were reclassified from Class C to Class AE Flood Zone.

What have been the governmental responses to these flooding events? Emergency responses to help manage problems in the short term? Planning and policy responses to better prepare the community to weather future events?

Back in the '70's, Middletown successfully got the Army Corps to build the levee, and Federal funds for the pumping station (because of rising bay levels, the street water just can't drain out to the bay anymore during high tide-storm events). I know that the town applied for a new levee and pumping station on the Port Monmouth side of the marsh (I'm on the North Middletown side) because Port Monmouth still gets flooded. I have heard that the levee has been denied but that a new street sewer pumping station may be built there.

Which of these responses have made a positive difference, in your opinion? Short-term? Long-term?

See questions 3.

Both state and federal government play large roles in helping communities and individuals cope with disasters. How has that played out here? Please give specific examples of what has worked well and not so well.

See answers above.

Are rising sea levels or more rain due to climate change seen as an emerging problem for this community? Is it something that you personally worry about? Please elaborate.

Yes, I am personally concerned about sea-level rise and heavier and more frequent rain and heavy storm events, particularly northeasters, which do the most damage to our bay dunes than any other weather. The erosion on the bay dunes is getting extremely bad, with now whole shrubs and trees falling onto the beach as the dunes recede. If electricity is lost to the pumping station during a storm, we will definitely have street flooding at high tides. We have very little beach left now in various areas at normal high tides. I thought that when I bought my home here 18 years ago that it would be my retirement cottage. Now I really don't think it will with sea-level rise and global warming effects.

Who else should I talk to in order to understand more about flooding and responses to this problem in this community?

I would suggest talking to a real estate agent, to see how property interests have been affected, and an insurance agent like State Farm to see their companies reactions. I also own a bit of property 1 mile from Delaware Bay in Cape May Court House, and I know that both Allstate and State Farm have pulled off the Cape May peninsula entirely as insurance companies.

Homeowners

Has your house ever been flooded? If so, when did it happen? What caused the flood? Was the damage bad?

My houses have never been flooded.

Did you have flood insurance? From whom (private insurer, federal government)? How much of your damage did it cover? Are the premiums expensive?

I have FEMA insurance currently at $350/yr. on the N. Middletown house. My insurance company in Cape May (it is a mobile home company) has not stipulated flood insurance yet for my area.

Did you consider moving after the flood occurred? Did you move? From where to where? What factors went into that decision?

I am carefully watching my proximities to the water in both my locations, plus gov't reactions (a highly endangered bird, the Red Knot, may be the key to Federal sand replenishment on the Delaware beaches of Cape May County) to determine when I should sell-out in order not to lose my investment in my properties.

When you bought your house, what information did the realtor provide about flood risks? Did you ask any local government officials about these issues? Your insurer?

When I bought my houses, the realtors said absolutely nothing about flood risks in the areas because, I guess, there were none at that time (18 years ago). Global warming and FEMA are changing all that. The info that I had about flooding in N. Middletown was my own personal observations through the decades. In Cape May Court House, I figured I was far enough away from the bay to buy in 10 years ago. I am still protected by the direct distance there, however, we are beginning to experience some flooding during heavy water (rain or snow) events due to the water table rising underneath us due to the increasing hydraulic pressure from the bay.

Appendix: List of Tables, Figures, and Pictures

Figures:

Tables:

Pictures:

Maps: