

**SECTION 2 -
IDENTIFICATION OF POTENTIAL HAZARDS**

FEMA’s current regulations and interim guidance require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of “human-caused” hazards (i.e., technological hazards and/or terrorism) is encouraged, though not required, for plan approval under DMA 2000. Atlantic County has chosen to focus solely on natural hazards at this time. Human-caused hazards can be evaluated in future versions of the plan, as it is a “living document” which will be monitored, evaluated and updated regularly.

After consideration of a full range of natural hazards, Atlantic County has identified a number of hazards that are addressed in this Multi-Jurisdictional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from Planning Group members, research of past disaster declarations in the County, and review of the New Jersey State Hazard Mitigation Plan (2008). Readily available online information from reputable sources (such as Federal and state agencies) was also evaluated to supplement information from these key sources.

The following table (Table 2.1) presents the full range of natural hazards considered and provides a brief description of the hazard. Subsequently, Table 2.2 documents the evaluation process for the hazards listed in Table 2.1 to determine the hazards worthy of further consideration in the plan. For each hazard considered, Table 2.2 indicates whether or not the hazard was identified as a significant hazard to be addressed in the plan, how this determination was made (i.e. the sources of information that were consulted while researching each hazard) and why this determination was made. The table summarizes not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not).

Some of these hazards are considered to be interrelated or cascading (e.g., hurricanes can cause wind damage and flooding), but for preliminary hazard identification purposes these individual hazards have been broken out separately. It should also be noted that some hazards, such as earthquakes or winter storms may impact a large area yet cause little damage, while other hazards, such as a tornado, may impact a small area yet cause extensive damage within that area.

Because this Hazard Mitigation Plan is a living document, hazard events not identified for inclusion at this time could be addressed during future evaluations and updates of the plan if deemed necessary by the Planning Group at that time.

Lastly, Table 2.3 provides a summary checklist of the hazard identification and evaluation process noting 15 of the 23 initially identified hazards are considered significant enough for further evaluation through Atlantic County’s multi-jurisdictional hazard risk assessment (marked with a “☑”).

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Table 2.1
Descriptions of the Full Range of Initially Identified Hazards

Hazard	Description
ATMOSPHERIC	
Avalanche	A rapid fall or slide of a large mass of snow down a mountainside.
Extreme Temperatures	Extreme heat and extreme cold constitute different conditions in different parts of the country. Extreme cold can range from near freezing in the South to temperatures well below zero in the North. Similarly, extreme heat is typically recognized as the condition whereby temperatures hover ten degrees or more above the average high temperature for a region for an extended period.
Extreme Wind	Wind is air that is in constant motion relative to the surface of the earth. Extreme wind events can occur suddenly without warning. They can occur at any time of the day or night, in any part of the country. Extreme winds pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris and can down trees and power lines. Extreme winds are most commonly the result of hurricanes, tropical storms, nor'easters, severe thunderstorms and tornadoes, but can also occur in their absence as mere "windstorms." One type of windstorm, the downburst, can cause damage equivalent to a strong tornado.
Hailstorm	Any storm that produces hailstones that fall to the ground; usually used when the amount or size of the hail is considered significant. Hail is formed when updrafts in thunderstorms carry raindrops in to parts of the atmosphere where the temperatures are below freezing.
Hurricane and Tropical Storm	Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which extends from June through November.
Lightning	Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States.
Nor'easter	Similar to hurricanes, nor'easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. Tornadoes are most often generated by thunderstorm activity when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm.
Winter Storm	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, powerlines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and

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	injuries to human life.
HYDROLOGIC	
Coastal Erosion	Landward displacement of a shoreline caused by the forces of waves and currents. Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. It is generally associated with episodic events such as hurricanes and tropical storms, nor'easters, storm surge and coastal flooding but may also be caused by human activities that alter sediment transport. Construction of shoreline protection structures can mitigate the hazard, but may also exacerbate it under some circumstances.
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning.
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. Human demands and actions have the ability to hasten or mitigate drought-related impacts on local communities.
Flood	The accumulation of water within a water body which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding (where shallow flooding refers to sheet flow, ponding and urban drainage).
Ice Jams	A formation of ice over a body of water that limits the flow of the water due to freezing. Ice jam flooding occurs when warm temperatures and heavy rain cause the snow to melt rapidly, causing frozen rivers or lakes to overflow. As the water lifts, the ice that's formed on top of the body of water breaks into small pieces of varying sizes. These pieces or large chunks of ice tend to float downstream and often pile up near narrow passages or near obstructions, such as bridges and dams. This accumulation can impact the integrity of the structures and also cause upstream flooding as water backs up behind the obstruction.
Storm Surge	A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Storm surge arrives ahead of a storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas.
Wave Action	The characteristics and effects of waves that move inland from an ocean, bay, or other large body of water. Large, fast moving waves can cause extreme erosion and scour and their impact on buildings can cause severe damage. During hurricanes and other high-wind events, storm surge and wind increase the destructiveness of waves and cause them to reach higher elevations and penetrate further inland.
GEOLOGIC	
Earthquake	A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earth's surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within plates. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.
Expansive Soils	Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking,

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	they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe.
Landslide	The movement of a mass of rock, debris, or earth down a slope when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high.
Land Subsidence	The gradual settling or sudden sinking of the Earth's surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.
Tsunami	A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively "pile up", and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing 'wall of water' with the potential to cause devastating damage in coastal areas located immediately along the shore.
Volcano	A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion.
OTHER	
Wildfire	An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

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Table 2.2 Documentation of the Hazard Evaluation Process			
Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
ATMOSPHERIC HAZARDS			
Avalanche	NO	<ul style="list-style-type: none"> • Review of FEMA’s Multi-Hazard Identification and Risk Assessment (MHIRA) • Review of US Forest Service National Avalanche Center web site • Input from planning group 	<ul style="list-style-type: none"> • The topography and climate of southern New Jersey including Atlantic County do not support conditions required for the occurrence of avalanches.
Extreme Temperatures	YES	<ul style="list-style-type: none"> • Review of New Jersey State Hazard Mitigation Plan 2008 (NJSHMP) • Review of FEMA MHIRA • Data from National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center storm events database (NCDC) • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP gives extreme temperature events a low qualitative ranking among the statewide hazards of concern, since impacts are considered limited, despite a relatively high annual probability. • NJSHMP discusses extreme cold events in the hazard profile section on winter storms, but devotes a separate section to extreme heat events, which reports that such events area not unusual, particularly in the southern portion of the state. Extreme heat and overexposure to summer temperatures in NJ result in approximately five deaths annually and 25 – 170 hospitalizations every year. • MHIRA places Atlantic County in an area with a Summer Heat Index of 115 – 120°C: i.e. there is a 5% chance that temperatures in this range will be equaled or exceeded in any given year. • NCDC reports 83 extreme temperature events for Atlantic County between July 1994 and September 2007. Of these 44 featured extreme heat and 11 featured extreme cold. The remainder were unseasonal high or low temperature events which, while unusual, are not generally associated with specific impacts. The NCDC attributes a total of 48 deaths to the recorded extreme temperature events affecting Atlantic County: 43 attributed to extreme heat, 5 to extreme cold.
Extreme Wind	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC storm events database • Review of American Society of Civil Engineers (ASCE) Standard 7-02 (Minimum Design Loads for Buildings and Other Structures) • Input from planning group 	<ul style="list-style-type: none"> • Atlantic County is located in a region that is highly susceptible to numerous types of extreme wind events including severe thunderstorms, hurricanes and tropical storms, nor’easters, and severe winter storms. MHIRA indicates that extreme wind speeds of up to 160mph are possible. • NJSHMP reports that high straight-line winds related to thunderstorms affect nearly all areas of the state equally. Atlantic County lies in an area which experiences and average of 33 thunderstorm days per year.

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**Table 2.2
Documentation of the Hazard Evaluation Process**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
(Extreme Wind, continued...)			<ul style="list-style-type: none"> • NCDC reports a total of 75 high wind events (wind speed at least 50 knots/58mph) affecting Atlantic County since 1950, with 1 death, 18 injuries, and almost \$10 million in damage attributed to these events, including some damage outside in areas outside Atlantic County. NCDC attributes a further 2 deaths, 10 injuries and \$6 million in damage to an additional 118 wind events affecting Atlantic County for which the wind speed was less than 50 knots or not recorded. • The 3-second wind gust for building design purposes in Atlantic County as per ASCE 7-02 is 110mph in the western half of the county, and 120mph in the eastern half of the county.
Hailstorm	NO	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC storm events database and National Severe Storms Laboratory (NSSL) web site • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP mentions hail as a hazard but one with a very low qualitative ranking among the identified statewide hazards of concern. Hailstorms are considered to have a high annual probability but limited impact in severity and area. • According to NSSL data Atlantic County lies in an area that can expect hailstorm events on 1-2 days per year, with coastal areas likely to experience more hailstorms than inland areas. • NCDC reports a total of 25 hailstorm events (hailstones at least 0.75” in diameter) affecting Atlantic County since 1962, including two events which featured “damaging hail” (hailstones of diameter 2” or more). No recorded deaths, injuries, or dollar losses are attributed to any of these events. • There are minimal hazard mitigation techniques available to reduce hailstorm impacts outside of general emergency preparedness procedures and severe weather warning systems already in place.
Hurricane and Tropical Storm	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC storm events database • Review of NOAA National Hurricane Center (NHC) website and analysis of published historical hurricane and tropical storm tracks • Input from planning group 	<ul style="list-style-type: none"> • NJSHMP gives hurricanes a high qualitative ranking among the identified statewide hazards of concern – second only to flooding. The Plan shows coastal areas of the state, including those in Atlantic County, to be the most affected by hurricane forces, and subject to the highest associated impacts of storm surge, wind, wave action, and rain. • FEMA mapping shows Atlantic County to be located in a hurricane-susceptible zone where winds of up to 160mph are possible.

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Documentation of the Hazard Evaluation Process**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
(Hurricane and Tropical Storm, continued...)			<ul style="list-style-type: none"> • According to the NHC the estimated return period for a Category 1 hurricane in the Atlantic County area is 22 years, rising to 480 years for a Category 5 hurricane. • Records from the NOAA National Hurricane Center show a total of 64 storm tracks passing within 65 nautical miles (75 miles) of Atlantic County since 1856, including 12 for which the center (or eye) has passed directly over parts of the county. Of the 64 total, 3 were Category 1 hurricanes, 8 were Category 2, and 28 were tropical storms. The remainder were tropical depressions and extratropical storms. • Other sources such as the NCDC database indicate that hurricanes passing significantly further than 75 miles from New Jersey have been responsible for damage, flooding and erosion in Atlantic County.
Lightning	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC storm events database and National Severe Storms Laboratory web site • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP mentions lightning only as a product of thunderstorms and a potential cause of wildfires. The plan does not include a separate hazard profile section for lightning. • According to NOAA, New Jersey did not rank among the top 25 US States for the most fatalities, injuries, or damage reports due to lightning strikes in the period 1959 through 1995. • According to NOAA and FEMA data, Atlantic County lies in an area that experiences a very low annual lightning flash density: generally less than one lightning flash per square kilometer per year. • NCDC reports 14 significant lightning strike events in Atlantic County since 1994, to which 3 injuries and \$1.06 million in property damages were attributed.
Nor'easter	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP gives nor'easters a high qualitative ranking among the identified statewide hazards of concern, behind only flooding and hurricanes. The plan considers that all areas of New Jersey are equally likely to experience nor'easters, but that coastal regions are most vulnerable to their sometimes devastating impacts, including high wind, flooding, erosion, wave damage, and heavy snow. Under some circumstances the effects (flooding, erosion) of nor'easters in coastal areas may be more severe than those of some hurricanes because the storm surge can be of longer duration.

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Table 2.2 Documentation of the Hazard Evaluation Process			
Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
Tornado	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC storm events database and National Severe Storms Laboratory web site • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP gives tornadoes a medium qualitative ranking among the identified statewide hazards of concern. The plan records a total of 144 tornadoes in the state of New Jersey since 1951, and plots the location of six that have occurred in Atlantic County. The plan considers the tornado season in NJ to be March through August, but acknowledges that they can occur at any time of year. • NCDC reports seven tornado events affecting Atlantic County since 1970. Of these, three were classed F2 on the Fujita Tornado Scale (considerable damage), one was classed F1 (moderate damage) and the remainder were classed F0 (light damage). A total of three injuries and just over \$1million in property damage was attributed to these events. • According to NSSL data, Atlantic County is located in an area which is likely to experience approximately one tornado in any given year.
Winter Storm	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC storm events database • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP gives winter storms a medium to high qualitative ranking among the identified statewide hazards of concern. The plan reports that winter storms affect all areas of the state equally and are responsible for “many” deaths each year. However, the average annual snowfall for Atlantic County is shown as 15-20 inches per year, significantly less than the northern third of the state, where average annual snowfalls reach upwards of 35 inches per year. While the plan highlights the upland areas in the north of the state as particularly susceptible to extremely low temperatures, it also reports that very low temperatures are also not unusual in the Pine Barrens, which partially cover significant areas of Atlantic County. • According to FEMA/NCDC data, Atlantic County is located in an area in which there is a 5% chance that snowfall depth of 50-75” will be equaled or exceeded in any given year. This range is the third lowest of seven snowfall ranges mapped by NCDC in the conterminous United States. • NCDC mapping also shows Atlantic County to be located in an area which experiences less than eight hours of freezing rain annually.

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<p align="center">Table 2.2 Documentation of the Hazard Evaluation Process</p>			
<p align="center">Natural Hazards Considered</p>	<p align="center">Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)</p>	<p align="center">Which sources of information were used to make this determination?</p>	<p align="center">Why was this determination made?</p>
<p>(Winter Storm, continued....)</p>			<ul style="list-style-type: none"> • NCDC reports 82 significant snow and ice-related events affecting Atlantic County since 1995, to which two deaths, two injuries, and \$30million in property damages have been attributed (including some in areas outside Atlantic County). Of these 82 events, 17 were specifically identified as “Heavy Snow” events. A further three were specifically identified as “Ice Storm” or “Freezing Rain” events. Heavy snow and freezing rain were also present in many of the other events simply identified as “Winter Storm” or “Winter Weather”.
<p>HYDROLOGIC HAZARDS</p>			
<p>Coastal Erosion</p>	<p align="center">YES</p>	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • New Jersey Department of Environmental Protection (NJDEP) Coastal Management Program website • Richard Stockton College of New Jersey, Coastal Research Center: New Jersey Beach Profile Network (NJBPN) website • Input from planning group 	<ul style="list-style-type: none"> • Despite acknowledging that localized coastal erosion has a relatively high annual probability, the NJSHMP gives coastal erosion the lowest qualitative ranking among the identified statewide hazards of concern. • Mapping presented in MHIRA places Atlantic County in an area where the overall shoreline is accreting (rather than eroding) by an average of one meter (3.3 feet) per year. Displacements of +/- 1 meter per year are considered stable and represent only a moderate risk. • Inspection of NJDEP mapped shorelines from 1836 to 1977 show that apart from the areas in and around tidal inlets, the Atlantic County shoreline is historically quite stable. • The 2006 NJBPN report for Atlantic County indicates that since 1986 most of the ocean shoreline in the county has experienced alternating periods of accretion and erosion, rather than a constant long-term movement in one direction or the other, even when accounting for periods of beach renourishment in certain areas. • Shoreline areas of Atlantic County remain vulnerable to occasional severe coastal erosion from periodic storm events such as hurricanes, tropical storms, and nor’easters. • Shore protection projects are routinely initiated and funded in the county through NJDEP and the U.S. Army Corps of Engineers. These projects in addition to many other elements of NJDEP’s Coastal Management Program serve to reduce damages to public and private property caused by coastal erosion.

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Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
Dam Failure	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • U.S. Army Corps of Engineers (USACE) National Inventory of Dams Database • Stanford University National Performance of Dams Program (NPD) website and database • NJDEP Dam Safety Program website • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP outlines the various roles and responsibilities for dam safety in the state but does not discuss dam failures in the hazard profiles section of the plan or rank it among the statewide hazards of concern. • The USACE database records 25 dams in Atlantic County, of which one is designated a “High Hazard” dam, and 11 are “Significant Hazard”. • The NPD database records 32 dams in the county, including one “High Hazard” dam and 10 “Significant Hazard” dams. • GIS data supplied by the county records 37 dams, some of which may no longer be in operation.
Drought	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC database • NJDEP Drought Information website • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP discusses drought in the hazard profile section of the plan, and notes that droughts of moderate severity occur at least once every few years in the state. Drought is given a medium qualitative ranking among the statewide hazards of concern. • According to the Palmer Drought Severity Index (PDSI) Map for the USA, Atlantic County is located in an area that experienced drought conditions for less than 5% (the lowest PDSI rating) of the period 1895 to 1995. • The NCDC database records 33 drought related events affecting Atlantic County since 1995, including one in 1999 to which \$80 million in crop damage was attributed across the whole state. • For the purposes of this plan the primary impacts of drought fall on agriculture, which is economically significant in the northern and western portions of Atlantic County.
Flood	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • NOAA NCDC database • Review of FEMA Q3 flood map data • Review of FEMA National Flood Insurance Program (NFIP) Community Status Book • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP discusses flooding in detail in the hazard profile section of the plan, and gives it the highest qualitative ranking among the statewide hazards of concern, since it has widespread impacts and a long history of occurrences in the state. • The NJSHMP reports that there are on average approximately \$1.8 million worth of NFIP claims made each year in Atlantic County, the 7th highest in the state (out of 22). • The NCDC database records 62 flood events in Atlantic County since 1993, with almost 80% of them categorized at least in part as coastal flooding incidents. These events

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Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
			<p>have caused almost \$88 million in property damage, including damage in areas outside Atlantic County.</p> <ul style="list-style-type: none"> • FEMA Q3 flood mapping shows that a Special Flood Hazard Area (SFHA: areas with a 1% probability of flooding in any given year) is present to some degree in every municipality in the County, with a few municipalities located entirely within the SFHA: 32% of the county land area and nearly \$9 billion worth of property are located in SFHAs. • All Atlantic County municipalities are currently active in the NFIP, and six participate in the Community Rating System.
Ice Jams	NO	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • USACE Cold Regions Research and Engineering Laboratory (CRREL) Database • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP mentions ice jams as a potential cause of flooding, but does not discuss them in any detail in the hazard profiles section. • CRREL records 98 ice jams occurring in New Jersey since 1867, ranking the state 25th in the USA for recorded ice jams. • The CRREL database lists one ice jam event occurring in Atlantic County since 1904. No specific impacts are recorded for this event, which occurred in Folsom in 1959.
Storm Surge	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • Review of USACE Sea, Lake and Overland Surges from Hurricanes (SLOSH) model • NOAA NCDC database • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP mentions storm surge as a significant cause of flooding in the hazard profile section of the plan, particularly in association with hurricanes. • Atlantic County has more than 20 miles of shoreline directly fronting the Atlantic Ocean, and many more miles of shoreline in areas between the barrier islands and the mainland. The topography of the county is also generally flat and low-lying. • MHIRA places Atlantic County in an area where storm surge elevations of 5-7 feet (which could occur during a category 1 hurricane) have an estimated recurrence interval of 10 years. • The SLOSH model results show that even the storm surge from a category 1 hurricane associated with worst-case combinations of direction, forward speed, landfall point and tides would be likely to cause damage to property in all Atlantic County municipalities except for four located along the western border of the county.

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**Table 2.2
Documentation of the Hazard Evaluation Process**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
Wave Action	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • NOAA NCDC database • Review of FEMA Q3 flood map data • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP mentions waves as a component of hurricanes and similar storms, but does not discuss wave action or damage in detail in the hazard profiles section of the plan. • The NCDC database records 62 coastal flooding/heavy ocean surf events affecting Atlantic County since 1995. These events are estimated to have caused 3 deaths, six injuries, and almost \$22 million in property damage (including damage in areas outside Atlantic County). • FEMA Q3 mapping shows that wave heights of three feet or more are expected for the base flood along the shoreline of all coastal municipalities in Atlantic County, and also in several backbay areas.
GEOLOGIC HAZARDS			
Earthquake	YES	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • US Geological Service (USGS) Earthquake Hazards Program website • National Atlas earthquake risk mapping • New Jersey Geological (NJGS) Survey website • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP discusses earthquakes in the hazard profile section of the plan, and gives them a medium qualitative ranking among the statewide hazards of concern. The plan highlights four historic earthquakes that caused significant damage in the state. • NJGS records 153 earthquakes epicentered in New Jersey, but only one in Atlantic County: an earthquake epicentered near Pleasantville in 1910 for which no magnitude was recorded. • USGS and National Atlas mapping place Atlantic County in an area with a 10% chance that a seismic event of Peak Ground Acceleration (PGA) 2-3% of gravity could be exceeded in 50 years. • FEMA currently recommends that earthquakes be comprehensively evaluated for mitigation purposes for all areas where events of PGA 3%g or more have a 10% chance of exceedance.
Expansive Soils	NO	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • New Jersey Geological (NJGS) Survey website • US Department of Transport, Federal Highway Administration Report FHWA-RD-76-82 • US Department of Agriculture, Natural Resources Conservation Service website 	<ul style="list-style-type: none"> • The NJSHMP does not specifically mention expansive soils as a hazard of concern. • MHIRA places Atlantic County in an area with little or no potential for swelling of clay soils. • Report FHWA-76-82 places Atlantic County in an area designated Nonexpansive: where high volume change soils do not occur or are extremely limited. • New Jersey has adopted the International Building Code of 2000, of which Chapter 18 includes mitigation measures for building on

RISK ASSESSMENT: IDENTIFICATION OF POTENTIAL HAZARDS

Table 2.2 Documentation of the Hazard Evaluation Process			
Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
(Expansive Soils, continued...)		<ul style="list-style-type: none"> • Input from planning group 	expansive soils through design, removal, or stabilization.
Landslide	NO	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • Review of USGS Landslide Incidence and Susceptibility Mapping • Review of New Jersey Geological Survey mapping • Input from planning group 	<ul style="list-style-type: none"> • The NJSHMP discusses landslides in the hazard profiles section of the plan, and collectively gives geological hazards a low qualitative ranking among the statewide hazards of concern. The plan reports that landslides are not particularly common in New Jersey, and tend to occur in the northern portion of the state. The plan has no record of any significant landslides in Atlantic County. • MHIRA places Atlantic County in an area of low potential for landslides and debris flows. • USGS mapping shows Atlantic County in an area of low incidence and low susceptibility to landslides. • The general topography of Atlantic County does not feature hilly terrain to any significant degree – the highest natural elevation in the county is approximately 150 feet above sea level.
Land Subsidence	NO	<ul style="list-style-type: none"> • Review of NJSHMP 2008 • Review of FEMA MHIRA • Review of New Jersey Geological Survey mapping • US Geological Survey Office of Ground Water • Input of planning group 	<ul style="list-style-type: none"> • The NJSHMP discusses land subsidence in the hazard profiles section of the plan, and collectively gives geological hazards a low qualitative ranking among the statewide hazards of concern. Recorded sinkholes in New Jersey have been primarily located in the northern and northeastern part of the state, and there is essentially no history of underground mining in Atlantic County. • MHIRA mapping shows New Jersey as having a historical record of very little or zero cumulative damages from subsidence caused by mining, sinkholes. • NJGS mapping does not indicate the presence in Atlantic County of any rock types which have the potential for the formation of sinkholes. • The USGS has identified the City of Atlantic City as a location where land subsidence has been attributed to the compaction of aquifer systems following groundwater extraction. However, the observed rates of subsidence are very small (0.035 to 0.15 inches per year) and exhibit no wild variations across the studied area. Also, USGS records no significant engineering or structural issues due to subsidence in the Atlantic Coastal Plain (which includes Atlantic County).

RISK ASSESSMENT: IDENTIFICATION OF POTENTIAL HAZARDS

Table 2.2 Documentation of the Hazard Evaluation Process			
Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	Which sources of information were used to make this determination?	Why was this determination made?
(Land Subsidence, continued...)			Therefore, while this phenomenon is expected to continue, its magnitude is sufficiently small for the likelihood of any future damages to be considered extremely low.
Tsunami	NO	<ul style="list-style-type: none"> Review of NJSHMP 2008 Review of FEMA MHIRA Review of FEMA “How-to” mitigation planning guidance volume 2 (FEMA publication 386-2) Input from planning group 	<ul style="list-style-type: none"> The NJSHMP briefly discusses tsunami events in the plan section profiling flood hazards. The plan concludes that while the mid-Atlantic region has been subject to minor tsunami action in the last 250 years, the probability of a large tsunami impacting the coast of New Jersey is very small, due to the position of the state on the trailing edge of the North Atlantic Plate. FEMA 386-2 indicates that locations on the Atlantic coast to the north of Virginia have a relatively low tsunami risk (compared to areas on the Pacific coast) and do not currently need to include tsunamis in the detailed risk assessment.
Volcano	NO	<ul style="list-style-type: none"> Review of USGS Volcano Hazards Website Review of FEMA MHIRA Input from planning group 	<ul style="list-style-type: none"> There are no known volcanoes located within approximately 2,000 miles of Atlantic County
OTHER HAZARDS			
Wildfire	YES	<ul style="list-style-type: none"> Review of NJSHMP 2008 Review of FEMA MHIRA Review of New Jersey Forest Fire Service (NJFFS) website Input from planning group 	<ul style="list-style-type: none"> The NJSHMP profiles wildfires and gives them a medium to low qualitative ranking among the statewide hazards of concern. The New Jersey Pine Barrens area, which lies partially within Atlantic County, is widely recognized as highly prone to forest fires, and the whole ecosystem is in some ways dependent on fire for its continued existence. Within these areas are a large number of homes and small communities, which were developed before the current regulations restricting development within the Pine Barrens. NJFFS reports that there were 2,713 wildfire incidents in Atlantic County from 1993 to 2006, with a peak of 251 incidents in 2006. NJFFS also reports 4,148 acres burned in the same period, with 2,150 acres burned in 1997 alone. Only one other county in the state had more incidents per year, and two had more acres burned per year. NJFFS mapping shows that there are significant areas in Atlantic County considered by NJFFS to be High and Extreme hazard areas for fire risk.

**Table 2.3
Summary Results of the Hazard Identification and Evaluation Process**

<p><u>ATMOSPHERIC</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Avalanche <input checked="" type="checkbox"/> Extreme Temperatures <input checked="" type="checkbox"/> Extreme Wind <input type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hurricane and Tropical Storm <input checked="" type="checkbox"/> Lightning <input checked="" type="checkbox"/> Nor'easter <input checked="" type="checkbox"/> Tornado <input checked="" type="checkbox"/> Winter Storm <p><u>HYDROLOGIC</u></p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Coastal Erosion <input checked="" type="checkbox"/> Dam Failure <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Flood <input type="checkbox"/> Ice Jams <input checked="" type="checkbox"/> Storm Surge <input checked="" type="checkbox"/> Wave Action 	<p><u>GEOLOGIC</u></p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Earthquakes <input type="checkbox"/> Expansive Soils <input type="checkbox"/> Landslide <input type="checkbox"/> Land Subsidence <input type="checkbox"/> Tsunami <input type="checkbox"/> Volcano <p><u>OTHER</u></p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Wildfire
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= Hazard considered significant enough for further evaluation through the Atlantic County multi-jurisdictional hazard risk assessment.