Section 5. Risk Assessment

5.21 Pandemic

For the 2014 Hazard Mitigation Plan (HMP) update, the hazard profile and vulnerability assessment were significantly enhanced to reflect updated, best-available data, as well as to provide additional information that can be used by both the State agencies in developing mitigation strategies, and local jurisdictions as they develop their mitigation plans according to the appropriate level of threat. Each declared event is summarized and includes information concerning severity based on appropriate data collected from various sources. The vulnerability assessment has been updated to assess vulnerability and estimates potential losses by jurisdiction and to State facilities.

5.21.1 Profile

Hazard Description

Pandemic is defined as a disease occurring over a wide geographic area and affecting a high proportion of the population. A pandemic can cause sudden, pervasive illness in all age groups on a local or global scale. A pandemic is a novel virus to which humans have no natural immunity that spreads from person-to-person. A pandemic will cause both widespread and sustained effects and is likely to stress the resources of both the State and federal government. An epidemic occurs when new cases of a certain disease, in a given population, substantially exceed what is expected. An epidemic may be restricted to one locale, or it may be global, at which point it is called a pandemic.

For this HMP update, disease outbreaks that occurred in New Jersey will be further discussed, including foodborne diseases, mumps, norovirus, influenza, and West Nile Virus.

Foodborne Disease Outbreaks

Foodborne illness is caused by consuming contaminated foods or beverages. Many different disease-causing microbes or pathogens can contaminate foods, so there are many different types of foodborne illnesses. Foodborne illness, caused by a variety of bacteria, viruses, and parasites, can be spread by consumption of improperly prepared food items, poor hygiene among food handlers, or contamination in food processing facilities or farms. Many foodborne pathogens also can be acquired through recreational or drinking water, from contact with animals or their environment, or through person-to-person spread (New Jersey Department of Health [NJDOH] 2013a).

After eating contaminated food, people can develop anything from a short, mild illness, often mistakenly referred to as "food poisoning," to life-threatening disease. The Centers for Disease Control and Prevention (CDC) indicate that foodborne illnesses, each year, result in 76 million becoming ill; more than 300,000 hospitalizations; and 5,000 deaths (NJDOH 2013a). Some of the foodborne diseases reported to NJDOH include:

- Campylobacteriosis
- Foodborne Poisonings
- Salmonellosis
- Cyclosporiasis
- Hepatitis A
- Shigellosis
- E. coli
- Listeriosis
- Vibriosis

An outbreak of foodborne illness occurs when a group of people consume the same contaminated food and two or more of them come down with the same illness. It may be a group that ate a meal together somewhere, or it may be a group of people who do not know each other at all, but who all happened to buy and eat the same contaminated item from a grocery store or restaurant. For an outbreak to occur, something must have happened to contaminate a batch of food that was eaten by a group of people. Often, a combination of events contributes to the outbreak (NJDOH 2013a).

Many outbreaks are local in nature. They are recognized when a group of people discovers that they all became ill after sharing a common meal. For example, a local outbreak might follow a catered meal at a reception, a potluck supper, or a meal at an understaffed restaurant on a particularly busy day. However, outbreaks are increasingly being recognized that are more widespread, that affect persons in many different places, and that are spread out over several weeks. For example, an outbreak of salmonellosis was traced to persons eating a breakfast cereal produced at a factory in Minnesota, and marketed under several different brand names in many different states. No one county or state had very many cases, and the cases did not know each other (NJDOH 2013a).

Mumps

Mumps is a contagious disease that is caused by the mumps virus. Mumps typically starts with a few days of fever; headache, muscle aches, tiredness, and loss of appetite, and is followed by swelling of salivary glands. Anyone who is not immune from either previous mumps infection or from vaccination can get mumps (CDC 2010).

The Immunization Action Coalition states that mumps spread from person to person by saliva or mucus from the mouth, nose, or throat of an infected person, usually when the person coughs, sneezes or talks. The virus may also be spread indirectly when someone with mumps touches items or surfaces without washing their hands. The incubation period of mumps is usually 16 to 19 days, but can range from 12 to 25 days.

Norovirus

Norovirus, formerly called norwalk-like virus, is a virus that causes acute gastroenteritis in humans. The most common symptoms of norovirus are diarrhea, vomiting, and abdominal pain. Fever, chills, headache, body aches and fatigue may also be present. Symptom onset is usually abrupt, which is very characteristic of norovirus. Norovirus is very contagious, and is spread through contaminated food or water, by contact with an infected person, or by contamination of environmental surfaces. The virus has an incubation period of 24 to 48 hours. Infected individuals are symptomatic for one to two days, but may not shed the virus for up to two weeks after recovering. Norovirus outbreaks are common in schools and daycare facilities. In New Jersey, norovirus is not reportable; however, outbreaks associated with the virus are reportable (NJDOH 2013b).

Influenza

The risk of a global influenza pandemic has increased over the last several years. This disease is capable of claiming thousands of lives and adversely affecting critical infrastructure and key resources. An influenza pandemic has the ability to reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability.

Pandemic influenza is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. Pandemic influenza is caused by an influenza virus that is new to people and is likely to affect many more people than seasonal influenza. In addition, seasonal flu occurs every year, usually during the winter season, while the timing of an influenza pandemic is difficult to predict.

Pandemic influenza is likely to affect more people than the seasonal flu, including young adults. A severe pandemic could change daily life for a time, including limitations on travel and public gatherings (Barry-Eaton District Health Department 2013).

At the national level, the CDC's Influenza Division has a long history of supporting the World Health Organization (WHO) and its global network of National Influenza Centers (NIC). With limited resources, most international assistance provided in the early years was through hands-on laboratory training of in-country staff, the annual provision of WHO reagent kits (produced and distributed by CDC), and technical consultations for vaccine strain selections. The Influenza Division also conducts epidemiologic research including vaccine studies and serologic assays and provided international outbreak investigation assistance (CDC 2011).

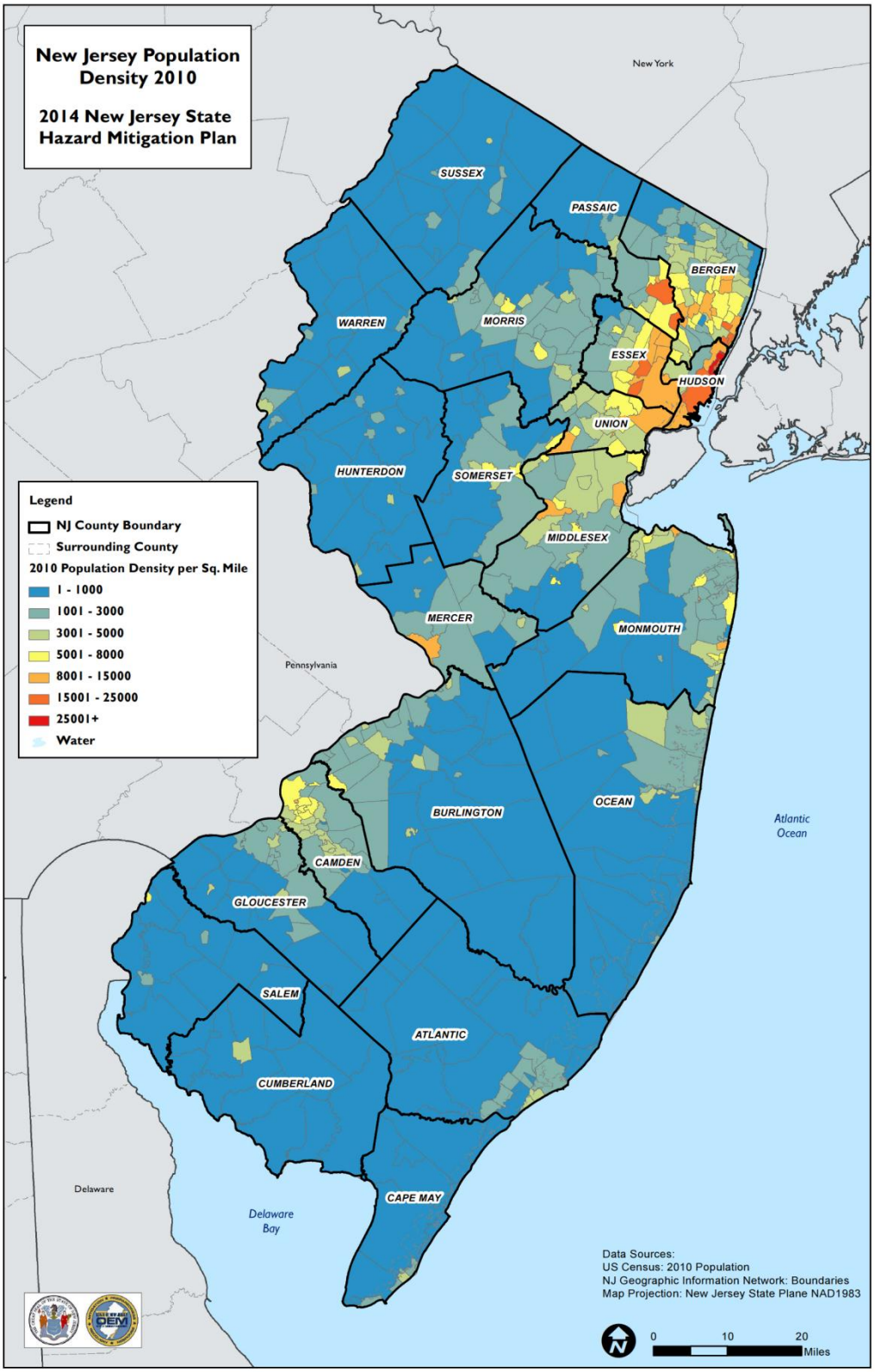
West Nile Virus

The CDC indicates that the West Nile virus (WNV) is most commonly transmitted to humans by infected mosquitoes. There are no medications to treat or vaccines to prevent WNV infection. Fortunately, most people infected with WNV will have no symptoms. About one in five people who are infected will develop a fever with no other symptoms. Less than 1% of infected people develop a serious, sometimes fatal, neurologic illness. WNV is established as a seasonal epidemic in North America that flares up in the summer mosquito season and continues into the fall. Mosquitos become infected when they feed on infected birds. The mosquitos can then spread WNV to humans and other animals when they bite. In 2012, there were 5,674 reported cases of WNV in the United States, along with 286 deaths from this disease (CDC 2013).

Location

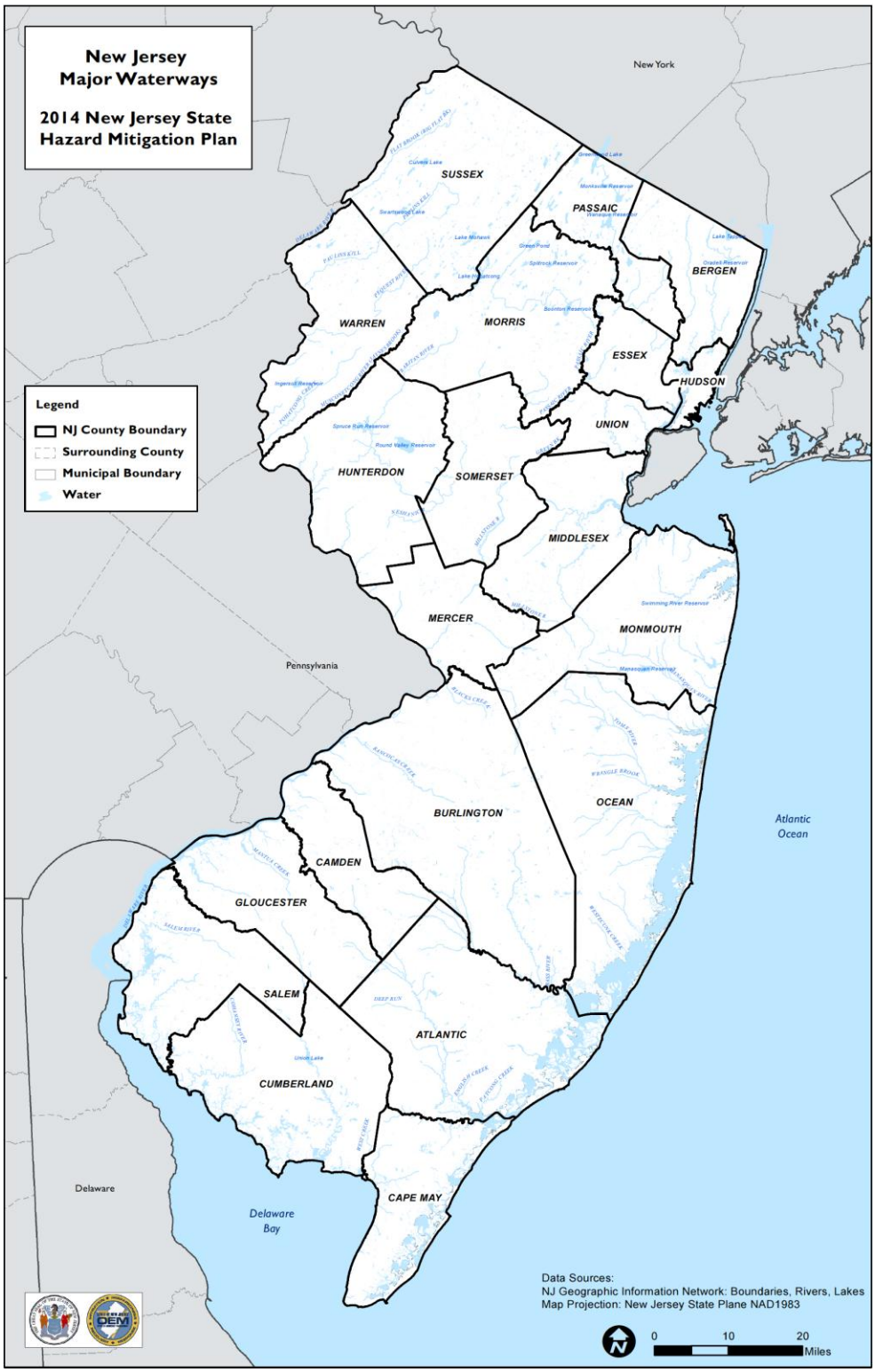
New Jersey's geographic and demographic characteristics make it particularly vulnerable to importation and spread of infectious diseases. All 21 counties in New Jersey have experienced the effects of a pandemic or disease outbreak. In terms of pandemic influenza, all counties may experience pandemic influenza outbreak caused by factors such as population density and the nature of public meeting areas. Densely populated areas will spread diseases quicker than less densely populated areas. Figure 5.21-1 shows population density throughout the State. Additionally, much of the State can experience other diseases such as WNV due to the abundance of water bodies throughout the State, which provide a breeding ground for infected mosquitos. Figure 5.21-2 shows the locations of water sources throughout the State.

Figure 5.21-1. New Jersey Population Density (United States Census 2010)



Source: United States Census 2010; New Jersey Geographic Information Network (NJGIN)

Figure 5.21-2. Water Sources in New Jersey



Source: NJGIN

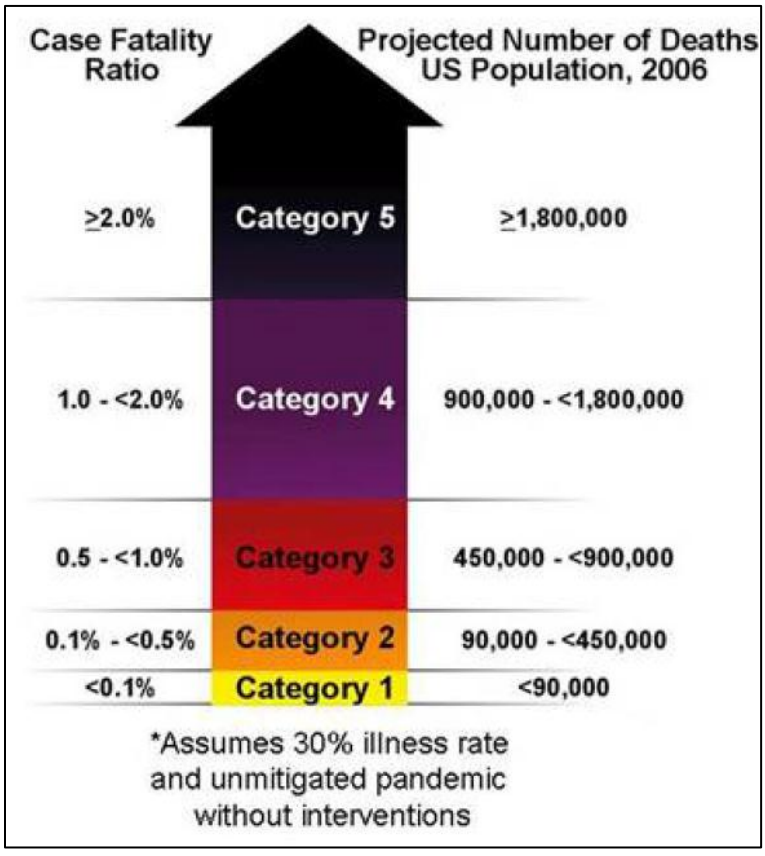
Extent

The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness.

The severity and length of the next pandemic cannot be predicted; however, experts expect that its effect on the United States could be severe. Based on previous pandemics and without medications or vaccines available, it is estimated that a severe pandemic could cause almost 2 million deaths in the United States, more than nine million hospitalizations, and more than 90 million people ill (New Jersey Department of Health [NJDOH] 2012).

The CDC and Prevention Community Strategy for Pandemic Influenza Mitigation guidance introduced a Pandemic Severity Index (PSI), which uses the case fatality ratio as the critical driver for categorizing the severity of a pandemic. The index is designed to estimate the severity of a pandemic on a population to allow better forecasting of the impact of a pandemic, and to enable recommendations on the use of mitigation interventions that are matched to the severity of influenza pandemic. Pandemics are assigned to one of five discrete categories of increasing severity (Category 1 to Category 5) (NJDOH 2012). Figure 5.21-3 illustrates the five categories of the PSI.

Figure 5.21-3. Pandemic Severity Index



Source: NJDOH 2012

In 1999, the WHO Secretariat published guidance for pandemic influenza and defined the six phases of a pandemic. Updated guidance was published in 2005 to redefine these phases. This schema is designed to provide guidance to the international community and to national governments on preparedness and response for pandemic threats and pandemic disease. Compared with the 1999 phases, the new definitions place more emphasis on pre-pandemic phases when pandemic threats may exist in animals or when new influenza virus subtypes infect people but do not spread efficiently. Because recognizing that distinctions between the two interpandemic phases and the three pandemic alert phases may be unclear, the WHO Secretariat proposes that classifications be determined by assessing risk based on a range of scientific and epidemiological data (WHO 2005). The WHO pandemic phases are outlined in Table 5.21-1.

Table 5.21-1. WHO Global Pandemic Phases

Phase	Description
Interpandemic Phase	
Phase 1	No new influenza virus subtypes have been detected in humans. An influenza virus subtype that has caused human infection may be present in animals. If present in animals, the risk of human infection or disease is considered to be low.
Phase 2	No new influenza virus subtypes have been detected in humans. However, a circulating animal influenza virus subtype poses a substantial risk of human disease.
Pandemic Alert Period	
Phase 3	Human infection(s) are reported with a new subtype, but no human-to-human spread or at most rare instances of spread to a close contact.
Phase 4	Small cluster(s) of influenza with limited human-to-human transmission, but spread is highly localized, suggesting that the virus is not well adapted to humans.
Phase 5	Larger cluster(s) of influenza but human-to-human spread is still localized, suggesting that the virus is becoming increasingly better adapted to humans but may not yet be fully transmissible (substantial pandemic risk).
Pandemic Period	
Phase 6	Disease has increased and sustained transmission in the general population.
Postpandemic Period	
	Return to the Interpandemic Period (Phase 1)

Source: WHO2005

In New Jersey, health and supporting agency responses to a pandemic are defined by the WHO phases and federal pandemic influenza stages, and further defined by New Jersey pandemic situations. The State's situations are similar, but not identical to the United States Department of Homeland Security federal government response stages. Transition from one situation to another indicates a change in activities of one or more New Jersey agencies. Table 5.21-2 compares the federal and New Jersey pandemic influenza phases and situations.

Table 5.21-2. Federal and New Jersey Pandemic Phases and Situations

Federal Pandemic Influenza Stage		New Jersey Situations	
0	New domestic outbreak in at-risk country (WHO Phase 1, 2, or 3)	1	Novel (new) influenza virus in birds or other animals outside the U.S.
		2	Novel (new) influenza virus in birds or other animals in the U.S./NJ
1	Suspected human outbreak overseas (WHO Phase 3)	3	Human case of novel (new) influenza virus outside of the U.S.
2	Confirmed human outbreak overseas (WHO Phase 4 or 5)	4	Human-to-human spread of novel (new) influenza outside the U.S. (no widespread human transmission)
		5	Clusters of human cases outside the U.S.
3	Widespread human outbreak in multiple locations overseas (WHO Phase 6)		
4	First human case in North America (WHO Phase 6)	6	Human case of novel (new) influenza virus (no human spread) in the U.S./NJ
5	Spread in the U.S. (WHO Phase 6)	7	First case of human-to-human spread of novel (new) influenza in the U.S./NJ
		8	Clusters of cases of human spread in the U.S./NJ
		9	Widespread cases of human-to-human spread of novel (new) influenza outside the U.S./NJ
6	Recovery and preparation for subsequent waves (WHO Phase 5 or 6)	10	Reduced spread of influenza or end of pandemic

Source: Homeland Security Council 2006; NJDOH 2012
NJ New Jersey
U.S. United States
WHO World Health Organization

Previous Occurrences and Losses

Three major influenza pandemics affected areas across the globe in the 20th century, causing millions of deaths. New Jersey saw the impacts of these pandemics. If a new influenza virus were to begin spreading throughout the world, New Jersey could experience more than 50,000 deaths, more than 275,000 people hospitalized, and more than 2.5 million people ill (NJDOH 2012).

Because the 2011 State HMP did not discuss specific pandemic events, this Plan update includes pandemic events that occurred in the State from January 1, 2010 to December 31, 2012. Table 5.21-3 provides detail events on those events where information was readily available, including events prior to 2010. However, this table does not include all incidents.

Table 5.21-3. Previous Occurrences and Losses

Date(s) of Event	Event Type	Counties Affected	Description
1918-1919	1918 "Spanish" Influenza Pandemic	Statewide	The influenza pandemic of 1918-1919 caused between 20 and 40 million deaths, more than World War I. This pandemic has been cited as the most devastating epidemic in recorded history. More people died of influenza in a single year than in the four years of the Black Death Bubonic Plague from 1347 to 1351. Known as "Spanish Flu" or "La Grippe" the influenza of 1918-1919 was a global disaster. The first person to fall victim to influenza in New Jersey was a soldier at Fort Dix who had just returned from Europe. From Fort Dix, the disease spread rapidly throughout the State. By September 27, 1918, the State health officer announced that the disease "was unusually prevalent" throughout New Jersey. The State was reporting that 2,000 cases had been reported in the preceding three days. On October 10, State officials formally banned all public gatherings. By October 15, officials had reported 88,256 cases of influenza. By the October 22, State authorities estimated that there were at least 149,540 cases, with 4,398 deaths being officially reported. On October 22, the pandemic peaked in New Jersey. On that day, there were 7,449 new cases and 366 deaths. The situation slowly improved after the third week of October.
1976	1976 Fort Dix Swine Influenza A Outbreak	Burlington	In early 1976, the novel A/New Jersey/76 (Hsw1N1) influenza virus caused severe respiratory illness in 13 soldiers with one death at Fort Dix. Because A/New Jersey was similar to the 1918–1919 influenza pandemic, rapid outbreak assessment and enhanced surveillance were initiated. A/New Jersey virus was detected only from January 19 to February 9 and did not spread beyond Fort Dix. A/Victoria/75 (H3N2) spread simultaneously, also caused illness, and persisted until March. Up to 230 soldiers were infected with the A/New Jersey virus. Rapid recognition of A/New Jersey, swift outbreak assessment, and enhanced surveillance resulted from excellent collaboration between Fort Dix, New Jersey Department of Health, Walter Reed Army Institute of Research, and CDC personnel.
1999-2002	West Nile Virus Outbreak	Statewide	WNV was identified in New York City in 1999, and spread rapidly across the United States, with human disease documented in 39 states and the District of Columbia. In 2002, WNV spread westward and activity was reported in all but six states (Arizona, Utah, Nevada, Oregon, Alaska, and Hawaii) and triggered the largest human arboviral encephalitis epidemic in U.S. history. From June 10 to December 31, 2002, there were 4,156 cases of WNV (including 284 deaths) reported in 39 states and the District of Columbia. In 2000, New Jersey received an Emergency Declaration from FEMA to deal with the incident.
2008	Mumps	Ocean County	On September 26, the NJDHSS was informed of eight suspected mumps cases in two Ocean County private schools. By October 30, a total of 40 cases were reported; the median age of patients was 19.5 years old.
2009	Global H1N1 Pandemic	Statewide	The first novel H1N1 patient in the United States was confirmed by laboratory testing at CDC on April 15, 2009. The second patient was confirmed on April 17, 2009. It was quickly determined that the virus was spreading from persontoperson. On April 22, the CDC activated its Emergency Operations Center to better coordinate the public health response. On April 26, 2009, the U.S. government declared a public health emergency and began actively and aggressively implementing the country's pandemic response plan. By June 19, 2009, all 50 states in the United States, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands had reported novel H1N1 infection. While nationwide U.S. influenza surveillance systems indicate that overall influenza activity was decreasing in the country at this time, novel H1N1 outbreaks were ongoing in parts of the United States, in some cases with intense activity. On June 11, 2009, the WHO signaled that a global pandemic of H1N1 was underway by raising the

Date(s) of Event	Event Type	Counties Affected	Description
			worldwide pandemic alert level to Phase 6. This action was a reflection of the spread of the new H1N1 virus, not the severity of illness caused by the virus. At the time, more than 70 countries had reported cases of novel influenza A (H1N1) infection and there were ongoing community level outbreaks of novel H1N1 in multiple parts of the world. In total there were 18,306 lab-confirmed deaths as a result of H1N1 worldwide. In the United States between April 2009 and August 2009 there were 9,079 cases that required hospitalization and 593 deaths. In New Jersey, cases were widespread in July 2009, with 1,414 confirmed cases and 15 deaths.
January – February 2011	*Escherichia coli* O157:H7	N/A	Between January 10 and February 15, 2011, a total of 14 persons were infected with the outbreak strain of *Escherichia coli* O157:H7 were reported in five states, including two reports in New Jersey. Three of the 14 were hospitalized; no deaths occurred. The outbreak was associated with Lebanon bologna.
February – September 2011	*Salmonella* Heidelberg	N/A	Between February 27 and September 13, 2011, a total of 136 persons infected with the outbreak strain of *Salmonella* Heidelberg were reported from 34 states, including one report in New Jersey. Ill persons ranged in age from less than one year old to 90years old. Thirty-seven people were hospitalized; one death was reported.
April – November 2011	*Salmonella* Heidelberg	N/A	Between April 1 and November 17, 2011, a total of 190 illnesses occurred due to *Salmonella* Heidelberg that was linked to kosher broiled chicken livers. Sixty-two of those illnesses were reported in New Jersey. Ill person's ages ranged from less than 1 year old to 97 years old. Thirty of the infected people were hospitalized.
August 2011	*Salmonella* Enteritidis	N/A	A total of 43 individuals infected with the outbreak strain of *Salmonella*Enteritidis were reported from five states, including two cases in New Jersey. Ill persons ranged in age from less than one year old to 94 years old. Two patients were hospitalized; no deaths occurred. The outbreak was linked to Turkish pine nuts purchased from bulk bins at Wegmans grocery stores.
January 2012	Norovirus Outbreak	Cumberland, Mercer	A norovirus outbreak impacted New Jersey during the early part of 2012. In January, medical staff at Cumberland Manor (Cumberland County) declared the third floor of the nursing home quarantined, as 34 of the 55 residents contracted the norovirus. Four of the residents were sent to the hospital. In February, an outbreak was reported at Rider and Princeton Universities. At Rider University (Mercer County), approximately 123 cases were reported and 40 students were sent to the hospital for treatment. At Princeton University (Mercer County), an unusually severe norovirus outbreak struck the University. At least 190 students came down with norovirus. This was the largest outbreak at the University in 10 years. The last outbreaks were in 2002 (73 students sick), 2004 (110 students sick), and 2008 (60 students sick).
January – June 2012	*Salmonella* Infantis	N/A	Between January 4 and June 26, 2012, a total of 49 individuals (human) were infected with the outbreak strain of *Salmonella* Infantis linked to multiple brands of dry dog food produced by Diamond Pet Foods produced at a facility in Gaston, South Carolina. Ten people were hospitalized; there were no deaths. Twenty states reported an outbreak, including two cases in New Jersey. Ill persons ranged in age from less than 1 year old to 82 years old.
January – July 2012	*Salmonella* Bareillyand *Salmonella* Nchanga	N/A	Between January 1 and July 7, 2012, a total of 425 individuals were infected with the outbreak strain of *Salmonella* Bareillyand *Salmonella* Nchanga. Twenty-eight states reported outbreaks, included 46 cases in New Jersey. The outbreaks were associated with an imported frozen raw yellowfin tuna product, known as

Date(s) of Event	Event Type	Counties Affected	Description
			Nakaochi Scrape, from Moon Marine USA Corporation. Ill persons ages ranged from less than 1 year old to 86 years old.
March-September 2012	*Salmonella* Infantis, *Salmonella* Newport, and *Salmonella* Lille	N/A	Between March 1, 2012 and September 24, 2012, a total of 195 individuals were infected with the outbreak strain of *Salmonella* Infantis, *Salmonella* Newport, and *Salmonella* Lille. Twenty-seven states reported an outbreak, including five cases in New Jersey. The outbreak was linked to chicks, ducklings, and other live poultry from Mt. Healthy Hatchery in Ohio. Ill persons ranged in age from less than 1 year old to 100 years old.
March-October 2012	*Listeria monocytogenes* Outbreak	N/A	Between March 28, and October 6, 2012, a total of 22 individuals were infected with the outbreak strain of Listeria monocytogenes. Ricotta salata cheese was the likely source of this outbreak. Thirteen states reported an outbreak, including three cases in New Jersey. Twenty of the persons infected were hospitalized, nine were related to pregnancy, and three were diagnosed in newborns. The others ranged from 30 years old to 87 years old.
June-September 2012	*Salmonella* Bredeney	N/A	Between June 14 and September 21, 2012, a total of 42 individuals were infected with the outbreak strain of *Salmonella*Bredeney. The outbreak was linked to Trader Joe's Valencia Peanut Butter. Twenty states reported an outbreak, including two cases in New Jersey. Ill persons ranged in age from less than 1 year old to 79 years old, with a median age of 7 years old.
July-September 2012	*Salmonella* Braenderup, *Salmonella*Typhimurium and Newport	N/A	Between July 3and September 1, 2012, a total of 127 individuals were infected with the outbreak of *Salmonella*Braenderup linked to mangoes originating from Agricola Daniella of Sinaloa, Mexico. Fifteen states reported an outbreak, including one case in New Jersey. Ill persons ranged in age from less than 1 year old to 86 years old. Between July 6 and September 16, 2012, a total of 261 individuals were infected with the outbreak of *Salmonella*Typhimurium and Newport linked to cantaloupe originating from Chamberlain Farms Produce in Owensville, Indiana. Twenty-four states reported an outbreak, including two cases in New Jersey. Ill persons ranged from less than one year old to 100 years old.
2012	West Nile Virus Outbreak	Statewide	During the summer-fall months of 2012, the worst WNV outbreak in the United States occurred. As of December 11, 2012, 48 states reported WNV infections in people, birds, or mosquitoes. A total of 5,387 cases of WNV in people, including 243 deaths, have been reported to CDC. Of these, 2,734 (51%) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 2,653 (49%) were classified as non-neuroinvasive disease. In New Jersey, there were 46 positive test results.

Sources: Billings 1997; DHHS 2013; CDC 2008; CDC 2009; WHO 2010; CDC 2011; Laday 2012; Jaslow 2012; Rochabrun 2012; Rochabrun 2012; CDC 2012

Notes:

CDC Center for Disease Control and Prevention
DHHS Department of Health and Human Services
N/A Not available
U.S. United States
WHO World Health Organization
WNV West Nile virus

FEMA Disaster Declarations

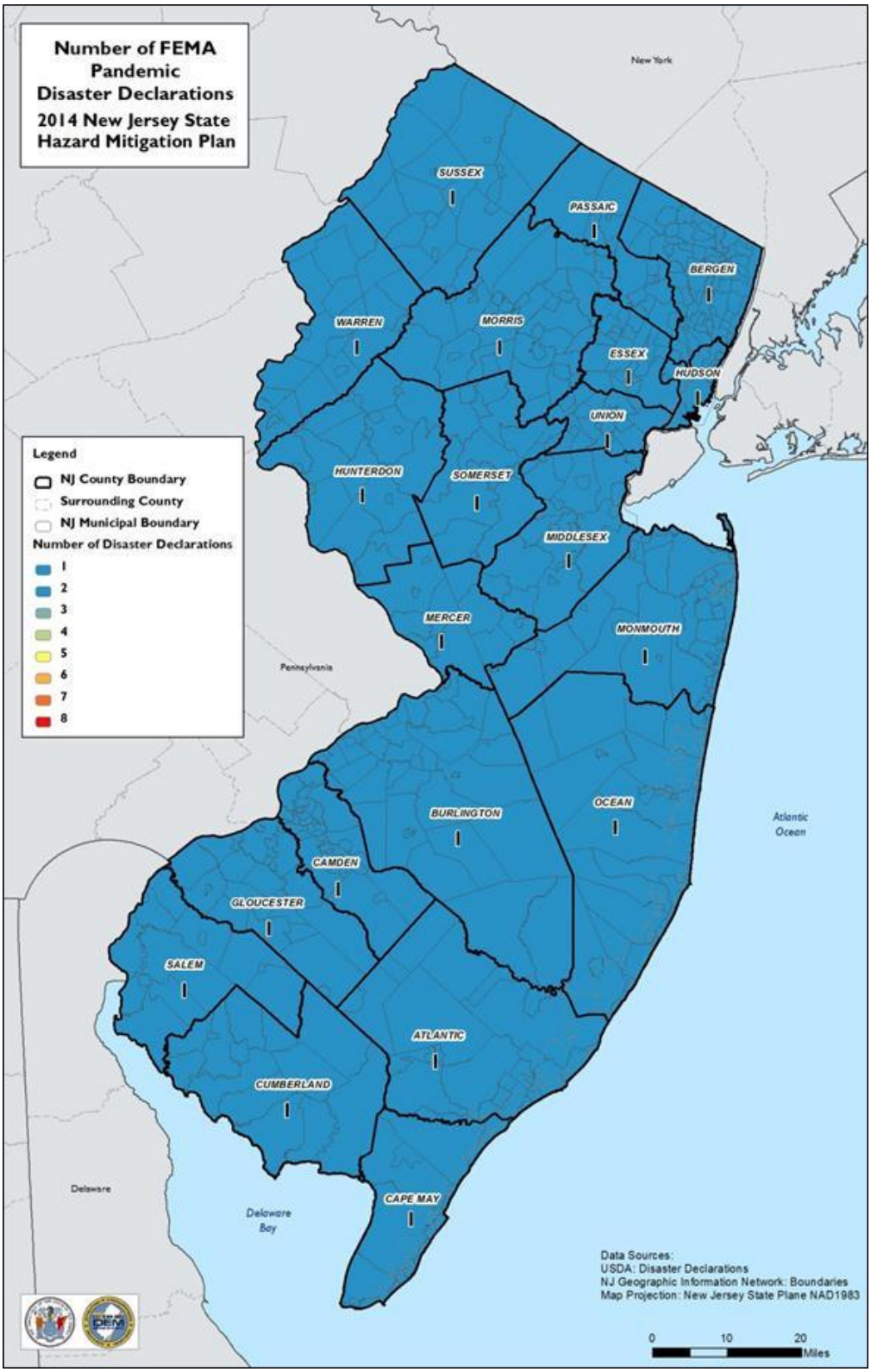
Between 1954 and 2012, FEMA declared one pandemic-related disaster (DR) or emergency (EM) in the State of New Jersey. This declaration, for the West Nile Virus human arboviral encephalitis epidemic, is identified in Table 5.21-4. Figure 5.21-4 illustrates the number of FEMA-declared disasters by County.

Table 5.21-4. FEMA Pandemic-Related Disaster Declarations, 1954 to 2012

Disaster #	Disaster Type	Declaration Date	Incident Period	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	# Counties Impacted
EM-3156	New Jersey Virus Threat	12/1/2000	5/30/2000 – 11/1/2000	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**21**

Source: FEMA 2013

Figure 5.21-4. Number of FEMA-Declared Pandemic Disasters by County, 1954 to 2012



Source: FEMA 2013

Probability of Future Occurrences

It is difficult to predict when the next pandemic will occur and how severe it will be because influenza viruses are always changing. The United States and other countries are constantly preparing to respond to pandemic influenza. The Department of Health and Human Services and others are developing supplies of vaccines and medicines. In addition, the United States has been working with the WHO and other countries to strengthen detection of disease and response to outbreaks. Preparedness efforts are ongoing at the national, State, and local level (Barry-Eaton District Health Department 2013).

In New Jersey, the probability for a future event is dependent on several factors. One factor that influences the spread of disease is population density. Populations that live close to one another are more likely to spread diseases. As population density increases in the State, so too will the probability of a pandemic event occurring.

Future occurrences of WNV are difficult to predict. Instances of the virus have been generally decreasing because of aggressive planning and eradication efforts, but some scientists suggest that as global temperatures rise and extreme weather conditions emerge from climate change, the range of the virus in the United States will grow (Epstein 2001).

Severity

The severity of a pandemic or infectious disease threat in New Jersey will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemics around the nation have the potential to affect New Jersey's populated areas.

Pandemic influenza is easily transmitted from person to person, but advances in medical technologies have greatly reduced the number of deaths caused by influenza. In terms of lives lost, the impact various pandemic influenza outbreaks have had globally over the last century has declined. The severity of illness from the 2009 H1N1 influenza flu virus has varied, with the gravest cases occurring mainly among those populations considered be at highest risk. Vulnerable, high-risk populations include children, the elderly, pregnant women, and patients with chronic diseases and reduced immune system capacity. Most people infected with H1N1 in 2009 have recovered without needing medical treatment. However, the virus has resulted in many deaths. According to the CDC, about 70% of those who have been hospitalized with the 2009 H1N1 flu virus in the United States belonged to a high-risk population group (CDC 2009).

The magnitude of a pandemic may be exacerbated by the fact that an influenza pandemic will cause outbreaks across the United States, limiting the ability to transfer assistance from one jurisdiction to another. Additionally, effective preventative and therapeutic measures, including vaccines and other medications, will likely be in short supply or will not be available.

During a pandemic wave in a community, during a six to eight week outbreak, between 25% and 30% of persons will become ill. Among working-aged adults, illness attack rates will be lower than in the community as a whole. A CDC model suggests that at the peak of pandemic disease, about 10% of the workforce will be absent because of illness or caring for an ill family member. Impacts will likely vary between communities and work sites and may be greater if significant absenteeism occurs because persons stay home for fear of becoming infected (Global Security 2011).

Warning Time

Pandemics are inevitable and arrive with very little warning. Air travel could hasten the spread of a new virus and decrease the time available for implementing interventions. Outbreaks are expected to occur

simultaneously throughout much of the United States, preventing shifts in human and material resources that usually occur in response to other disasters. Warning time for influenza will depend the origin of the virus and the amount of time needed to identify the virus.

Secondary Hazards

Secondary hazards related to pandemics are related to an outbreak's direct impact on the population of New Jersey. Directly affected will be the State's critical infrastructure and healthcare systems. Approximately 10% of the workforce will be absent at a given time during a pandemic. Without workers to fulfill key roles during a pandemic, secondary effects may include utility failures and other critical infrastructure disruptions.

Maintaining certain key functions is important to preserve life and decrease societal disruption. Heat, clean water, waste disposal, and corpse management all contribute to public health. Ensuring functional transportation systems also protects health by making it possible for people to access medical care and by transporting food and other essential goods (Global Security 2011).

Critical infrastructure groups have a responsibility to maintain public health, include public safety or transportation of medical supplies and food, implementing a pandemic response, and maintaining societal functions. Public safety workers include police, fire, 9-1-1 dispatchers, and correctional facility staff. Utility workers are essential for maintenance of power, water, and sewage system functioning. Transportation workers transport fuel, water, food, and medical supplies as well as provide public transportation. Telecommunications is essential in network operations and maintenance as well as public service communications regarding health and safety measures for citizens to take. Without workers, these systems will fail (Global Security 2011).

Mortuary services will be substantially impacted due to the increased numbers of deaths from a pandemic and the fact that impact will be high in the elderly, a growing segment of the population. The timely, safe, and respectful disposition of the deceased is an essential component of an effective response. Pandemic influenza may quickly rise to the level of a catastrophic incident that results in mass fatalities, which will place extraordinary demands (including religious, cultural, and emotional burdens) on local jurisdictions and the families of the victims. Without sufficient numbers of these workers, secondary diseases may emerge and impact the State further (Global Security 2011).

The healthcare system will be severely taxed if not overwhelmed from the large number of illnesses and complications from influenza requiring hospitalization and critical care. CDC models estimate increases in hospitalization and intensive care unit demand of more than 25%, even in a moderate pandemic. In a pandemic, everything from syringes to hospital beds, respirators, masks, and protective equipment would be in short supply. Ventilators will be the most critical shortage in a pandemic (Global Security 2011).

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

The New Jersey Climate Adaptation Alliance is a network of policymakers, public and private-sector practitioners, academics, non-governmental organizations (NGO), and business leaders aligned to build climate change preparedness in the state of New Jersey. The Alliance is facilitated by Rutgers University, which provides science and technical support, facilitates the Alliance's operations and advances its recommendations. A document titled *Change in New Jersey: Trends and Projections* was developed to

identify recommendations for State and local public policy that will be designed to enhance climate change preparedness and resilience in New Jersey (Rutgers 2013).

Temperatures in the Northeast United States have increased 1.5 degrees Fahrenheit (°F) on average since 1900. Most of this warming has occurred since 1970. The State of New Jersey, for example, has observed an increase in average annual temperatures of 1.2°F between the period of 1971-2000 and the most recent decade of 2001-2010 (ONJSC 2011). Winter temperatures across the Northeast have seen an increase in average temperature of 4 °F since 1970 (Northeast Climate Impacts Assessment [NECIA] 2007). By the 2020s, the average annual temperature in New Jersey is projected to increase by 1.5°F to 3°F above the statewide baseline (1971 to 2000), which was 52.7°F. By 2050, the temperature is projected to increase 3°F to 5°F (Sustainable Jersey Climate Change Adaptation Task Force 2013).

ONJSC indicates that both northern and southern New Jersey have become wetter over the past century. Northern New Jersey's 1971-2000 precipitation average was over five inches (12%) greater than the average from 1895-1970. Southern New Jersey became two inches (5%) wetter late in the 20th century. Average annual precipitation is projected to increase in the region by 5% by the 2020s and up to 10% by the 2050s. Most of the additional precipitation is expected to come during the winter months (New York City Panel on Climate Change [NYCPCC] 2009). In addition, heavy precipitation events have increased in the past 20 years.

The relationship between climate change and infectious diseases is somewhat controversial. The notion that rising temperatures will increase the number of mosquitoes that can transmit malaria among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. Climate change accelerates may likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

5.21.2 Vulnerability Assessment

To understand risk, the assets exposed to the hazard are identified. This section discusses New Jersey's vulnerability, in a qualitative nature, to a pandemic. A consequence analysis for this hazard was also conducted and presented in Section 9. Impacts on the public, responders, continuity of operations, delivery of services, property, facilities and infrastructure, the environment, economic condition of the State, and the public confidence in the State's governance is discussed in Section 9in accordance with Emergency Management Accreditation Program (EMAP) standards.

Assessing Vulnerability by Jurisdiction

The entire State's population is vulnerable to the effects of a pandemic. However, areas with higher population density will have a higher exposure to contagious diseases. Additionally, vulnerable populations such as the young and elderly are considered at higher risk. Section 4 of this HMP (State Profile) includes a detailed description of the State's demographics. As noted in Section 5.1 (Risk Assessment Overview), no counties included pandemic as a hazard of concern in their hazard mitigation plans.

Assessing Vulnerability to State Facilities

While the actual structures of State buildings, critical facilities, and infrastructure will not be impacted by a pandemic or disease outbreak, the effect of absenteeism on State workers will impact State services.

Estimating Potential Losses by Jurisdiction

A pandemic would have a significant impact on the economy in New Jersey. A recent study that attempted to estimate the economic impact of a significant pandemic flu outbreak indicated that New Jersey could lose around $23.4 billion dollars, representing a 5.4% drop in the State's economy (Trust for American Health 2007).

In New Jersey, tourism at the beach towns on the coast would likely be affected, depending upon the timing of the pandemic. Table 5.21-5 outlines the projected losses from a severe flu pandemic. Table 5.21-6 breaks down economic loss by industry.

Table 5.21-5. Losses Related to Severe Flu Pandemic in New Jersey

Category	Losses
GDP Loss from Severe Pandemic	$23.4 billion
GDP Percent Loss from Severe Pandemic	5.42%
Percentage Losses Out of 50 States (Highest = 1)	35%
Losses from Workforce Absenteeism and Deaths	$11 billion
Losses to State Industries	$8.1 billion
Losses from Potential Drop in Trade	$4.3 billion
Lives Lost	71,000
Number of Illnesses	2,585,000

Source: Trust for American Health 2007
Notes:
GDP Gross Domestic Product

Table 5.21-6. Potential Losses by Industry in New Jersey During a Severe Flu Pandemic

Private Industry/Government	2005 Annual GDP (Rounded to millions of dollars)	Demand Loss in GDP (Rounded to millions of dollars)
Agriculture, forestry, fishing, and hunting	$623,000,000	$16,000,000
Mining	$262,000,000	$7,000,000
Utilities	$7,917,000,000	-
Manufacturing	$41,034,000,000	$1,026,000,000
Wholesale trade	$34,985,000,000	$875,000,000
Retail trade	$27,766,000,000	$694,000,000
Transportation and warehousing	$12,836,000,000	$150,000,000
Information	$20,268,000,000	-
Finance and insurance	$36,808,000,000	$920,000,000
Real estate, rental, and leasing	$69,515,000,000	-
Professional and technical services	$35,770,000,000	-
Management of companies and enterprises	$9,242,000,000	-
Administrative and waste services	$13,804,000,000	-
Educational services	$3,694,000,000	$92,000,000
Health care and social assistance (increase)	$30,661,000,000	$1,150,000,000
Arts, entertainment, and recreation	$3,805,000,000	$761,000,000
Accommodation and food services	$10,888,000,000	$2,178,000,000
Other services, except government	$9,125,000,000	$114,000,000
Government	$44,228,000,000	-

Source: Trust for American Health 2007
Notes: GDP = Gross Domestic Product; Demand losses are for a three-month period.

Estimating Potential Losses to State Facilities

Procedures for continuity of government operations will need to be implemented during a pandemic. A CDC model suggests that approximately 10% of the workforce will be ill or caring for an ill family member at the peak of a pandemic disease (United States Department of Health and Human Services 2005). According to Census data, in 2010 there were 150,300 State workers in New Jersey. A 10% absentee rate would mean that a shortage of 15,300 State employees would impact State facilities and thus the services they provide.

Similar to State buildings, the most significant impact on critical facilities would be employees who are unable to come to work resulting in a loss of service. Using the CDC absentee rate of 10% of the population, and the 2010 census data, the following table illustrates critical infrastructure industries and the impact of a pandemic. Table 5.21-7 presents the number of ill workers based on the 10% estimate discussed.

Table 5.21-7. Approximate Critical Facility Absent Workers During a Pandemic

Industry	Workforce Statewide	Number of Ill Workers
Admin Support/Waste Mgt/ Remediation Services	238,600	23,860
Health Care and Social Assistance	511,300	51,130
Utilities	14,200	1,420
	Total	**76,410**

Source: United States Census 2010

In addition, an increase in hospitalization and emergency room visits will take place as a result of the outbreak, creating a greater demand on these critical facilities, their staff, and resources. CDC's model estimates increases of more than 25% in the demand for hospitalization and intensive care unit services, even in a 'moderate pandemic' (United States Department of Health and Human Services 2005). As noted in Table 5.21-5 above, an estimated $8.1 billion is projected for losses to State industries in New Jersey as a result of a severe pandemic.

Environmental Impacts

The type of disease pandemic will determine the severity of any effect on the environment. Diseases which are transmitted from man to animals or animals to man (zoonotic) may have agricultural impacts. Sixty percent of emerging infection diseases that affect humans are zoonotic, they originate in animals; with more than two-thirds originating in wildlife. Environmental hazards include infected livestock and poultry populations. With more catastrophic disease pandemics the necessity for mass burials of animals or humans may impact the environment as well (CDC 2013; NJ HMP 2011).