

4.3.2 Disease Outbreak

Hazard Profile

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the disease outbreak hazard in Rockland County.

Hazard Description

A pandemic is a global outbreak of disease that occurs when a new virus emerges in the human population, spreading easily in a sustained manner, and causing serious illness. An epidemic describes a smaller scale infectious outbreak, within a region or population, that emerges at a disproportional rate. Infectious disease outbreaks may be widely dispersed geographically, impact large numbers of the population, and could arrive in waves lasting several months at a time (Columbia University 2021).

Rockland County has a history of pandemics, epidemics, and disease outbreaks. For the purposes of this hazard mitigation plan update, the following infectious diseases will be discussed in further detail: Influenza, West Nile Virus (WNV), Lyme Disease, and Coronavirus.

Influenza

Influenza is a contagious virus that affects the nose, throat, lungs, and other parts of the body. It can quickly spread from one person to another, causing mild to severe illness and can lead to death. Symptoms include fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headache, and tiredness (NYSDOH 2021).

Pandemic influenza differs from seasonal influenza (or ‘the flu’) because outbreaks of seasonal flu are caused by viruses already living amongst people. Pandemic influenza is a global outbreak of a new influenza virus, which can infect people easily and spread from person to person in an efficient and sustained manner (CDC 2020). Additionally, the seasonal flu happens annually and usually peaks between December and February, whereas a pandemic influenza does not occur as regularly.

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

West Nile Virus

West Nile Virus (WNV) is the leading cause of mosquito-borne disease in the United States. It is most spread to people who are bitten by an infected mosquito. WNV is usually diagnosed during mosquito season, starting in the summer and continuing through the fall (CDC 2021). WNV was first found in the State of New York in 1999. Between 2000 and 2017 (most recent available data), 490 human cases and 37 deaths of WNV have been reported statewide (NYS DOH 2017). When WNS progresses to severe infection it is called West Nile encephalitis or meningitis, which can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. WNV can cause serious illness, and in some cases, death. Usually, symptoms occur from three to 14 days after being bitten by an infected mosquito (NYS DOH 2017).

Lyme Disease

Lyme disease is the most common vector-borne disease (vectors are mosquitoes, ticks, and fleas that spread pathogens) in the United States. This disease is caused when an individual is bitten by a tick carrying a specific bacterium (either *Borrelia burgdorferi* and rarely, *Borrelia mayoni*). Typical symptoms include fever, headache, fatigue, and skin rash. If left untreated, symptoms can be severe. Most cases of Lyme disease can be treated successfully with a few weeks of antibiotics. Steps to prevent Lyme disease include using insect repellent, removing ticks promptly, applying pesticides, and reducing tick habitat (CDC 2022). In New York, the commonly infected tick is the deer tick. Immature ticks become infected by feeding on infected white-footed mice and other small mammals. Deer ticks can also spread other tick-borne diseases. Anyone who is bitten by a tick carrying the bacteria can become infected (NYS DOH 2019).

Coronavirus

Coronaviruses are a type of virus. There are many different kinds, and some cause disease. Coronaviruses are spread through droplets and virus particles released into the air when an infected person breathes, talks, laughs, sings, coughs, or sneezes. Larger droplets may fall to the ground in a few seconds, but tiny infectious particles can linger in the air and accumulate in indoor places, especially where many people are gathered and there is poor ventilation (John Hopkins University 2022).

Coronavirus disease (Covid-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illnesses (WHO 2022). The Covid-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes.

Reported illnesses have ranged from mild symptoms to severe illness and death. Reported symptoms include difficulty breathing and shortness of breath, fever or chills, cough, fatigue, muscle or body aches, loss of smell or taste, sore throat, congestion, and nausea or vomiting. Emergency symptoms that require immediate medical attention include trouble breathing, persistent pain or pressure in the chest, confusion, or inability to wake or stay awake, and bluish lips or face. Symptoms may appear two to 14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC 2021).

Location

Disease outbreaks can occur without regard for location, therefore can occur throughout Rockland County.

Extent

The extent of disease outbreaks depend on the preferred habitat of the species, as well as the species' ease of movement and establishment. The magnitude of disease outbreaks ranges from nuisance to widespread. The exact size and extent of an infected population depend 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, and whether a vaccine, cure, or treatment is available. The threat is typically intensified when the ecosystem or host species is already stressed, such as during periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted by an infestation.

The severity and length of the next pandemic cannot be predicted; however, experts anticipate that its effect on the United States could be severe.

The World Health Organization (WHO) has identified the six phases of a global pandemic (World Health Organization 2009). Phases 1 to 3 and 5 to 6 have been grouped to include common action points. The WHO pandemic phases are outlined in Table 4.3.2-1 below.

New York State uses WHO classification system guidance to inform its activities during a pandemic event.

Table 4.3.2-1. WHO Global Pandemic Phases

Phase	Description
Preparedness and Response– Global, Regional, National, Sub-National Level	
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Containment	
Phase 4	Human-to-human transmission (H2H) of an animal or human-animal influenza reassortant virus able to sustain community-level outbreaks has been verified.
Response – Global Level	
Phase 5	The same identified virus has caused sustained community-level outbreaks in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in Phase 5, the same virus has caused sustained community-level outbreaks in at least one other country in another WHO region.
Post-Pandemic	
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible New Wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post-Pandemic Period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance

Source: World Health Organization 2009

Influenza

The United States Environmental Protection Agency (US EPA) has noted fine droplets and particles spread and accumulate more rapidly in an indoor setting. Therefore, the transmission of respiratory illness from contact with infected individuals is more likely to occur in indoor spaces. Seasonal flu epidemics occur yearly, typically beginning at the end of October and continuing through the colder months (NYS DOH 2023).

West Nile Virus

West Nile Virus (WNV) disease is spread by the bite of a mosquito infected with the virus. Mosquitos become infected when they feed on infected birds (NYS DOH 2017). The West Nile Virus cases will increase in portions of the state during the late summer and early fall seasons. There are no vaccines to prevent or medications to treat WNV in people, and those infected rarely experience sickness or symptoms.

Lyme Disease

Most cases of Lyme disease in New York are reported from May through August, which corresponds to the peak activity period for nymphs. This suggests that the majority of Lyme disease cases are transmitted by nymphal deer

ticks. Young deer ticks, called nymphs, are active from mid-May to mid-August and are about the size of poppy seeds. Adult ticks, which are approximately the size of sesame seeds, are most active from March to mid-May and from mid-August to November. Both nymphs and adults can transmit Lyme disease. Ticks can be active any time the temperature is above freezing (NYS DOH 2023).

Coronavirus

Similar to influenza, coronaviruses are spread through droplets and virus particles released into the air when an infected person breathes, talks, laughs, sings, coughs, or sneezes, which is more likely to occur in indoor spaces.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2023, Rockland County was included in three major disaster (DR) or emergency (EM) declarations for disease outbreak-related events (FEMA 2023). For declarations that occurred between 2017 and 2023, refer to Table 4.3.2-2. Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

Table 4.3.2-2. FEMA Declarations for Disease Outbreak Events in Rockland County (2017 to 2023)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Rockland County included in declaration?	Location Impacted	Description
January 20, 2020 - May 11, 2023	Pandemic: Coronavirus	EM-3434-NY	Yes	County-wide	New York Covid-19
January 20, 2020 - May 11, 2023	Pandemic: Coronavirus	DR-4480-NY	Yes	County-wide	New York Covid-19 Pandemic

Sources: FEMA 2023

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2018 and 2023, Rockland County was not included in any disease outbreak-related agricultural disaster declarations.

Previous Events

For this 2024 HMP update, known hazard events that impacted Rockland County between January 2017 and December 2023 are discussed in Table 4.3.2-3. For events prior to 2017, refer to the 2018 Rockland County HMP.

Table 4.3.2-3. Hazard Events in Rockland County (2017 to 2023)

Date(s) of Event	Event Type	Declaration Number (if applicable)	Rockland County included in declaration?	Location Impacted	Description
2017	Influenza	N/A	N/A	County-wide	666 confirmed cases of Influenza in Rockland County
2017	West Nile Virus	N/A	N/A	County-wide	1 confirmed case of West Nile Virus in Rockland County
2017	Lyme Disease	N/A	N/A	County-wide	49 confirmed cases of Lyme Disease in Rockland County
2018	Influenza	N/A	N/A	County-wide	1,487 confirmed cases of Influenza in Rockland County
2018	West Nile Virus	N/A	N/A	County-wide	1 confirmed case of West Nile Virus in Rockland County
2018	Lyme Disease	N/A	N/A	County-wide	48 confirmed cases of Lyme Disease in Rockland County
2019	Influenza	N/A	N/A	County-wide	1,912 confirmed cases of Influenza in Rockland County
2019	West Nile Virus	N/A	N/A	County-wide	1 confirmed case of West Nile Virus in Rockland County
2019	Lyme Disease	N/A	N/A	County-wide	48 confirmed cases of Lyme Disease in Rockland County
2020	Influenza	N/A	N/A	County-wide	1,961 confirmed cases of Influenza in Rockland County
2020	West Nile Virus	N/A	N/A	County-wide	1 confirmed case of West Nile Virus in Rockland County
2020	Lyme Disease	N/A	N/A	County-wide	54 confirmed cases of Lyme Disease in Rockland County
2020	Coronavirus	DR-4480-NY, EM-3434-NY	Yes	County-wide	Rockland County has reported 27,510 positive cases of Covid-19 and 587 deaths.
2021	Influenza	N/A	N/A	County-wide	1,985 confirmed cases of Influenza in Rockland County
2021	West Nile Virus	N/A	N/A	County-wide	1 confirmed case of West Nile Virus in Rockland County
2021	Lyme Disease	N/A	N/A	County-wide	51 confirmed cases of Lyme Disease in Rockland County
2021	Coronavirus	DR-4480-NY, EM-3434-NY	Yes	County-wide	Rockland County has reported 39,055 positive cases of Covid-19 and 219 deaths.
2022	Influenza	N/A	N/A	County-wide	12,114 confirmed cases of Influenza in Rockland County
2022	West Nile Virus	N/A	N/A	County-wide	1 confirmed case of West Nile Virus in Rockland County
2022	Lyme Disease	N/A	N/A	County-wide	201 confirmed cases of Lyme Disease in Rockland County
2022	Coronavirus	DR-4480-NY, EM-3434-NY	Yes	County-wide	Rockland County has reported 49,262 positive cases of Covid-19 and 115 deaths.
2023 ^a	Influenza	N/A	N/A	County-wide	3,974 confirmed cases of Influenza in Rockland County
2023 ^b	West Nile Virus	N/A	N/A	County-wide	0 confirmed cases of West Nile Virus in Rockland County
2023 ^c	Lyme Disease	N/A	N/A	County-wide	201 confirmed cases of Lyme Disease in Rockland County
2023 ^d	Coronavirus	DR-4480-NY, EM-3434-NY	Yes	County-wide	Rockland County has reported 5,489 positive cases of Covid-19 and 29 deaths.

Sources: Sources: CDC 2023; NYSDOH 2023; CDC 2022; NYS DOH 2023

Note: Lyme Disease incidences for 2022 and 2023 were unable to be identified

- a As of September 14, 2023*
 - b As of September 14, 2023*
 - c As of September 14, 2023*
 - d As of July 23, 2023*
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Probability of Future Occurrences

For the 2024 HMP update, best available data was used to collect hazard event details. These details were used to calculate the probability of future occurrence of hazard events in the County. Information from the Centers for Disease Control and Prevention, New York State Department of Health, the 2019 State of New York HMP, the 2018 Rockland County HMP, and FEMA were used to identify the number of events that occurred between 2017 and 2023. Table 4.3.2-4 provides the calculated probability of future disease outbreak events in Rockland County.

Table 4.3.2-4. Probability of Future Disease Outbreak Events in Rockland County

Hazard Type	Number of Occurrences Between 2017 and 2023	Percent Chance of Occurring in Any Given Year
Disease Outbreak	25	100 percent

Sources: CDC 2023; NYSDOH 2023; CDC 2022; NYS DOH 2023

Notes: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected disease outbreak events since 1968. Due to limitations in data, not all disease outbreak events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for Rockland County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Partnership, the probability of occurrence for disease outbreak in the County is considered ‘frequent’.

In Rockland County, the probability for a future disease outbreak 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, depending on how they are transmitted. As population density increases in the County, so too will the probability of a disease outbreak event to occur. When there is a significant change in a circulating strain of a virus, more of the population is susceptible and the strain could rapidly spread from person to person.

Another key factor in the likelihood of future events is how well-prepared Rockland County is to respond to a disease outbreak. Instances of WNV have been generally decreasing throughout the northeast United States due to planning and eradication efforts. Disease-carrying ticks will continue to inhabit Rockland County and the threat of Lyme disease and other tick-borne diseases will continue. Like mosquitoes, there are eradication efforts in place to control the tick population and new methods of control are being developed (Steere, Coburn and Glickstein 2004). Therefore, based on all available information and available data regarding mosquito and tick populations, it is anticipated that mosquito- and tick-borne diseases will continue to be a threat to Rockland County. However, vaccines are currently being developed for Lyme Disease, which may assist in slowing the contraction rates (CDC 2022).

Climate Change Projections

Some scientists anticipate an increase in WNV and other mosquito-borne diseases due to changing climate conditions creating suitable habitats for disease carriers (CDC 2013). Warmer temperatures and changing rainfall patterns provide an environment where mosquitos can remain active longer, greatly increasing the risk for animals and humans. Lyme disease could also expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The climate changes can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (NRDC 2015).

An increase in temperature and humidity may also lead to a larger number of influenza outbreaks. Studies have shown that warmer winters led to an increase in influenza cases. During warm winters, fewer people contract influenza which causes a large number in population to remain vulnerable into the next season. This causes an early and strong occurrence of the virus (Towers, et al. 2013). Temperatures in the State of New York are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across the State by 2 to 3.4 °F by the 2020s, 4.1 to 6.8 °F by the 2050s, and 5.3 to 10.1 °F by the 2080s (NYSERDA 2014). In Rockland County, it is estimated that temperatures will increase by 3.0 °F to 5.0 °F by the 2050s and 4.0 °F to 8.0 °F by the 2080s (baseline of 48.0 °F, mid-range projection) (NYSERDA 2014).

Sitting water can be a breeding ground for mosquitos, which spread diseases. Precipitation totals will increase between 0 and 10 percent by the 2050s and 0 to 15 percent by the 2080s (baseline of 48.0 inches, mid-range projection). Table 4.3.2-5 displays the projected seasonal precipitation change for the Region 2 (NYSERDA 2014).

Table 4.3.2-5. Projected Seasonal Precipitation Change in Region 2, 2050s (% change)

Winter	Spring	Summer	Fall
0 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSEDA 2014

The relationship between climate change and increase in infectious diseases is difficult to predict with certainty, but there are scientific linkages between the two. Increased rainfall and heavy rainfalls increase the chances of standing water where mosquitos breed. As flooding events increase in the County owing to climate change, water-borne and vector-borne diseases (particularly those associated with mosquitos) may similarly increase owing to the prevalence of standing water over long periods (National Geographic 2022).

The notion that rising temperatures will increase the number of ticks and mosquitoes that can transmit diseases such as Lyme disease and WNV 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 (Jordan 2019). However, a warming climate is likely to increase the length of the insect season, increasing the potential rates of transmission of insect borne disease.

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard. The following discusses Rockland County’s vulnerability, in a qualitative nature, to the disease outbreak hazard.

Impact on Life, Health, and Safety

The entire population of Rockland County is vulnerable to disease outbreak. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease due to their proximity to potentially infected people. Further, the elderly and immunocompromised individuals may have increased vulnerability to becoming infected or experience exacerbated impacts depending upon the disease.

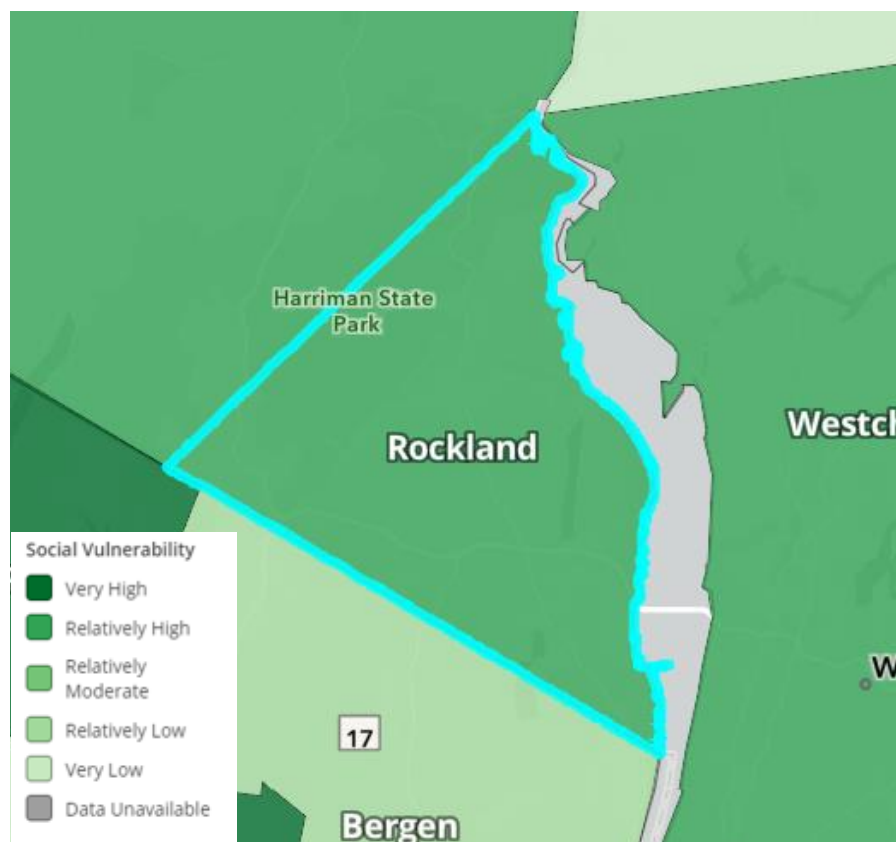
Overall Population

The entire population of Rockland County (336,485) is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard.

Socially Vulnerable Population

Most recently with Covid-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2021). According to the 2021 ACS, there are 52,060 (15.5 percent of the County's total population) persons over 65 and 49,451 (14.7 percent of the County's total population) persons living in poverty in Rockland County. For the purpose of this HMP and as determined by the Steering Committee, ALICE data for Rockland County was used to determine the number of households and individuals that earn more than the federal poverty level but not enough to afford the basics (e.g., housing, childcare, food, transportation, health care, and utilities) where they live. According to the ALICE data, there are 109,704 persons (32.6 percent of the County's total population) living below the ALICE threshold (\$48,048 annually for a single adult) for Rockland County. Figure 4.3.2-1 displays the FEMA National Risk Inventory's Social Vulnerability Index for the County of Rockland, which is identified as 'relatively high'.

Figure 4.3.2-1. FEMA Social Vulnerability Index for Natural Hazards



Source: FEMA n.d.

Impact on General Building Stock

No structures are anticipated to be directly affected by disease outbreaks.

Impact on Critical Facilities and Community Lifelines

A pandemic or disease outbreak will not be directly impact the actual structures of County and municipal buildings, critical facilities, and infrastructure. However, the effect of worker absenteeism will impact local government services.

The most significant impact on critical facilities would be the increased service demands, such as hospitalization and emergency room visit that would take place because of the outbreak. This would create a greater demand on these critical facilities, their staff, and resources. 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. Ventilators will be the most critical shortage if a respiratory outbreak were to occur (Homeland Security Council 2006).

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 (Homeland Security Council 2006). Mortuary services could be substantially impacted due to the anticipated increased numbers of deaths. The timely, safe, and respectful disposition of the deceased is an essential component of an effective response.

Impact on the Economy

The impact disease outbreaks have on the economy in estimated dollar losses is difficult to measure. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. Instead, activities and programs have been implemented by the County and State to address this hazard.

The Covid-19 pandemic had significant economic impacts across the State of New York, including Rockland County. Over the course of two months, nearly 2 million jobs as businesses were forced to close, disrupting the economy at the state, county, and local levels. Rockland County saw a 2.7 percent decrease in sales tax collection between 2019 and 2020, from \$232.2 million (2019) to \$225.9 million (2020) (Office of the New York State Comptroller 2021). As a result, Rockland County received \$63.18 million in funding through the American Rescue Plan Act of 2021 that went towards mental health services, food security initiatives, support for businesses and frontline workers, and affordable housing (Rockland County Executive 2021).

Impact on the Environment

Disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat. One study has shown that invasive mosquitos such as the Asian tiger mosquito, a common invasive mosquito found in New Jersey, have “desiccation-resistant eggs,” which means that they have enhanced survival in inhospitable environments (Juliano and Lounibos 2005). This species is considered a competitive predator and will prey on other species of mosquitos and a range of insects disrupting the natural food chain. Invasive species of mosquitos can be the major transmitters of disease like Zika, dengue, and yellow fever (CDC 2020).

Secondary impacts from mitigating disease outbreaks could also have an impact on the environment. Pesticides used to control disease carrying insects like mosquitos have been reviewed by the EPA and United States Department of Health. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. New York State Department of Environmental Conservation's (NYSDEC) Bureau of Pest Management's pesticide laws, regulations and policies ensure that pesticides are used and sold in compliance with the Environmental Conservation Law (NYSDEC 2014).

Future Changes That May Impact Vulnerability

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Potential or Project Development

Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire county is exposed. As population counts change in the County, there may be at increased risk to certain diseases. Higher concentrations of persons traveling via public transportation may become more vulnerable to the exchange of disease through airborne transmission. Increased development in rural areas may expose a higher percentage of the population to insect-borne diseases.

Projected Changes in Population

Rockland County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately 8.5 percent between 2010 and 2020 (County of Rockland 2021). Cornell University's Program on Applied Demographics projects Rockland County will have a population of 356,758 by 2030 and 372,432 by 2040 (Cornell University 2018).

An increase in population will expose more people to the pandemic hazard as residents move into area and the population exposed increases. Population density changes when households move throughout the County could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, but density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease.

Other Identified Conditions

As discussed earlier in this section, the relationship between climate change and increased infectious diseases is difficult to predict with certainty, however there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the CDC (CDC 2021). Localized changes in climate and human interaction may also be a factor in the spread of disease.

The relationship between infectious diseases occurrence and climate change is difficult to predict with certainty. However, there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease. For example, in the wake

of significant flooding events, prolonged and intense precipitation often provides breeding grounds for mosquitos that necessitate mosquito control measures.

The relationship between climate change and infectious diseases is not universally agreed upon. Climate change may affect the spread of disease, while others are not convinced. However, research indicates that 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. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

Change of Vulnerability Since 2018 HMP

Disease outbreak was not included as a hazard of concern in the 2018 HMP. However, with an increase in population it can be assumed that the vulnerability to disease outbreak events has slightly increased since 2018.