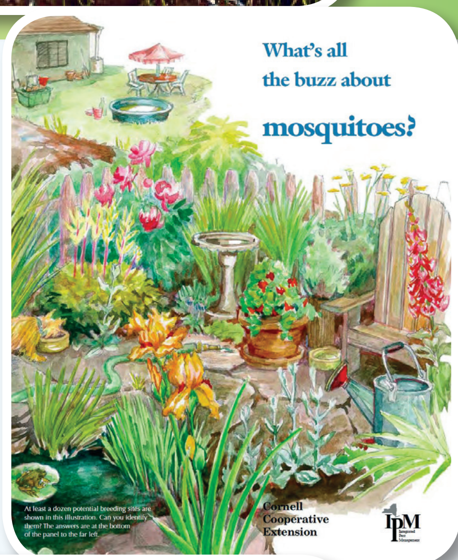

COUNTY OF NASSAU

DEPARTMENT OF PUBLIC WORKS
DEPARTMENT OF HEALTH

MOSQUITO CONTROL PLAN
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

MARCH 2017

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COUNTY OF NASSAU

DEPARTMENT OF PUBLIC WORKS

DEPARTMENT OF HEALTH

MOSQUITO CONTROL PLAN

FINAL

GENERIC ENVIRONMENTAL IMPACT STATEMENT

MARCH 2017

COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT (FGEIS)

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SECTION 1.0

EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

This section summarizes all of the major sections of the Final Generic Environmental Impact Statement (FGEIS) associated with the Nassau County Mosquito Control Program (MCP). The major topics are presented and organized in the same general sequence as the subsequent sections of the FGEIS.

1.1 Introduction

The County has planned, organized, and prepared this FGEIS in accordance with the New York State Environmental Quality Review Act (SEQRA) and the implementing regulations at 6 NYCRR Part 617. As the regulations point out, a generic environmental impact statement (GEIS) is broader, and more general than a site, or construction-specific, environmental impact statement. GEIS's are appropriate for programs or plans having wide application because they discuss the logic and rationale for the choices advanced, and can be based on conceptual information that analyzes in general terms actions that may occur. This final GEIS follows the December 2016 DGEIS and provides responses to comments.

The GEIS for the MCP is prepared to be consistent with Part 617.9; and be clearly and concisely written in plain language that can be read and understood by the public and address only those potential significant adverse environmental impacts that can be reasonably anticipated and/or have been identified in the scoping process. The FGEIS should not contain more technical detail than is appropriate considering the SEQA requirement to be concise and readily understood by the general public. Technical material deemed to be important to include has been summarized and, if necessary, has been included in its entirety as an appendix. A list of acronyms, abbreviations and references are included in Section 7.0.

Background and History

As stated in the original MCP, mosquito control began in Nassau County in 1915 as a response to mosquito-borne malarial outbreaks. The malarial threat was under control by 1920. In the 1930s, ditching became a way of draining salt marshes to reduce mosquito-breeding areas. In 1948, the Nassau County Department of Public Works (NCDPW) took over mosquito control in Nassau County. At that time existing control measures were improved by mechanizing ditching procedures, using spray trucks, and using new mosquito-control products. When the Nassau County Department of Health (NCDH) joined the Mosquito Control Program in 1996, surveillance activities were greatly enhanced, as were analytical and virus-testing abilities.

After the first reported incidence of West Nile Virus (WNV) in the County in 1999, the mosquito control program was expanded using Integrated Pest Management (IPM) principles. The IPM approach avoids the use of chemicals to control pests wherever possible. Contact pesticides (adulticides) are used only if other methods of control fail and the risk of mosquito-borne disease reaching the human population outweighs the impacts of pesticide application.

In 2006, responsibilities within the MCP were divided into Mosquito Surveillance under the direction of the NCDH and Mosquito Control conducted by the NCDPW. The NCDH assumed responsibility for mosquito trapping, surveillance and public education and outreach. The NCDPW took over physical controls such as water resource and storm water system management and maintenance as well as any necessary pesticide application.

In 2009, the County issued the original MCP. The MCP was, and continues to be, implemented as a "dynamic" plan. Much of the information in this FGEIS is derived from the MCP and subsequent updates. The most recent update of the MCP is included in its entirety in Appendix A.

Public Health Issues

The principal public health issue associated with mosquitos is West Nile Virus (WNV). Only about one in 150 people infected with WNV will develop severe illness. The severe symptoms can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. These symptoms may last several weeks, and neurological effects may be permanent. Up to 20 percent of the people who become ill have less severe symptoms such as fever, headache, and body aches, nausea, vomiting, and sometimes swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms can last for as short as a few days, though even healthy people have become sick for several weeks. Approximately 80 percent of people who are infected with WNV will not show any symptoms at all.

In addition to WNV, Eastern Equine Encephalitis (EEE) is a mosquito-borne virus that presents a threat to the health of humans, horses, and other large mammals. Mosquitoes become infected with EEE when they feed on birds that are infected with the virus. Infected mosquitoes transmit the disease to other animals when they feed on horses, humans, and other mammals. Horses and humans are not a source of infection for EEE and cannot transmit the disease. To date, there have been no confirmed human cases of EEE in Nassau County.

Recently, Zika virus has emerged as a mosquito-borne disease of concern in the Americas. The virus was first isolated in 1947 in the Zika Forest of Uganda and spread eastward across the Pacific Ocean. In 2015, the virus presented in Mexico, Central America, the Caribbean, and South America. Recently, local mosquito borne Zika virus transmission has been reported in the continental United States. Zika can infect humans. Most cases show no or mild symptoms, however; Zika can be passed from a pregnant woman to a baby causing microcephaly and other brain problems. Zika can result in Guillain-Barré syndrome in adults. In 2015-2016, there have been no locally acquired cases of Zika Virus in New York State.

Mosquito Surveillance

Surveillance of the larval and adult stages of the mosquito is integral to the success of the MCP. Two methods of monitoring actual and/or potential mosquito populations are “dipping” for larvae, and “trapping” adult mosquitoes with the Federal Center for Disease Control (CDC) light traps, gravid traps, and BG-Sentinel traps. Details of the dipping and trapping elements of the MCP are provided in Section 2.6.

1.2 Mosquito Control Plan

The NCDPW and the NCDH work together to suppress mosquito populations through mosquito surveillance and control. Both departments are committed to utilizing the IPM approach, which focuses on long-term suppression or prevention with a minimal impact on the environment and on non-target organisms.

IPM control measures emphasize prevention and promote the most environmentally benign measures such as public education, outreach, and participation and physical controls such as surface water, wetlands, and storm water system management and maintenance. Controls utilizing New York State Department of Environmental Conservation (NYSDEC)-approved larvicides or adulticides are avoided unless necessary. If aerial spraying of larvicides or adulticides is used, it is in response to an imminent public health threat (i.e., outbreak of WNV) and other control measures have proved insufficient. Such spraying would be targeted to localized, specific, problem areas, and would be subject to public notification requirements. The County's goal is to avoid the use of aerial spraying of pesticides. The County has not conducted aerial spraying of adulticide in the last six years.

The MCP is reviewed regularly to manage the mosquito program in the County. The Plan is evaluated each year based on mosquito surveillance reports, the prevalence of disease, the impact of previous control measures, and lessons learned from other programs in the region.

The purpose of the MCP is to provide the residents of the County with an integrated approach to mosquito control that maximizes prevention, and provides protection from, mosquito-borne diseases (particularly West Nile Virus) while at the same time, avoiding or minimizing adverse impacts to the natural and human environment.

The major implementation elements of the MCP are as follows:

1. Public Education, Outreach, and Participation.
2. Physical Controls such as ditch maintenance and storm water system maintenance.

3. Larviciding, as needed.

4. Adulticiding if other measures are not sufficient.

Public Education, Outreach, and Participation

Given the IPM approach of avoiding the use of chemical controls, the role of public education and outreach is the first, and most effective, line of defense, and is the least costly and least environmentally impactful approach. Simply stated, the more public awareness, education and participation, the less likely the need for chemical control. The three main goals of the public education and outreach element of the MCP are:

- To increase public awareness of mosquito-borne diseases, mosquito breeding locations, and simple preventive measures that can be taken to reduce mosquito populations and minimize impacts on human health.
- To provide information regarding routine mosquito control activities in Nassau County.
- To provide timely and accurate information in the event of a WNV public health threat and subsequent pesticide treatments.

Agency Resources

The hotline phone number of the NCDH (516-572-1211) is the main contact point for information on WNV activity. The Department's website has a page detailing the threat that WNV presents to the County, including recommendations on how to prevent infection (http://www.nassaucountyny.gov/agencies/Health/westnile.html). It also outlines the mosquito surveillance activities of the NCDPW. Throughout the mosquito season, citizens can also visit the website to see a map of the county with towns highlighted where mosquitoes have tested positive for WNV. It also contains links to the New York State Department of Health (NYSDOH) and the CDC for further information on WNV.

Mosquito-control activities are directed by the NCDPW, so all inquiries regarding mosquito nuisance complaints, stagnant water concerns or mosquito control activities (application of larvicides or pesticides) should be directed to the NCDPW (516-571-6900).

Additional information on mosquito control available to the public can be found on the following websites:

http://www2.epa.gov/mosquitocontrol	Mosquito Control USEPA
http://www.cdc.gov/ncidod/dvbid/westnile/index	National Center for Disease Control
http://npic.orst.edu/index.html	National Pesticide Information Center
http://www.health.ny.gov/diseases/west_nile_virus	NYSDOH
http://www.nysipm.cornell.edu/	NYS Integrated Pest Management Program
http://ccenassau.org/gardening/ipm	Cornel Coop Ext. Nassau County IPM

Community Notification

Nassau County Local Law No. 30-2000, Section 2) outlines notification procedures NCDH must follow for any planned adulticide spraying. It requires that the NCDH notify members of the County Legislature when the NCDH submits a request to the NYSDOH to apply aerial adulticide. Major news outlets must be notified 24 hours in advance of any planned aerial adulticide spraying. Notice must also be posted on the NCDH website at least 24 hours in advance of any spraying activity. Information released must include the timing, duration, location, and method (i.e., aerial or truck) of spraying, as well as name of pesticide to be used, health concerns of this pesticide, safety recommendations for residents, and the NCDH contact information (phone and website).

In the case of adulticide application that is cancelled and rescheduled, the legislator, media, and public are still notified 24 hours in advance of any spraying.

The NCDH has also publicized spraying dates and locations on local sources such as News 12, the Long Island Newsday newspaper, and local radio stations. Media companies are not required to disseminate information regarding spraying, but are encouraged to do so.

In the event of a public health emergency due to an outbreak of mosquito-borne diseases, NCDH notifies media outlets and publishes information on the Nassau County website.

Complaints and Inquiries

As stated previously, concerns about mosquito-borne diseases in the community can be directed to the NCDH at (516) 572-1211. Mosquito nuisance inquiries or complaints can be directed to the NCDPW at (516) 571-6900.

Concerns about mosquito-borne diseases are received by the NCDH which responds with information on the diseases. Mosquito-nuisance inquiries are received by the NCDPW. All complaints and inquiries are logged and assigned for follow-up. Follow-up procedures for mosquito nuisance complaints generally involve a visit to the complainant's home, inspection of a specific situation and/or visual survey of the neighborhood. Surveys include visual observations of streams, ponds, marshes, drainage ditches, standing water, swimming pools, artificial containers, street drains, and nearby storm water recharge basins. Property owners are notified if home when the visit occurs, otherwise a visit notice and informational pamphlets are left at the residence. If appropriate, treatment is made by hand with a suitable larvicide. If treatment is applied, the homeowner is notified and signs, or placards are placed at the location where the treatment was applied (i.e., bird bath, swimming pool, ditch, etc.). If a major breeding area is identified, follow-up inspections are scheduled. Following an inspection, conditions and control efforts are logged.

Methods of Avoidance for Citizens and the Home

Obviously, avoiding mosquito bites is the most effective way of avoiding mosquito borne diseases like WNV. The following simple methods of eliminating mosquito breeding areas around the home are strongly encouraged and should be taken by County residents to avoid mosquitoes:

- Remove standing water. Any standing, stagnant water that remains for 7 to 10 days after a rain can, and usually will, produce mosquitoes;
- Empty all water holding containers in your yard on a regular basis, including children's wading pools, toys, rain barrels, buckets, wheel barrels, bird baths and stored boats are prime examples of mosquito breeding sites;

- Clean out eaves, troughs, gutters and down spouts of leaves and other debris that slows drainage; and

- Keep small excavations for outdoor home improvement projects free of vegetation and other debris to promote rapid drainage, and backyard pond edges should be kept clean of invasive aquatic vegetation.

To reduce the number of adult mosquitoes in your yard:

- Keep your lawn mowed as short as is practical;

- Keep all ornamental shrubs and bushes trimmed and pruned to give mosquitoes less places to hide;

- Cut back all low, dense under-growth surrounding your yard;

- Have large trees trimmed to allow sunlight to penetrate dark, damp areas;

- Plan outdoor activities and parties during daylight hours or later in the evening; and

- Utilize one or more fans to create a slight breeze.

Other simple methods of avoidance, particularly when gathering outdoors, include the following:

- Wearing long sleeves, socks, and pants when outside;

- Avoiding bright “loud” colors;

- Avoiding lotions or perfumes or colognes;

- Applying safe, EPA/DEC approved insect repellant;

- Keeping all doors and windows closed; and

- Maintaining screens on doors and windows.

Appendix B includes numerous examples of available public information and outreach materials.

Mosquito Surveillance

In 2006, responsibilities within the mosquito control program were divided into Mosquito Surveillance under the direction of the NCDH and Mosquito Control conducted by NCDPW. The NCDH assumed responsibility for mosquito trapping, surveillance and public relations. NCDPW took over all larvicide and pesticide applications, dipping for mosquito larvae and complaint response.

Two methods of monitoring actual and/or potential mosquito populations are “dipping” for larvae, and “trapping” adult mosquitoes with CDC light traps, gravid traps, and BG-Sentinel traps.

“Dipping” for larvae is the sampling technique used by DPW inspectors to estimate the number of larvae present in standing water. If the number of larvae is excessive, the habitat may be modified or an appropriate larvicide applied. All treatments are made in compliance with the product labels and permits obtained from the NYSDEC. The information gained from these larval dipping surveys determines if control measures are necessary and, if so, what measures to take to limit larvae in standing water. The County’s IPM dictates that pest control products are not indiscriminately applied; therefore, dipping and analyzing the results of the dipping plays an important role in minimizing the use of pesticides. When necessary, treatment (larviciding) can be applied by hand to specific breeding locations or by helicopter over larger and less accessible areas. Photographs of dippering equipment and mosquito rearing chambers, taken from the most current mosquito surveillance report, are provided in the 2014 Mosquito Surveillance and Control Report (see Appendix D).

“Trapping” of mosquitoes is conducted to: estimate the Countywide adult mosquito population at a given time; identify specific areas with high mosquito populations; identify genus and species of mosquitoes; test for disease, especially WNV and EEE; and assess effectiveness of control efforts.

If the number of adult mosquitoes is excessive, an appropriate control measure may be recommended. There are currently 42 sites situated strategically throughout the County where

CDC light traps, BG-Sentinel and gravid traps were utilized, although auxiliary sites may be added to assess special situations.

CDC light traps use a combination of light and carbon dioxide (from the sublimation of dry ice) to attract mosquitoes. CDC light traps were placed at all 42 trap sites throughout the season.

Gravid traps are another type of trap used to capture mosquitoes (especially *Culex*). In 2014, gravid traps were also used at all 42 trap sites. A female mosquito is considered to be gravid when she is heavy with eggs. Gravid mosquitoes are considered to have a higher probability of carrying disease because they are more likely to have taken a blood meal.

BG-Sentinel traps are primarily used for attracting the *Aedes albopictus* species of mosquito that are known vectors for West Nile Virus and increasingly significant vectors for dengue and chikungunya. The BG- Sentinel trap:

- mimics convection currents created by a human body;
- employs attractive visual cues; and
- releases artificial skin emanations through a large surface area.

After trapping, the mosquitoes are delivered to the NCDH Laboratory for identification and enumeration. The mosquitoes are then sorted into "pools". Pools are groups of mosquitoes sorted by genus and species. These pools consist of 10-60 mosquitoes which are then shipped to the NYSDOH Laboratory for viral testing.

In 2014, there were 76,768 mosquitoes that were captured, identified, and screened for disease. Those mosquitoes were divided into 855 pools of mosquitoes. Of those 855 pools sent to the NYSDOH Laboratory, 107 were reported positive for West Nile Virus.

A map of trap sites in the County is provided in Section 2.6. Photographs of traps are provided in Appendix D.

Other surveillance activities utilized in the County are: boat surveys, salt marsh surveys, upland surveys, and storm water recharge basin surveys.

Larval Control

After public education/outreach/participation and mosquito surveillance, the next technique in the County's preferred mosquito control hierarchy is pre-emergent larval control. Emphasis is placed on early season larviciding to limit the need for adult control. Larval control refers to the methods aimed at controlling mosquitos while in the larvae stage. The larvae, also known as "wrigglers," and the pupae, sometimes called "tumblers," require a water habitat.

Mosquito larval development occurs in most aquatic habitats except fast-moving water and the open water of lakes, seas, and oceans. Habitat types are permanent pools; transient water; floodwater; artificial containers (e.g., tires and un-maintained swimming pools) and natural containers such as holes in tree stumps.

In Nassau County, larval control is accomplished primarily by public education aimed at reducing household habitats for larvae, physical controls such as ditch maintenance and storm water system maintenance, and finally, and as needed based on the surveillance program, chemical larvicides. The larvicides used in the County include: Methoprene, trade name Altosid; Bti, trade name Vectobac or Aquabac; Bacillus sphaericus, trade name Vectolex or Fourstar LLC spheratax; and monomolecular surface film, trade name Agnique MMF. All of these larvicides are vetted and registered by the NYSDEC, and can only be applied by a licensed applicator with a NYSDEC permit. Larvicides are applied by hand using larvicide briquettes to small, easily accessible standing water bodies that are considered prime mosquito development sites, including those on the pre-treatment list and those that have been the subject of complaints from citizens (swimming pools and street catch basins). If high larval populations in non-populated, inaccessible marsh areas are predicted, larvicides can be applied by aerial application, usually by helicopter. Decisions as to when and where to treat are based upon the salt marsh surveys, tidal conditions, boat surveys and a decision matrix discussed below.

Adult Mosquito Control

Adult mosquito control is undertaken when excessive numbers of adult mosquitoes are present, disease is detected, and other means of control are ineffective. The County developed a decision matrix in 2016 to define the conditions necessary to consider adult mosquito control. The decision matrix, discussed further in Section 2.0, was developed utilizing NYSDOH and CDC guidance documents and approximately 10 years of local surveillance data and experience. Similar to the case with controlling larvae, the County controls adult mosquitoes first by public education aimed at reducing mosquitoes around the house, physical controls such as ditch maintenance and storm water system maintenance, and finally, and as determined based on the surveillance program, chemical adulticides. The adulticides that have been used in the County are: Resmethrin, trade name, Scourge and Sumithrin, trade name, Anvil. However, Bayer Chemical has discontinued producing Scourge. The USEPA asked Bayer to run additional environmental tests on Scourge. Bayer indicated the millions in costs to do the testing was prohibitive and not cost-effective, so they elected to discontinue production of the product. The County can continue to use Scourge at their discretion, until the supply runs out. Currently, the County is using Duet, which NYSDEC vetted and registered for use in New York State last year. Duet combines the proven efficacy of sumithrin (the active ingredient also found in Anvil) plus the exceptional knockdown of prallethrin. Together, these two active ingredients cause “benign agitation”, or a unique, non-biting excitation. This offers the potential to draw mosquitoes from a resting state enabling greater control of the natural population.

The NCDPW uses a truck-mounted fogging unit to apply adulticide to areas outside the south shore marshes. The unit is an ultra-low volume generator mounted on the back of the pickup truck and is calibrated so that the fog flows at a height of approximately 4 feet and evaporates before it reaches the ground. Driven at a constant 5 miles per hour (mph) rate, this method can treat large areas on either side of a roadway. The equipment is outfitted with a global positioning system (GPS) device that tracks the areas covered with adulticide and also monitors the speed of the vehicle to ensure it is constrained to allowable speeds. If the truck exceeds permissible speeds for fog application, the fogging unit automatically shuts down.

As a last resort, adulticides are sprayed by helicopter or a small plane during health emergencies when WNV is found in mosquito pools within a very large area. Health emergencies are initiated by NCDH. GPS software is utilized to track the areas that have been treated with each aerial application.

Aerial application, if required, is done only during mild temperature conditions, with wind speeds of 10 mph or less, and spraying is prohibited in rain. The application of pesticide will not be applied during cold weather. The spray nozzle used in both truck and aerial application is calibrated so that the liquid released evaporates before the droplets reach the ground. Additional information on the MCP can be found in Section 2.0, and Appendix A.

1.3 Environmental Setting

The County encompasses an area approximately 16 miles wide and extends approximately 30 miles from north to south. The County covers a total area of 453 square miles, of which, 287 square miles is land and 166 square miles is water. The County lies between the New York City borough of Queens (Queens County) to the west and Suffolk County to the east. The County contains three towns, two cities, and sixty-four incorporated villages.

The north shore of the County is divided among harbors and bays that are tributary to the Long Island Sound. The south shore of the County is protected from the Atlantic Ocean by the barrier islands of Jones Beach and Long Beach.

Geology, Soils, Topography

The geology, soils and topography of Nassau County is characteristic of the rest of Long Island, which is relatively uniform. The County is part of the Atlantic Coastal Plain physiographic province. Long Island rests on a southward-dipping crystalline metamorphic and igneous bedrock that is covered by unconsolidated deposits of clay, silt, sand, and gravel. The unconsolidated deposits range in thickness on Long Island from 1,100 feet in the southwest part of Nassau County to 2,000 feet in south-central Suffolk County (Nemickas et al., 1989, USEPA, 1975).

The County is part of the Atlantic Coastal Plain physiographic province and the NYSDEC Coastal Lowlands Ecozone (Edinger et al., 2014). Long Island rests on a southward-dipping crystalline metamorphic and igneous bedrock that is covered by unconsolidated deposits of clay, silt, sand and gravel. The unconsolidated deposits range in thickness on Long Island from 1,100 feet in the southwest part of Nassau County to 2,000 feet in south-central Suffolk County (Nemickas, et al., 1989, USEPA, 1975).

Based on the General Soils Map provided by the U.S. Department of Agriculture Soil Conservation Service Soil Survey of Nassau County, NY, the predominant soils associated with the County are: Beaches, Endfield, Hempstead, Ipswich, Montauk, Plymouth, Riverhead, Sudbury, Udipsamments, and Urban Land.

The County is characterized by four major physiographic regions: the eroded headlands, terminal moraines, the glacial plain, and barrier beaches. Elevations range from sea level along the north and south shores to about 115 meters (370 feet) above sea level near Ash Drive in East Hills and Clock Tower Lane in Old Westbury (Figure 3-5). The eroded headlands of the north shore have undulating, gently sloping and irregular topography that empty into deep bays. The areas of higher elevations in the County are the convergence of the two terminal moraines. Just south of the terminal moraines is a glacial outwash plain that begins just northeast of Hicksville and slopes gradually to the south shore bays. The majority of the County south of the Long Island Expressway (I-495) is relatively flat and less than 50 feet above sea level. Just south of the plain is an extensive shallow tidal area with marshes that make up Hempstead Bay, Middle Bay, East Bay and South Oyster Bay. The barrier beach islands of Long Beach and Jones Beach form the southern outline of the County along the Atlantic Ocean (USEPA, 1975, Wulfrost, 1987).

Surface Waters

The surface waters in the County are dominated by the estuary/marine waters of the Long Island Sound and Atlantic Ocean. Most of the natural surface drainage in the County is via creeks and streams that drain into the bays and harbors of the north shore and the shallow tidal and marsh areas on the south shore. The streams and wetlands in the County are sustained by groundwater near the land surface (Nemickas, et al., 1989). A sizable portion of the runoff that originates in the central portion of the County enters the groundwater water by collecting storm sewers directed towards manmade recharge basins or natural closed depressions.

There are five major bays or harbors in the County. Each of these harbors and bays has small tributary named and unnamed streams, creeks and lakes/ponds flowing from south to north. Due to the topography of the County, most of the north shore tributaries are relatively short in length.

The major south shore tidal and marsh areas between the south shore of the County and the barrier beach islands include: Jamaica Bay. Hempstead Bay, Middle Bay. East Bay, and South Oyster Bay. The named and unnamed freshwater and tidal tributaries draining south to the estuaries tend to be longer in length and arise in the vicinity of Southern State Parkway.

Water quality in the Long Island Sound and Atlantic Ocean watersheds experience impact and stresses from the area’s population density, urban setting, early settlement and aging infrastructure. According to NYSDEC, the primary water quality issues in the Long Island Sound and Atlantic Ocean watersheds include low dissolved oxygen, toxic contamination, municipal wastewater overflows, and urban/storm water runoff (NYSDEC, 2011).

Groundwater

Groundwater is the primary source of drinking water supply on Long Island. Consequently, the aquifers underling Nassau and Suffolk Counties have been designated by the USEPA as a sole source aquifer under the provisions of the Safe Drinking Water Act. The three major aquifers in the County are, from top to bottom:

- Upper Glacial – Under water table conditions
- Magothy – Confined in most areas and is the major source of water in the County

- Lloyd – Confined with bedrock forming the lower limit and is the major source of water supply for many south shore coastal communities

The predominant flow pattern of groundwater on Long Island is northward and southward from the water table divide at the Ronkonkoma moraine (Buxton and Modica, 1992).

Wetlands

There are two main types of wetlands that are protected under State law in the County: tidal wetlands along the coastal areas; and freshwater wetlands found in inland areas near streams and ponds. Wetlands, by definition, are transition areas between dry uplands and marine or freshwater habitats. Areas to be protected as wetlands are designated based on the presence of characteristic vegetation, soil and/or frequency of inundation. Additional information on terrestrial and aquatic resources is provided in Section 3.2.

Flora and Fauna

Over 80% of the County is suburbanized development, which has substantially reduced natural wildlife habitats in the County present prior to European settlement of Long Island. However, there are small pockets of open land that provide habitat for the flora and fauna of the County. The majority of these areas are the approximately 34,000 acres of protected land established by the Federal, State, County and municipal governments. These areas consist of public parks, agricultural districts, cemeteries and other uses that preclude them from being changed to residential, commercial or institutional uses and subsequently developed (Nassau County Planning Department, 2010).

There are a number of rare, threatened and endangered species found in Nassau County (see Section 3.2.4). The animals and plants listed by NYSDEC as Endangered, Threatened, Special Concern and Rare are protected under New York State law. The species designated by NYSDEC as “Unlisted” do not have the same level of regulatory protection as listed species.

However, they are considered rare and a vulnerable natural resource of conservation concern by the NYSDEC Natural Heritage Program (NYSDEC, 2104c).

Land Use and Zoning

The County is a highly suburbanized community with single use areas connected to one another by roadways. Single use areas are areas in the County with one single type of land use (i.e., residential, commercial, industrial). Mixed use would be areas where there is a combination of land uses allowed (i.e., one area with residential and commercial uses). The predominant land use in the County is residential development, which makes up nearly 60% of the County's total land area. Mixed-use, commercial, office and more densely populated areas are concentrated in downtowns, along major transportation thoroughfares and near Long Island Railroad stations. Areas in the central and southern portions of the County and along railroad lines have higher concentrations of industrial sites. Scattered throughout the County are open spaces, parks, recreation areas, conservation lands, agriculture, institutional uses and vacant land (Nassau County Planning Department , 2010).

Land use and zoning decision-making in the County occurs at the local level within respective town or village governments. However, the County had developed a Master Plan, which lays out land use and zoning current problems and challenges; and future visions and growth for the entire County. As the County is fully developed, the Master Plan advances strengthening downtowns, revitalizing underutilized commercial properties, redeveloping brownfields and protecting environmental, scenic and historic resources (Nassau County Planning Department , 2010).

Representative Areas of Mosquito Habitat

Mosquito species are categorized based on the certain types of aquatic habitat they prefer for laying eggs, development and breeding. These aquatic habitats include permanent pools, transient habitats and floodwaters. All three habitats are present throughout the County.

Mosquitoes preferring permanent pools are generally found in bodies of still, fresh water such as permanent, shallow or marginal ponds, lakes and smaller impoundments. Species adapted for transient habitats prefer waters found in storm drains, roadside ditches, clogged streams and puddles. Artificial containers and holes in trees are extremely common in all residential areas of the County. Storm water recharge basins, swimming pools, birdbaths, rain gutters, old tires, pails, cans, children's toys or any other manmade or natural object that can collect and hold water may serve as a breeding site.

Culex pipiens and *Cx. restuans* are the predominant species that carry West Nile Virus in the County. They are not limited by water quality and can develop in water that is clean, high in organic content or even highly polluted. Therefore, most bodies of standing water are possible breeding sites for these vector species (Crans, 2007).

The third category of aquatic habitat preferred by mosquito species are floodwater areas that are intermittently inundated with water such as the pannes in the high salt marsh areas of tidal wetlands. The high marsh areas have the potential to produce optimal breeding habitats for the golden salt marsh mosquito (*Ochlerotatus sollicitans*) and other salt marsh mosquito species. The County's tidal salt marshes found along the north shore and more considerably on the south shore provide extensive areas of typical high marsh and floodwater habitats for mosquito breeding and development. There are more than 100 small bodies of land (e.g., meadows, marshes, fields, islands) on the south shore bays found north of the Atlantic Ocean by the Jones Beach and Long Beach barrier islands. Most of these bodies of land are fully inundated with water at a typical high tide and therefore are not suitable mosquito breeding grounds.

1.4 Impacts and Mitigation

The County's hierarchy for mosquito control, namely public education, outreach, and participation, followed by physical controls, such as ditch, catch basin and recharge basin maintenance, followed by "as needed" hand or aerial application of larvicides, and, as a last-resort, truck or aerial application of adulticides. There has not been a need for aerial application of adulticide in the last four years.

The MCP emphasizes public education, outreach and participation. Educating the public on the relatively simple mosquito avoidance measures such as maintain and repairing screens on doors and windows, eliminating stagnant of "pooling" of water in basins or containers in backyards, and proper use of safe, EPA/DEC-approved insect repellants, is the most effective mosquito control measure, and carries no adverse impacts to the environment. Additional details of the public education program for mosquito control are provided in Section 2.5.

Physical controls implemented by the County are predominantly maintenance of ditches in the marsh areas and inspection and maintenance of storm water catch basins and recharge basins. The efficacy of ditching as a mosquito control measure has been a subject of debate for many years (see Section 4.1.1). The County's preference is to inspect and maintain ditches to keep them clear of debris or accumulated sediment that could increase the pooling of stagnant water in the marsh areas. However, the County has no plans to create or remove any ditches in the marsh areas. Catch basins and storm water recharge basins are regularly inspected and maintained to remove excess growth, sedimentation, and other debris that can be a haven for mosquito breeding and habitat. These structures are also maintained in response to complaints or requests from the community.

Potential adverse impacts from the MCP are predominately related to the use of chemical larvicides or adulticides. As with all chemical pesticides, potential adverse impacts to the environment or to humans are related to amount, concentration, and exposure.

Larvicides

The larvicides currently used in the County, listed by active ingredient, include the following:

- Methoprene
- *Bacillus thuringiensis, israelensis*
- *Bacillus sphaericus*

- Monomolecular Surface Film

Methoprene is contained in two products used by the County: Zoecon Altosid XR Extended Residual Briquets and Zoecon Altosid Liquid Larvicide Concentrate. *Bacillus thuringiensis, israelensis* (BTI), is contained in two products, Vectobac and Aquabac. *Bacillus sphaericus* is also contained in two products, Vectolex and Fourstar LLC Spheratex. Monomolecular Surfade Film is contained in the product, Agnique MMF. All are approved by the NYSDEC, require stringent permits for use and storage, and can only be applied by state-licensed applicators.

The potential adverse impacts to the environment, habitats, or humans from use of chemical larvicides or pesticides (described in Section 4.0) have been found to occur at application rates and the frequencies much higher than used by the County; from improper or unauthorized use and application of the chemicals; or in association with products the County does not use.

Application of larvicides is done on an "as needed" basis, prompted by elevated levels positive tests for WNV reported as part of the Mosquito Surveillance Program, an outbreak of WNV, or in some cases, visual site survey prompted by a public complaint. Larvicides can be applied by hand, truck or by helicopter. Whether application is by truck or by helicopter, the County undertakes a targeted public notification process. Since 2011, there have been only 5 helicopter treatments of larvicide.

Over the same period of time, there has been no significant increase in the number of mosquitoes trapped or the number of mosquito pools testing positive for WNV. Furthermore, the number of confirmed cases of WNV in Nassau County decreased from 16 to 4 during the period 2011 to 2014. One death from WNV was reported in 2011 and one in 2012. There had been no deaths from WNV reported in the County from 2012 to present, except for one WNV death reported this year in 2016.

The most effective measure to reduce potential impacts of chemical larvicides or adulticides is to avoid using them altogether. The next best mitigation measure is to minimize use or make their use as infrequent as possible. If deemed necessary, based on surveillance parameters, a WNV outbreak, or other public health contingency, the County will apply NYSDEC approved larvicides and adulticides. The County also avoids, to the extent possible, aerial spraying.

Adulticides

Beyond reducing mosquito populations through larval control, the County also uses chemical products, as needed, to control adult mosquito populations. Adulticides currently used in the County include Scourge (active ingredient resmethrin) and recently Anvil to combat the invasive Asian Tiger Mosquito (active ingredient sumethrin).

Resmethrin, the active ingredient in Scourge, is moderately toxic to humans if ingested, and slightly toxic through the skin. Scourge is applied at very low concentrations to control mosquitoes. It is unlikely that adverse health effects will occur as a result of this use for most people, but some individuals may experience health effects. For these reasons, individuals should consider taking common sense steps to minimize their exposure to Scourge if it is applied to control mosquitoes (see Section 4.2.4). The County has not resorted to aerial spraying of adulticide in the last 4 years. In any future necessity for aerial application of adulticide, the County would provide extensive public notification via TV, radio, and through its website.

The company producing Scourge, Bayer Chemical, was asked by EPA to run additional environmental tests on this material. Bayer indicated the millions in costs to do the testing is not cost effective so they elected to discontinue production of the product. The County is authorized to continue using Scourge until the current stock runs out. After that, the County will consider using Duet, which was registered for use in NY by NYSDEC last year.

Sumithrin, the main active ingredient in Anvil, is a synthetic pyrethroid pesticide, belonging to the same group as resmethrin and permethrin. Sumithrin can be applied by ground spraying (truck) or by aerial spraying (airplane). Sumithrin is not persistent. It is a broad spectrum insecticide which can kill target and non-target insects. Accidentally spraying a water body can harm some species of aquatic insects and other invertebrates. Sumithrin is extremely toxic to fish. Sumithrin does not appear to accumulate in the tissues of fish and wildlife. The environmental hazards of sumithrin (Anvil) labels carry the warning "do not apply directly to water, or areas where surface water is present or to intertidal areas below the mean high water mark. In addition, any aerial application of adulticide must utilize Adapco technology. Adapco is a GPS based computer/navigation system, pre-programmed to alert the pilot when he nears an area in which spraying is restricted, such as residential areas or areas of sensitive natural resources.

Areas where adulticide has been applied by truck have decreased from 2011 to present. As stated previously, there has been no aerial spraying of adulticide in Nassau County in the last 6 years.

1.5 Alternatives

The County considered a range of alternatives for its MCP from the "no action" alternative to the various options available for public education and outreach, physical controls, natural controls, and chemical controls. Details of the alternatives evaluation are provided in Section 5.0.

No Action

SEQR regulations require that the "no action" alternative be considered. The no action alternative is discussed to provide a comparison of impacts from a project compared to impacts, from the project not being implemented at all. This is particularly suited to site-specific, construction projects, for which a clear comparison can be made between pre-construction and post-construction impacts to the environment. The comparison is less certain when considering the implementation of a "plan" that has none of the typical "construction" activities such as clearing, grading, excavating, filling, demolition, or other major physical elements such as prolonged noise, odor, or traffic.

In the case of the MCP, it is a plan compelled by a potentially significant public health emergency, namely the outbreak of a serious mosquito-borne disease such as WNV. Failure to develop and implement a comprehensive plan, essentially taking no action, is not acceptable. Therefore, the no action alternative cannot be considered a viable alternative.

Public Education and Outreach Alternatives

There are a number of alternatives for maximizing public education, outreach and participation, including utilization of:

- Internet Websites
- Publication and Mailings of Written Materials (pamphlets, brochures, articles)
- Public Meetings and Events
- Radio and Television
- Newspapers, Newsletters
- School Programs

Larval Control Alternatives

Physical controls generally refer to modification of habitat and they include:

- Ditches
- Storm Drainage System Maintenance
- Source Reduction
- Oil Drip

Natural Controls for larvae generally refer to using natural, aquatic predators the feed on larvae. Two such aquatic predator alternatives for larval control include:

- Killifish
- Mos-quitofish (Gambusia)

Chemical Control involves the use of chemical Larvicides to reduce mosquito populations. They can be applied by hand, truck, or aircraft. Larvicides considered as part of the alternatives evaluation included:

- Methoprene (Altosid)
- Monomolecular Surface Film (Agnique)
- Malathion
- Bti (Vectobac)
- Methoxychlor
- Temephos
- Bacillus Sphaericus (Vectolex)

Adult Mosquito Control Alternatives

Physical Control Alternatives:

- Ditches
- Storm Water Drainage System Maintenance
- Misting Systems
- Bug Zappers

Natural Control Alternatives:

- Bats
- Citrosa Plants
- Fungi

Chemical Adulticides Alternatives

- Scourge
- Anvil
- Duet
- Naled
- Pyrethrins
- Chlorpyrifos
- Methoxychlor
- Permethrin
- Pyrethrins

Other Alternatives

Other alternatives include the following methods, mostly recommended by the County for residential and commercial entities.

- Source reduction
- Misting Systems
- Bug Zappers
- Citrosa Plants

Experimental Biocontrol Methods

Scientists have created spermless male mosquitoes and are experimenting with methods of introducing the sterile males into the environment in the hope of reducing overall mosquito numbers.

Another approach under investigation for the control of the mosquito species *Aedes aegypti* uses a strain that is genetically modified to require the antibiotic Tetracycline to develop beyond the larval stage. Modified males raised in a laboratory will develop normally as they are supplied with this chemical and can be released into the wild. However, their subsequent offspring will lack tetracycline in the wild and will never develop into adults.

In recent years, control of mosquitoes by genetic methods like sterile male technique, cytoplasmic incompatibility, chromosomal translocations, sex distortion and gene replacement have been explored. Their use is still in research phase. They are cheaper, more efficient and not subject to vector resistance.

SECTION 2.0

DESCRIPTION OF THE MOSQUITO CONTROL PROGRAM

2.0 DESCRIPTION OF MOSQUITO CONTROL PLAN

As stated in the County's original Mosquito Control Plan (MCP) in 2009, the Nassau County Department of Public Works (NCDPW) and the Nassau County Department of Health (NCDH) work together to suppress mosquito populations through mosquito surveillance and control. Both departments are committed to utilizing the Integrated Pest Management (IPM) approach, which focuses on long-term suppression or prevention with a minimal impact on the environment and on non-target organisms.

IPM control measures emphasize prevention and promote the most environmentally benign measures such as water management and physical control methods, and natural and biological controls, including larvicides targeted to specific areas. The County's goal is to avoid, or reduce to the maximum extent possible, the use of aerial spraying of pesticides that kill adult mosquitoes on contact (also called adulticides). Such is only intended to be used when a public health threat is imminent and other control measures have proved insufficient.

The MCP is reviewed regularly and updated/revised as necessary to manage the mosquito problem in the County. The MCP is evaluated based on mosquito surveillance and control reports, the prevalence of disease, the impact of previous control measures, and lessons learned from programs elsewhere in the region, including neighboring Suffolk County.

This section of the FGEIS describes the major elements of the MCP. The original MCP was prepared for the NCDPW and the NCDH in 2009 by Ecology and Environment, Inc. The MCP was essentially the result of an assessment of a wide range of alternatives available to the County. The most recent update of the MCP is provided in Appendix A. Annual Mosquito Surveillance and Control Reports are also prepared. The narrative herein draws upon these documents as well as documents, studies, and data from federal, state, local agencies and public and private institutions.

As previously stated, the County's MCP was developed with a preference toward the IPM approach, utilizing and relying on not one, but several of the alternatives that were considered, including those described in Section 5.0 of this FGEIS. The selection of the preferred alternative(s) for the County's plan are, and will continue to be, focused on maintaining public health and safety while at the same time, protecting the environment, based on a careful assessment of the environmental, technical, and economic feasibility of any alternative considered in the past, present, or future.

2.1 Purpose and Need

The purpose of the MCP is to provide the residents of the County with an integrated approach to mosquito control that maximizes prevention, and provides protection from, mosquito-borne diseases while at the same time, avoiding or minimizing adverse impacts to the natural and human environment. Although control of mosquitoes as a "nuisance" is incidental to the program, it is not the major thrust. Through public education, outreach, and participation, and use of integrated technologies and methods, the County can fulfill the need to protect its citizens, properties, and environment without relying on one single solution, but rather, the most efficient and safe elements of a variety of management alternatives.

2.2 Background and History

As stated in the original MCP, mosquito control began in Nassau County in 1915 as a response to mosquito-borne malarial outbreaks. At that time, kerosene and No. 2 fuel oil were used to coat bodies of standing water, suffocating the mosquito larvae and reducing the adult mosquito populations. The malarial threat was under control by 1920, but the practice of spraying oil on standing water continued for mosquito nuisance control. In the 1930s, after the formation of a Mosquito Commission in Nassau County, ditching was instituted as a way of draining salt marshes to reduce mosquito-breeding areas. In 1948, the NCDPW took over mosquito control in Nassau County. At that time existing control measures were improved by mechanizing ditching procedures, using spray trucks, and using new mosquito-control products. When the NCDH joined the Mosquito Control Program in 1996, surveillance activities were greatly enhanced, as were analytical and virus-testing abilities.

In 1999, with the reported incidence of West Nile Virus (WNV), Nassau County expanded its mosquito control program using the IPM principles. The IPM approach prefers the use of non-chemical means to control pests wherever possible. Contact pesticides (adulticides) are used only if other methods of control fail and the risk of mosquito-borne disease reaching the human population outweighs the impacts of pesticide application.

In 2006, responsibilities within the MCP were divided into Mosquito Surveillance under the direction of the NCDH and Mosquito Control conducted by the NCDPW. The NCDH assumed responsibility for mosquito trapping, surveillance and public education and outreach. The NCDPW took over physical controls such as water resource and storm water system management and maintenance as well as any necessary pesticide application.

2.3 Public Health Issues

Mosquitoes carry many diseases that can affect human, livestock, and wildlife populations. Fortunately, many of the worst diseases, including yellow fever, dengue fever and Zika, are rare in the continental United States. Although rare in the continental United States, some of these diseases are endemic in Puerto Rico and in many popular tourist destinations in Latin America, Southeast Asia and the Pacific islands. The threat of locally-transmitted malaria was minimal in Nassau County following the control measures in the 1920s. It was not until WNV appeared in Nassau County and other parts of the United States in 1999 that mosquito-borne disease again posed a potential human health threat.

In general, the populations most susceptible to mosquito-borne illnesses are children under the age of 15 and adults over the age of 50. The most effective way for a person to reduce their risk of WNV and other mosquito-borne disease is through the prevention of mosquito bites. Wearing long pants and sleeves, applying insect repellent while outdoors, and keeping screens on all open windows and doors while indoors are some simple, but effective methods of preventing mosquito bites. The public education, information, outreach, and participation measures are explored in more detail in Section 2.5.

2.3.1 West Nile Virus

Most people who become infected with WNV will not develop any type of illness. About 1 in 150 people infected with WNV will develop severe illness. The severe symptoms can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. These symptoms may last several weeks, and neurological effects may be permanent. Approximately 20% of the people who become infected will develop a fever with mild to moderate flu-like symptoms that usually last from three days to a week but can last several months. In most cases these symptoms will go away without treatment. In severe WNV cases, encephalitis (swelling of the brain) or meningitis (inflammation of the brain and spinal cord) can occur and be fatal. Children and the elderly are more at risk of developing the severe form of WNV than the rest of the general population. There is no vaccine or medication that can treat WNV. Hospital care for severe cases consists of administering intravenous fluids, assistance breathing if needed, and help preventing secondary illnesses such as pneumonia.

WNV Transmission Cycle

In the United States, wild birds, primarily crows and jays, are the main reservoir or source of WNV. However, the virus is actually spread by certain species of female mosquitoes. Only females require a blood meal because of the nutritional demands of making eggs; male mosquitoes do not bite. Mosquitoes become infected with WNV when they feed on infected birds. The virus enters the bloodstream of the mosquito and circulates for a few days, settling in the salivary glands. When the infected mosquito bites an animal or a human, the virus enters the host’s bloodstream, potentially causing serious illness.

Mosquito Species

There are approximately 70 different mosquito species in New York State. Sixteen of these species have been associated with WNV in Nassau County but only a few are common carriers that bite humans. In recent years, up to 23 different mosquito species have been identified in County traps, as well as several unidentified species. In 2014, there were 16 different mosquito species identified in County traps. The larval habitats by species trapped in 2014 are shown in Table 2-1.

Culex pipiens and r*estuans* are the predominant species that carry WNV in Nassau County. Both species can tolerate a wide range of breeding habitats and are often found in larval form in natural stagnant pools, in artificial containers where water has collected, and in still catch basins. They also can develop in water that is clean or high in organic content or even highly polluted. Therefore, most bodies of standing water are possible breeding sites for these vector species.[6,7]

2.3.2 Eastern Equine Encephalitis

In addition to WNV, eastern equine encephalitis (EEE) is a mosquito-borne virus that presents a threat to the health of humans, horses, and other large mammals. Mosquitoes become infected with EEE when they feed on birds that are infected with the virus. Infected mosquitoes transmit the disease to other animals when they feed on horses, humans, and other mammals. Horses and humans are not a source of infection for EEE and cannot transmit the disease.

There has never been a human case of EEE in Nassau County. A vaccine is available to protect horses, but there is no vaccine for humans. The last case of EEE detected in Nassau County was in a horse in 2005.

EEE symptoms in humans usually appear within 5 to 15 days after the bite of an infected mosquito. Symptoms range from a mild flu to inflammation of the brain, coma, and death. Like

TABLE 2-1

LARVAL HABITAT BY SPCIES TRAPPED IN 2014

Larval Habitat by Species Trapped - 2014			
Species	Larval Habitat	Total	Percentage
Culex pipiens-restuans	AC, T, CB	44,168	57.53
Aedes vexans	WP, FW	11,393	14.84
Ochlerotatus cantator	SM	6,089	7.93
Aedes albopictus	AC, CW, FBW	1,925	2.51
Ochlerotatus trivittatus	WP, SP	1,536	2.00
Ochlerotatus canadensis	FW, SP	851	1.11
Ochlerotatus triseriatus	AC, T, TH	490	0.64
Ochlerotatus sollicitans	SM	486	0.63
Psorophora ferox	FW, WP	370	0.48
Anopheles quadrimaculatus	CW	312	0.41
Ochlerotatus japonicus	AC, T, TH, RP	284	0.37
Coquillettidia perturbans	FM	273	0.36
Anopheles punctipennis	AC, CW, FBW	116	0.15
Uranotaenia sapphirina	FW, WP	78	0.10
Anopheles crucians	WP	2	0.00
Orthopodomyia signifera	TH, T	2	0.00
Unspecified species*		8,394	10.93
GRAND TOTAL		76,769	100.00
Total Trap Nights		944	
Mosquitoes per trap night		81.3	
Total Species		16	
KEY: Larval Habitats			
AC - Artificial Containers	**SM** – Salt Marsh	**WP** - Woodland Pools	**FW** - Floodwater
CW - Confined Bodies of Water	**CB** –Catch Basins	**SP** - Snowmelt Pools	**FM** - Freshwater Marsh
FBW - Flowing Bodies of Water	**T** - Tires	**TH** - Tree Holes	**RP** - Rock Pools

* - unspecified species include female mosquito specimens that were damaged either in collection or transport that no longer can be identified to the species level

Source: Nassau County DPW 2014 Mosquito Surveillance & Control Report

WNV, some people who contract the virus will not develop any symptoms. The most susceptible populations are children and the elderly. For people who develop the most severe symptoms, where infection of the central nervous system occurs, fever, muscle pains, and headache can be quickly followed by seizures or a coma. The most dangerous condition of the virus is encephalitis, or swelling of the brain. EEE is one of the most pathogenic mosquito-borne diseases in the U.S., with a reported case fatality rate of 30% to 70%. It is estimated that 35% of the people who survive EEE will have mild to severe disabilities. Like WNV, there is no specific treatment for EEE. Treatment focuses on reducing fever and swelling in the brain.[9]

2.3.3 Zika Virus

Zika virus is a member of the virus family Flaviviridae and the genus Flavivirus. It is spread by daytime-active Aedes mosquitoes, such as A. aegypti and A. albopictus. Its name comes from the Zika Forest of Uganda, where the virus was first isolated in 1947. Zika virus is related to dengue, yellow fever, Japanese encephalitis, and West Nile viruses.

The infection, known as Zika fever, often causes no or only mild symptoms, similar to a mild form of dengue fever. It is treated by rest. Since the 1950s, it has been known to occur within a narrow equatorial belt from Africa to Asia. The virus spread eastward across the Pacific Ocean 2013–2014 with outbreaks occurring in Oceania to French Polynesia, New Caledonia, the Cook Islands, and Easter Island, and in 2015 to Mexico, Central America, the Caribbean, and South America. As of 2016, the illness cannot be prevented by medications or vaccines. Zika may spread from a pregnant woman to the baby. This may result in microcephaly and other severe brain problems. Zika infections in adults can result in Guillain-Barré syndrome.

As of early 2016, an outbreak of Zika was ongoing, primarily in the Americas. The outbreak began in April 2015 in Brazil, and has spread to other countries in South America, Central America, Mexico, the Caribbean and Miami, Florida. In January 2016, the United States Centers for Disease Control and Prevention (CDC) issued travel guidance on affected countries, including the use of enhanced precautions, and guidelines for pregnant women including considering postponing travel. Other governments or health agencies also issued similar travel warnings, while

Colombia, the Dominican Republic, Ecuador, El Salvador, and Jamaica advised women to postpone getting pregnant until more is known about the risks.

Zika in the United States

As of November 30, 2016 **-** This update from the CDC Arboviral Disease Branch includes provisional data reported to ArboNET for January 1, 2015 – November 30, 2016.

- Travel-associated Zika virus disease cases reported: 4,310
- Locally acquired mosquito-borne cases reported: 185
- Total: 4,495
  - Sexually transmitted: 36
  - Guillain-Barré syndrome: 13

Zika in New York State

In 2015-2016, there have been no locally acquired cases of Zika Virus in New York State. However, in the same period, there were 921 travel-related cases.

In response to the Zika virus issue, the Nassau County Department of Health has adopted and will implement a Zika Action Plan (ZAP) that will perform monitoring of human cases as well as educate the public and healthcare providers regarding Zika virus in various was to reduce the risk of exposure. The Zika Virus Action Plan, provided in its entirety in Appendix E, includes, but is not limited to, the following elements:

- Disease Monitoring, Organization of Data, Electronic Data;
- Planning Requirements for Providing Education about Zika virus;
- Individual Cases Under Investigation;
- Public Education;

- Enhanced Human Disease Monitoring and Control;
- Syndromic Surveillance for Zika Positive Pool;
- Active Surveillance for Locally Acquired Zika Cases;
- Enhanced Education on Local Transmission;
- Aedes albopictus Surveillance;
- Surveillance after Zika Detection in Mosquito Pool or Locally Acquired Human Case
- Mosquito Control;
- Individual Home Visits;
- Zika Rapid Response Team (ZRRT)

2.4 WNV Monitoring Since 2011

The number of pools testing positive for WNV was 29 in 2011, 81 in 2012, 40 in 2013 and 107 in 2014. The peak of 107 in 2014 is likely due to the above average rainfall in April which may also have resulted in the high overall mosquito population. Diligent surveillance and a lack of coastal storms kept the salt marsh mosquito populations low. The continued decline in the Asian Tiger mosquito population may be attributed to several visits from the "polar vortex" during the prior winter. Long Island is on the northern edge of the Asian Tiger mosquitoes range and the harsh temperatures apparently impacted its overwintering success.

Despite the 2012 and 2014 peaks in mosquito population and positive pool testing, the number of human cases of WNV decreased from 16 in 2011 to 4 in 2014. There were 9 cases reported in 2015. According to the USGS Cumulative Data as of December 5, 2016, there have been 7 cases of WNV in the County in 2016.

2.5 Public Education and Outreach

To implement the IPM approach of avoiding the use of chemical controls whenever possible, public education, outreach, and involvement is essential. It is the first, and most effective, line of defense, and is the least costly and is not impactful or invasive to environmentally sensitive areas. Public awareness, education and participation reduces the need for chemical control. The three main goals of the public education and outreach element of the MCP are:

- To increase public awareness of mosquito-borne diseases, mosquito breeding locations, and simple preventive measures that can be taken to reduce mosquito populations and minimize impacts on human health.
- To provide information regarding routine mosquito control activities in Nassau County.
- To provide timely and accurate information in the event of a WNV public health threat and subsequent pesticide treatments.

2.5.1 Agency Resources

The hotline phone number of the NCDH (516-572-1211) is the main contact point for information on WNV activity. The department's website has a page detailing the threat that mosquito borne diseases present to the County, including recommendations on how to prevent infection (http://www.nassau countyny.gov /agencies/Health/westnile.html) and Zika information pamphlets in seven different languages. It also outlines the mosquito surveillance activities of the NCDPW. Throughout the mosquito season, citizens can also visit the website to see a map of the County with towns highlighted where mosquitoes have tested positive for WNV. It also contains links to NYSDOH and the CDC for further information on WNV and Zika.

Mosquito-control activities are directed by the NCDPW, so all inquiries regarding mosquito nuisance complaints, stagnant water concerns or mosquito control activities (application of larvicides or pesticides) should be directed to the NCDPW (516-571-6900).

Additional information on mosquito control available to the public can be found on the following websites:

http://www2.epa.gov/mosquitocontrol	Mosquito Control USEPA
http://www.cdc.gov/ncidod/dvbid/westnile/index	National Center for Disease Control
http://npic.orst.edu/index.html	National Pesticide Information Center

http://www.health.ny.gov/diseases/west_nile_virus	NYSDOH
http://www.nysipm.cornell.edu/	NYS Integrated Pest Management Program
http://ccenassau.org/gardening/ipm	Cornel Coop Ext. Nassau County IPM

2.5.2 Community Notifications

Legislation passed in 2009 (Nassau County Legislature Amendment to Local Law No. 30-2000, Section 2) outlines notification procedures NCDH follows for any planned adulticide spraying. It requires the NCDH to notify members of the County Legislature when the Department submits a request to the NYSDOH to apply aerial adulticide. Major news outlets are notified 24 hours in advance of any planned aerial adulticide spraying. Notice is also posted on the NCDH website at least 24 hours in advance of any spraying activity. Information released includes the timing, duration, location, and method (i.e., aerial or truck) of spraying; as well as name of pesticide to be used, health concerns of this pesticide, safety recommendations for residents, and the NCDH contact information (phone and website).

In the case of adulticide application that is cancelled and rescheduled, the Legislator, media, and public are notified 24 hours in advance of any spraying.

The NCDH has publicized spraying dates and locations on local sources such as News 12, the Long Island Newsday newspaper, and local radio stations. Media companies are not required to disseminate information regarding spraying, but are encouraged to do so.

In the event of a public health emergency due to an outbreak of WNV, NCDH notifies media outlets and publishes information on the Nassau County website.

2.5.3 Complaints and Inquiries

Concerns about WNV and Zika in the community are received by the NCDH and are followed up with information on mosquito borne diseases. Mosquito-nuisance inquiries are received by the NCDPW. All complaints and inquiries received are logged and assigned for follow-up. Follow-up procedures for mosquito nuisance complaints generally involve a visit to the complainant's home, inspection of a specific situation and/or a visual survey of the immediate neighborhood. Surveys include visual inspection of nearby streams, ponds, marshes, drainage ditches, standing water, swimming pools, artificial containers, street drains, and nearby storm water recharge basins. Property owners are notified when the visit occurs. Otherwise a visit notice and informational pamphlets are left at the residence. If appropriate, treatment is made by hand with a suitable larvicide. If a major breeding area is identified, follow-up inspections are scheduled. Following an inspection, conditions and control efforts are logged.

County literature aimed at educating and informing the public on the MCP has increased the public's awareness that standing, stagnant water at the home is conducive to mosquito breeding. Standing water, in which mosquitos deposit their larvae, includes unused or unkempt swimming pools, backyard ponds, bird baths, excavations from landscaping activity, unused or discarded tires, trash can tops, or other equipment. In such cases, County DPW teams will visit the home and investigate. They visually inspect and/or sample the standing water for evidence of larvae. If present, the DPW crew will apply larvicide in the standing water and provide literature to the resident instructing them how to avoid standing water in the future. The crew will post a sign on or next to the structure or area in which larvicide was applied, and advise residents to avoid the structures and keep children away.

If the crew observes a significant adult mosquito problem, it could arrange for application of adulticide. If adulticide treatment is necessary, the County provides public notice of the time and location of the application. However, application of adulticide in the County is extremely rare. There has been no spraying of adulticide in Nassau County in more than 4 years.

As stated previously, concerns about WNV in the community can be directed to the NCDH at (516) 572-1211. Mosquito nuisance inquiries or complaints can be directed to the NCDPW at (516) 571-6900.

2.5.4 Methods of Avoidance

To state the obvious, avoiding mosquito bites is the most effective way of avoiding mosquito borne diseases like WNV. The following simple methods of eliminating mosquito breeding areas around the home are strongly encouraged and should be taken by County residents to avoid mosquitoes:

- Standing water means mosquitoes. Any standing, stagnant water that remains for 7 to 10 days after a rain can, and usually will, produce mosquitoes. For example, one coffee can full of water has been shown to produce in excess of 10,000 mosquitoes over an entire summer season.

- Empty all water holding containers in your yard on a regular basis, at least once a week. Children's wading pools, toy wagons, rain barrels, buckets, wheel barrels, bird baths and stored boats are prime examples of mosquito breeding sites.

- Over-watering and poor irrigation practices are common producers of mosquitoes around the home, in parks and on golf courses. Report standing water to appropriate maintenance personnel.

- Clean out eaves, troughs, gutters and down spouts of leaves and other debris that slows drainage.

- Ditches must be kept free of vegetation and other debris to promote rapid drainage, and pond edges should be kept clean of cattails and other aquatic vegetation. This is where mosquito larvae develop and mature.

- To reduce the number of adult mosquitoes in your yard:

  - Keep your lawn mowed as short as is practical.

  - Keep all ornamental shrubs and bushes trimmed and pruned to open them up to light and air flow. This will not only give mosquitoes one less place to hide, but will promote growth and vigor in the plant.

  - Cut back as far as possible, all low, dense under-growth surrounding your yard. This is where mosquitoes go to hide during the day.

  - Have large trees trimmed to allow sunlight to penetrate dark, damp areas.

  - Plan outdoor activities and parties during daylight hours or later in the evening. Many mosquitoes are most active at dusk and for about an hour after dusk.

- On particularly stagnant days (i.e., no breeze), utilize one or more fans to create a slight breeze in the yard. Mosquitoes are not strong flyers and cannot fly against a breeze.

Other simple methods of avoidance, particularly when gathering outdoors, include the following:

- Wearing long sleeves, socks, and pants when outside;
- Avoiding bright “loud” colors;
- Avoiding lotions or perfumes or cologne’s;
- Applying safe, EPA/DEC approved insect repellant;
- Keeping all doors and windows closed; and
- Maintaining screens on doors and windows.

2.6 Mosquito Surveillance

In 2006, responsibilities within the mosquito control program were divided into Mosquito Surveillance under the direction of the NCDH and Mosquito Control conducted by NCDPW. The NCDH assumed responsibility for mosquito trapping, surveillance and public relations. NCDPW took over all larvicide and pesticide applications, dipping for mosquito larvae and complaint response. This section of the FGEIS describes the recent mosquito surveillance activities.

2.6.1 Mosquito Biology and Habitat

Mosquitoes have four distinct life stages; the egg, larvae, pupae and adult. The larvae, also known as “wrigglers” and the pupae, sometimes called “tumblers,” are found in water. Although the larvae live and get their food in the water, they must come to the surface for air or obtain air from the underwater portions of aquatic plants. Mosquitoes have adapted to most kinds of aquatic habitats except running water and the open water of lakes, seas, and oceans. Different species of mosquitoes prefer certain types of aquatic habitat, and can be categorized based on this preference.

The five types of habitat are: permanent pools, transient water, floodwater, artificial containers and tree holes. Mosquitoes preferring permanent pools are generally found in fresh bodies of quiet water. Typical habitats are shallow marginal ponds, lakes, and smaller impoundments, the main characteristic being a degree of permanency. Transient water types are generally associated with waters found in street storm drains, roadside ditches, clogged streams and puddles. Floodwater species of mosquitoes prefer areas that are intermittently inundated with water. Tidal marshes on the County's north and south shores provide extensive areas of floodwater habitat. The final category is composed of mosquitoes that favor artificial containers and tree holes. These two types of habitat are extremely common in all residential areas of the County. Swimming pools, bird baths, rain gutters, old tires, pails, cans, children's toys, or any object that can collect and hold water may serve as breeding sites.

2.6.2 Monitoring Weather Variations

Nassau County's mosquito program operates throughout the year; however the most active time is from May through October with peak viral activity from July through early September. In the past, mosquito larvae have been found as late as the middle of November. For the 2014 mosquito season, surveillance activities began on May 12th and continued through September 26th.

Air temperatures have a critical effect on mosquito activity. Hot, dry periods during the summer months may lead to increased viral activity in the mosquito population. Extended periods of high temperatures with low precipitation can cause birds to travel distances further than their normal habitat, in search of water. It is suggested that this activity, alongside reproduction, can thereby stress birds which can then cause them to become viremic; mosquitoes searching for a blood meal from a bird, can then become infected with West Nile Virus.

Precipitation is also a factor affecting mosquito activity. Storms from April through October are a major factor leading to mosquito breeding, as well as higher than normal tides, which affect the egg hatching of the salt marsh mosquito. The accumulation of water, with the presence of organic matter in any container, depression, or object, for as little as 4 days, or in most cases 1-2 weeks, can serve as a breeding site for mosquitoes. Rainfall was elevated above the monthly average for April. This had a direct influence on the number of flood water mosquitoes collected during the 2014 mosquito season.

Surveillance of the larval and adult stages of the mosquito is an integral part for the success of the program. Two methods of monitoring actual and/or potential mosquito populations are “dipping” for larvae, and “trapping” adult mosquitoes with CDC light traps, gravid traps, and BG-Sentinel traps.

2.6.3 Dipping

As stated previously, surveillance of the larval and adult stages of the mosquito is an integral part for the success of the program. Two methods of monitoring actual and/or potential mosquito populations are “dipping” for larvae, and “trapping” adult mosquitoes with CDC light traps, gravid traps, and BG-Sentinel traps.

Dipping for Mosquito Larvae

The most effective means of controlling mosquito populations is to identify breeding sites so that they can be modified to prevent standing water conditions conducive to mosquito breeding and/or treated to kill the larvae before they become flying, biting adult mosquitoes.

“Dipping” for larvae is the sampling technique used by DPW inspectors to estimate the number of larvae present in standing water. If the number of larvae is excessive, the habitat may be modified or an appropriate larvicide applied. All treatments are made in compliance with the product labels and permits obtained from NYSDEC. The information gained from these larval dipping surveys determines if control measures are necessary and, if so, what measures to implement. NCDH’s IPM dictates that pest control products are not indiscriminately applied; therefore, dipping plays an important role in minimizing the use of pesticides. When necessary, treatment (larviciding) can be applied by hand to specific breeding locations or by helicopter over larger and less accessible areas.

A “dipper” consists of a long pole with a cup on the end. The inspector dips the cup into the standing water and then views what is captured in the cup. Larvae and debris are scooped from the standing water. The larvae are counted and possibly speciated, to provide the inspector with information to determine proper treatment, and/or type of mosquito that is breeding in the body of water. There are 4 molts or “instars”, lasting approximately 4 days each, which provide information as to how soon the flying mosquitoes might emerge.

Photographs of dippers and mosquito rearing chambers and other aspects of the surveillance program are provided in Appendix D.

2.6.4 Trapping

Mosquito trapping is conducted for the following purposes:

1. Estimate the Countywide adult mosquito population at a given time.
2. Identify specific areas with high mosquito populations.
3. Identify genus and species of mosquitoes.
4. Test for disease, especially WNV and EEE and Zika.
5. Assess effectiveness of control efforts.

If the number of adult mosquitoes is excessive, an appropriate control measure may be recommended, including a closer look at breeding areas in the vicinity. There are currently 42 sites situated strategically throughout the County where CDC, BG-Sentinel and gravid traps were utilized, although auxiliary sites may be added to assess special situations.

For the 2014 mosquito season, trapping began on May 12th and continued through September 26th. Trapping begins with CDC light traps, exclusively, until a sufficient population is detected at which point gravid traps are added to each site. Gravid traps were first placed in the field on June 9th.

CDC light traps use a combination of light and carbon dioxide (from the sublimation of dry ice) to attract mosquitoes. CDC light traps were placed at all 42 trap sites throughout the season. In total, 822 CDC traps were run, capturing 31,380 mosquitoes, resulting in an average of 38.2 mosquitoes per trap night.

Gravid traps are another type of trap used to capture mosquitoes (especially *Culex*.) In 2014, gravid traps were also used at all 42 trap sites. A female mosquito is considered to be gravid when she is heavy with eggs. Generally, a blood meal is required to provide the nourishment necessary to develop her eggs, which then can be deposited. Gravid mosquitoes are considered to have a higher probability of carrying disease because they are more likely to have taken a blood meal.

The gravid trap consists of a tray containing standing water with the high organic content necessary to nourish mosquito larvae once they emerge from their eggs. Just above the water level in the tray is a cylinder with a battery-driven fan inside. The fan sucks the mosquitoes into the collection bag above when they fly in to deposit their eggs on the organically rich water. In total, 350 gravid traps were run, trapping 44,936 mosquitoes, resulting in an average of 128.4 mosquitoes per trap night.

BG-Sentinel traps are primarily used for attracting the *Aedes albopictus* species of mosquito that are known vectors for West Nile Virus and increasingly significant vectors for dengue, chikungunya and possibly Zika. The BG- Sentinel trap:

- mimics convection currents created by a human body;
- employs attractive visual cues; and
- releases artificial skin emanations through a large surface area.

These traps are utilized when numbers of *Aedes albopictus* increase in light traps or gravid traps. Since larger numbers of Aedes albopictus are drawn to the BG-Sentinel traps it affords NCDH a greater opportunity to actively survey and test the *A. albopictus* population for virus. In total, BG-Sentinel traps were utilized 14 times, trapping 452 mosquitoes, resulting in an average of 32.3 mosquitoes per trap night in 2014.

After trapping, the mosquitoes are delivered to the NCDH Laboratory for identification and enumeration. The mosquitoes are then sorted into “pools”. Pools are groups of mosquitoes sorted by genus and species. These pools consist of 10-60 mosquitoes which are then shipped to the NYSDOH Laboratory for viral testing.

In 2014, there were 76,768 mosquitoes that were captured, identified, and screened for disease. Those mosquitoes were divided into 855 pools of mosquitoes. Of those 855 pools sent to the NYSDOH Laboratory, 107 were reported positive for West Nile Virus. The percentage breakdown of mosquitoes collecting in 2014 is shown in Figure 2-1.

A map of 2014 mosquito trap locations is provided in the County is shown in Figure 2-2. Photographs of traps are provided in Appendix D.

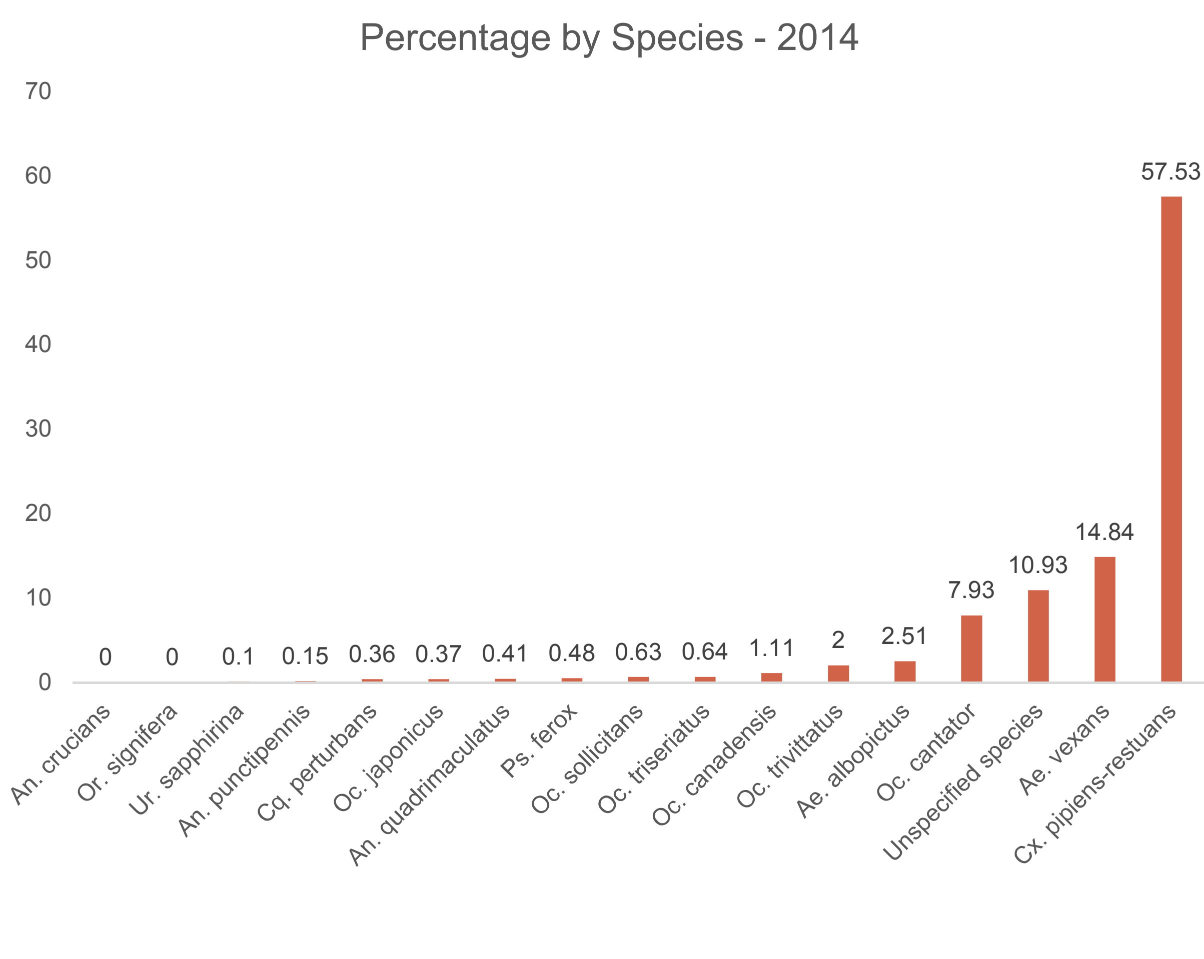
Asian Tiger Mosquito

Mosquito surveillance in 2014 saw a reduction in numbers for the population of the Asian Tiger Mosquito (ATM) or Aedes albopictus. The ATM is an invasive species whose control is posing challenges for vector control staff.

It will seek blood meals (bite) during the day, not solely at dawn and dusk. Its competence as a vector of WNV has not been established. It has demonstrated its competence as a vector of other arbovirus’, specifically Dengue, Chikungunya and Zika in the United States and other regions of the world. The Department is planning an education campaign to inform the public regarding this new pest and the need for continued diligence with respect to eliminating local breeding sites.

The graph above depicts the percentage, by species, of all mosquitoes collected this season in Nassau County; it begins in May and continues into October. Culex pipiens-restuans (the northern house mosquito), comprised 58% of all the mosquitoes captured and resulted in 97% of the WNV positive pools.

The 2014 season's trap night average for all sites was 64.7 mosquitoes/ night. The traps were set 1,186 times collecting a total of 76,768 mosquitoes.



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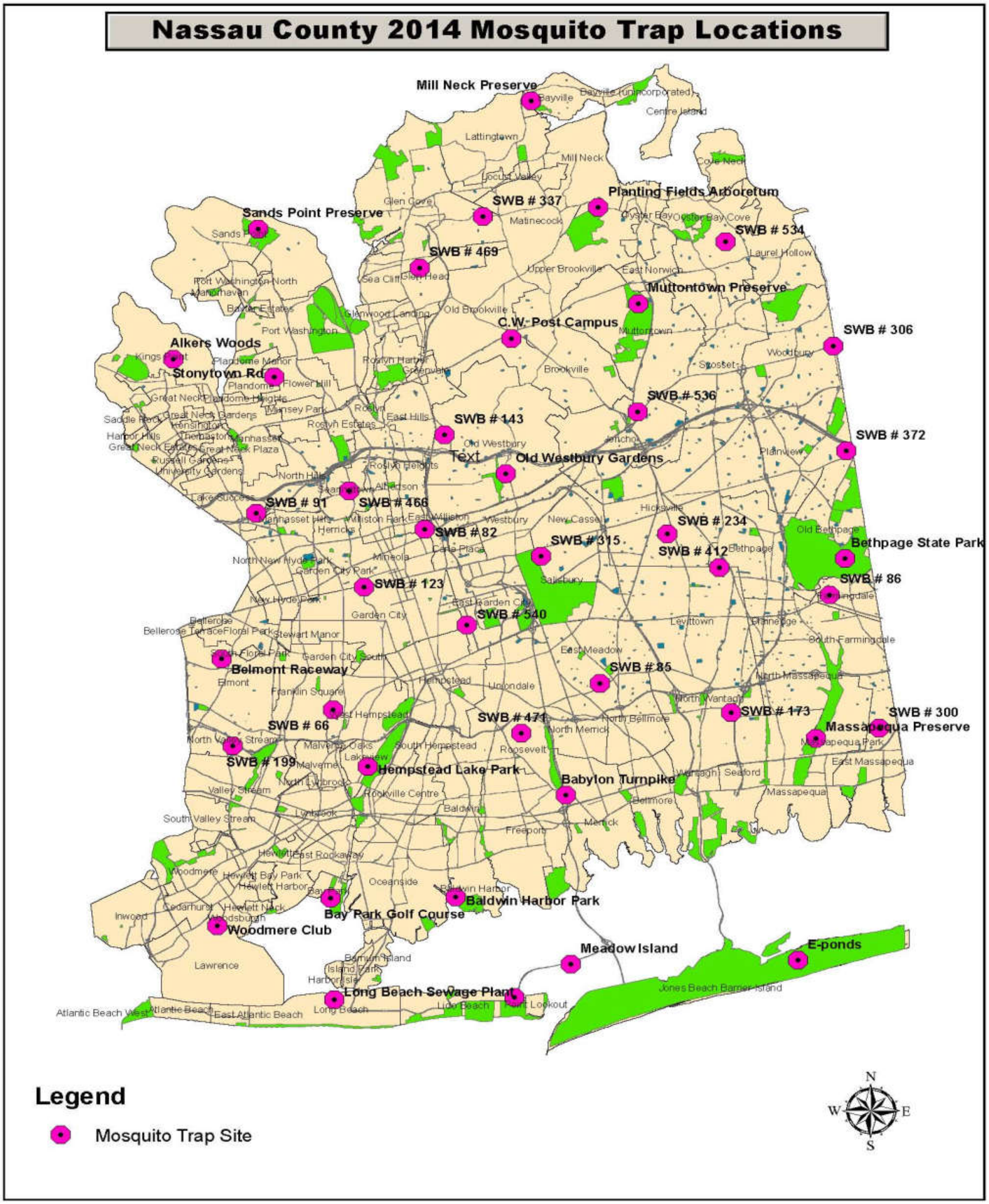
D&B ENGINEERS AND ARCHITECTS, P.C.

COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

Source: Nassau County DPW
2014 Mosquito Surveillance
& Control Report

PERCENTAGE BREAKDOWN OF MOSQUITOES COLLECTED IN 2014

FIGURE 2-1



COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

Source: Nassau County DPW
2014 Mosquito Surveillance
& Control Report

D&B ENGINEERS AND ARCHITECTS, P.C.

MOSQUITO TRAP LOCATIONS

FIGURE 2-2

The ATM presents new challenges due to their feeding habits. They are active during the day time hours yet they are not active flyers. Traditional methods of adult treatment have demonstrated limited effectiveness on the ATM.

A chart showing the yearly totals of the ATM is shown in Figure 2-3.

2.6.5 Other Surveillance

Boat Surveys

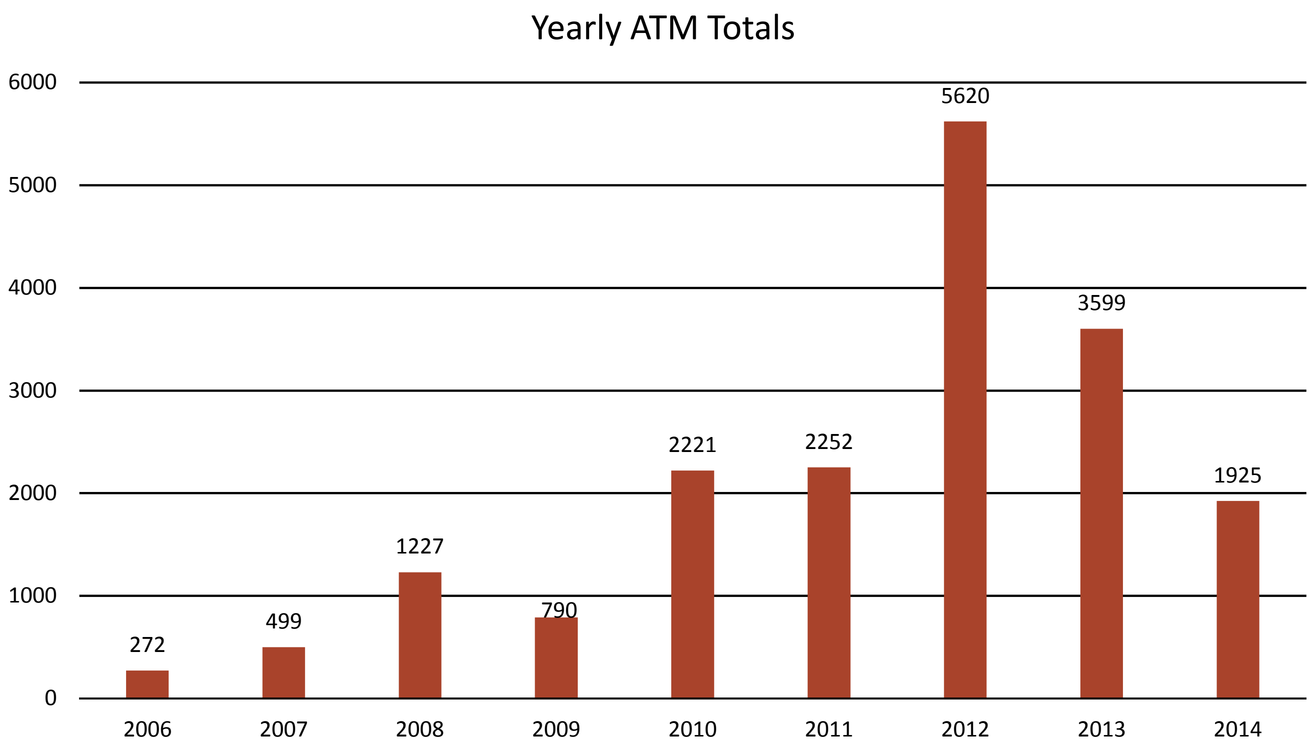
There are more than 100 bodies of land in the south shore bays of Nassau County (hassocks, meadows, marshes, fields, islands, etc.) Most of these are underwater at high tide and so are unsuitable for mosquito breeding. The few islets that do remain wholly or partially above a typical high tide, and thus are capable of supporting breeding pools of *Ochlerotatus sollicitans* and other salt marsh mosquitoes, were monitored periodically by boat.

Salt Marsh Surveys

Salt marsh areas, especially on the south shore of Nassau County, are potential breeding sites for mosquitoes. High tides, storm water, or heavy rains can cause areas not normally covered by daily tidal activity to flood, hatching mosquito eggs within minutes of contact with the water. Therefore, periodically, the marsh areas are surveyed and larvicide is applied where necessary.

Upland Surveys

In addition to the salt marsh surveys, upland surveys of streams, drains, ponds and freshwater marshes were made to determine mosquito breeding potential and, especially, to determine suitability of these sites as breeding areas for *Culiseta melanura* and *Culex pipiens* mosquitoes which are involved in the bird-to-bird/human transmission of EEE and WNV.



The table above illustrates an decrease in the ATM population since 2012.

COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

Source: Nassau County DPW
2014 Mosquito Surveillance
& Control Report

D&B ENGINEERS AND ARCHITECTS, P.C.

ASIAN TIGER MOSQUITO TOTALS
2006-2014

FIGURE 2-3

J:_EnvPermitting\3424 (Nassau County DPW)\Mosquito Control Program GEIS\FINAL GEIS\Updated Figures\Updated Charts FGEIS

Storm Water Recharge Basin Surveys

Storm water recharge basins (SWB's), commonly called sumps, are designed to return surface runoff water to the ground water table. There are approximately 953 sumps in Nassau County: 580 sumps are managed by Nassau County, the rest are managed by New York State or local municipalities. Sometimes, they retain sufficient water to become major sources of mosquitoes. In 2012, 85 sumps were pretreated because they are known mosquito breeding locations. Throughout the summer other sumps are visited routinely to assess their physical condition or on a complaint basis.

2.7 Larval Control

The most effective strategy for mosquito control is pre-emergent larval control and diligent surveillance. Continued emphasis should be placed on early season larviciding to limit the need for adult control. Larval control refers to the methods aimed at controlling mosquitos while in the larvae stage. The larvae, also known as "wrigglers," and the pupae, sometimes called "tumblers," require a water habitat. Although the larvae live and get their food in the water, they must come to the surface for air or obtain air from the underwater portions of aquatic plants.

Mosquito larval development occurs in most aquatic habitats except fast-moving water and the open water of lakes, seas, and oceans. Habitat types are permanent pools; transient water; floodwater; artificial containers (e.g., tires and un-maintained swimming pools) and natural containers such as holes in tree stumps. Different species of mosquitoes prefer certain types of aquatic habitat for breeding and development and can be categorized based on this preference.

2.7.1 Physical Control

Approximately 1,000 miles of drainage ditches were constructed up through the 1950s in order to reduce salt marsh mosquito populations as well as to improve drainage along the shoreline of the south shore barrier islands and islets. Since 1977, approximately 700 miles have been reconditioned to improve drainage along the shoreline, on the south shore barrier islands, and among the numerous hassocks and islets. The reconditioning reduces the size and number of puddles and areas of standing water suitable for mosquito egg hatching and larval development. The DPW utilizes specialized equipment to maintain and recondition the drainage ditches, and to cut access paths that facilitate inspection, maintenance and treatment of mosquito breeding areas.

The natural forces of wind, rain, tides, and major storms continually influence the marsh topography, resulting in new and altered mosquito breeding areas, and so the county occasionally maintains (restores) the drainage ditches. Well-maintained ditches provide habitat for killifish, which feed on mosquito larvae, facilitate tidal water movement, and also create a suitable habitat for waterfowl. Nassau County inspects and maintains all existing ditches; however, based on considerable debate over the years on the efficacy of ditching, there are no immediate plans by the NCDPW to undertake new drainage ditching or other modification of habitat techniques in the next few years.

2.7.2 Natural Control

Many saltwater fish eat mosquito larvae. Killifish are naturally present in large numbers in the bays and ditches of the south shore. In the past, the NCDPW has introduced several varieties of small top-feeding freshwater fish, including mos-quitofish (*Gambusia*), to some SWBs that hold water year-round. However, the NYSDEC no longer allows the introduction of *Gambusia* to waterways in Nassau County because it is a non-native species.

The NCDPW also manages vegetation overgrowth in and around SWBs by cutting back plant life around the basins listed on the pre-treatment list. Other overgrown SWBs are managed throughout the summer, as needed.

2.7.3 Chemical Control

Early-season source reduction (that is, larval habitat elimination) and the application of larvicides, if properly carried out, can greatly reduce the likelihood of exposure to mosquito-borne illness. Unfortunately, once emergence of new adult mosquitoes has peaked and large numbers of infected mosquitoes are present, larviciding and source reduction are much more limited in their impact on virus transmission. At this point, adult mosquito control becomes the primary resource for interrupting virus transmission.

A decision matrix was utilized for the 2014 mosquito season to define the parameters by which control measures would be implemented. This matrix was developed utilizing current New York State Health Department and the Centers for Disease Control guidance documents along with ten years of local surveillance data and experience. The Nassau County Mosquito Control Decision Matrix is depicted in Table 2-2.

If application of the Decision Matrix indicates the need to utilize larvicides, the County uses the following larvicides which can be applied via hand treatment, truck spraying or aerial spraying. Again, the use of these materials, and the application technique, is determined using the Decision Matrix.

- **Vectobac, BTI (*Bacillus thuringiensis* var. israeliensis)** is a naturally occurring soil bacterium that is eaten by the larvae, infecting and killing them. It is available in granular form or in a doughnut-shaped briquette. It is target- specific to mosquitoes but does not kill the pupal stage because pupae do not eat.

- **Vectolex CG (Bacillus sphaericus)** is also a naturally occurring bacterium that infects mosquito larvae. It persists well in the organic-rich environments favored by the *Culex genus* of mosquitoes. It too is ineffective against the non-feeding pupae.

- **Altosid (Methoprene)** is an insect-growth regulator that prevents mosquito larvae from changing into adults. It is sometimes called a juvenile hormone because it keeps the insects in a juvenile state. It is applied in a briquette form for manually treating SWBs and other sites requiring long-acting control. One briquette is used per 100 square feet of surface area up to two feet in depth. The two varieties of briquettes are each effective for 50 or 150 days. A liquid variety is also available for treatment of sites with limited accessibility.

- **Agnique** is a non-toxic, liquid larvicide that is sprayed by hand on suburban mosquito pools. It spreads an invisible mononuclear film over the water, reducing the surface tension, making it difficult for larvae and pupae to attach to the surface. The film also drowns the larvae and pupae by blocking their breathing tubes.

Nassau County - Mosquito Control Decision Matrix

Early Season (prior to July 15)	Mid Season (July 15 - Sept 15)	Late Season (after September 15)
Single elevated trap site (aedes sp. >50, culex / other sp. > 100)		
Increase larval surveillance Increase larval control Consider aerial larvicide for *O. sollicitans*	Increase larval surveillance Increase larval control Consider ground based adult control Conduct aerial larvicide for *O. sollicitans*	Increase larval surveillance Consider ground based adult control of targeted species if weather pattern favors continued activity
Persistent elevated trap site or multiple elevated trap sites (aedes sp. >50, culex / other sp. > 100)		
above actions plus… Consider ground based adult control Conduct aerial larvicide for *O. sollicitans*	*above actions plus…* Conduct ground based adult control Consider aerial control of adult mosquitoes	*above actions plus…* Conduct ground based adult control of targeted species if weather pattern favors continued activity
West Nile virus detection - single trap site		
Increase larval surveillance Increase larval control	Increase larval surveillance Increase larval control Consider ground based adult control	Increase larval surveillance Consider ground based adult control of targeted species if weather pattern favors continued activity
West Nile virus detection -persistent or multiple trap sites		
above actions plus… Consider ground based adult control	*above actions plus…* Conduct ground based adult control Consider aerial control of adult mosquitoes	*above actions plus…* Conduct ground based adult control of targeted species if weather pattern favors continued activity

note : detection of EEE, other non-endemic virus' or other extraordinary circumstances may require additional control activity

Arboviruses transmitted by Aedes albopictus

Zika, Dengue, Chikungunya or Yellow Fever virus detection
Single confirmed locally acquired case or positive mosquito pool

Perform larval surveillance and control, eliminate larval habitats up to 200 yards around detection site
Conduct community education aimed at preventing or minimizing contact between vectors and residents (source reduction, disposing/emptying water holding containers).
Conduct ground based adult mosquito control up to 200 yards around detection site.
Initate/maintain adult mosquito surveillance at detection site to estimate mosquito abundance and evaluate control efforts.

Zika, Dengue, Chikungunya or Yellow Fever virus detection
Outbreak; clusters of confirmed locally aquired human cases or multiple positive mosquito pools

Conduct community education and outreach aimed at preventing or minimizing contact between vectors and residents (source reduction, disposing/emptying water holding containers).
Divide the outbreak area into operational management areas where adult control measures can be applied within a few days and repeated as needed to reduce mosquito density.
Increase adult mosquito surveillance within operational management areas to estimate mosquito abundance and evaluate control efforts.

Aerial Spraying of Larvicides

DPW has a contract with a private company for aerial larvicide spraying by helicopter. The helicopter is able to spray large non-populated, inaccessible areas with a suitable larvicide, usually a liquid formulation of Altosid. Areas sprayed include the marshy areas of Jones Beach, Lido Beach, and a number of islets and hassocks on the south shore of Nassau County. Decisions as to when and where to treat are based upon the salt marsh surveys, tidal conditions, and boat surveys. The helicopter has been a very effective control measure. The helicopter was used six times in 2014 to control Ochlerotatus sollicitans populations. There was an overall reduction in numbers of Ochlerotatus sollicitans population compared to prior years and this can be attributed to early season larviciding.

2.8 Adult Control

Adult mosquito control (Adulticiding) is only done when excessive numbers of adults are present, disease is detected, and other means of control are ineffective. As described in Section 2.7.3, the decision matrix is utilized to define the conditions necessary to consider adult mosquito control

2.8.1 Physical Control

Physical controls largely do not apply to adult mosquito populations because they fly and cannot be contained easily. Apart from the aforementioned maintenance of existing ditches in the marsh areas and the inspection and maintenance of the storm water drainage system (catch basins, recharge basins, sumps), the County does not pursue this approach.

2.8.2 Natural Control

Adult mosquitoes have some natural predators such as dragonflies and bats, but as they are difficult to introduce successfully, Nassau County does not pursue this option.

2.8.3 Chemical Control

As a last resort, and in accordance with Decision Matrix, adulticides are applied only when WNV is present in consecutive trap locations or is found to be in an extensive area where larviciding is not enough to contain viral activity. The presence of WNV in one mosquito is not necessarily a trigger for adulticide application. The persistence of WNV activity in a larger group (60+) of like species of mosquito grouped together, would be more of a determining factor, and more likely to result in adulticiding. There is no correlation between viral activity and population size.

Adult mosquitoes are sensitive to a number of contact pesticides. "Scourge" (Resmethrin 18% and Piperonyl butoxide 54%) has been the mosquito adulticide utilized in Nassau County. This product can be sprayed by an ultra low volume (ULV) generator mounted on the back of a pickup truck. Driven at a constant 5 mph rate, this method can treat large areas on either side of a roadway. Spraying must be done at times of low wind, usually early morning or evening, to minimize drift. Adulticiding is only done when excessive numbers of adults are present, disease is detected, and other means of control are ineffective. As stated earlier a decision matrix was utilized to define the conditions necessary to consider adult mosquito control.

Scourge (resmethrin and piperonyl butoxide) kills mosquitoes upon contact. The product is released as a fine mist in areas where mosquitoes are known to be active. It is the main adulticide used in Nassau County. However, the company producing Scourge, Bayer Chemical, was asked by EPA to run additional environmental tests on this material. Bayer indicated the millions in costs to do the testing is not cost effective so they elected to discontinue production of the product. The County is authorized to continue using Scourge until the current stock runs out. After that, the County will consider using Duet, which was registered for use in NY by NYSDEC last year.

As stated previously, the Asian Tiger Mosquito presents new challenges due to their feeding habits. This invasive species is active during the day time hours yet they are not active flyers. Traditional methods of adult treatment have demonstrated limited effectiveness on the Asian Tiger Mosquito. Therefore, the County may consider adding Duet to its arsenal.

Duet™, an advanced dual-action mosquito adulticide, combines the proven efficacy of sumithrin (the active ingredient also found in Anvil) plus the exceptional knockdown of prallethrin. “Knockdown” is a word applied to spraying of adulticide and it refers to the ability of the adulticide to kill mosquitos immediately on contact. Together, these two active ingredients cause “benign agitation”, or a unique, non-biting excitation. This offers the potential to draw mosquitoes from a resting state enabling greater control of the natural population.

There has been no aerial application of Duet as yet.

Spray Truck Application

The NCDPW uses the truck-mounted fogging unit called the Guardian 95ES to apply adulticide to areas outside the south shore marshes. The Guardian is a ULV generator mounted on the back of the pickup truck and is calibrated so that the fog flows at approximately 4 feet high and evaporates before it reaches the ground. Driven at a constant 5 mph rate, this method can treat large areas on either side of a roadway. The equipment is outfitted with a GPS device that tracks the areas covered with adulticide and also monitors the speed of the vehicle to assure it is constrained to allowable speeds. If the truck exceeds permissible speeds for fog application, the Guardian unit automatically shuts down.

In 2014 adulticiding, via ground spraying, was performed in several areas of the County. Spraying operations occurred on August 7th, 14th, 20th, 21st and 27th. The communities addressed by ground spraying include the following listed by date sprayed:

- August 7th – portions of Bethpage, Plainedge, Farmingdale, Plainview, Old Bethpage, Hicksville and Levittown
- August 14th – portions of East Meadow, Hicksville, Levittown, Salsbury, Westbury and New Cassel
- August 20th – portions of Flower Hill, Manhasset, Munsey Park, Plandome, Plandome Heights, Port Washington, Roslyn, Roslyn Heights, Roslyn Estates and North Hills

- August 21st – Potions of Albertson, East Hills, Garden City, Garden City Park, Herricks, Manhasset Hills, Mineola, North Hills, Roslyn Heights, Searingtown and Williston Park

- August 27th – portions of Woodmere, Cedarhurst, Inwood, Lawrence and Woodsburgh

The public was informed of the spraying through print, radio, televised media and direct phone call announcement. During the spraying operations a West Nile virus call center was established. The call center received and responded to 533 calls from concerned citizens.

Helicopter and Aerial Application

As stated previously, aerial application of adulticides would occur if WNV detection was persistent or in multiple trap sites. The County has not conducted aerial application of adulticide since 2010.

If necessary, all liquid applications are limited to mild weather conditions, with wind speeds of 10 mph or less, and spraying is prohibited in rain. The spray nozzle used in both truck and helicopter application is calibrated so that the liquid released evaporates before the droplets reach the ground.

Adulticides would only be applied in accordance with product labeling and NYSDEC regulations. Adulticides would not be applied within 150 feet of freshwater wetlands, except for an emergency response to a viral breakout, which would be issued by the NYSDOH. Furthermore, adulticides would not be applied where runoff is directed into bays or other bodies of water.

Adulticides would not be applied directly to water or wetlands in order to avoid any potential contact with aquatic organisms. Waterbodies could be subject to drift of runoff from adulticides. However, amounts entering the water would not be expected to exceed U.S. Environmental Agency (EPA) limits because the county uses ULV application techniques and the adulticides applied rapidly biodegrade.

All state and federal threatened and endangered species habitats are avoided during adulticide application. Habitat information is provided by NYSDEC and coordination with NYSDEC minimizes impacts on threatened and endangered species. U.S. Fish and Wildlife Service (USFWS) access restrictions and county setback restrictions are followed.

To repeat, there has been no aerial application of adulticides in Nassau County since 2010.

2.9 Program Monitoring

2.9.1 Annual Mosquito Surveillance and Control Reports

The County prepares a Mosquito Surveillance and Control Report (MSCR) every year. The MSCR includes: updates of seasonal duration and weather, climatological data; dipping and trapping data;, WNV activity in mosquito pools by week; comparative mosquito program statistics; complaints/service requests and inquiries; physical controls such as maintenance of ditches and storm catch basin and recharge basin; and larvicide and adulticide applications.

The MSCR also provides information on the decision matrix that is used every season to determine what control measure is most appropriate in response to elevated trap sites or WNV detection. Finally, the MSCR provides a Season Conclusion and goals and objectives for the upcoming off season.

2.9.2 Changes to the Mosquito Control Plan from the Previous Year

Any changes made to the MCP are noted in Section 11 of the MCP updates in the following year. In the most recent update, the following changes were noted:

1. The Decision Spraying Matrix and associated text was updated to include adulticiding for the nuisance control of mosquitos and detection of Zika in the mosquito population.
2. The inclusion of the Aedes albopictus, the Asian Tiger Mosquito was incorporated in the plan.

3. The Nassau County Zika Action Plan is now part of the overall MCP.
4. Tables and Figures were updated to include data thru 2011.

2.9.3 Overall Plan Effectiveness

All components of the MCP are reviewed every year to determine the overall effectiveness of mosquito control and surveillance in Nassau County.

2.9.4 Recommendations and Improvements

Recommendations and improvements stem from the MCP review process and the MSCR and are incorporated into the plan on a yearly basis.

SECTION 3.0

ENVIRONMENTAL SETTING

3.0 ENVIRONMENTAL SETTING

This section describes the physical and environmental setting of Nassau County. This GEIS covers the entire geographical extent of all of Nassau County, which is the westernmost county of Long Island.

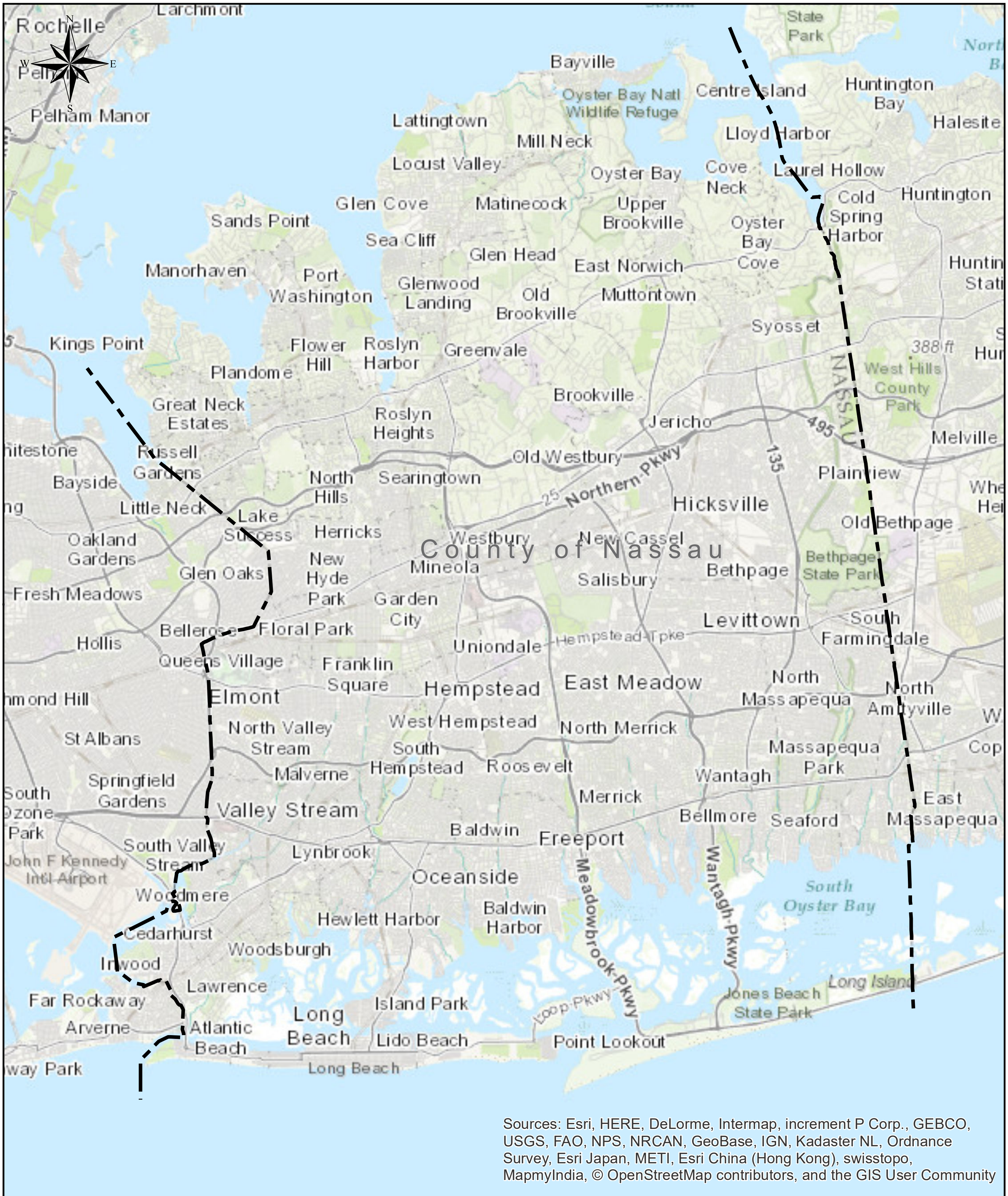
The County encompasses an area approximately 16 miles wide and extends approximately 30 miles from north to south. The County covers a total area of 453 square miles, of which, 287 square miles of it is land and 166 square miles of it is water. The County lies between the New York City borough of Queens (Queens County) to the west and Suffolk County to the east (Figure 3-1). The north shore of the County is divided among harbors and bays that are tributary to the Long Island Sound. The south shore of the mainland of the County is protected from the Atlantic Ocean by the Jones Beach and Long Beach barrier islands.

The County is divided into three towns (Figure 3-2):

- Town of North Hempstead
- Town of Hempstead
- Town of Oyster Bay

There are 2 cities and 64 separate Incorporated Villages that fall within the County's borders (Figure 3-3):

City of Glen Cove	Village of Hewlett Bay Park	Village of Old Westbury
City of Long Beach	Village of Hewlett Harbor	Village of Oyster Bay Cove
Village of Atlantic Beach	Village of Hewlett Neck	Village of Plandome
Village of Baxter Estates	Village of Island Park	Village of Plandome Heights
Village of Bayville	Village of Kensington	Village of Plandome Manor
Village of Bellerose	Village of Kings Point	Village of Port Washington North
Village of Brookville	Village of Lake Success	Village of Rockville Centre
Village of Cedarhurst	Village of Lattingtown	Village of Roslyn
Village of Centre Island	Village of Laurel Hollow	Village of Roslyn Estates
Village of Cove Neck	Village of Lawrence	Village of Roslyn Harbor
Village of East Hills	Village of Lynbrook	Village of Russell Gardens



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COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

GENERAL LOCATION MAP

Figure 3-1

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TOWNS

Figure 3-2

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MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

CITIES AND VILLAGES

Figure 3-3

Village of East Rockaway	Village of Malverne	Village of Saddle Rock
Village of East Williston	Village of Manorhaven	Village of Sands Point
Village of Farmingdale	Village of Massapequa Park	Village of Sea Cliff
Village of Floral Park	Village of Matinecock	Village of South Floral Park
Village of Flower Hill	Village of Mill Neck	Village of Stewart Manor
Village of Freeport	Village of Mineola	Village of Thomaston
Village of Garden City	Village of Munsey Park	Village of Upper Brookville
Village of Great Neck	Village of Muttontown	Village of Valley Stream
Village of Great Neck Estates	Village of New Hyde Park	Village of Westbury
Village of Great Neck Plaza	Village of North Hills	Village of Williston Park
Village of Hempstead	Village of Old Brookville	Village of Woodsburgh

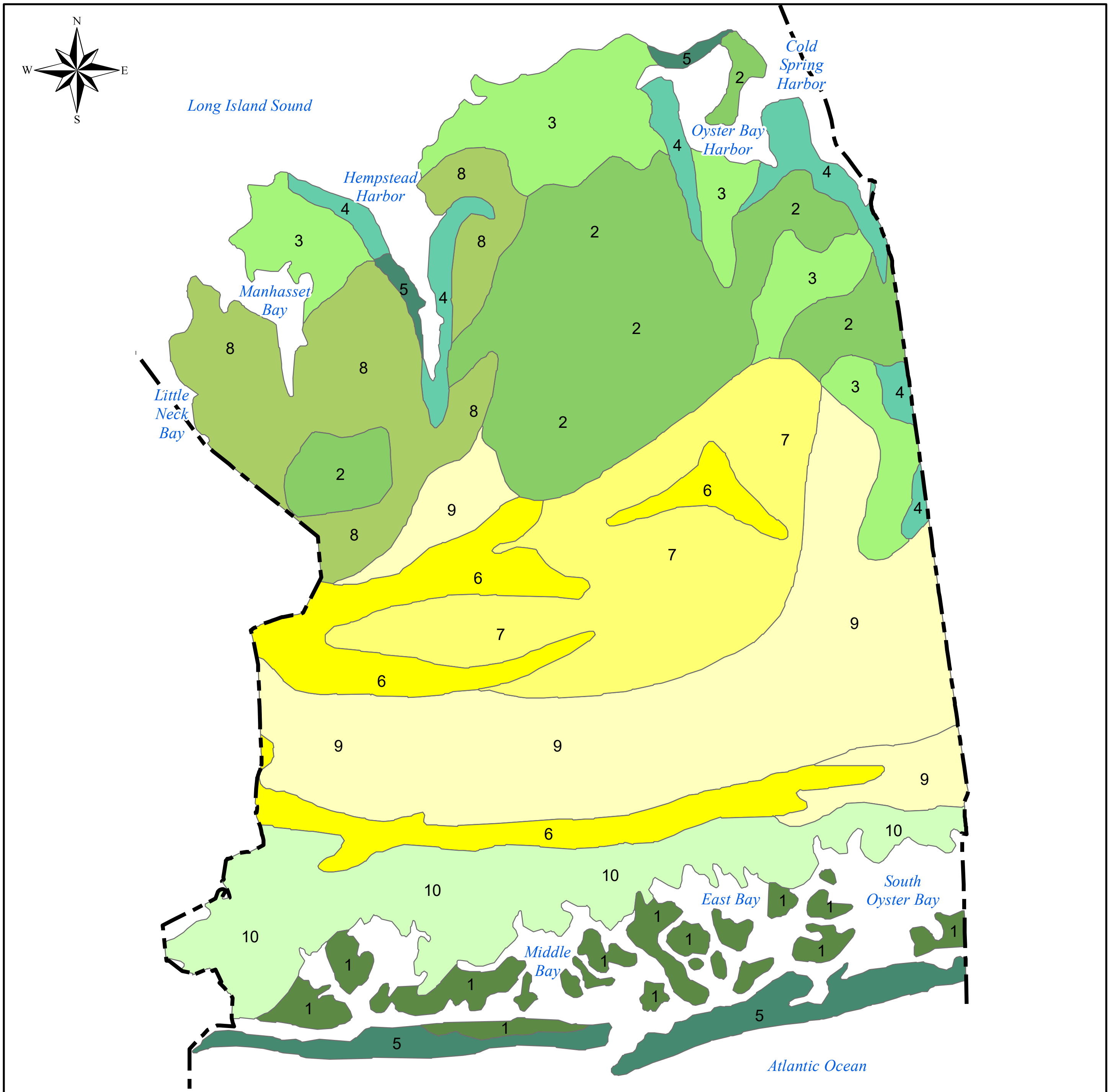
3.1 Geology, Soils, Topography

The geology, soils and topography of Nassau County is characteristic of the rest of Long Island, which is relatively uniform and shaped by its glacial history. Advances of the Wisconsin ice sheet during the Pleistocene Era formed the sandy outwash plains and two terminal glacial moraines that make up Long Island. The Harbor Hill-Roanoke Point Moraine is along the north shore, while the Ronkonkoma Moraine is found running through the middle of Long Island (Tiner, 2011).

The County is part of the Atlantic Coastal Plain physiographic province and the NYSDEC Coastal Lowlands Ecozone (Edinger et al., 2014). Long Island rests on a southward-dipping crystalline metamorphic and igneous bedrock that is covered by unconsolidated deposits of clay, silt, sand and gravel. The unconsolidated deposits range in thickness on Long Island from 1,100 feet in the southwest part of Nassau County to 2,000 feet in south-central Suffolk County (Nemickas et al., 1989, USEPA, 1975).

Based on the General Soils Map provided by the U.S. Department of Agriculture Soil Conservation Service Soil Survey of Nassau County, NY (Figure 3-4), the predominant soils associated with the County are as follows:

- **Beaches** – Sandy areas subject to constant wave action between the levels of normal high and low tides.



LEGEND

1	Ipswich-Udipsamments	6	Urban Land
2	Montauk-Enfield	7	Urban Land-Hempstead
3	Riverhead-Enfield-Urban Land	8	Urban Land-Riverhead-Montauk
4	Riverhead-Plymouth	9	Urban Land-Riverhead
5	Udipsamments-Beaches-Urban Land	10	Urban Land-Udipsamments-Sudbury

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GENERAL SOIL MAP

Figure 3-4

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- **Enfield** – Very deep, well drained soils that formed in a mantle of eolian or water-laid deposits that overlie deposits of gravel and sand. The soils are on side slopes and tops of outwash plains.

- **Hempstead** – Very deep, well drained soils on outwash plains. The soils formed in a loamy mantle overlying stratified sand and gravel.

- **Ipswich** – Very deep, very poorly drained soils formed in partially decomposed organic material from salt-tolerant herbaceous plants. These soils are in tidal marshes near the ocean and are subject to inundation by saltwater twice daily.

- **Montauk** – Very deep, well drained soils on upland hills and ridges. These soils formed in loamy glacial till that is more compact than nearby glacial outwash deposits.

- **Plymouth** – Very deep, excessively drained soils that formed in sandy glacial outwash deposits. These soils are on outwash plains and low morainic hills and ridges.

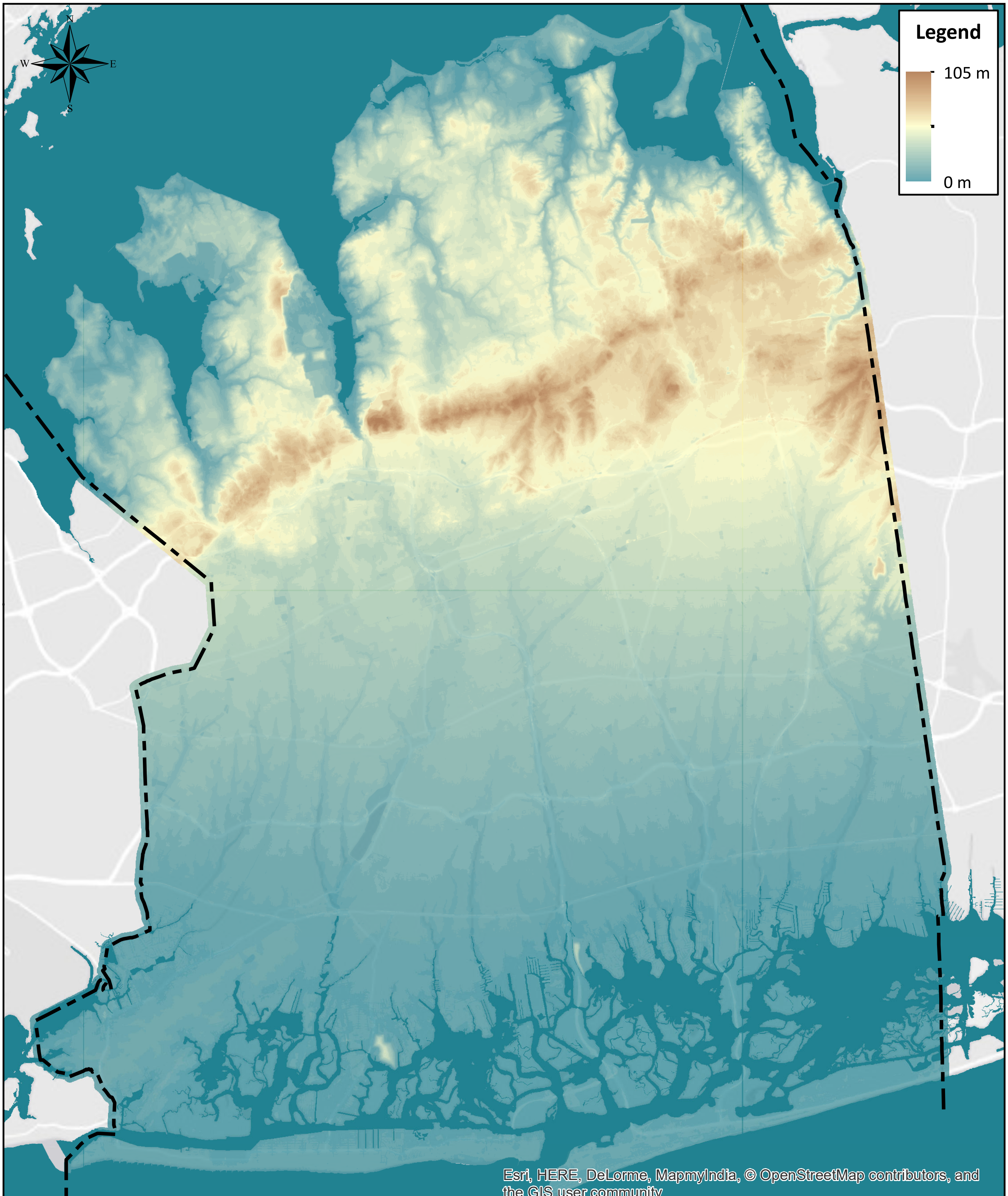
- **Riverhead** – Very deep, well drained soils that formed in glacial outwash deposits. The soils are on crests and side slopes of low morainic hills and on the tops and sides of outwash plains and terraces.

- **Sudbury** – Very deep, moderately well drained soils on outwash plains. The soils formed in a thin loamy mantle and underling deposits of sand and gravel outwash.

- **Udipsamments** – Very deep, excessively drained to moderately well drained, acid soils. The soils dominantly are loamy sand or sand and are commonly in areas of manmade cuts and fills, some of which contain dredged or pumped fill material.

- **Urban Land** – Areas consisting of a high percentage of manmade impervious cover including buildings, roads, driveways, parking lots and other similar structures.

The County is characterized by four major physiographic regions: the eroded headlands, terminal moraines, the glacial plain, and barrier beaches. Elevations range from sea level along the north and south shores to about 115 meters (370 feet) above sea level near Ash Drive in East Hills and Clock Tower Lane in Old Westbury (Figure 3-5). The eroded headlands of the north shore have undulating, gently sloping and irregular topography that empty into deep bays. The areas of higher elevations in the County are the convergence of the two terminal moraines. Just south of the terminal moraines is a glacial outwash plain that begins just northeast of Hicksville



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NATIONAL ELEVATION DATASET MAP

Figure 3-5

and slopes gradually to the south shore bays. The majority of the County south of the Long Island Expressway (I-495) is relatively flat and less than 50 feet above sea level. Just south of the plain is an extensive shallow tidal area with marshes that make up Hempstead Bay, Middle Bay, East Bay and South Oyster Bay. The barrier beach islands of Long Beach and Jones Beach form the southern outline of the County along the Atlantic Ocean (USEPA, 1975, Wulfrost, 1987).

3.2 Terrestrial and Aquatic Resources

3.2.1 Surface Water

The surface waters in the County are dominated by the estuary/marine waters of the Long Island Sound and Atlantic Ocean. The County has approximately 17 miles of coastline along the Atlantic Ocean to the south. The Long Island Sound lies to the north of the County and is designated as an "Estuary of National Significance" under the National Estuary Program established by Section 320 of the Clean Water Act. The entire Long Island Sound covers an area approximately 100 miles long and extends approximately 21 miles from north to south at its widest point between New Haven, CT and Port Jefferson, NY. The Long Island Sound has a total area of 1,300 square miles, of which, 52 square miles of it is considered "Nassau County Waters" (NYSDEC and CTDEP, 2000).

Only a few rivers occur on all of Long Island due to geologic history and soils (Tiner, 2011). Most of the natural surface drainage in the County is via small creeks and streams that drain into the bays and harbors of the north shore and the shallow tidal and marsh areas on the south shore. The streams and wetlands in the County are sustained by groundwater near the land surface (Nemickas, et al., 1989). A sizable portion of the runoff that originates in the central portion of the County enters the groundwater water by collecting storm sewers directed towards manmade recharge basins or natural closed depressions.

Figure 3-6 shows the major surface waters in the County. The north shore harbors and bays tributary to the Long Island Sound in the County include:

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FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

MAJOR SURFACE WATERS

Figure 3-6

- Little Neck Bay
- Manhasset Bay
- Hempstead Harbor
- Oyster Bay Harbor
- Cold Spring Harbor

Each of these harbors and bays has small tributary named and unnamed streams, creeks and lakes/ponds flowing from south to north. Due to the topography of the County, most of the north shore tributaries are relatively short in length.

The south shore tidal and marsh areas between the south shore of the County and the barrier beach islands include:

- Jamaica Bay
- Hempstead Bay
- Middle Bay
- East Bay
- South Oyster Bay

The named and unnamed freshwater and tidal tributaries draining south to the estuaries tend to be relatively longer in length than the north shore tributaries. Due to the position of the Ronkonkoma Moraine, these tributaries generally arise in the vicinity of Southern State Parkway.

Water quality in the Long Island Sound and Atlantic Ocean watersheds experience impact and stresses from the area's population density, urban setting, early settlement and aging storm water drainage system infrastructure. NYSDEC has identified primary water quality issues in the Long Island Sound and Atlantic Ocean watersheds (NYSDEC, 2011). These include:

- **Low Dissolved Oxygen (Hypoxia) –** Hypoxia is linked to an overabundance of nitrogen that fuels the excessive growth of algal species. As these algae die, sink to the bottom of a body of water and are then consumed by bacteria, the available dissolved oxygen in the lower water column is depleted. If exposed to hypoxic conditions, oxygen-breathing organisms may suffocate, die or flea the area. Low dissolved oxygen levels are generally found during the late summer in the western part of the Long Island Sound and areas of the north shore harbors and bays (NYSDEC and CTDEP, 2000).

- **Toxic Contamination –** Metals, pesticides, polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs) are toxic pollutants of concern on Long Island. Land development, industrial activity and manufacturing have historically contributed contaminants to waters and benthic sediments (Stacey and Beristain, 1990).

- **Municipal Wastewater –** Increasing population and development pressures have directed wastewater treatment needs in the County. Poorly managed wastewater can lead to nutrient and pathogen contamination of surface waters. These contaminants can lead to algal blooms, closed beaches and shellfishing areas and habitat degradation (Beristain, n.d.).

- **Urban/Storm Water Runoff –** The contaminants in urban/storm water runoff vary by land use type. Typical pollutants in urban/storm water runoff include nutrients, bacteria, oil/grease, sediment, pesticides, herbicides, fertilizer and litter/floatables. Like municipal wastewater contamination, urban/storm water runoff can lead to algal blooms, closed beaches and shellfishing areas and habitat degradation (Beristain, 1989).

3.2.2 Groundwater

Groundwater is the primary source of drinking water supply on Long Island. Consequently, the aquifers underling Nassau and Suffolk Counties have been designated by the USEPA as a sole source aquifer under the provisions of the Safe Drinking Water Act. The three major aquifers in the County are, from top to bottom:

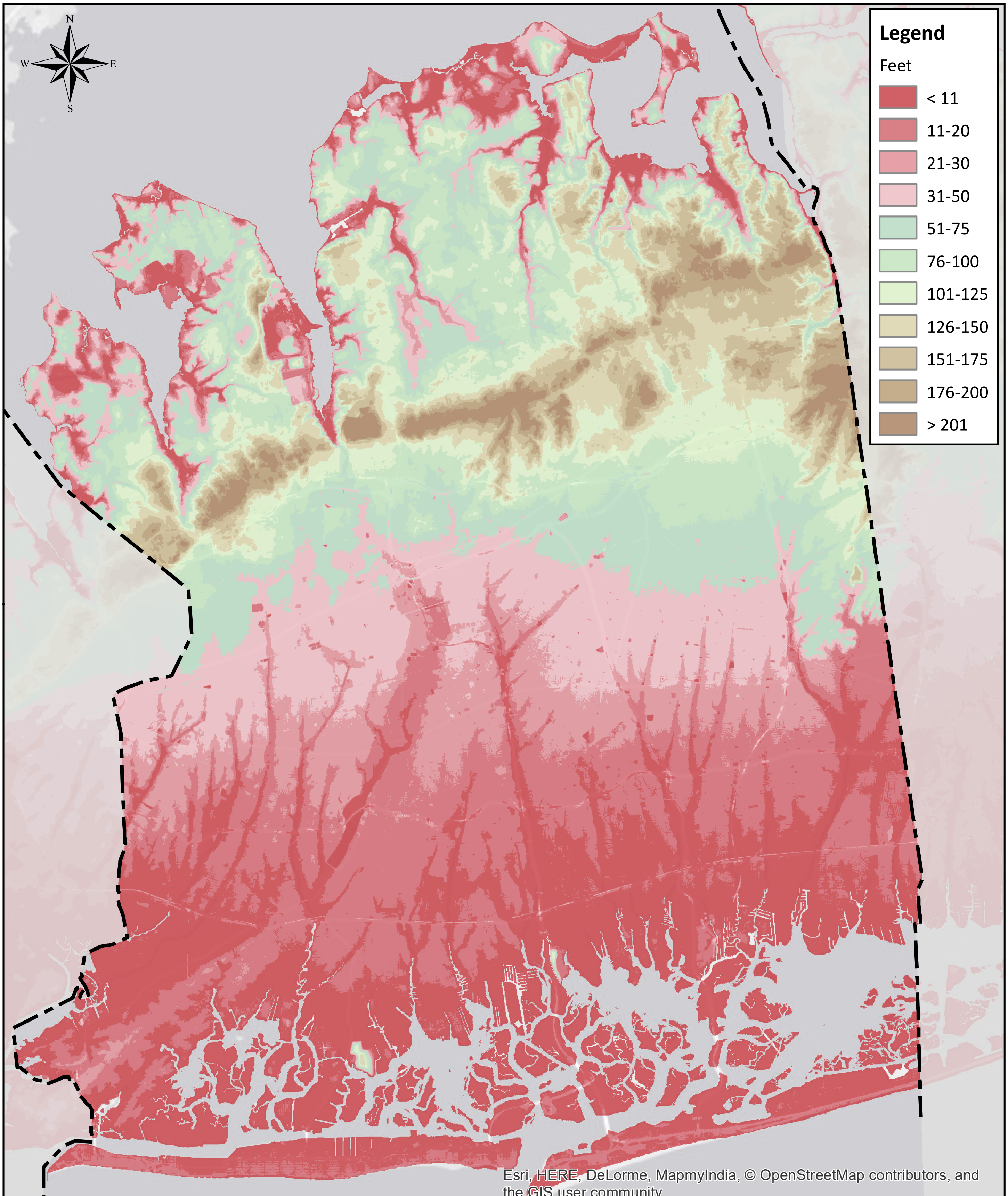
- Upper Glacial – Under water table conditions
- Magothy – Confined in most areas and is the major source of water in the County
- Lloyd – Confined with bedrock forming the lower limit and is the major source of water supply for many south shore coastal communities

The only source of freshwater into the groundwater system on Long Island is precipitation that infiltrates and percolates to the water table. The average rainfall for Nassau County is 46.5 inches per year. About half of that precipitation infiltrates into the groundwater system through the soil in unpaved areas or through the bottom of storm water recharge basins and other infiltrative practice in developed areas that are designed to return surface water to the groundwater table (Nassau County, 2005; Nemickas, et al., 1989). There are hundreds of storm water recharge basins in Nassau County managed by the County, State, towns, villages and private property owners. The predominant flow pattern of groundwater on Long Island is northward and southward from the water table divide at the Ronkonkoma moraine (Buxton and Modica, 1992). Figure 3-7 displays the depth to the water table below the land surface for the County as determined by the United States Geological Survey in April-May 2010 (Monti et al., 2013).

3.2.3 Wetlands

There are two main types of wetlands that are protected under State law in the County: tidal wetlands along the coastal areas; and freshwater wetlands found in inland areas near streams and ponds. Wetlands, by definition, are transition areas between dry uplands and marine or freshwater habitats. Areas to be protected as wetlands are designated based on the presence of characteristic vegetation, hydric soil and/or frequency of inundation. The approximate locations of the New York State-designated wetlands are shown on Figure 3-8.

According to an analysis of the New York State tidal wetlands GIS data, there are approximately 19,000 acres of mapped tidal wetlands in Nassau County. The State maps were generated from 1974 sets of aerial infrared photographs that were used delineate and classify all the tidal wetlands in New York. This figure excludes the lands constantly under tidal waters defined as the Littoral Zone. Due to the geology and topography of Long Island, the vast majority of the tidal wetlands in the County, approximately 17,000 acres, are the salt marshes found north of the barrier beach islands along the south shore of the County. The remaining 2,000 acres of tidal wetlands in the County are found along the harbors, coves and bays of the north shore (LISS, 2003).



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Source: Monti et al., 2013

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DEPTH TO WATER TABLE BELOW LAND SURFACE

Figure 3-7

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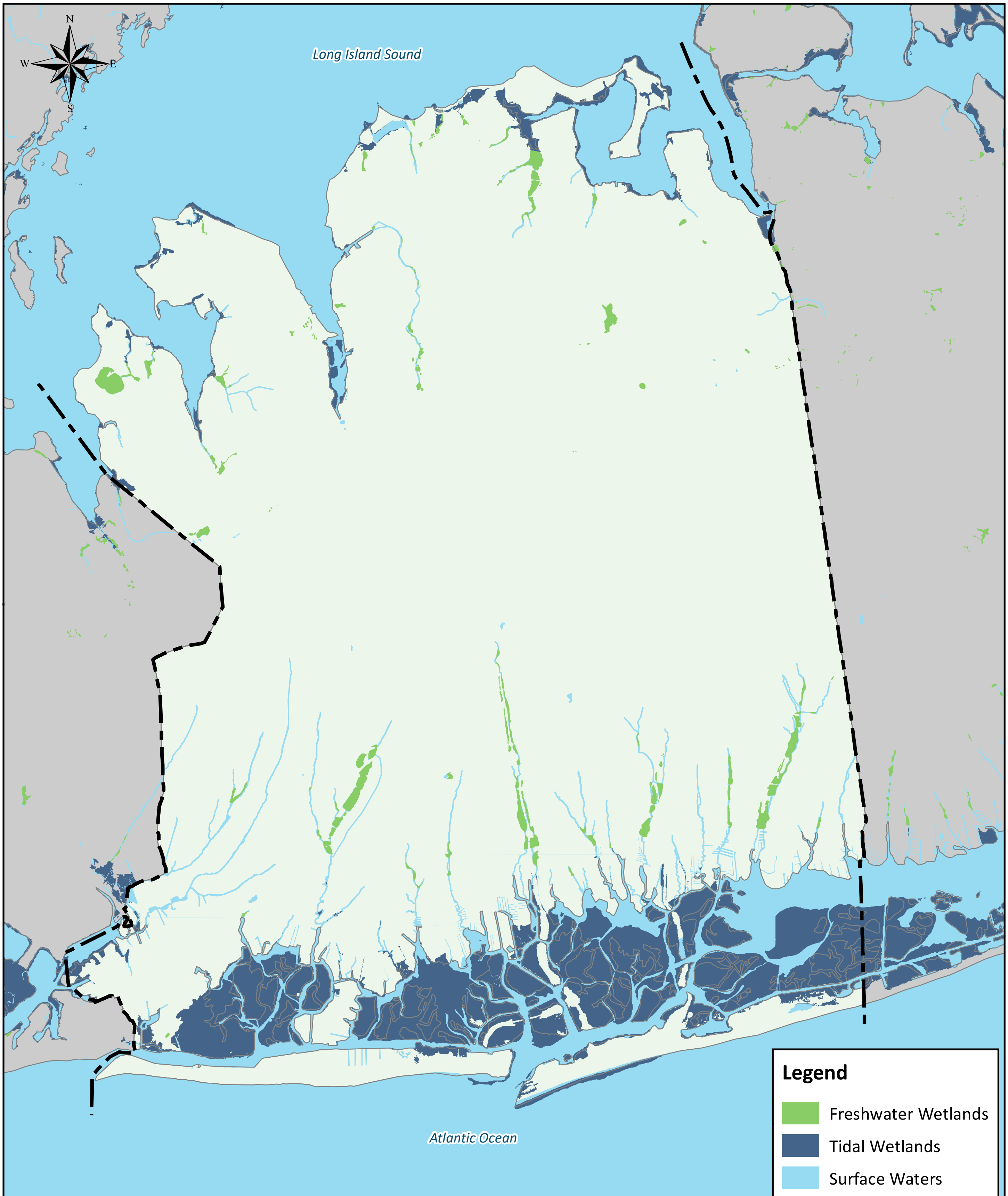

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NYSDEC WETLANDS

Figure 3-8

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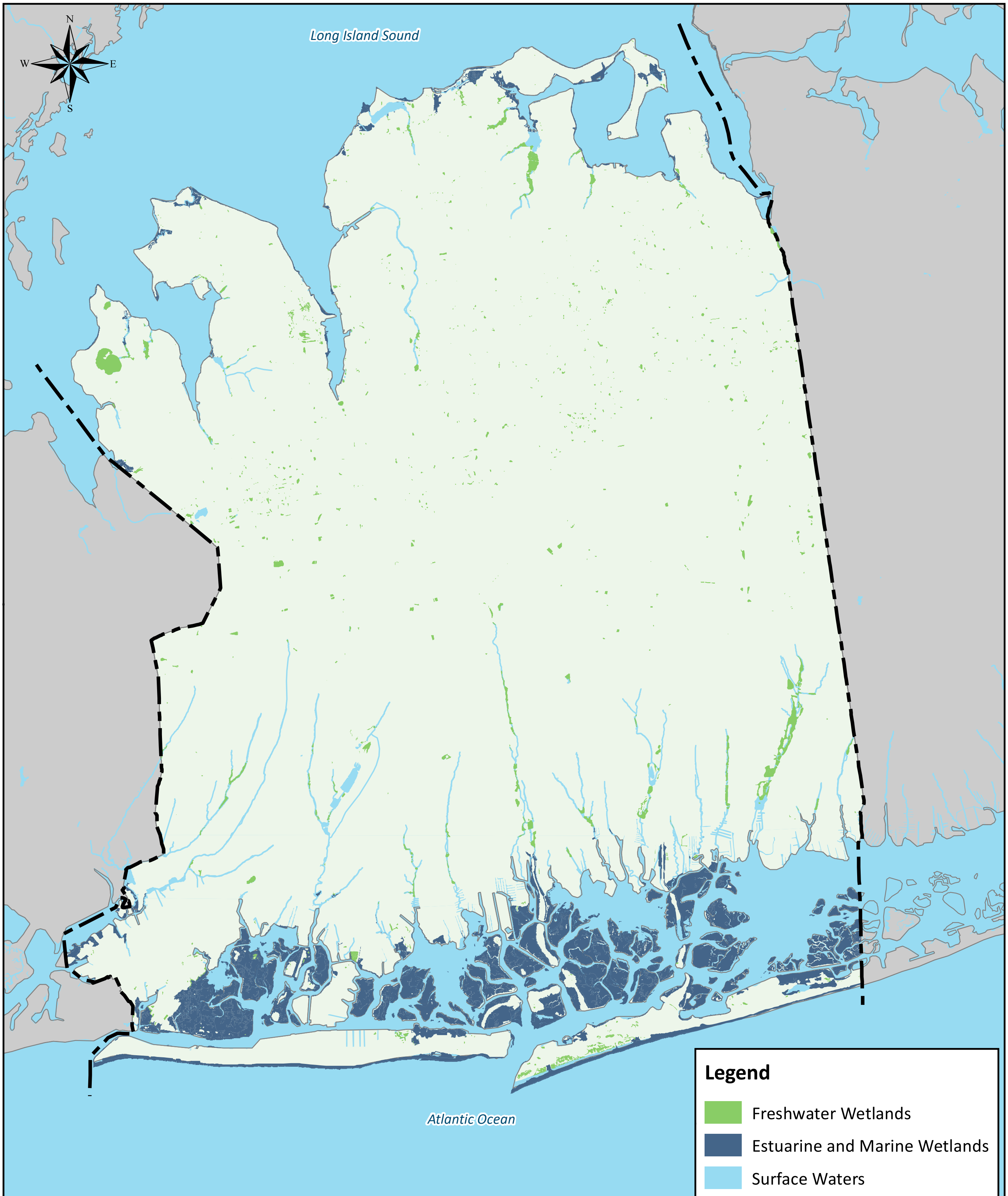
Tidal wetlands are subject to constant short-term changes of inundation due to diurnal tidal influences, as well as, long-term changes in elevation and vegetation due to regional erosion, sedimentation and sea level rise. The categories of tidal wetlands are based on the area's depth of water at high and low tides, salinity gradients and the type of saltwater-tolerant grasses and other marsh vegetation present in the area (Niedowski, 2000). Low marsh zones are flooded twice daily by the tides and are found along seaward edges, creeks and ditches. The high marsh zones are found at higher elevations and are flooded by spring and storm tides (NYSDEC, 2014a). These areas usually contain salt pannes, which are shallow ponds and depression that are irregularly flooded (Edinger, et al., 2014).

There are approximately 2,200 acres of mapped freshwater wetlands according to an analysis of the New York State freshwater wetlands GIS data for Nassau County. Freshwater wetlands tend to be found along interior streams, ponds and lakes. The State maps include wetlands 12.4 acres or larger and smaller areas that are considered of unusual local importance. Smaller freshwater wetlands, including manmade areas (e.g., recharge basins), are regulated by the US Army Corps of Engineers. These areas are not officially mapped by the federal government. However, the National Wetlands Inventory prepared by the US Fish and Wildlife Service provides their general locations (Figure 3-9).

Freshwater wetlands are ponds, bogs, fens, swamps and marshes, which are typically fed by groundwater or rainwater. The soils associated with freshwater wetlands are typically saturated long enough to produce anaerobic conditions in the upper layers. Freshwater wetlands tend to be more ecologically diverse than tidal wetlands due to the stressful environment shaped by the diurnal tides. The categories of freshwater wetlands are based on the bodies of water the wetland is associated with (i.e., riverine, lacustrine and palustrine).

Overall, wetlands are dynamic systems that provide many diverse ecological, economic and social benefits. Wetlands serve as natural habitat for species of animals and plants, including many rare and endangered species. The aquatic and submerged vegetation of wetlands provides shelter, feeding, breeding, spawning and nursery habitat for invertebrate animal communities



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NATIONAL WETLANDS INVENTORY

Figure 3-9

including crustaceans, bivalves, mollusks, insects and spiders. The high productivity of wetland vegetation and invertebrates provides essential habitat for vertebrate species including a wide variety of birds, mammals, reptiles, amphibians and fish.

In addition to providing food and habitat for many animals, wetlands protect and stabilize nearby areas and shorelines through the control and absorption of floodwater, storm surge and storm water runoff forces. Wetlands deflect these erosive forces and absorb floodwaters, which prevents upland soil, habitat and property damages. Wetland vegetation and soils cleanse water and filter out natural and manmade pollutants, which are then broken down or immobilized through marsh surface plant-sediment reactions. The vegetation and underlying substrate also slow down water velocities, which allow suspended sediments and particulate matter to settle out of the water (LISS, 2003).

The US Fish and Wildlife Service estimates that the County may have lost almost 18,000 acres (59%) of its wetlands since the early 1900s. Human activities that may have led to wetland loss across Long Island include: introduction of invasive species, dredging for shipping lanes and marinas; disposal of municipal waste; and the placement of fill to create land for commercial, industrial, and residential developments (Tiner et al., 2012). However, since the passing of the Tidal Wetlands Act in 1973 and the Freshwater Wetlands Act in 1975, wetlands loss has ceased or reversed for the most part (NYSDEC, 2014b).

3.2.4 Flora and Fauna

Over 80% of the County is suburbanized development, which has substantially reduced natural wildlife habitats in the County present prior to European settlement of Long Island. However, there are small pockets of open land that provide habitat for the flora and fauna of the County. The majority of these areas are the approximately 34,000 acres of protected land established by the Federal, State, County and municipal governments. These areas consist of public parks, agricultural districts, cemeteries and other uses that preclude them from being changed to residential, commercial or institutional uses and subsequently developed (Nassau County Planning Department, 2010).

There are a number of rare, threatened and endangered species found in Nassau County. Table 3-1 lists these species and Appendix C lists the animal and plant species that have been identified by the NYSDEC Natural Heritage Program as endangered, threatened, special concern, rare or unlisted. The animals and plants listed as Endangered, Threatened, Special Concern and Rare are protected under New York State law. The species designated as “Unlisted” do not have the same level of regulatory protection as listed species (i.e., endangered, threatened, special concern, rare). However, they are considered rare and a vulnerable natural resource of conservation concern by the NYSDEC Natural Heritage Program (NYSDEC, 2104c).

3.3 Land Use and Zoning

The County is a highly suburbanized community with single use areas connected to one another by roadways. Single use areas are areas in the County with one single type of land use (i.e., residential, commercial, industrial). Mixed use would be areas where there is a combination of land uses allowed (i.e., one area with residential and commercial uses). The predominant land use in the County is residential development, which makes up nearly 60% of the County’s total land area. Mixed-use, commercial, office and more densely populated areas are concentrated in downtowns, along major transportation thoroughfares and near Long Island Railroad stations. Areas in the central and southern portions of the County and along railroad lines have higher concentrations of industrial sites. Scattered throughout the County are open spaces, parks, recreation areas, conservation lands, agriculture, institutional uses and vacant land (Nassau County Planning Department, 2010).

Land use and zoning decision-making in the County occurs at the local level within respective town or village governments. However, the County had developed a Master Plan, which lays out land use and zoning current problems and challenges; and future visions and growth for the entire County. As the County is fully developed, the Master Plan advances strengthening downtowns, revitalizing underutilized commercial properties, redeveloping brownfields and protecting environmental, scenic and historic resources (Nassau County Planning Department, 2010).

Table 3-1
NYSDEC NATURAL HERITAGE PROGRAM
SPECIES OF CONCERN IN NASSAU COUNTY

Group	Common Name	Scientific Name	State Protection Status
Amphibians	Tiger Salamander	Ambystoma tigrinum	Endangered
	Eastern Spadefoot	Scaphiopus holbrookii	Special Concern
	Southern Leopard Frog	Lithobates sphenocephalus	Special Concern
Beetles	American Burying Beetle	Nicrophorus americanus	Endangered
	Northeastern Beach Tiger Beetle	Cicindela dorsalis dorsalis	Threatened
	Hairy-necked Tiger Beetle	Cicindela hirticollis	Unlisted
Birds	Roseate Tern	Sterna dougallii	Endangered
	Piping Plover	Charadrius melodus	Endangered
	Black Rail	Laterallus jamaicensis	Endangered
	Bald Eagle	Haliaeetus leucocephalus	Threatened
	Pine Falcon	Falco peregrinus	Endangered
	Short-eared Owl	Asio flammeus	Endangered
	Black Skimmer	Rynchops niger	Special Concern
	Common Loon	Gavia immer	Special Concern
	Common Nighthawk	Chordeiles minor	Special Concern
	Cooper's Hawk	Accipiter cooperii	Special Concern
	Horned Lark	Eremophila alpestris	Special Concern
	Osprey	Pandion haliaetus	Special Concern
	Red-headed Woodpecker	Melanerpes erythrocephalus	Special Concern
	Seaside Sparrow	Ammodramus maritimus	Special Concern
	Yellow-breasted Chat	Icteria virens	Special Concern
	Common Tern	Sterna hirundo	Threatened
	Least Bittern	Ixobrychus exilis	Threatened
	Least Tern	Sternula antillarum	Threatened
	Northern Harrier	Circus cyaneus	Threatened
	Pied-billed Grebe	Podilymbus podiceps	Threatened
	Upland Sandpiper	Bartramia longicauda	Threatened
	European Starling	Sturnus vulgaris	Unlisted
	House Sparrow	Passer domesticus	Unlisted
	Monk Parakeet	Myiopsitta monachus	Unlisted
	Rock Pigeon	Columba livia	Unlisted

Group	Common Name	Scientific Name	State Protection Status
Butterflies & Moths	Hessel's Hairstreak	Callophrys hesseli	Endangered
	Frosted Elfin	Callophrys irus	Threatened
	A Hand-maid Moth	Datana ranaeceps	Unlisted
	Red-banded Hairstreak	Calycopis cecrops	Unlisted
	Tawny Emperor	Asterocampa clyton	Unlisted
Dragonflies & Damselflies	Pine Barrens Bluet	Enallagma recurvatum	Threatened
	Comet Darner	Anax longipes	Unlisted
	Rambur's Forktail	Ischnura ramburii	Unlisted
Fish	Atlantic Needlefish	Strongylura marina	Unlisted
	Atlantic Silverside	Menidia menidia	Unlisted
	Inland Silverside	Menidia beryllina	Unlisted
Other Animals	Yellow Bumble Bee	Bombus (Thoracobombus) fervidus	Unlisted
Reptiles	Eastern Box Turtle	Terrapene carolina	Special Concern
	Eastern Hog-nosed Snake	Heterodon platirhinos	Special Concern
	Eastern Wormsnake	Carphophis amoenus	Special Concern
	Spotted Turtle	Clemmys guttata	Special Concern
	Italian Wall Lizard	Podarcis sicula	Unlisted
	Slider	Trachemys scripta	Unlisted

3.4 Representative Areas of Mosquito Habitat

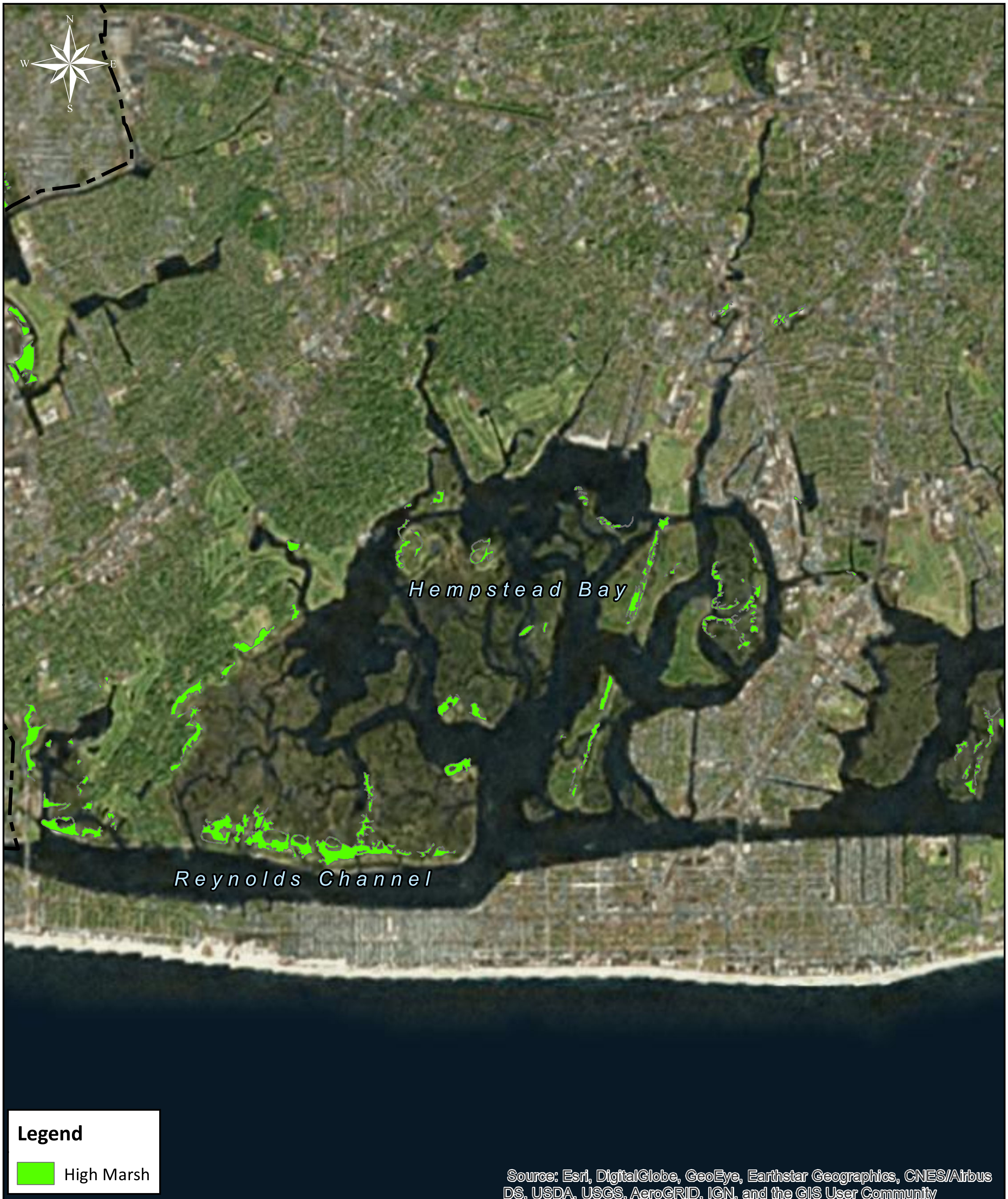
The mosquito life cycle is dependent on the presence of aquatic habitats. Given that mosquito larvae are air-breathing organisms, the only waters that are not conducive to mosquito development are fast-moving waters and the open waters of lakes, seas and oceans. Depending on the species, adult female mosquitos can lay eggs in standing water or in damp soil following a flooding event (e.g., higher than normal tides). The larvae and pupae stages of the mosquito life cycle require an aquatic habitat to survive. Optimal habitat types include permanent pools; transient water; floodwater; artificial containers; and natural containers such as holes in tree stumps.

Mosquito species are categorized based on the certain types of aquatic habitat they prefer for laying eggs, development and breeding. These aquatic habitats include permanent pools, transient habitats and floodwaters. All three habitats are present throughout the County. Mosquitoes preferring permanent pools are generally found in bodies of still, fresh water such as permanent, shallow or marginal ponds, lakes and smaller impoundments. Species adapted for transient habitats prefer waters found in storm drains, roadside ditches, clogged streams and puddles. Artificial containers and holes in trees are extremely common in all residential areas of the County. Storm water recharge basins, swimming pools, birdbaths, rain gutters, old tires, pails, cans, children's toys or any other manmade or natural object that can collect and hold water may serve as a breeding site.

Culex pipiens and *Cx. restuans* are the predominant species that carry West Nile Virus in the County. Both species can tolerate a wide range of breeding habitats and are often found in larval form in natural stagnant pools, in artificial containers where water has collected, and in still catch basins. They are not limited by water quality and can develop in water that is clean, high in organic content or even highly polluted. Therefore, most bodies of standing water are possible breeding sites for these vector species (Crans, 2007).

The third category of aquatic habitat preferred by mosquito species are floodwater areas that are intermittently inundated with water such as the pannes in the high salt marsh areas of tidal wetlands. These species of mosquitoes that breed in salt marshes require a dry period after their eggs are laid. As a result, female marsh mosquitoes ready to lay eggs search for moist ground following a flood event. If the dry period between floods is of sufficient length, which is generally longer than the daily changes in tides, the development of larvae will occur next time the eggs become wetted. This typically coincides with a higher tide. Heavy rains can also cause areas not normally covered by daily tidal activity to flood, hatching mosquito eggs within minutes of contact with the water. The high marsh areas of tidal wetlands are the ideal areas to support marsh mosquito larval development (CA-CE, 2004).

The high marsh areas have the potential to produce optimal breeding habitats for the golden salt marsh mosquito (*Ochlerotatus sollicitans*) and other salt marsh mosquito species. The County's tidal salt marshes found along the north shore and more considerably on the south shore provide extensive areas of typical high marsh and floodwater habitats for mosquito breeding and development. There are more than 100 small bodies of land (e.g., meadows, marshes, fields, islands) on the south shore bays found north of the Atlantic Ocean by the Jones Beach and Long Beach barrier islands. Most of these bodies of land are fully inundated with water at a typical high tide and therefore are not suitable mosquito breeding grounds. However, there are a few islets that remain wholly or partially above a typical high tide. Figures 3-10 to 3-12 show the high marsh areas defined and mapped by the NYSDEC along the south shore bays from Reynolds Channel in the west to South Oyster Bay in the east.



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COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

SOUTH SHORE TIDAL SALT MARSHES
REYNOLDS CHANNEL TO MIDDLE BAY

Figure 3-10

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MOSQUITO CONTROL PROGRAM
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SOUTH SHORE TIDAL SALT MARSHES
MIDDLE BAY TO EAST BAY

Figure 3-11

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D&B Engineers and Architects, P.C.

COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

SOUTH SHORE TIDAL SALT MARSHES
EAST BAY TO SOUTH OYSTER BAY

Figure 3-12

SECTION 4.0

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 ENVIRONMENTAL IMPACTS AND MITIGATION

Virtually any project, whether a site-specific construction project, or the implementation of a plan or set of procedures over a broad area, has the potential to impact the environment in some way. The purpose of the FGEIS is to identify such impacts and devise, as appropriate, measures to eliminate, reduce, or lessen the severity of (i.e., mitigate) the impact while also giving consideration to the overall public health and safety goals of the project. This section of the FGEIS describes the potential impacts, mitigation measures, associated with the specific mosquito control practices used by the by the County. For ease of review, sources for this section appear at the end of the section, after page 4-20.

4.1 Larval Control

This section describes the potential environmental impacts associated with the type of larval control measure, physical, natural, and chemical. The potential impacts are described in the context of the natural environment (i.e., water resources, fish and wildlife) and to humans.

4.1.1 Physical Control

Apart from maintenance of existing ditches in marsh areas, and the maintenance of storm water drainage systems (catch basins and recharge basins), and reacting to occasional public complaints regarding the condition of catch basins or recharge basins, the County does not employ physical or natural larval control alternatives described in Section 5.0.

As stated in Section 2.7.1, approximately 1,000 miles of drainage ditches were constructed up through the 1950s in order to reduce salt marsh mosquito populations as well as to improve drainage along the shoreline of the south shore barrier islands and islets. The natural forces of wind, rain, tides, and major storms continually influence the marsh topography, resulting in new and altered mosquito breeding areas, and so the County occasionally maintains (restores) the drainage ditches. Well-maintained ditches provide habitat for killifish, which feed on mosquito larvae, facilitate tidal water movement, and also create a suitable habitat for waterfowl. Nassau

County inspects and maintains all existing ditches; however, there are no immediate plans by the NCDPW to undertake new drainage ditching or other modification of habitat techniques in the next few years. Therefore, there are no expected environmental impacts of ditching to the environmental setting and resources discussed in Section 3.0.

A detailed analysis of the impacts of ditching was provided in Suffolk County's Vector Control & Wetlands Management Long Term Plan & Environmental Impact Statement. Given the similarity in physical characteristics of the salt marshes in Suffolk to the salt marshes in Nassau County, this is an appropriate reference.

As stated in the Suffolk County DGEIS, the effectiveness of ditching as a mosquito reduction technique has been disputed (Nixon, 1982; Daiber, 1986), although most accounts agree that the combination of marsh filling and ditch construction in the early 20th Century did suppress mosquito populations sufficiently to allow for much greater development in many shoreline areas. This was particularly noted for the south shore of Long Island (Taylor, 1938).

The overall impact of this ditching on the condition and health of salt marshes has been the subject of acrimonious disputes. Generally, ditching is said to have changed marshes in three ways (which sometimes intersect and overlap). They are:

1. reductions in the amount of mosquito breeding;
2. alterations of the salt water table found in the marsh peats; and
3. vegetation distribution changes in use of the marsh by important species or species guilds (Cashin Associates, 2004a).

Most of the observed impacts of (or impacts attributed to) ditching stem from water table differences. Loss of surface water, for example, results in loss of habitat for muskrats (Bourn and Cottam, 1950) and diminished water fowl use of the marsh (Clarke et al., 1984). Other birds, for complex reasons, may not find the habitat as amenable, as was suggested for sharp tailed sparrows (Post and Greenlaw, 1975). Changes in the water table may promote different vegetation on the marsh. Woody, upland type vegetation are often found out on the marsh after ditch installation

(Miller and Egler, 1950), and Phragmites invasion is believed to be fostered by ditching (Bart and Hartman, 2002). Phragmites, (*Phragmites australis*) is a perennial grass common in wetland areas throughout temperate and tropical regions of the world. On Long Island, it is considered an invasive species that can adversely impact the structure and functioning of marsh habitats. Phragmites colonization after ditching may be supported by drying out of the marsh in general, or it may be that Phragmites first colonizes drier areas along the ditches, and then spreads into the interior of panels, although the water table there is no lower or fresher than it was pre-ditching. There is ample evidence that Phragmites propagation by runner does not require the drier, less salty conditions that seed germination needs (Warren et al., 2001). The drier area along the ditch may be from drainage, or from the establishment of a berm along the ditch edge from poor spoils placement or the hypothetical settling out of particles as the tide wells up out of the ditch.

The aesthetics of ditching are usually judged to be inferior. Salt marshes are generally perceived as being part of the natural, wilder world surrounding Long Island suburbia. The presence of geometrical structures across such environments is an unacceptable reminder of their managed nature to many people.

In addition, the County also has the choice of not altering a marsh, and allowing natural processes to proceed in that environment.

4.1.2 Natural Control

As stated in Section 2.7.2, many saltwater fish eat mosquito larvae. Killifish are naturally present in large numbers in the bays and ditches of the south shore. In the past, the NCDPW has introduced several varieties of small top-feeding freshwater fish, including mosquitofish (*Gambusia*), to some storm water recharge basins that hold water year-round. However, the NYSDEC no longer allows the introduction of *Gambusia* to waterways in Nassau County because it is a non-native species. As this practice has ended, there are no expected adverse impacts to the surface water resources described in Section 3.0.

The NCDPW continues to manage vegetation overgrowth in and around SWBs by cutting back plant life around the basins. Other overgrown SWBs are managed throughout the summer, as needed. Vegetation overgrowth, including the proliferation of invasive species, can adversely impact the natural, native species habitats. Thus, the removal of such overgrowth and invasive species would have a beneficial impact on the terrestrial and aquatic resources described in Section 3.0.

4.1.3 Chemical Larvicides

The principal impacts discussed in this section are those potential impacts that are associated with the use of chemical larvicides. The potential impacts to the natural environment (i.e., water resources, fish and wildlife) as well as potential impacts to humans are described for each larvicide used in the County.

As stated in Section 2.7.3, the County uses the following larvicides to control mosquito populations:

*Bacillus thuringiensis var. israeliensis (*Vectobac, Bti/Aquabac)

Bti is a biological control pesticide produced from bacteria, Bacillus thuriniensis israelensis serotype H-14. These bacteria produce spores containing crystals. It is available in granular form or in a doughnut-shaped briquette. It is target- specific to mosquitoes but does not kill the pupal stage because pupae do not eat. When the spores or the crystals are eaten by mosquito larvae, their digestive system is affected, killing the larvae. Used as a larvicide and applied directly to the water, Bti is not persistent. Bti is very specific, killing only the larvae of mosquitos, blackflies, and a few non-biting flies. Most other species of aquatic insects are not affected by Bti. The potential for toxicity to fish is so small as to be considered negligible. Bti does not accumulate in fish and wildlife.

The only long-term study on the non-target effects of Bti for mosquito control demonstrated significant adverse effects on the chironomid (non-biting midges) community of treated wetlands, translating into negative effects within the food web. The intensity of Bti applications used in this study, both the application rate and the frequency of applications, would represent the high end of those that would normally occur for operational mosquito control. In addition, entire wetlands were treated, which may or may not occur with aerial applications of Bti. Thus, the Minnesota study may represent a “worst-case scenario” of potential mosquito control operations, but it has generated the only data available on the long-term non-target effects from Bti. (1)

The EPA has not issued restrictions for the use of Bti around bodies of water. It can be effective for up to 48 hours in water. Afterwards, it gradually settles out or adheres to suspended organic matter. (2)

Microbial pesticides such as Bti are classified as immobile because they do not move, or leach, with groundwater. Because of their rapid biological breakdown and low toxicity, they pose no threat to groundwater. (3)

Pesticides pose a potential threat to groundwater quality when they are misused in violation of pesticide laws, rules and regulations, including use in contravention of label directions (pesticide misuse). Pesticides may also pose a threat to groundwater, even when they are lawfully used in accordance with label directions, if their use pattern or chemical and physical properties are such that they have an increased potential to leach through soil.

Because of its selectivity, Bti generally is not considered a risk to non-target organisms, and USEPA has concluded that that Bti does not pose significant adverse risks to non-target organisms or the environment, especially since rates higher than those used for vector control are needed to produce any adverse effects (USEPA, 1998c). Recent literature confirms Bti’s limited overall toxicity to wildlife (Brown et al., 2002; Russell et al., 2003; Lacey and Merritt, 2003). (4)

There is some evidence of Bti effects to non-target aquatic midges (Chironomidae), biting midges (Ceratopogodinae), and dixid midges (Dixidae), which are commonly associated with mosquitoes within the aquatic environment.” (5)

Bti does not appear to be toxic to humans. USEPA (1998c) reported that there was no evidence that it is pathogenic to mammalian species, not that it caused adverse effects on body weight gain or tissue or organ damage upon necropsy of treated animals (CA-SCDHS, 2005). WHO (1999) has concluded that Bti products are unlikely to pose a health risk to humans. (6)

To date, no known mammalian health effects have been demonstrated in any infectivity/pathogenicity study. Some strains of *Bacillus thuringiensis* have the potential to produce various toxins that may exhibit toxic symptoms in mammals, however the manufacturing process includes monitoring to prevent these toxins from appearing in products." (7)

*Bacillus sphaericus (*Vectolex; Fourstar LLC)

Bacillus sphaericus is a biological control pesticide produced from bacteria, Bacillus sphaericus serotype H5a5b, Strain 2362. These bacteria produce spores containing crystals, similar to Bti. When the spores or the crystals are eaten by mosquito larvae, their digestive system is affected, killing the larvae. Used as a larvicide and applied directly to the water, Bacillus sphaericus is not persistent. It is particularly effective in murky, high organic water bodies. Bacillus sphaericus is very specific, and is labeled for only killing the larvae of mosquitos. Most other species of aquatic insects are not affected Bacillus sphaericus. The potential for toxicity to fish is so small as to be considered negligible. Bacillus sphaericus does not accumulate in fish and wildlife. (dec.ny.gov/docs/wildlife). It persists well in the organic-rich environments favored by the *Culex* genus of mosquitoes. It too is ineffective against the non-feeding pupae.

Once released into the aquatic environment, it is non-persistent, with a half-life of about 30-40 hours. Micro-encapsulated and extended-release formulations will, of course, be present in the water longer as the pesticide is slowly released over time, 7-150 days, depending on the formulation. (8)

Summary of the Human Health Risk Assessment for Larvicides reports that *Bacillus sphaericus* is not expected to be harmful to humans due to limited exposure. (9)

*Methoprene (*Altosid)

Methoprene is an insect-growth regulator that prevents mosquito larvae from changing into adults. It is sometimes called a juvenile hormone because it keeps the insects in a juvenile state. It is applied in a briquette form for manually treating SWBs and other sites requiring long-acting control. One briquette is used per 100 square feet of surface area up to two feet in depth. The two varieties of briquettes are each effective for 50 or 150 days. A liquid variety is also available for treatment of sites with limited accessibility.

Methoprene is a chemical that mimics juvenile insect hormones. It interferes with the transformation of a mosquito larva into an adult. The larval mosquitoes remain as non-biting larvae longer than normal and their growth and survival is disrupted. Methoprene is used primarily as a mosquito larvicide and is applied directly to water. Methoprene is not persistent. It is fairly specific for mosquito larvae, but some studies have shown impacts on other non-target aquatic insects. While methoprene is listed as being somewhat toxic to fish, very little potential for toxicity to fish and wildlife exists. Methoprene may accumulate to low levels in fish. Some specific products are labeled "Do not use in waters that are known fish habitat".

“Methoprene may be less disruptive to the food chain in wetlands than Bti because it kills slowly, allowing more larvae to reach the pupal stage before they die and thus potentially be available for a longer time as prey for other species.” (10)

“Fresh water invertebrates are especially sensitive to methoprene, with a lowest observable adverse effect concentration (LOAEC) of 51 ppb reported (USEPA, 2002a). Overall, the potential for aquatic toxicity is mitigated by the rapid degradation of methoprene in surface water (Extoxnet, 1996a).” (11)

“Methoprene degrades rapidly in sunlight, both in water and on inert surfaces. The pesticide also is metabolized rapidly in soil and does not leach. Thus, it should not persist in soil or contaminate ground water.” (12)

As stated previously, pesticides pose a potential threat to groundwater quality when they are misused in violation of pesticide laws, rules and regulations, including use in contravention of label directions (pesticide misuse). Pesticides may also pose a threat to groundwater, even when they are lawfully used in accordance with label directions, if their use pattern or chemical and physical properties are such that they have an increased potential to leach through soil.

“At sufficiently high concentrations, it also has been shown to be toxic to fresh water invertebrates and fish, estuarine and marine invertebrates, and amphibians (USEPA, 2002a).” (13)

“Methoprene is generally considered to be slightly toxic to non-toxic to terrestrial wildlife. The oral median lethal dosage (LD50) for rats is greater than 10,000 mg/kg (USEPA, 2002a). Methoprene is considered slightly toxic to birds (Extoxnet, 1996a). In mallards, an acute oral LD50 of greater than 2,000 mg/kg in the diet was determined. Dietary no observed effect concentrations (NOECs) (based on reproductive endpoints) range from three ppm for mallard ducks to 30 ppm for bobwhite quail (USEPA, 2002a). Some data also suggest that methoprene may be toxic to bees. Schulz et al. (2002) reported that methoprene affected honeybee foraging activity.” (14)

“Information on the use of the slow-release methoprene briquet is currently under review by the EPA because studies suggest that the use of this product in estuarine areas may cause undue risks to estuarine invertebrates.” (15)

“Overall, methoprene is not expected to be toxic to humans. Its insecticidal properties are due to its action as an insect juvenile hormone analogue, which is a mechanism that is selective to insects (WHO, 1984). Methoprene has been shown to produce liver and kidney toxicity in laboratory animals under certain exposure conditions (CA-SCDHS, 2005). Methoprene does not appear to be carcinogenic or to cause endocrine or reproductive effects.” (16)

“According to EPA’s review, methoprene has shown no adverse effects on human health if ingested or inhaled, but may be slightly toxic if absorbed through the skin.” (17)

Monomolecular Surface Film (Agnique)

A monomolecular surface film (MSF) is a completely unique way to get a pesticide effect. It is not ingested by target organisms to produce a toxic effect. Instead, it interferes with the ability of mosquito larvae and pupae to breathe. Most aquatic invertebrates possess gills, or can absorb dissolved oxygen directly out of the water. Most mosquito larvae, however, must migrate to or remain at the surface and obtain oxygen through a respiratory tube, or siphon. An MSF uses an isostearyl alcohol. It modifies the surface tension by creating a monomolecular surface layer that prevents the larvae from obtaining air through the respiratory tube. The larvae can absorb some dissolved oxygen from the water, and many larvae have small gills, but deprived of atmospheric oxygen, most mosquito larvae die in 24 to 72 hours. The MSF does not interfere with organism that breathe with gills, nor does it prevent atmospheric oxygen from dissolving in the water, so most fish and other aquatic invertebrates are unaffected. An MSF is not very toxic to aquatic life, and the isostearyl alcohol does not accumulate. It is not persistent, and is degraded usually within 2 - 10 days. This type of control has been used extensively on Long Island. An MSF is not effective against blackflies, and should be only applied to standing water.

As stated previously, pesticides pose a potential threat to groundwater quality when they are misused in violation of pesticide laws, rules and regulations, including use in contravention of label directions (pesticide misuse). Pesticides may also pose a threat to groundwater, even when they are lawfully used in accordance with label directions, if their use pattern or chemical and physical properties are such that they have an increased potential to leach through soil.

4.1.4 Mitigation Measures

To mitigate means to make something less severe, or to alleviate a harsh or hostile condition. For SEQR purposes, mitigation may be defined even more broadly. In addition to considering measures which could reduce or minimize adverse environmental impacts, measures which could avoid impacts altogether may also be considered. In the context of this broader definition, a key mitigation measure associated with the use of chemical larvicides is to avoid, or minimize their use. If avoidance of use is not sufficient based on surveillance results, larvicide treatment methods are considered based on the size of the area of concern, its accessibility, and the developmental stage of the larvae. The preferred larvicide is a briquette because it is easy to apply. If an area of concern is not suitable for briquette application, a liquid larvicide suitable for the developmental stage of the larvae can be used with the 48-ounce hand sprayer.

Larvicide is applied aerially by helicopter or a small plane only when mosquito larvae in late stages of development are found across a large area. If Aerial larvicide is applied aerially, it must be applied using Adapco Wingman technology. Adapco Wingman in simple terms is an electronic, computerized GPS unit that will turn on and off when the helicopter reaches a pre-programed no spray area or an area of concern. The unit is also preprogramed to control the application rate as directed on the product label, so it is not over applied. The pesticide label is the law and must be followed to avoid adverse effects in the environment. Aerial application of larvicide is suitable for the south shore marshes because this is a sizeable area, largely unpopulated, with much potential for mosquito development.

NYSDEC prohibits the aerial application of larvicide or adulticide within 500 feet of the breeding areas of threatened species between April 1 and August 31 (see Appendix C for a list of the species of concern and a catalogue of locations where they are known to breed).

Pesticide training and certification is another key mitigation measure. New York State requires all pesticide applicators to hold a Commercial Pesticide Certification in category 5B, Aquatic Insect and Miscellaneous Aquatic Organisms Control, and Public Health Control Certification in category 8 in order to apply pesticides. This certification is valid for three years following initial receipt, and it necessitates that all holders pursue 16 credits of continuing education. It allows staff to apply pesticides by either hand or truck application.

Nassau County holds aquatic pesticide permits authorizing the use of larvicide. Aerial larvicides are applied by a private contractor who holds a NYSDEC permit of aerial pesticide application.

4.2 Adult Control

4.2.1 Physical Control

As stated in Section 2.8.1, physical controls largely do not apply to adult mosquito populations because they fly and cannot be contained easily.

4.2.2 Natural Control

As stated in Section 2.8.2, adult mosquitoes have some natural predators such as dragonflies and bats, but as they are difficult to introduce successfully, Nassau County does not pursue this option.

4.2.3 Chemical Adulticides

The principal impacts discussed in this section are those potential impacts that are associated with the use of chemical adulticides. The potential impacts to the natural environment (i.e., water resources, fish and wildlife) as well as potential impacts to humans are described for each adulticide used in the County.

As the County is not currently pursuing physical or natural controls beyond what already exists in the natural environment, chemical control is applied as needed. Because pesticide products are inherently toxic, no pesticide exposure is risk free. The likelihood of experiencing adverse health effects from exposure to any pesticide, including Scourge, depends primarily on the amount of pesticide that a person contacts and the amount of time the person is in contact with that pesticide. In addition, a person's age, sex, genetic makeup, life style and/or general health characteristics can affect his or her likelihood of experiencing adverse health effects as a result of exposure to pesticides.

Resmethrin (Scourge)

Resmethrin is a synthetic pyrethroid pesticide. Pyrethroids are similar to pyrethrum, a natural pesticide obtained from chrysanthemums. Scourge is the trade name of a formulation of resmethrin that has been synergized. This means that the toxicity has been increased by adding ingredients that enhance the toxic effects. Resmethrin can be applied by ground spraying (truck) or by aerial spraying (airplane). Resmethrin is not persistent. It is a broad spectrum pesticide which will kill target and non-target insects. Accidentally spraying a water body can harm some species of aquatic insects and other invertebrates. It is also extremely toxic to fish. Resmethrin does not appear to accumulate or persist in the tissues of fish and wildlife. The environmental hazard section of resmethrin product (Scourge) labels carry the warning "Do not apply to lakes, streams, or ponds."

Short-term exposures to very high levels of pyrethroid pesticides similar to resmethrin can affect the nervous system, causing effects such as loss of coordination, tremors or tingling and numbness in areas of skin contact. The active ingredients of Resmethrin are dissolved in a petroleum solvent. Short-term exposure to high levels of petroleum solvents can cause irritation of the eye, skin, nose, throat or lung. Vomiting or central nervous system depression may occur if very high levels of petroleum solvents are ingested.

Most people would not be expected to experience any symptoms when Scourge is sprayed for mosquito control. However, there could be some individuals who may be particularly sensitive to one or more constituents of Scourge, and could possibly experience short-term effects such as eye, skin, nose or throat irritation or breathing problems. Children, in particular, may be at greater risk of experiencing adverse effects from the application of Scourge since they may have the potential for greater exposure than adults. Children, particularly infants and toddlers, are most vulnerable because they are in the "oral" stage of life during which they try to understand or experience their environment by touching virtually everything and/or putting them in their mouth. For this reason, they are have a potential for greater exposure than adults, who know better than to touch or ingest items that have come in contact with potentially dangerous products. Children's immune systems are also not fully developed and therefore not as capable of protecting their systems from exposure to harmful materials.

"Permethrin and resmethrin have very low solubility in water, and bind tightly to soil and sediment particles, rarely leaching into groundwater. Permethrin and resmethrin are moderately persistent in soil (half-life of 30 days or less), and certain environmental conditions (i.e., greater organic matter, presence of microbes, sunlight) can facilitate the breakdown process." (18)

As stated previously, pesticides pose a potential threat to groundwater quality when they are misused in violation of pesticide laws, rules and regulations, including use in contravention of label directions (pesticide misuse). Pesticides may also pose a threat to groundwater, even when they are lawfully used in accordance with label directions, if their use pattern or chemical and physical properties are such that they have an increased potential to leach through soil. (21)

The Suffolk County DGEIS, in *A Summary of the Ecological Risk Assessment for Adulticides* concludes that terrestrial birds, mammals and reptiles, and aquatic life are at no risk when resmethrin is used. Terrestrial insects, non-target insects such as butterflies, bees and dragonflies were at risk when resmethrin was used. However, terrestrial insect risks can be mitigated by timing applications (19).

The table, *Summary of the Human Health Risk Assessment for Adulticides* from the Suffolk County DGEIS concluded that "the use of resmethrin products for vector control does not pose a health risk under study conditions." Further no pathways or populations presented acute or chronic risks of concern and no locations had risks of concern under risk assessment conditions (20).

The Minnesota Metropolitan Mosquito Control District reported that resmethrin contains piperonyl butoxide (PBO) which is a synergist making mosquitos more susceptible to the effects of resmethrin. Studies conducted in Japan revealed that PBO can cause cancer in mice and rats. However, the same study found that human safety would only become a concern if the human was exposed to 18,000 times the amount allowed by the Japanese government in a daily food allocation.

The EPA classified PBO as a possible human carcinogen in 1995. Even so, the product does not have restricted uses. (10)

Resmethrin, in another Minnesota Metropolitan Mosquito Control District report was stated to be “highly toxic to fish and bees, and moderately toxic to humans by ingestion and slightly toxic through the skin.” In the same report it was noted that the EPA has established a limit for the presence of resmethrin in food and the World Health Organization stated that when used correctly and at appropriate amounts, resmethrin was unlikely to cause harm to the general public. The Minnesota Department of Health conducted further studies accounting for worse-case scenarios and sensitive populations and found that exposure to resmethrin through skin or inhalation should not pose a health risk. (22)

As with chemical exposures in general, pregnant women should take care to avoid exposure when practical, as the fetus may be vulnerable. Resmethrin and piperonyl butoxide are unlikely to affect pregnancy outcomes in people as a result of spraying. Although some effects occurred in laboratory animals that were given large amounts of either resmethrin or piperonyl butoxide during pregnancy, these amounts far exceeded the amounts that individuals are likely to contact from the spraying with Scourge.

Some pesticide residues may be present on outdoor surfaces after spraying. Limited studies on other chemicals suggest the amount of pesticide transferred to skin:

- decreases with more time after spraying (and very little transfers 24 hours after spraying);
- is less on dry skin compared to wet skin; and
- is less from porous surfaces compared to non-porous ones.

Scourge is applied at very low concentrations to control mosquitoes. It is unlikely that adverse health effects will occur as a result of this use for most people, but some individuals may experience health effects. For these reasons, individuals should consider taking common sense steps to minimize their exposure to Scourge if it is applied to control mosquitoes (see Section 4.2.4).

Sumithrin (Anvil)

Sumithrin (also called phenothrin) is a synthetic pyrethroid pesticide, belonging to the same group as resmethrin and permethrin. Anvil is the trade name for a synergized formulation of sumithrin. Sumithrin can be applied by ground spraying (truck) or by aerial spraying (airplane). Sumithrin is not persistent. It is a broad spectrum insecticide which can kill target and non-target insects. Accidentally spraying a water body can harm some species of aquatic insects and other invertebrates. Sumithrin is extremely toxic to fish. Sumithrin does not appear to accumulate in the tissues of fish and wildlife. The environmental hazards section of sumithrin (Anvil) labels carry the warning "do not apply directly to water, or areas where surface water is present or to intertidal areas below the mean high water mark.

4.2.4 Mitigation Measures

Similar to the case with larvicides, the principal mitigation measure associated with use of adulticides is avoidance, or minimization of use. It is important to note that the County has not utilized aerial spraying of either of the above described adulticides in the last 6 years.

In Nassau County, adulticides are applied only when WNV is present in consecutive and contiguous trap locations or is found to be persistent in an extensive area where larviciding is not enough to contain viral activity and/or adult mosquito population. As stated previously, the presence of WNV in one mosquito is not necessarily a trigger for adulticide application. The persistence of WNV activity in a larger group (60+) of like species of mosquito grouped together, would be more of a determining factor, and more likely to result in adulticiding. There is no correlation between viral activity and population size. Adulticides may also be applied when elevated populations of mosquitoes are causing public distress, after Integrated Pest Management (IPM) and other vector control measures have proved insufficient.

Pesticides are degraded from surfaces more rapidly when exposed to sunlight and water. Although not necessary under most circumstances, if spraying has just occurred and surface contact is high (e. g., playing field sports), then exposure can be minimized by wearing long pants and sleeves and washing exposed skin. Normally, most people would not be expected to experience any symptoms from contact with outdoor surfaces after spraying. However, if you want to take extra steps with small babies, the infant could be placed on a blanket instead of grass if spraying has just occurred. In addition, some small toys, such as those that babies may place in their mouths, could be taken inside before spraying.

Another mitigation measure is to ensure community awareness about any planned, aerial or roadside application of any chemical mosquito control. Legislation passed in 2009 (Nassau County Legislature Amendment to Local Law No. 30-2000, Section 2) outlines notification procedures NCDH must follow for any planned adulticide spraying. It requires that the NCDH notify members of the County Legislature when the department submits a request to the NYSDOH to apply aerial adulticide. Major news outlets are notified 24 hours in advance of any planned aerial adulticide spraying. Notice is posted on the NCDH website at least 24 hours in advance of any spraying activity. Information released must include the timing, duration, location, and method (i.e., aerial or truck) of spraying; as well as name of pesticide to be used, health concerns of this pesticide, safety recommendations for residents, and the NCDH contact information (phone and website). In the case of adulticide application that is cancelled and rescheduled, the legislator, media, and public are notified 24 hours in advance of any spraying.

The NCDH has publicized spraying dates and locations on local sources such as News 12, the Long Island Newsday newspaper, and local radio stations. Media companies are not required to disseminate information regarding spraying, but are encouraged to do so.

As stated in Section 4.1.4 pesticide training and certification is another key mitigation measure. New York State requires all pesticide applicators to hold a Commercial Pesticide Certification, in category 5B, Aquatic Insect and Miscellaneous Aquatic Organisms Control, and Public Health Control Certification in category 8 in order to apply pesticides. This certification is valid for three years following initial receipt, and it necessitates that all holders pursue 16 credits of continuing education. It allows staff to apply pesticides by either hand or truck application.

Nassau County holds aquatic pesticide permits authorizing the use of adulticides. Aerial adulticides can only be applied by a private contractor who holds a NYSDEC permit for aerial pesticide application.

In the event of a public health emergency due to an outbreak of WNV, NCDH notifies media outlets and publishes information on the Nassau County website.

Once community notification has been completed, there are other measures and steps that can be taken to reduce possible exposures during or after aerial spraying, including:

- Children and pregnant women should take care to avoid exposure when practical. If possible, remain inside or avoid the area whenever spraying takes place and for about thirty minutes after spraying. That time period will greatly reduce the likelihood of your breathing pesticide in air.
- Close windows and doors and turn off window air-conditioning units or close their vents to circulate indoor air before spraying begins. Windows and air-conditioner vents can be reopened about 30 minutes after spraying.
- If you come in direct contact with Scourge spray, protect your eyes. If you get Scourge spray in your eyes, immediately rinse them with water. Wash exposed skin. Wash clothes that come in direct contact with spray separately from other laundry. This measure is more applicable to those handling the materials (i.e., County crews applying the spray).
- Consult your health care provider if you think you are experiencing health effects from spraying.
- If spraying just occurred, minimize your contact with surfaces and wash skin that has come in contact with surfaces.
- Pick homegrown fruits and vegetables you expect to eat soon before spraying takes place. Rinse homegrown fruits and vegetables (in fact, all produce) thoroughly with water before cooking or eating.
- Cover outdoor tables and play equipment before spraying or wash them off with detergent and water after they have been sprayed.

- Bring laundry and small toys inside before spraying begins (wash with detergent and water if exposed to Scourge during spraying).

- Prior to spraying, bring pet food and dishes inside, and cover ornamental fishponds to avoid direct exposure. If possible, keep your pet inside during the spraying and for about 30 minutes afterwards to help minimize exposure. The amount of pesticide that a pet is likely to track into the house will depend on many of the same factors that were discussed above.

Scourge breaks down fairly quickly in water and in sunlight. No special precautions or waiting periods are needed for swimming pools. However, if you have a pool cover, you may wish to use it before spraying.

Pesticide impacts are also avoided or mitigated by:

- Continued implementation of the MCP expected to reduce the need to use larvicides.

- Use of the previously described Adapco Wingman technology would optimize aerial adulticide applications (maximize mosquito control while minimizing pesticide usage).

- Continued consultation with the NYSDEC and other resource agencies will ensure that all pesticide applications avoid impacts to endangered species and minimize impacts to settings of particular concern, whether through the use of setbacks, adjustments in application timing, or avoidance of specific areas.

Notwithstanding the above, it is important to repeat that the County has not had to utilized aerial spraying of either of the above described adulticides in the last 6 years.

4.3 Irreversible and Irretrievable Commitments of Resources

Irreversible and/or irretrievable commitments of resources refers to the extent to which a proposed action may cause permanent loss of one or more natural or man-made resources that would be consumed, converted or made unavailable for further uses due to construction, operation, or use of the proposed project. Typical examples include the filling of wetlands; paving over or construction on valuable agricultural soils; use of non-renewable, or non-recyclable materials in new structures; and use of fossil fuels in construction or operation of the project.

The physical controls such as inspection and maintenance of ditches in the marsh areas or inspection and maintenance of storm water system structures such as catch basins, sumps, and/or recharge basins do not "consume" resources or make them unavailable for future use. The minimal extent to which chemical larvicides or adulticides are used has not resulted in any consumption or permanent loss of natural or man-made resources.

4.4 Growth Inducing Aspects

Growth-inducing effects of an action generally relate to whether the proposed action may support or encourage:

- significant increases in local population by creating or relocating employment, or by providing support facilities or services (stores, public services, etc.), or
- the development potential of a local area, for example, by the extension of roads, sewers, water mains, or other utilities.

The physical controls such as inspection and maintenance of ditches in the marsh areas or inspection and maintenance of storm water system structures such as catch basins, sumps, and/or recharge basins has no bearing on significant increases in local population. It does not generally create, or relocate, employment opportunities or support facilities or services. The minimal extent to which chemical larvicides or adulticides are used has no potential to trigger the development potential of a local area or the basic infrastructure in that area (i.e., roads, sewers, water, or other utilities).

4.5 Impacts on the Use and Conservation of Energy

Impacts on the use and conservation of energy generally relate to a description of energy sources to be used during both construction and operational phases of the proposed project, and/or anticipated levels of demand or consumption.

There are no major “construction” elements associated with the MCP, no major long-term structures like buildings, warehouses, or other residential, commercial or industrial elements. Apart from the minor maintenance and inspection associated with existing storm water system elements, there are no typical, energy consuming, vehicles or machinery such as would be used for clearing, grading, demolition, excavation, or filling, and other activities associated with construction and operation. The energy consumption associated with vehicles for truck spray application or the rare, aerial application, is negligible compared to the energy consumption for even a moderate sized construction project or permanent structure.

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SECTION 5.0

ALTERNATIVES

5.0 ALTERNATIVES

As required, the County evaluated a full range of alternatives for the technical approach, procedures, and implementation of the MCP. This section describes the range of alternatives, from the "no action" alternative to the various control alternatives that the County considered for the MCP.

5.1 No Action

The responsibilities of the NCDH and the NCDPW are specifically written in Chapters IX and XII of the Nassau County Charter and Administrative Code. These responsibilities include maintenance of public health and mosquito control. Therefore, after the first recorded occurrence of WNV in the County in 1999, the "no action" alternative was never a viable solution. The potential, however small in terms of percentage, for mosquitoes to carry and transmit West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE), the need for a mosquito control plan has far larger goals than simply dealing with mosquitos as a "nuisance."

In the context of environmental review under SEQRA, the no action alternative can also refer to keeping the status quo of a particular program. The County's MCP was, and continues to be, a dynamic plan. That is, a plan can evolve, be expanded or reduced as needed, or be revised based on what is learned as it is monitored. So, keeping the status quo with respect to the MCP, even as it appears to be working, may not always be a viable alternative.

5.2 Public Education and Outreach

There is general agreement that public education, outreach, and participation is the most environmentally friendly alternative for mosquito control, and should be the foundation of an effective mosquito control program. There are numerous alternatives for facilitating public education, outreach, and participation for mosquito control, including:

- Internet Websites

- Publication and Mailings of Written Materials (pamphlets, brochures, articles)
- Public Meetings and Events
- Radio and Television
- Newspapers, Newsletters

5.2.1 Internet

The abundance and popularity of personal computers, tablets and hand-held devices makes the internet the most readily available and immediate source of information today. For the small segment of the population that does not have access to a personal computer, there are places such as internet cafes and public libraries where people can access information about mosquito control in general, and specifically, the County's MCP. Municipal agencies and educational institutions also maintain websites where they can post articles, announcements, publications, and weblinks on virtually any subject of interest regarding mosquito control. So called "smart phones" and "tablets" are also abundantly available and provide a most convenient means to look for, and find information. Listservs (e-mail lists maintained by municipal agencies or other organizations) also provides a convenient means to distribute information to interested parties and the public.

5.2.2 Publication and Mailings of Written Materials

Municipal entities (counties, towns, cities, incorporated villages) can produce written materials such as brochures, pamphlets, articles, newsletters, and inserts and mail them to residents and businesses as part of mass or targeted mailings, such as residents and businesses in particularly mosquito prone areas such as areas near tidal marshes, wetlands or surface water bodies.

5.2.3 Public Meetings and Events

Municipal entities can plan, organize, and coordinate public informational meetings, hearings, or events at specific locations, dates, and times to inform, educate, and encourage the participation of, the general public. Municipalities can also work with, or provide assistance and support to, civic groups and organizations that hold regular public meetings. Presentations, demonstrations, and dissemination of written materials at popular public events such as Earth Day, or other community awareness or clean-up events, are also good means of achieving public information, outreach and participation goals.

5.2.4 Radio and Television

Municipalities can also work with local radio and television stations to spread important information or announcements related to the MCP. Both public and cable TV services can also be utilized for this purpose.

5.3 Larval Control

Control of larvae can be accomplished through use of contact poisons, growth regulators, surface films, stomach poisons (including bacterial agents), and biological agents such as fungi, nematodes, copepods, and fish. A chemical commonly used in the United States is methoprene, considered slightly toxic to larger animals, which mimics and interferes with natural growth hormones in mosquito larvae, preventing development. Methoprene is frequently distributed in time-release briquette form in breeding areas.

It is believed by some researchers that the larvae of *Anopheles gambiae* (important mosquito vector of malaria) can survive for several days on moist mud, and that treatments should therefore include mud and soil several meters from puddles.

5.3.1 Physical Control

As stated in Section 2.7.1, approximately 1,000 miles of drainage ditches were constructed up through the 1950s in order to reduce salt marsh mosquito populations as well as to improve drainage along the shoreline of the south shore barrier islands and islets. Since 1977, approximately 700 miles have been reconditioned to improve drainage along the shoreline, on the south shore barrier islands, and among the numerous hassocks and islets. This reduces the size and number of puddles and areas of standing water suitable for mosquito egg hatching and larval development. The DPW utilizes specialized equipment to maintain and recondition the drainage ditches, and to cut access paths that facilitate inspection, maintenance and treatment of mosquito breeding areas. Ditching was intended to reduce mosquito breeding by draining standing water on the marshes and also by allowing fish access to breeding areas where they could feed on the mosquito larvae. The overall effectiveness of ditching as a mosquito control technique has been debated for some time, with no clear conclusion as to its efficacy.

Most of the impacts of (or impacts attributed to) ditching stem from water table differences. Loss of surface water, for example, results in loss of habitat for muskrats (Bourn and Cottam, 1950) and diminished water fowl use of the marsh (Clarke et al., 1984). Other birds, for complex reasons, may not find the habitat as amenable, as was suggested for sharp tailed sparrows (Post and Greenlaw, 1975). Changes in the water table may promote different vegetation on the marsh. Woody, upland type vegetation are often found out on the marsh after ditch installation (Miller and Egler, 1950), and Phragmites invasion is believed to be fostered by ditching (Bart and Hartman, 2002). Phragmites colonization after ditching may be supported by drying out of the marsh in general, or it may be that Phragmites first colonizes drier areas along the ditches, and then spread s into the interior of panels, although the water table there is no lower or fresher than it was pre-ditching. There is ample evidence that Phragmites propagation by runner does not require the drier, less salty conditions that seed germination needs (Warren et al., 2001). The drier area along the ditch may be from drainage, or from the establishment of a berm along the ditch edge from poor spoils placement or the hypothetical settling out of particles as the tide wells up out of the ditch.

The aesthetic impacts of ditching are usually judged to be negative. Salt marshes are generally perceived as being part of the natural system. The presence of geometrical structures n these environments is often considered an artificial intrusion in a natural setting. As a consequence, the County can allow natural processes to proceed in that environment (often called reversion). This is essentially a “no-action” alternative. There is also some debate as to whether allowing the ditched areas to revert to their natural condition would actually increase mosquito populations.

The County's preferred approach for the present is to continue ditch maintenance. It is the only kind of activity explicitly allowed under New York State Tidal Wetlands regulations (6 NYCRR Part 661). The presence of ditches in almost all marshes in the County reflects an environment that has already been altered, and it is unclear that allowing natural processes to occur will result in remediated, good functioning salt marshes, especially on a time scale acceptable to people, in all instances. In addition, it is generally thought that most natural salt marshes will produce large numbers of mosquitoes, although the truth of this assertion is difficult to prove. Chapman (1974) asserted that "wild" salt marshes produce tremendous numbers of mosquitoes, and evidence from before the advent of large-scale ditching indicates that salt marshes on the East Coast generated so many pestiferous mosquitoes as to make their general surroundings uninhabitable (Daiber, 1986). Anecdotal information from times over the past half-century in Suffolk or Nassau Counties when ditch maintenance slacked suggests that mosquito breeding increased markedly then, too (mosquito problems may have been checked by additional pesticide use, however).

5.3.2 Natural Control

Many saltwater or brackish water fish, amphibians or reptiles eat mosquito larvae. The common killifish are abundant in these waters of the bays and ditches on the south shore. Several varieties of small, top-feeding fish, including mos-quitofish (*Gambusia)* can be introduced to storm water basins that hold water year-round. However, the NYSDEC no longer allows the introduction of *Gambusia* to waterways in Nassau County because it is a non-native species.

5.3.3 Chemical Controls

Mosquito larvae can also be control through application of larvicides. Larvicides considered by the County include Altosid (Methoprene); Agnique, Anvil, Malathion, Scourge, and Vectypbac BTI.

Methoprene (Altosid)

Methoprene is a juvenile hormone (JH) analog which acts as a growth regulator when used as an insecticide. It is an amber-colored liquid with a faint fruity odor which is essentially nontoxic to humans when ingested or inhaled. It is used in drinking water cisterns to control mosquitoes which spread dengue fever and malaria.

Methoprene does not kill adult insects. Instead, it acts as a growth regulator, mimicking natural juvenile hormone of insects. Juvenile hormone must be absent for a pupa to molt to an adult, so methoprene-treated larvae will be unable to successfully change from pupae to adults. This breaks the biological life cycle of the insect, preventing recurring infestation. Methoprene is used in the production of a number of foods, including meat, milk, mushrooms, peanuts, rice, and cereals. It also has several uses on domestic animals (pets) for controlling fleas. Methoprene is considered a biochemical pesticide because rather than controlling target pests through direct toxicity, methoprene interferes with an insect’s lifecycle and prevents it from reaching maturity or reproducing. Methoprene is used most widely as the mosquito larvicide Altosid, which is an important measure in reduction of the spread of West Nile Virus.

Methoprene is not persistent. It is fairly specific for mosquito larvae, but some studies have shown impacts on other non-target aquatic insects. While methoprene is listed as being somewhat toxic to fish, very little potential for toxicity to fish and wildlife exists. Methoprene may accumulate to low levels in fish. Some specific products are labeled "Do not use in waters that are known fish habitat." (USFWS, 2004)

Agnique

Agnique® MMF is a biodegradable, alcohol ethoxylated (AE) surfactant (the greatest use of AE's is in domestic detergents, household cleaners, and personal care products such as shampoos. AE's are readily biodegradable under aerobic and anaerobic conditions), made from renewable plant oils. AGNIQUE® MMF can be applied to any mosquito habitat with standing water. Using conventional spraying methods, an invisible monomolecular film rapidly spreads over the surface of standing water habitats. This film interrupts the critical air/water interface in the mosquito’s larval and pupal development cycle causing them to drown. Field tests have shown the AGNIQUE® MMF film to remain potent for up to 21 days. AGNIQUE® MMF is highly effective and has the unique ability to spread quickly and completely across the water’s surface. When the correct amount has been applied, there will be no breaks or gaps in the film from which mosquitoes can emerge. A significant advantage is that mosquitoes cannot develop resistance to AGNIQUE® MMF because control is through a physical mode of action. Another advantage of the physical mode of action is its effectiveness on all mosquito species.

Agnique MMF “can be used around humans, birds, fish, pets and all other animals and wildlife. Control is by a physical mode of action rather than chemical toxicity.” (23)

Agnique MMF remains on the water’s surface and does not enter the water column. Thus, contact with organisms feeding or living throughout the aquatic habitat is minimized. Ninety-six hour, static, acute toxicological tests were conducted to determine the effects of up to a 100-fold excess of a monomolecular film. The results from this test showed no acute effect on any life stage of the following:

- Long-nose killifish
- Freshwater shrimp
- Freshwater amphipod
- Fairy shrimp
- Grass shrimp
- Fiddler crab
- Freshwater isopod
- Snail

Other published studies have shown:

- Daphnia, dragonfly, bluegill, easter oysters, amphipod, crayfish, mallard duck, many arthropods and microcrustacea are not affected.

- Green tree frog, when exposed to a constant film presence for six months, showed no adverse effects. The frog progressed normally from tadpole to adult through several generations.

- Some arthropods requiring access to the water surface in their lifecycles have shown to be affected by the physical mode of action of Agnique. However, complete regeneration of the population occurred in 3 to 7 days. (23)

Cognis corporation Material Safety Data Sheet reports that Agnique MMF is not irritating to the skin but may cause eye irritation (24).

Malathion

Malathion is a pesticide that is mainly used to protect food-producing plants from threatening insects. Often used in agriculture, Malathion pesticides are known to combat destructive pests while maintaining low toxicity to humans.

In fact, Malathion has also been used in public health programs designed to get rid of mosquitos. Additionally, Malathion (when used in lower portions) can be used to treat head and body lice.

Vectobac, BTI

Vectobac BTI, (*Bacillus thuringiensis* var. israeliensis) is a naturally occurring soil bacterium that is eaten by the mosquito larvae, infecting and killing them. It is available in granular form or in a doughnut-shaped briquette. It is target- specific to mosquitoes but does not kill the pupal stage because pupae do not eat.

Bti is a biological control pesticide produced from bacteria, Bacillus thuriniensis israelensis serotype H-14. These bacteria produce spores containing crystals. When the spores or the crystals are eaten by blackfly or mosquito larvae, their digestive system is affected, killing the larvae. Used as a larvicide and applied directly to the water, Bti is not persistent. Bti is very specific, killing only the larvae of mosquitos, blackflies, and a few non-biting flies. Most other species of aquatic insects are not affected by Bti. The potential for toxicity to fish is so small as to be considered negligible. Bti does not accumulate in fish and wildlife.

Methoxychlor

Methoxychlor: Methoxychlor is an organochlorine pesticide, belonging to the same group of pesticides as DDT. Methoxychlor had been primarily used as a larvicide in New York State and had limited use as an adulticide. As a larvicide, methoxychlor was applied directly to water. Unlike DDT, methoxychlor is not persistent. Methoxychlor is a broad spectrum pesticide, killing target and non-target aquatic insects alike. Methoxychlor at application rate is toxic to some mayflies, stoneflies, and caddisflies. These non-target aquatic insects are important food for many fishes. While methoxychlor is very toxic to fish, actual field studies in streams treated with methoxychlor have not demonstrated any lethality from proper applications. Accumulation in fish flesh was not a serious problem. Methoxychlor is no longer labeled for aquatic (larvicide) use.

Temephos

Temephos is an organophosphate pesticide, belonging to the same group as malathion and naled. Temephos is used primarily as a larvicide and is applied directly to the water. When applied at a concentration of 0.1 ppm, temephos will not harm most non-target aquatic insects, yet it is effective against mosquito and blackfly larvae. It does not pose a significant threat to fish. Temephos is not persistent. It is however a broad spectrum pesticide and at higher concentrations it will kill target as well as non-target aquatic insects. It does not accumulate, so contamination of fish flesh should not occur. (USFWS, 2004)

Monomolecular Surface Film (Agnique)

A monomolecular surface film (MSF) is a completely unique way to get a pesticide effect. It is not ingested by target organisms to produce a toxic effect. Instead, it interferes with the ability of mosquito larvae and pupae to breathe. Most aquatic invertebrates possess gills, or can absorb dissolved oxygen directly out of the water. Most mosquito larvae, however, must migrate to or remain at the surface and obtain oxygen through a respiratory tube, or siphon. An MSF uses an isostearyl alcohol. It modifies the surface tension by creating a monomolecular surface layer that prevents the larvae from obtaining air through the respiratory tube. The larvae can absorb some dissolved oxygen from the water, and many larvae have small gills, but deprived of atmospheric oxygen, most mosquito larvae die in 24 to 72 hours. The MSF does not interfere with organism that breathe with gills, nor does it prevent atmospheric oxygen from dissolving in the water, so most fish and other aquatic invertebrates are unaffected. An MSF is not very toxic to aquatic life, and the isostearyl alcohol does not accumulate. It is not persistent, and is degraded usually within 2 - 10 days. This type of control has been used extensively on Long Island. An MSF is not effective against blackflies, and should be only applied to standing water. (USFWS, 2004)

5.4 Adult Control

In 1958, the National Malaria Eradication Program implemented the wide-scale use of DDT for mosquito control.

Control of adult mosquitoes is the most familiar aspect of mosquito control to most of the public. It is accomplished by ground-based applications or via aerial application of residual chemical insecticides. Generally modern mosquito-control programs in developed countries use low-volume applications of insecticides, although some programs may still use thermal fogging.

5.4.1 Physical Control

Ditches

More of a mosquito breeding control, Open water marsh management (OWMM) involves the use of shallow ditches, about 4 feet (1.2 m) wide and 2 feet (0.61 m) deep, to create a network of water flow within marshes and to connect the marsh to a pond or canal. The network of ditches drains the mosquito habitat and lets in fish which will feed on mosquito larvae. This reduces the need for other control methods such as pesticides. Simply giving the predators access to the mosquito larvae can result in long-term mosquito control. Ditching is used on both the eastern and western coasts of the United States.

Rotational Impoundment Management (RIM)

RIM involves the use of large pumps and culverts with gates to control the water level within an impounded marsh. RIM allows mosquito control to occur while still permitting the marsh to function in a state as close to its natural condition as possible. Water is pumped into the marsh in the late spring and summer to prevent the female mosquito from laying her eggs on the soil. The marsh is allowed to drain in the fall, winter, and early spring. Gates in the culverts are used to permit fish, crustaceans, and other marsh organisms to enter and exit the marsh. RIM allows the mosquito-control goals to be met while at the same time reducing the need for pesticide use within the marsh. Rotational impoundment management is used to a great extent on the east coast of Florida.

5.4.2 Natural Control

Also known as “biological” control, natural control is the use of natural enemies to manage mosquito populations. There are several types of natural control including the direct introduction of parasites, pathogens and predators to target mosquitoes. Effective natural control agents include predatory fish that feed on mosquito larvae such as mosquitofish (Gambusia affinis) and some cyprinids (carps and minnows) and killifish. Tilapia will also consume mosquito larvae. Direct introduction of tilapia and mosquitofish into ecosystems around the world have had disastrous consequences. However, utilizing a controlled system via Aquaponics provides the mosquito control without the adverse effects to the ecosystem.

Other predators include dragonfly naiads, which consume mosquito larvae in the breeding waters, adult dragonflies, which eat adult mosquitoes, and some species of lizard and gecko. Some other natural agents that have had lesser degrees of success include the predator mosquito Toxorhynchites and predator crustaceans—Mesocyclops copepods, nematodes, and fungi. Some public agencies also employ other predators such as birds, bats, lizards and frogs, but evidence of effectiveness of these agents is only anecdotal.

Like all animals, mosquitoes have their own set of diseases. Invertebrate pathologists study these diseases in the hope that some of them can be utilized for mosquito management. Microbial pathogens of mosquitoes include viruses, bacteria, fungi, protozoa, nematodes, and microsporidia (Davidson 1981, Jahn 1996).

Bats and Mosquitoes

One commonly recommended approach for controlling mosquitos is to attract bats to your backyard with a bat-roost box (aka bat house). While studies have shown that bats devour a huge number of insects, mosquitoes are only a small part of their diet. A study of fecal pellets of bats in Indiana conducted throughout an entire summer revealed that the primary food items were beetles, moths, and leafhoppers. A very small number of mosquitoes (0.7%) were found in the stomachs of bats in another study. Bats are "selective opportunists" when it comes to their feeding habits, and they will take a variety of prey. Bats will often prefer larger prey over the relatively small mosquito. Unfortunately, mosquitoes are just not a significant part of their diet. The evidence from stomach analysis and feces examination does not justify the hypothesis that insectivorous bats specialize on particular types of insects.

Recently the Colorado Department of Public Health advised that bats can be infected with rabies, and that attempting to attract bats to your yard may increase the potential for human disease.

5.4.3 Chemical Control

Resmethrin (Scourge)

Scourge is a pesticide product that is used to control mosquitoes in outdoor residential and recreational areas. It contains resmethrin and piperonyl butoxide as active ingredients. Resmethrin is a man-made pyrethroid insecticide that can also be found in other pesticide products used indoors and on pets to control ticks and insects, such as fleas and ants. Piperonyl butoxide does not directly kill insects on its own, but acts to increase the ability of resmethrin to kill insects. These active ingredients are dissolved in a petroleum solvent. Petroleum solvents are similar to paint thinner or kerosene. Scourge may be applied as is or may be diluted with other petroleum-based products, such as mineral oil, before application.

Resmethrin is a synthetic pyrethroid pesticide. Pyrethroids are similar to pyrethrum, a natural pesticide obtained from chrysanthemums. Scourge is the trade name of a formulation of resmethrin that has been synergized. This means that the toxicity has been increased by adding ingredients that enhance the toxic effects. Resmethrin can be applied by ground spraying (truck) or by aerial spraying (airplane). Resmethrin is not persistent. It is a broad spectrum pesticide which will kill target and non-target insects. Accidentally spraying a water body can harm some species of aquatic insects and other invertebrates. It is also extremely toxic to fish. Resmethrin does not appear to accumulate or persist in the tissues of fish and wildlife. The environmental hazard section of resmethrin product (Scourge) labels carry the warning "Do not apply to lakes, streams, or ponds."

Because pesticide products are inherently toxic, no pesticide exposure is risk free. The likelihood of experiencing adverse health effects from exposure to any pesticide, including Scourge, depends primarily on the amount of pesticide that a person contacts and the amount of time the person is in contact with that pesticide. In addition, a person's age, sex, genetic makeup, life style and/or general health characteristics can affect his or her likelihood of experiencing adverse health effects as a result of exposure to pesticides.

Sumithrin (Anvil/Duet)

Sumithrin (also called phenothrin) is a synthetic pyrethroid pesticide, belonging to the same group as resmethrin and permethrin. Anvil is the trade name for a synergized formulation of sumithrin. Sumithrin can be applied by ground spraying (truck) or by aerial spraying (airplane). Sumithrin is not persistent. It is a broad spectrum insecticide which can kill target and non-target insects. Accidentally spraying a water body can harm some species of aquatic insects and other invertebrates. Sumithrin is extremely toxic to fish. Sumithrin does not appear to accumulate in the tissues of fish and wildlife. The environmental hazards section of sumithrin (Anvil) labels carry the warning “do not apply directly to water, or areas where surface water is present or to intertidal areas below the mean high water mark.” (USFWS, 2004)

Anvil is applied aerially via fixed-wing and rotary aircraft or via ground applications (truck/ATV/backpack) using ultra-low volume (ULV) sprayers. According to the Anvil Technical Bulletin published in January 2006, these sprayers create a fine mist of drops that average 17 micrometres in size -- smaller than the size of a pinhead. A very small amount of active ingredient is used; about 6 tenths of an ounce of active ingredient is used to treat an acre (4.2 kg/km^2).

The active ingredients in Anvil break down quickly in sunlight and do not bioaccumulate. There are no restricted entry intervals (REI) or reentry precautions for Anvil. An REI or re-entry time, is the time after the end of a pesticide application during which entry into the treated area is restricted. This time allows residues to disperse and not pose a risk.

Duet™, an advanced dual-action mosquito adulticide, combines the proven efficacy of sumithrin (the active ingredient found in Anvil) plus the exceptional knockdown of prallethrin. Together, these two active ingredients cause “benign agitation”, or a unique, non-biting excitation. This offers the potential to draw mosquitoes from a resting state…enabling greater control of the natural population.

Duet is toxic to aquatic organisms, including fish and aquatic invertebrates. Runoff from treated areas or deposition of spray droplets into a body of water may be hazardous to fish and aquatic invertebrates. It is recommended that Duet not be applied to bodies of water (lakes, rivers, permanent streams, natural ponds, commercial fish ponds, swamps, marshes or estuaries), except when necessary to target areas where adult mosquitoes are present, and weather conditions will facilitate movement of applied material beyond the body of water in order to minimize incidental deposition into the water body.” (25)

Duet is considered a pyrethroid. “Permethrin is readily broken down or degraded in most soils except organic types. … The addition of nutrients to soil may increase the degradation of permethrin in the soil.” (26)

Duet is toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply to or allow drift onto blooming crops or weeds when bees are visiting the treatment area, except when applications are made to prevent or control a threat to public and/or animal health determined by a state, tribal or local health vector control agency on basis of documented evidence of disease causing agents in vector mosquitoes or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort. (27)

There is also a synergistic effect associated with Duet. The third ingredient in Duet is piperonyl butoxide (PBO) which isn't an insecticide but an ingredient which makes the insecticides more potent. "Piperonyl butoxide is especially harmful to the developing fetal brain. A 2011 study, conducted at Columbia University and published in the journal Pediatrics, found that infants whose mothers had been exposed to low levels of piperonyl butoxide (PBO) during their third trimester showed delayed mental development by the age of three."

Naled

Naled is an organophosphate pesticide, belonging to the same group of pesticides as temephos and malathion. Until a few years ago, Naled was probably the most commonly used mosquito/blackfly adulticide used in New York State. It is applied by ground spraying (truck) or by aerial spraying (airplane). Naled does not persist more than two days after application. Naled is a broad spectrum pesticide which kills target and non-target terrestrial insects. Naled will kill aquatic insects and is potentially toxic to fish and birds. Naled does not accumulate in fish and wildlife tissue. The environmental hazards section of naled product labels carry the warning "Do not apply directly to water or wetlands (swamps, bogs, marshes, or potholes)." The label instructions specify ". . .vegetation around stagnant pools, marshy areas, swamps, . . . may be treated." Naled applied to vegetation can be taken up by plants and metabolized. One of the breakdown products resulting from the plant's metabolism of Naled is itself another organophosphate insecticide known as dichlorvos, or DDVP, which can be further metabolized or evaporated off. (USFWS, 2004)

Pyrethrins

Pyrethrins are a mixture of similar natural pesticides obtained from chrysanthemums (pyrethrum). They frequently have synergists added which increases their toxicity. Pyrethrins can be applied by ground spraying (truck) or by aerial spraying (airplane). Pyrethrins are not persistent and breakdown rapidly in sunlight. They are a broad spectrum pesticide which will kill target and non-target insects. Accidentally spraying a water body can harm some species of aquatic insects and other invertebrates. They are also extremely toxic to fish. Pyrethrins do not appear to accumulate or persist in the tissues of fish and wildlife. The environmental hazard section of this product (Pyrethrins) labels carry the warning "Do not apply to any body of water."

Chlorpyrifos

Chlorpyrifos is an organphosphate pesticide, belonging to the same class of pesticides as malathion and naled. It can be applied by ground spraying or aerial spraying. Unfortunately, chlorpyrifos is very persistent, unlike most organophosphate pesticides. It is also extremely toxic to fish and wildlife. It is a broad spectrum pesticide which kills target and non-target insects. Chlorpyrifos will kill aquatic invertebrates and has a strong potential to be toxic to fish and birds. Field applications, at labeled rates, have been shown to kill fish and ducklings. Some studies indicate that chlorpyrifos can bioaccumulate. Chlorpyrifos was developed for use as a larvicide, but is no longer registered for that use. The environmental hazards section of chlorpyrifos product labels carry the warning "Do not apply directly to water." Because of possible regulatory actions by both the EPA and New York State, chlorpyrifos may soon be no longer available in New York for use as a mosquito control pesticide. (USFWS, 2004)

Methoxychlor

As an adulticide, methoxychlor is applied by either ground or aerial spraying. It is not persistent relative to DDT, but it is more persistent than the organophosphate or pyrethroid type insecticides. Methoxychlor is a broad spectrum pesticide which will kill target and non-target insects alike. Direct application to water can harm some species of aquatic insects and other invertebrates. Accumulation in fish and wildlife tissue is not a serious problem. The environmental hazards section of methoxychlor (adulticide formulation) product labels carry the warning "Do not apply directly to lakes, streams, and ponds."

Permethrin

Permethrin is a synthetic pyrethroid pesticide, belonging to the same group as resmethrin and sumithrin. Biomist is the trade name for a synergized formulation of permethrin. Permethrin can be applied by ground spraying (truck) or by aerial spraying (airplane). Permethrin is not persistent. It is a broad spectrum insecticide which can kill target and non-target insects, including bees. Accidentally spraying a water body can harm some species of aquatic insects and other invertebrates. Permethrin is extremely toxic to fish. Permethrin does not appear to accumulate in the tissues of fish and wildlife. The environmental hazards section of permethrin (Biomist) labels carry the warning “do not apply directly to water, or wetlands (swamps, bogs, marshes, and potholes)”. In addition, it contains a warning that it “is highly toxic to bees exposed to direct treatment on blooming crops or weeds.”

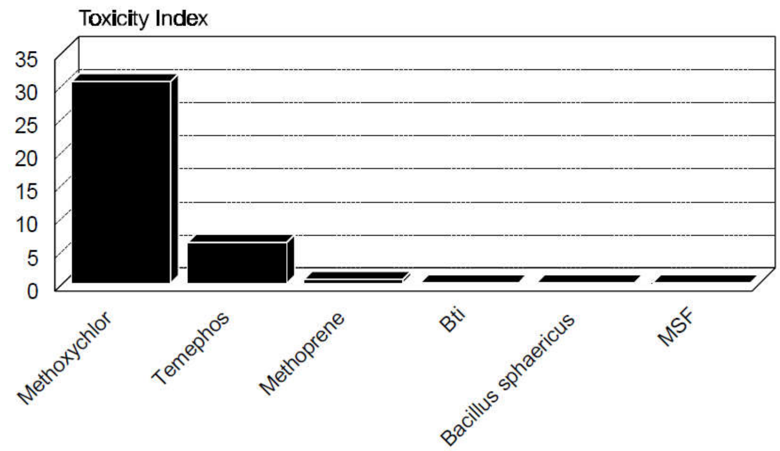
The relative toxicity of larvicides and adulticides to fish and birds is illustrated in Figure 5-1.

5.5 Other Alternatives

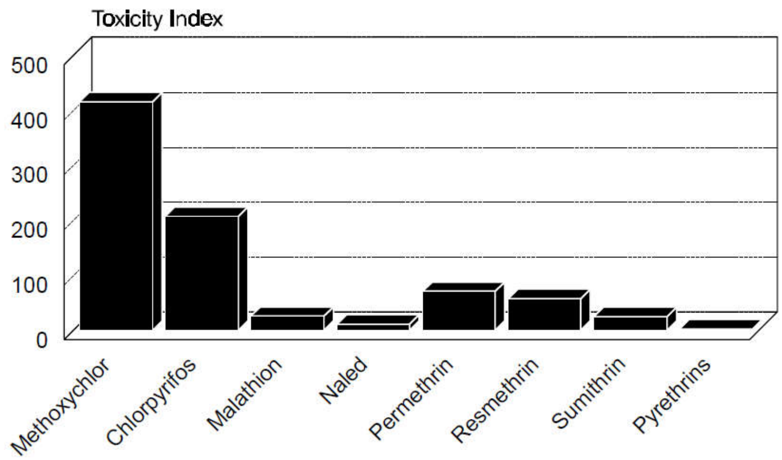
Source Reduction

As already mentioned, since many mosquitoes breed in standing water, source reduction can be as simple as emptying water from containers around the home. This is something that homeowners can accomplish. For example, homeowners can eliminate mosquito breeding grounds by removing unused plastic pools, old tires, or buckets; by clearing clogged gutters and repairing leaks around faucets; by regularly changing water in bird baths; and by filling or draining puddles,

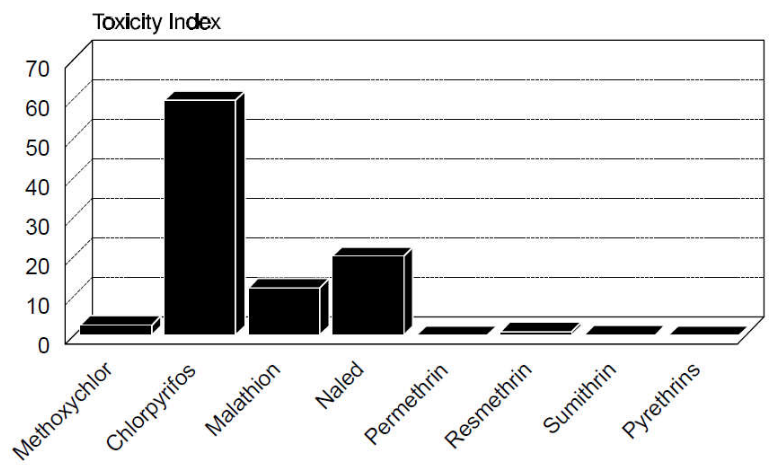
Relative Toxicity of Larvicides to Fish



Relative Toxicity of Adulticides to Fish



Relative Toxicity of Adulticides to Birds



Note: The smaller the index, the less likely the risk of toxicity

Source: Paul and Sinnott, 2000

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COUNTY OF NASSAU
MOSQUITO CONTROL PROGRAM
FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

RELATIVE TOXICITY OF PESTICIDES

FIGURE 5-1

J:_EnvPermitting\3424 (Nassau County DPW)\Mosquito Control Program GEIS\FINAL GEIS\Updated Figures\Updated Charts FGEIS swampy areas, and tree stumps. Eliminating such mosquito breeding areas can be an extremely effective and permanent way to reduce mosquito populations without resorting to insecticides. Source reduction is an important consequence of the public education, outreach, and participation elements of the County's MCP.

Misting Systems

Installed residential misting systems have also been a hot topic lately. There are numerous problems with these systems which include but are not limited too; un-needed pesticide application, over application, development of pesticide resistance, etc. Again the AMCA has addressed this issue. CMC concurs with the AMCA statement.

Bug Zappers

Almost 2 million homeowners have turned to the use of ultraviolet or black light electrocutors to zap their mosquito problems. However, researchers have found that while these traps do attract and kill thousands of insects every night, mosquitoes comprised only 6.4% of a five-day insect catch. Not only was the mosquito population a small percentage of all insects killed during this particular study, but only half of the mosquitoes killed were the biting, blood-feeding females.

Citrosa Plants

Many plants are commonly thought to repel mosquitoes. Over the past few years the citrosa plant was created by crossing tissue cultures of an African Germanium with the Grass of China. The Grass of China contains citronella oil, and has been used for years as an active ingredient in mosquito repellent candles. No studies are available to support the idea that the citrosa plant or any other plant actually repels mosquitoes strongly enough to improve human comfort. In fact, some researchers believe that the only way the citrosa plant can release the citronella oil is if the plant is crushed.

Natural Soil Bacteria

Also used as biological control agent are the dead spores of varieties of the natural soil bacterium Bacillus thuringiensis, especially Bt israelensis (BTI). BTI is used to interfere in the digestion systems of larvae. It can be dispersed by hand or dropped by helicopter in large areas. BTI is no longer effective after the larvae turn into pupae, because they stop eating.

Two species of fungi are currently also being used for killing adult mosquitoes: Metarhizium anisopliae and Beauveria bassiana.

Experimental Biocontrol Methods

Scientists have created spermless male mosquitoes and are experimenting with methods of introducing the sterile males into the environment in the hope of reducing overall mosquito numbers.

Another approach under investigation for the control of the mosquito species Aedes aegypti uses a strain that is genetically modified to require the antibiotic Tetracycline to develop beyond the larval stage. Modified males raised in a laboratory will develop normally as they are supplied with this chemical and can be released into the wild. However, their subsequent offspring will lack tetracycline in the wild and will never develop into adults.

In recent years, control of mosquitoes by genetic methods like sterile male technique, cytoplasmic incompatibility, chromosomal translocations, sex distortion and gene replacement have been explored. Their use is still in research phase. They are cheaper, more efficient and not subject to vector resistance.

Oil Drip

An oil drip can or oil drip barrel was a common and nontoxic antimosquito measure. The thin layer of oil on top of the water prevents mosquito breeding in two ways: mosquito larvae in the water cannot penetrate the oil film with their breathing tube, and so drown and die; also adult mosquitoes do not lay eggs on the oiled water.

SOURCE LIST

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(25) Duet Produce Label
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SECTION 6.0

RESPONSES TO COMMENTS ON DGEIS

6.0 RESPONSES TO COMMENTS ON DGEIS

On January 25, 2017, the NCDPW issued a Notice of Completion and Notice of Public Hearing for the Draft Environmental Impact Statement (DGEIS) for the Nassau County Mosquito Control Program. This marked the start of the required public comment period during which time interested parties and the public were invited to review the DGEIS document and submit comments or questions. The public comment period extended through March 17, 2017. To enhance the opportunity for interested parties and the public to comment on the DGIES, the NCDPW held the public hearing on February 16, 2017 at the Legislative Chamber, Theodore Roosevelt Executive & Legislative Building in Mineola NY. During the public hearing, interested parties and members of the public were invited up to the podium to make any comments for the record. Copies of the official transcript of the hearing and copies of the written comments that were received during the public comment period are provided in **Appendix F**.

This section of the Final Generic Environmental Impact Statement (FGEIS) provides responses to the relevant and substantive comments provided at the public hearing, or submitted in writing. Comments are paraphrased from either the transcript of the public hearing or the written comments that were received. Each paraphrased comment is followed by a parenthetical that identifies the last name of the person who made the comment, and then followed by the County's response.

Comments/Responses

Comment: It is appropriate to use the least toxic spraying methods and do it in a manner that minimizes any potential negative impact. (Lewis)

Response: Agreed. As shown in the Relative Toxicity charts on page 5-18 of the FGEIS, the larvicides and adulticides preferred by the County are among the least toxic. The County's use of spraying methods is avoided altogether unless other Integrated Pest Control (IPM) preventive measures, and non-chemical methods are shown to be insufficient.

<u>Comment</u>: On page 17 and 24, it talks about bird baths and then talks about bug zappers. I think that those are two things that get too much attention. First of all, I think if a bird bath does not have any leaf debris in it, it's unlikely to present a mosquito problem. The Mosquito larvae is going to be dropped in a place where there is some food source for the larvae. (Lewis)

<u>Response</u>: Bird baths are mentioned throughout the DGEIS as one of several source reduction methods that homeowners can use to eliminate mosquito breeding grounds, and was not meant to be emphasized over any of the other objects that harbor standing water (i.e., swimming pools, rain gutters, old tires, children's toys, wheel barrels, pails, cans, and other objects). Even without leaves in it, bird baths can accumulate organic material (i.e., bird droppings) that can be a source of food for mosquito larvae.

As for the use of zappers, it is acknowledged on page 5-19 and in Appendix B, of the DGEIS that these devices do not necessarily help to prevent mosquito problems. These devices generally kill more beneficial insects than pests. There was no intention in the DGEIS to emphasize or recommend these items for mosquito control.

<u>Comment</u>: The thing that's more important in the homes is the rain gutters. That I believe is mentioned on 213. You talk about cleaning out gutters and eaves. This I think required, this should get a lot more focus. (Lewis)

<u>Response</u>: Agreed. The issue of rain gutters is mentioned throughout the DGEIS including pages 1-18, 2-15, 3-22, and several parts of Appendix A and Appendix B.

<u>Comment</u>: In the case of foreclosed or abandoned homes, the plan should address the question of whether banks should be required to submit documentation to the County to say that all the properties they own have been checked by a professional, and that any standing water's been removed. (Lewis)

<u>Response</u>: Agreed. Abandoned homes, garages, and other places of business can become a source of standing water and mosquitos if not inspected and maintained, not to mention a variety

of other vermin. The NCDPW will confer with Nassau County Department of Health and its legal department and explore the possibility of working with banks, or other deed holders, to prevent such properties from becoming a haven for mosquitos or other vermin.

<u>Comment</u>: *There is reference to stored boats in the plan, and I would raise sort of a similar concern, because of how stored boats can become a major breeding ground if they're not stored properly. (Lewis)*

<u>Response</u>: Agreed. Like rain gutters, swimming pools, and other places where standing water can provide a breeding place for mosquitos, stored boats, whether covered or not, should be monitored for standing water by the owner. This is one of many suggestions in the public information inserts contained in the DGEIS, particularly, Appendix B.

<u>Comment</u>: *One of the things that we've been recommending for years is using garlic spray prior to having large, public events like outdoor concerts and other outdoor events. There's a mosquito magnet and other machines that are seen as more effective than bug zappers. One is electric based and uses carbon dioxide. There is a Sustainability Institute's Newsletter that addresses these recommendations. (Lewis)*

<u>Response</u>: The County is open to other safe and appropriate measures, methods and materials aimed at controlling mosquito populations and protecting the public health. The Sustainability Institute's Newsletter referenced in the above comment has been added to Appendix B - Public Education and Outreach Materials.

<u>Comment</u>: *Cleaning out catch basins is important because they can be major breeding grounds for mosquitos. (Lewis)*

<u>Response</u>: Agreed. The issue of catch basins, and their potential for providing mosquito breeding locations is emphasized throughout the DGEIS, including pages 1-11, 1-19, 2-5, 2-6, 2-28, 3-22, 4-1,4-19, and Appendix A. It should also be noted that all municipalities in Nassau County are required to submit a Storm Water Management Plan Annual Report to the NYSDEC

which must document storm water pollution prevention measures, including the inspection and cleaning out of catch basins and outfalls.

Comment: I think that I'm on this side of believing that the ditches should be maintained. I believe that they're a major breeding ground for mosquitos if they're not maintained. And people who live in the most South Shore parts of Nassau County would benefit greatly if they were maintained. (Lewis)

Response: Agreed. Inspection and maintenance of ditches is an important element of the County's Mosquito Control Program. As stated on page 1-19, "Physical controls implemented by the County include maintenance of ditches in the marsh areas and inspection and maintenance of storm water catch basins and recharge basins." The County's preference is to inspect and maintain ditches to keep them clear of debris or accumulated sediment that could increase the pooling of stagnant water in the marsh areas.

Comment: In our materials and our research, we found that the CDC had done research and found that lemon eucalyptus products can be effective as personal repellants. And so this is what we recommend. I know there's a brand, Cutter, and there's a brand Repel. (Lewis)

Response: In Appendix B of the DGEIS, on the page heading "Centers for Disease Control and Prevention, FAQ: Insect Repellent Use & Safety," the CDC recommends the use of products containing active ingredients which have been registered with the U.S. Environmental Protection Agency (EPA), for use as repellents applied to skin and clothing, including oil of lemon eucalyptus. However, the CDC also recommends that products containing oil of lemon eucalyptus SHOULD NOT be used on children under the age of 3 years. The Sustainability Institute's Newsletter that addresses the items in the above comment has been added to Appendix B of this FGEIS.

Comment: I respectfully request that the Village of Hewlett Harbor be considered for spraying and treatment due to the increased number of mosquitos that appeared in our Village last spring and thru the end of the summer. (Ryder)

Response: The County is always open to considering requests from individual municipalities to inspect, monitor, and/or evaluate mosquito concerns, and apply appropriate mosquito control materials, as needed and as appropriate.

SECTION 7.0

ABBREVIATIONS, ACRONYMS, REFERENCES

7.0 ABBREVIATIONS, ACRONYMS, REFERENCES

7.1 Abbreviations and Acronyms

AMCA	American Mosquito Control Association
BMPs	Best Management Practices
CCMP	Comprehensive Conservation and Management Plan
CDC	Centers for Disease Control and Prevention
EEE	Eastern Equine Encephalitis
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
GPS	Global Positioning System
IPM	Integrated Pest Management
MCP	Mosquito Control Plan
NCDOH	Nassau County Department of Health
NCDPW	Nassau County Department of Public Works
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
SEQRA	State Environmental Quality Review Act
SWB	Storm Water Recharge Basin
ULV	Ultra-low Volume
USFWS	U.S. Fish and Wildlife Service
VCMS	Vector Control Management System
WNV	West Nile Virus

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APPENDIX A

MOSQUITO CONTROL PLAN UPDATE

Nassau County
Mosquito Control Plan

NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS

and

NASSAU COUNTY DEPARTMENT OF PUBLIC HEALTH

Revised May 2012 NCDPW/NCDOH

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Appendix

List of Tables

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List of Abbreviations and Acronyms

CDC	Centers for Disease Control and Prevention
EEE	eastern equine encephalitis
EPA	U.S. Environmental Protection Agency
GIS	geographic information system
GPS	global positioning system
IPM	Integrated Pest Management
MCP	Mosquito Control Plan
NCDOH	Nassau County Department of Health
NCDPW	Nassau County Department of Public Works
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
SWB	storm water recharge basin
ULV	ultra-low volume
USFWS	U.S. Fish and Wildlife Service
WNV	West Nile virus

1 Introduction

The Nassau County Department of Public Works (NCDPW) and the Nassau County Department of Health (NCDOH) work together to suppress mosquito populations through mosquito surveillance and control. Both departments are committed to utilizing the Integrated Pest Management (IPM) approach, which focuses on long-term suppression or prevention with a minimal impact on the environment and on non-target organisms.

IPM control measures emphasize prevention and promote the most environmentally benign measures such as water management and physical control methods and natural and biological controls, including larvicides targeted to specific areas. Pesticides that kill adult mosquitoes on contact (also call adulticides) are used when a public health threat is imminent or elevated populations of mosquitoes causing public distress are present and other control measures have proved insufficient.

This Mosquito Control Plan (MCP) summarizes mosquito control activities through 2011. Subject to the commitment made in the *Generic Environmental Impact Statement for the Nassau County Mosquito Control and Surveillance Program* , the MCP will be reviewed annually to manage the mosquito problem in the county. The Plan will be evaluated each year based on mosquito surveillance reports, the prevalence of disease, the impact of previous control measures, and lessons learned from other programs in the region. Historic data on mosquito surveillance and mosquito-borne disease cases in Nassau County can be found in Appendix A.

2 Background Information

Mosquito control began in Nassau County in 1915 as a response to mosquito-borne malarial outbreaks.[1] Kerosene and No. 2 fuel oil were used to coat bodies of standing water, suffocating the mosquito larvae and reducing the adult mosquito populations. The malarial threat was under control by 1920, but the practice of spraying oil on standing water continued for mosquito nuisance control. In the 1930s, after the formation of a Nassau County Mosquito Commission, ditching became an effective way of draining salt marshes to reduce mosquito-breeding areas. In 1948, the NCDPW took over mosquito control in Nassau County. At that time existing control measures were improved by mechanizing ditching procedures, using spray trucks, and using new mosquito-control products. When the NCDH joined the mosquito control program in 1996, surveillance activities were greatly enhanced, as were analytical and virus-testing abilities.[2]

In 1999, with the outbreak of West Nile Virus (WNV), Nassau County expanded its mosquito control program using IPM principles. IPM promotes the use of non-chemical means to control pests wherever possible. Contact pesticides (adulticides) are used if other methods of control fail and the risk of mosquito-borne disease reaching the human population or the presence of elevated populations of mosquitoes causing public distress outweighs the impacts of pesticide application.

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[1] Nassau County. *Mosquito Surveillance and Control Report*. 2005.
[2] Nassau County. *Nassau County Mosquito Control Program 2002 Plan of Work*. 2002.

3 Public Health Concerns

Mosquitoes carry many diseases that can affect humans and livestock and wildlife populations. Fortunately, many of the worst diseases, including yellow fever, are not present in the United States. The threat of locally transmitted malaria was minimal in Nassau County following the control measures in the 1920s. It was not until WNV appeared in Nassau County and other parts of the United States in 1999 that mosquito-borne disease again posed a significant human health threat.

In general, the populations most susceptible to mosquito-borne illnesses are children under the age of 15, immunocompromised, and adults over the age of 50. The most effective way for a person to reduce their risk of WNV and other mosquito-borne disease is through the prevention of mosquito bites. Wearing long pants and sleeves, applying insect repellent while outdoors, and keeping screens on all open windows and doors while indoors are some simple, but effective methods of preventing mosquito bites.

3.1 West Nile Virus

WNV is a mosquito-borne viral disease that can cause serious illness and, in some cases, death. However, the chances of a person becoming ill with WNV are small. Most people who are infected with the virus will not exhibit any symptoms. Approximately 20% of the people who become infected will develop a fever with mild to moderate flu-like symptoms that usually last from three days to a week but can last several months. In most cases these symptoms will go away without treatment. In severe WNV cases, encephalitis (swelling of the brain) or meningitis (inflammation of the brain and spinal cord) can occur and be fatal. Approximately 1 in 150 people infected with the virus will develop these severe symptoms.[3] Children and the elderly are more at risk of developing the severe form of WNV than the rest of the general population. There is no vaccine or medication that can treat WNV. Hospital care for severe cases consists of administering intravenous fluids, assistance breathing if needed, and help preventing secondary illnesses such as pneumonia.[4]

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[3] New York State Department of Health. 2007. *West Nile Virus*. Retrieved July 2009 from http://www.health.state.ny.us/diseases/west_nile_virus/

[4] Essig, MG. *West Nile Virus – Topic Overview*. Retrieved July 2009 from http://health.yahoo.com/infectiousdisease-overview/west-nile-virus-topic-overview/healthwise--uf4421.html

3.1.1 WNV Cases

WNV was first reported in North America in 1999 and has spread across the United States. Since 2000 there have been more than 473 cases and 39 deaths in New York State alone.

Nassau County historically has had high incidences of human WNV cases compared with other counties in New York State (Table 3-1). The higher incidence of WNV is likely due to the fact that much of Nassau County is suburban, where human population densities are high and artificial containers are common. Standing water collects in swimming pools, bird baths, rain gutters, old tires, children's toys and other objects, and these pools provide prime breeding ground for mosquitoes.

Table 3-1

Cumulative Human West Nile Virus Cases and Deaths by New York County/Boroughs (2007-2011)

	2011	2010	2009	2008	2007
Albany	1(0)	0	0	0	0
Bronx (NYC)	2(0)	7(0)	1	1(0)	2(0)
Brooklyn (NYC)	2(0)	6(0)	1(0)	3(0)	7(1)
Broome	1(0)	0	0	0	0
Chenango	0	1(0)	0	0	0
Erie	3(0)	0	0	0	0
Manhattan (NYC)	2(0)	6(0)	0	1(0)	1(0)
Monroe	0	0	1(0)	0	0
Nassau	16(1)	57(3)	0	20(4)	2(0)
Niagara	0	0	1(0)	0	0
Onondaga	2(0)	0	0	0	0
Orange	0	0	1(0)	0	0
Putnam	1(0)	0	0	0	0
Queens (NYC)	5(1)	14(1)	1(0)	5(0)	7(1)
Rockland	0	0	0	0	1(0)
Staten Island (NYC)	0	9(0)	0	5(1)	1 (0)
Suffolk	4(0)	25(1)	1(0)	9(0)	0
Tompkins	1(0)	0	0	0	0
Washington	1(0)	0	0	0	0
Westchester	3(0)	4(0)	0	2(1)	1(0)
New York State (Total)	44(2)	129(5)	7(0)	46(6)	22 (2)

( ) – Values in parentheses denote the number of human deaths

3.1.2 WNV Transmission Cycle

In the United States, wild birds, primarily crows and jays, are the main reservoir or source of WNV. However, the virus is actually spread by certain species of female mosquitoes. Only females require a blood meal because of the nutritional demands of making eggs; male mosquitoes do not bite. Mosquitoes become infected with WNV when they feed on infected birds. The virus enters the bloodstream of the mosquito and circulates for a few days, settling in the salivary glands. When the infected mosquito bites an animal or a human, the virus enters the host's bloodstream, potentially causing serious illness.

3.1.3 Mosquito Species

There are approximately seventy (70) different mosquito species in New York State. Sixteen of these species have been associated with WNV in Nassau County but only a few are common carriers that bite humans. Appendix B lists the kinds and number of female mosquito species trapped in 2011. Of the identified species trapped in 2011, Aedes vexans and Culex pipiens-restuans tested positive for WNV.

Culex pipiens and Culex restuans are the predominant species that carry WNV in Nassau County. Both species can tolerate a wide range of breeding habitats and are often found in larval form in natural stagnant pools, in artificial containers where water has collected, and in still catch basins. They also can develop in water that is clean or high in organic content or even highly polluted. Therefore, most bodies of standing water are possible breeding sites for these vector species.[5,6]

Aedes albopictus, the Asian Tiger Mosquito, is an introduced invasive species which first appeared in Nassau County in 2003. Since that time, it has been one of the predominant species collected. Aedes albopictus is an aggressive day-biting mosquito that poses unique control challenges. This mosquito is a container-inhabiting species which lays eggs in any water-containing receptacle. The primary habitats of this species are artificial containers such as tires, flower pots, buckets, tin cans, rain gutters, and ornamental ponds. Larvae are also found in natural containers such as tree holes.

3.2 Eastern Equine Encephalitis

In addition to WNV, eastern equine encephalitis (EEE) is a mosquito-borne virus that presents a threat to the health of humans, horses, and other large mammals. Mosquitoes become infected with EEE when they feed on birds that are infected with the virus. Infected mosquitoes transmit the disease to other animals when

[5] Crans, W.J. 2007. *Culex pipens* Linnaeus. Retrieved July 24, 2009 from Rutgers University Center for Vector Biology, http://www.rci.rutgers.edu/~insects/pip2.htm.

[6] Crans, W.J. 2007. *Culex restuans* Theobald. Retrieved July 24, 2009 from Rutgers University Center for Vector Biology, http://www.rci.rutgers.edu/~insects/rest.htm.

they feed on horses, humans, and other mammals. Horses and humans are not a source of infection for EEE and cannot transmit the disease.

There has never been a human case of EEE in Nassau County. The last human case in New York State was diagnosed in 1983, but states in the northeastern U.S. have seen EEE in the human population in 2004, 2005, 2006, and 2007.[7] A vaccine is available to protect horses, but there is no vaccine for humans. The last case of EEE detected in Nassau County was in a horse in 2005.

EEE symptoms in humans usually appear within 5 to 15 days after the bite of an infected mosquito. Symptoms range from a mild flu to inflammation of the brain, coma, and death. Like WNV, some people who contract the virus will not develop any symptoms. The most susceptible populations are children and the elderly. For people who develop the most severe symptoms, where infection of the central nervous system occurs, fever, muscle pains, and headache can be quickly followed by seizures or a coma. The most dangerous condition of the virus is encephalitis, or swelling of the brain. EEE is one of the most pathogenic mosquito-borne diseases in the U.S., with a reported case fatality rate of 30% to 70%. It is estimated that 35% of the people who survive EEE will have mild to severe disabilities. Like WNV, there is no specific treatment for EEE. Treatment focuses on reducing fever and swelling in the brain.[8]

3.3 Health Impacts of Pesticide Use

The accidental exposure of humans and pets to high concentrations of pesticides could result in risks to health. Application plans are designed to prevent such exposures, but the NCDOH has procedures in place to monitor any reports of human exposure through local medical authorities.

To ensure its programs are not impacting the health of county residents, the Nassau County Department of Health maintains contact with the local medical community through its medical staff. The NCDOH also supports on-staff physicians who are available 24/7 to respond to medical inquiries. If county residents contact NCDOH with concerns related to pesticides, the department would monitor these concerns and follow up appropriately.

All public notification materials released for pesticide application events include a summary of pesticide exposure symptoms as well as NCDOH's contact information.

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[7] U.S. Center for Disease Control and Prevention. 2008. *Confirmed and Probable Cases of Eastern Equine Encephalitis, United States, 1964-2007, By State*. Retrieved July 2009 from www.cdc.gov/ncidod/dvbid/Arbor/pdf/EEE_DOC.pdf

[8] New York State Department of Health. 2006. *Eastern Equine Encephalitis*. Retrieved July 2009 from http://www.health.state.ny.us/diseases/communicable/eastern_equine_encephalitis/fact_sheet.htm.

4 Mosquito Biology

4.1 Mosquito Life Cycle

Mosquitoes have four distinct stages in their life history: the egg, larva, pupa, and adult. Adults feed on plant materials; only females feed on the blood of birds or mammals to provide the nourishment needed for their eggs to develop. Adults mate and the females lay eggs in water or in damp soil that may become inundated. The eggs hatch into larvae, which look wormlike and feed on microorganisms, including algae. They grow and molt through four stages and undergo a metamorphosis during which they become pupae, the non-feeding stage where the wings develop internally. The pupae emerge as adults to complete the life cycle.

The larvae, also known as "wrigglers," and the pupae, sometimes called "tumblers," require a water habitat. Although the larvae live and get their food in the water, they must come to the surface for air or obtain air from the underwater portions of aquatic plants.

4.2 Mosquito Season

The mosquito life cycle depends on temperature and moisture. Warm, wet conditions are most hospitable to mosquito breeding and larvae development. As such, warm weather storms in the spring, summer, and fall foster mosquito breeding, as do above-average tidal height, which can induce salt marsh mosquito eggs to hatch.

Duration of the mosquito life cycle is species-specific. Some species can take as little as four days to complete a life cycle, while others develop over a period as long as several weeks. The accumulation of water in any object or natural depression that contains some organic matter for even a few days can serve as a breeding site for mosquitoes.

Although mosquitoes are usually active from early spring until freezing weather, Nassau County's mosquito control program operates throughout the year. The busiest time is from May until October, but mosquito larvae have been found as late as November. Mosquitoes sometimes survive the winter as adults in residences, street drains, and other warm/moist places, emerging on mild days.

4.3 Mosquito Habitats

Mosquito larval development occurs in most aquatic habitats except fast-moving water and the open water of lakes, seas, and oceans. Habitat types are permanent pools; transient water; floodwater; artificial containers (e.g., tires and un-maintained swimming pools); and natural containers such as holes in tree stumps. Different species of mosquitoes prefer certain types of aquatic habitat for breeding and development and can be categorized based on this preference.

Mosquitoes preferring permanent pools are generally found in bodies of still, fresh water such as permanent, shallow, or marginal ponds, lakes, and smaller impoundments. Transient habitats include waters found in storm drains, roadside ditches, clogged streams, and puddles. Floodwater mosquito species prefer areas that are intermittently inundated with water.

Both permanent and transient habitats for mosquitoes are present in Nassau County. The tidal marshes on the county's north and south shores also provide extensive areas of floodwater habitat. Artificial containers and holes in trees are extremely common in all residential areas of the county. Swimming pools, bird baths, rain gutters, old tires, pails, cans, children's toys, or any object that can collect and hold water may serve as a breeding site.

5 Mosquito Surveillance

Nassau County is committed to applying IPM principles to all of its pest control activities. Accordingly, the cornerstone of the county's mosquito control program is surveillance. Treatment strategies based on surveillance are best because they work with the latest information on the mosquito population. All treated areas are revisited following treatment in order to monitor the efficacy of that strategy.

Two methods of monitoring actual and/or potential mosquito populations are "dipping" for larvae and "trapping" adult mosquitoes with CDC (Centers for Disease Control and Prevention) light traps, gravid traps, B-G Sentinel traps, Faye-Prince traps and New Jersey light traps.

5.1 Dipping

The most effective means of controlling mosquito populations is to limit their ability to breed, thereby decreasing the future population size. In order to reduce their breeding potential, the NCDPW identifies likely breeding sites and checks to see if there are mosquito larvae developing in the water. This process is called dipping.

The results from the dipping surveys determine if control measures are necessary and what measures to take to reduce mosquito populations. When larvae are present, physical control methods and/or the appropriate larvicide may be applied. IPM practices call for using pest control products only when mosquito larvae are identified, so dipping plays an important role in minimizing the use of pesticides.

5.1.1 Dipping Methodology

"Dipping" for larvae is the sampling technique used to estimate the number of larvae present in standing water and the type of mosquito breeding. A dipper consists of a long pole with a cup on the end. Larvae are collected, counted, and, when feasible, identified to the species level and larval stage.

5.1.2 Dipping Frequency

Dipping surveys are conducted on the South Shore marshes every Monday from May through November. Other areas are dipped based on citizen complaints.

5.2 Trapping

Trapping provides important and detailed information about mosquito populations. Through this process:

- The adult mosquito population throughout the county at any given time is estimated.
- Specific areas with high mosquito populations are identified.
- The genus and species of the mosquitoes are identified.
- Mosquitoes are tested for diseases, particularly WNV and EEE.
- The effectiveness of control methods are assessed.

After trapping, the mosquitoes are delivered to the NCDOH laboratory for identification and enumeration. The mosquitoes are pooled together by species and shipped to the New York State Department of Health (NYSDOH) laboratory for analysis.

5.2.1 Trapping Methodology

Nassau County currently uses four different kinds of traps: CDC light traps, gravid traps, B -G Sentinel traps, and New Jersey light traps.

5.2.1.1 CDC Light Traps

CDC light traps use a combination of light (battery-operated) and carbon dioxide to attract mosquitoes. Carbon dioxide comes from the sublimation of dry ice, which is simply frozen carbon dioxide. At ambient air temperatures, dry ice converts directly to gaseous carbon dioxide. CDC traps are placed at designated trap sites throughout the season.

5.2.1.2 Gravid Traps

"Gravid" refers to the female mosquito when she is heavy with eggs. Generally, a blood meal is required to provide the nourishment necessary to develop and deposit her eggs. Gravid mosquitoes are considered to have a higher probability of carrying disease because they are more likely to have taken a blood meal.

A gravid trap consists of a tray containing standing water and a high amount of organic matter, which is necessary to nourish mosquito larvae once they emerge from their eggs. Just above the water level in the tray is a cylinder with a battery-driven fan. As mosquitoes fly into the tray to deposit their eggs on the putrid water, the fan sucks the mosquitoes into a collection bag. Because gravid traps are more effective later in the season when mosquitoes have obtained blood meals, fewer gravid traps are set than CDC traps.

5.2.1.3 B-G Sentinel Traps

BG-Sentinel traps are primarily used for attracting the Aedes albopictus species of mosquito that are known vectors for West Nile Virus an increasingly significant vector for dengue, chikungunya and other diseases. The BG trap:

- Mimics convection currents created by a human body.
- Employs attractive visual cues.
- Releases artificial skin emanations through a large surface area

These traps are utilized when numbers of Aedes albopictus increase in light traps or gravid traps. Since larger numbers of Aedes albopictus are drawn to the BG – Sentinel traps if affords NCDOH a greater opportunity to actively survey and test the Aedes Albopictus population for virus.

5.2.2 Trapping Frequency

Mosquitoes are collected from forty-two (42) trap sites on a two-week rotating schedule (see Figure 5-1). Traps are left overnight at predetermined locations and the contents are collected the following morning. Additional traps are used during pre and post adulticide application to verify mosquito population reduction. Supplemental mosquito traps are sometimes placed in additional surveillance locations where positive mosquito pools have been found or additional monitoring is desirable.

5.2.3 Numeration, Identification and Evaluation

After trapping, the mosquitoes are delivered to Wadsworth Center, the NYSDOH laboratory in Albany, New York. At the laboratory, the female mosquito pools are tested for WNV and other viruses. Results are returned to the NCDOH and forwarded to the NCDPW.

The NCDOH evaluates the number of positive results in each mosquito pool and the number of adjacent positive mosquito pools. Multiple positive results in neighboring pool sites may indicate the need for additional control methods. The positive sites are examined, and appropriate control methods (see Section 8) are then implemented as necessary.

5.3 Permanent Surveillance Locations

Storm Water Recharge Basins

Storm water recharge basins (SWBs), commonly called sumps, are designed to return surface water runoff to the groundwater table. There are approximately 795 SWBs in Nassau County, and 612 are managed by the county. The remaining are managed by local municipalities and private property owners. Some SWBs become a dumping ground for old tires and debris that collect rainwater and serve as ancillary breeding sites for mosquitoes. The NCDPW removes these items from the SWBs on a regular basis.

At times SWBs can retain water long enough that mosquitoes can breed and larvae can develop. Certain SWBs are known to drain slowly and, thus, they often contain standing water. The NCDPW maintains a pre-treatment list of SWBs listed in Appendix C, Table C-1, that are often wet and hospitable for mosquito development. SWBs are treated with larvicides when the results from dipping surveys show the presence of larvae.

5.4 Additional Surveillance Locations

5.4.1 Boat Surveys

There are more than 100 bodies of land (meadows, marshes, fields, islands) on the south shore bays of Nassau County. Most of these bodies of land are under water at high tide and therefore are not suitable mosquito breeding grounds. However, the few islets that do remain wholly or partially above a typical high tide are capable of breeding the golden salt marsh mosquito (*Ochlerotatus sollicitans*) and other salt marsh mosquito species. Populations of these mosquito species are periodically monitored by boat.

5.4.2 Salt Marsh Surveys

Salt marsh areas, especially those on the south shore of Nassau County, are potential breeding sites for mosquitoes. High tides and heavy rains can cause areas not normally covered by daily tidal activity to flood, hatching mosquito eggs within minutes of contact with the water. Therefore, at the beginning of each week during mosquito season, the marsh areas are surveyed and larvicide is applied where necessary.

5.4.3 Upland Surveys

In addition to the salt marsh surveys, many upland stream, drain, pond, and freshwater marsh surveys are made. Upland locations are surveyed when complaints from the public are received by the NCDPW. Catch basins, storm water recharge basins, and abandoned swimming pools in the area are then checked for larvae.

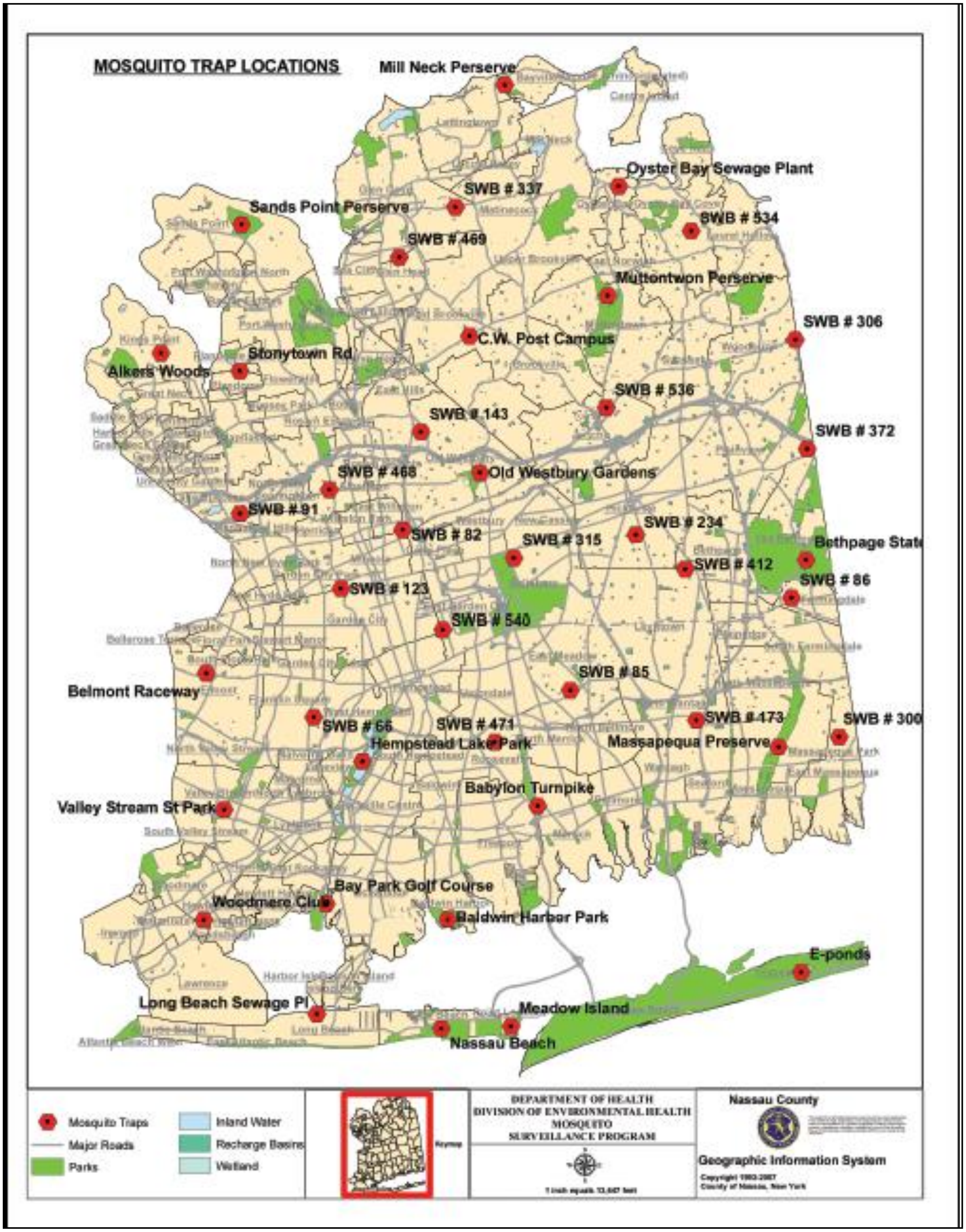
5.5 Use of Geographic Information System (GIS) Mapping

The county maintains an advanced GIS system to map the vector-borne diseases detected in the environment. These maps, generated from laboratory positive identifications and historical data, are useful in the decision-making process. The NCDPW and the NCDOH use these maps to:

- Determine the proximity of positive pools to one another
- Confirm the location of environmentally sensitive areas
- Compare the location of past WNV activity to the location of the current viral activity.

GIS is also used to record the areas covered in each aerial treatment of the south shore marshes. The helicopter and small plane used by the NCDPW are equipped with global positioning system (GPS) software that tracks the areas that have been sprayed in each application of larvicide or adulticide. After each session the GPS data are entered into the NCDPW's GIS database.

5-1 Mosquito Trap Locations



6 Host Surveillance

As noted above, birds such as American crows (*Corvus brachyrhynchos*) and blue jays (*Cyanocitta cristata*) have been implicated as a source or reservoir of WNV. Although most birds are sick for only a few days and fully recover with immunity to a new infection, crows are likely to die from the disease.

Birds are difficult hosts to map because they can travel long distances and are less important in making treatment decisions than the results of mosquito pool testing.

6.1 Bird Surveillance Methodology

Birds have been implicated as the reservoir or source of WNV. When a mosquito bites a bird that is infected with WNV, the mosquito may then spread the virus to another bird, other animal or human. Apparently, the American Crow is quite sensitive to WNV. Although most birds are sick for a few days and fully recover with immunity to new infection, crows are more likely to die from the disease. NYS has deemed that the collection of dead birds is no longer a useful indicator of West Nile Virus activity.

6.2 EEE Host Surveillance

Although rarer than WNV, EEE is important to monitor because it presents a grave threat to the human and equine populations of Nassau County. It is difficult to capture the local mosquito species that are capable of carrying EEE because they are not drawn to conventional trapping methods. Although suspected rare due to the current practice of horse vaccinations for EEE, the county would investigate horse deaths if populations on mosquitos carrying EEE were confirmed.

7 Larval Control

7.1 Control Methods

7.1.1 Physical Controls

Modification of Habitat

Approximately 1,000 miles of drainage ditches were constructed up through the 1950s in order to reduce salt marsh mosquito populations as well as to improve drainage along the shoreline of the south shore barrier islands and islets (Figure 7-1). The natural forces of wind, rain, tides, and major storms continually influence the marsh topography, resulting in new and altered mosquito breeding areas, and so the county occasionally maintains (restores) the drainage ditches. Well-maintained ditches provide habitat for killifish, which feed on mosquito larvae, facilitate tidal water movement, and also create a suitable habitat for waterfowl. Nassau County inspects and maintains all existing ditches; however, there are no immediate plans by the NCDPW to undertake new drainage ditching in the next few years.

7.1.2 Natural Controls

Many saltwater fish eat mosquito larvae. Killifish are naturally present in large numbers in the bays and ditches of the south shore. In the past, the NCDPW has introduced several varieties of small top-feeding freshwater fish, including mosquitofish (*Gambusia*), to some storm water recharge basins that hold water year-round. However, the New York State Department of Environmental Conservation (NYSDEC) no longer allows the introduction of *Gambusia* to waterways in Nassau County because it is a non-native species.

The NCDPW also manages vegetation overgrowth in and around SWBs by cutting back plant life around the basins listed on the pre-treatment list. Other overgrown SWBs are managed throughout the summer, as needed.

7.1.3 Chemical Controls (Larvicides)

7.1.3.1 Types of Larvicides

Nassau County uses four larvicides to control mosquito populations:

- **Spheratax SPH (50G) (Bacillus thuringiensis var. israeliensis)** is a naturally occurring soil bacterium that is eaten by the larvae, infecting and killing them. It is available in granular form or in a doughnut-shaped briquette. It is target-specific to mosquitoes but does not kill the pupal stage because pupae do not eat.

- **Aquabac 200 G (Bacillus sphaericus)** is also a naturally occurring bacterium that infects mosquito larvae. It persists well in the organic-rich environments favored by the Culex genus of mosquitoes. It too is ineffective against the non-feeding pupae.

- **Altosid (Methoprene)** is an insect-growth regulator that prevents mosquito larvae from changing into adults. It is sometimes called a juvenile hormone because it keeps the insects in a juvenile state. It is applied in a briquette form for manually treating SWBs and other sites requiring long-acting control. One briquette is used per 100 square feet of surface area up to two feet in depth. The two varieties of briquettes are each effective for 30 days. A liquid variety is also available for treatment of sites with limited accessibility.

- **Agnique** is a non-toxic, liquid larvicide and pupicide that is sprayed by hand on suburban mosquito pools. It spreads an invisible mononuclear film over the water, reducing the surface tension and making it difficult for larvae and pupae to attach to the surface. The film also drowns the larvae and pupae by blocking their breathing tubes.

7.1.3.2 Larvicide Application Methods

- **Hand Application.** Larvicide briquettes are applied to small, easily accessible standing water bodies that are considered prime mosquito development sites, including those on the pre-treatment list and those that have been the subject of complaints from citizens (swimming pools and street catch basins). Pre-treated areas include storm water recharge basins where mosquito populations may or may not be present. These areas are checked weekly by NCDPW. The briquettes are dropped into the water and left to dissolve. Sites that require larvicide treatment and are too remote for direct briquette application are treated with liquid larvicide applied with a 48-ounce hand sprayer that can spray over any obstacles, such as large vegetated areas, and into more isolated water bodies.

- **Aerial Application.** The NCDPW has a contract with a private company for spraying larvicide by helicopter or a small plane if high larval populations in non-populated, inaccessible marsh areas are predicted. Aerial applications are used to spray large, non-populated, inaccessible areas with a suitable larvicide, usually a liquid formulation of Altosid. Aerial larvicide application occurs around 6:00 a.m. Areas sprayed include the south shore marshes of Jones Beach, Lido Beach, and a number of islets and hassocks on the south shore of Nassau County. Decisions as to when and where to treat are based upon the salt marsh surveys, tidal conditions, and boat surveys.

7-1 Location of Aerial Historic Drainage Ditching

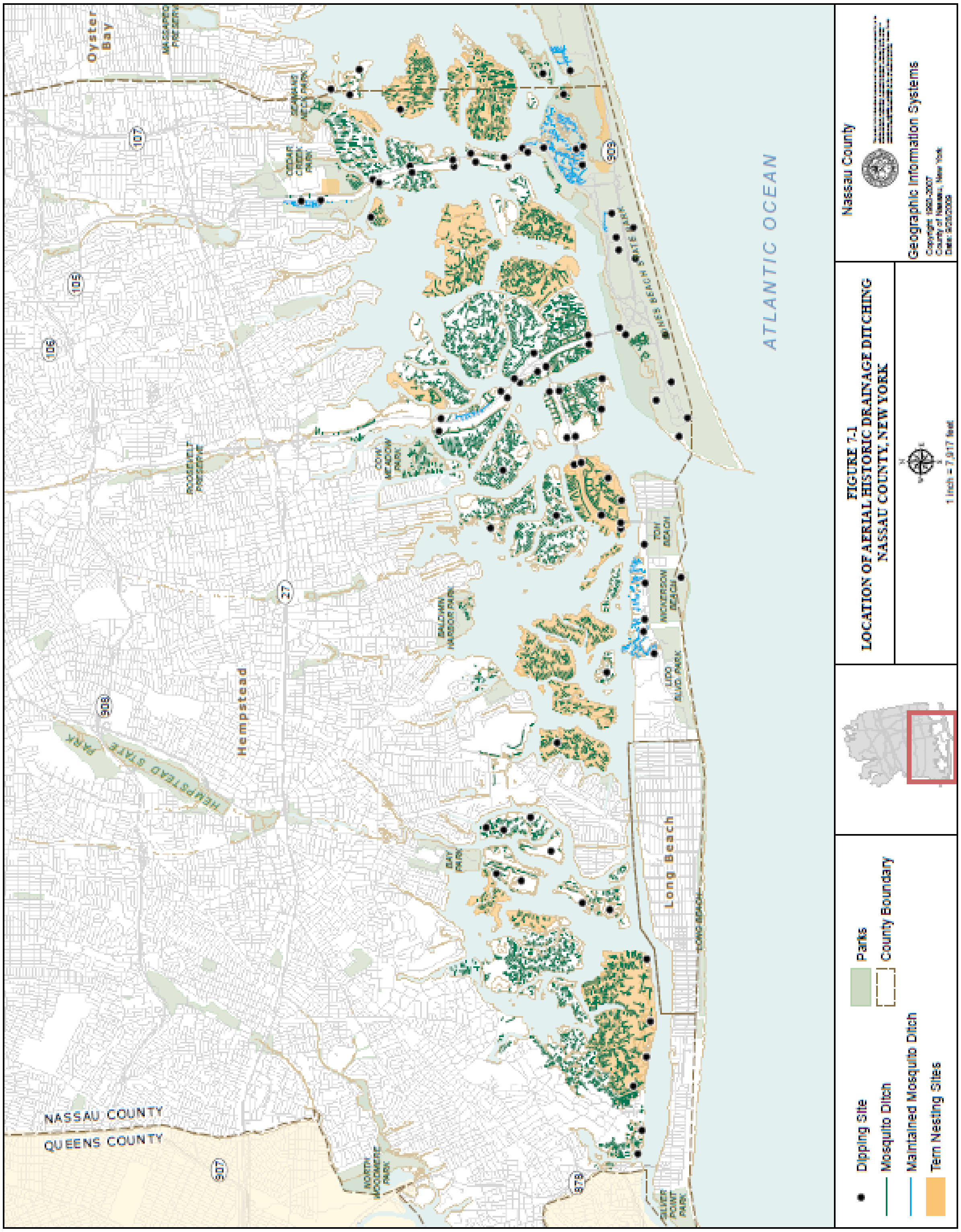


FIGURE 7-1
LOCATION OF AERIAL HISTORIC DRAINAGE DITCHING
NASSAU COUNTY, NEW YORK
Dipping Site
Mosquito Ditch
Maintained Mosquito Ditch
Tern Nesting Sites
Parks
County Boundary
Nassau County
Geographic Information Systems
ATLANTIC OCEAN
Oyster Bay
Hempstead
Long Beach
HEMPSTEAD STATE PARK
NASSAU COUNTY
QUEENS COUNTY

All liquid applications are limited to mild weather conditions with wind speeds of 10 mils per hour (mph) or less, and spraying is prohibited in rain.

7.2 Criteria and Procedures

7.2.1 Identifying Locations of Concern

The pre-treatment list (Appendix C) catalogues the storm water recharge basins that require treatment regardless of larval activity because these basins are known to be hospitable environments for mosquito breeding. Other areas of concern are identified by the NCDPW through a combination of dipping surveys, review of historical data on mosquito and virus activity, and complaints from the public.

The process of identifying water bodies requiring larval control is not formulaic because the hydrologic environment and the mosquito population can transform or shift each year, necessitating a variation in treatment regimen. The most important factor to consider when designing a larvicide plan is the results of dipping because this reveals the number of larvae in the water and their developmental stage. In the past, larvicide has been applied to sites where dipping shows a high number of mosquito larvae in late developmental stages and the hydrological setting is considered favorable for further development.

7.2.2 Determining Appropriate Control Methods

Once the areas of concern are identified, larvicide treatment methods are determined based on the size of the water body, its accessibility, and the developmental stage of the larvae. The preferred larvicide is a briquette because it is easy to apply.

If an area of concern is not suitable for briquette application, a liquid larvicide suitable for the developmental stage of the larvae can be used with the 48-ounce hand sprayer.

Larvicide is applied aerially by helicopter or a small plane when mosquito larvae in late stages of development are found across a large area. Aerial application of larvicide is suitable for the south shore marshes because this is a sizeable area, largely unpopulated, with much potential for mosquito development. The helicopter sprays a liquid variety of larvicide.

7.2.3 Limitations of Application

NYSDEC prohibits the aerial application of larvicide or adulticide within 500 feet of the breeding areas of threatened species between April 1 and August 31 (see Appendix D for a list of the species of concern and a catalogue of locations where they are known to breed)

8 Adult Control

8.1 Control Methods

8.1.1 Physical Controls

Physical controls largely do not apply to adult mosquito populations because they fly and cannot be contained easily.

8.1.2 Natural Controls

Adult mosquitoes have some natural predators such as dragonflies and bats, but as they are difficult to introduce successfully, Nassau County does not pursue this option.

8.1.3 Chemical Controls (Adulticides)

Adulticides are applied when WNV is present in consecutive and contiguous trap locations or is found to be in an extensive area where larviciding is not enough to contain viral activity and/or population. The number of mosquitoes infected with WNV is not the primary determining factor for applying adulticides. There is no correlation between viral activity and population size. Adulticides may also be applied when elevated populations of mosquitoes are causing public distress, after Integrated Pest Management (IPM) and other vector control measures have proved insufficient.

Adult mosquitoes are sensitive to a number of contact pesticides. The adulticides utilized in Nassau County are pyrethroids, which are synthetic compounds similar to pyrethrins, which are produced by chrysanthemum flowers. The county does not apply organophosphate adulticides.

8.1.3.1 Types of Adulticides

Scourge (active ingredient: resmethrin) and Anvil (active ingredient: sumithrin) are adulticides that kill mosquitoes upon contact. In both of these products, the active ingredients are synergized with piperonyl butoxide in an organic solvent. The product is released as a fine mist in areas where mosquitoes are known to be active.

8.1.3.2 Adulticide Application Methods

- **Hand Application.** Adulticides are not applied by hand.

- **Spray Truck Application.** The NCDPW uses a truck-mounted fogging unit to apply adulticide to areas outside the south shore marshes. The unit is an ultra-low volume (ULV) generator mounted on the back of the pickup truck and is calibrated so that the fog flows at a height of approximately 4 feet and evaporates before it reaches the ground. Driven at a constant 5 miles per hour (mph) rate, this method can treat large areas on either side of a roadway. The equipment is outfitted with a GPS device that tracks the areas covered with adulticide and also monitors the speed of the vehicle to ensure it is constrained to allowable speeds. If the truck exceeds permissible speeds for fog application, the fogging unit automatically shuts down.

- **Aerial Application.** Adulticides are sprayed by helicopter or a small plane during health emergencies when WNV is found in mosquito pools within a very large area. Health emergencies are initiated by NCDOH. GPS software is utilized to track the areas that have been treated with each aerial application.

All liquid applications are made only during mild temperature conditions, with wind speeds of 10 mph or less, and spraying is prohibited in rain. The application of pesticide will not be applied during cold weather. The spray nozzle used in both truck and aerial application is calibrated so that the liquid released evaporates before the droplets reach the ground.

8.1.3.3 Adulticide Application Regulations

Adulticides are applied in accordance with product labeling and NYSDEC regulations. The NYSDEC pesticide application permit requires that any spraying avoid sensitive areas, including wetlands and conservation areas. Small airplanes and helicopters used for pesticide application in Nassau County are equipped with GPS equipment that locates the application equipment with reference to areas that are to be sprayed as well as the sensitive areas to be avoided. Spray trucks are given maps to follow that outline the areas not to be sprayed.

The maps are generated on the county's GIS system. The 'no spray zone' is made up of sensitive waterbodies, wetlands, Heritage sites, and organic farms. Buffer zones are included around these areas in accordance with the NYSDEC application permit. Also, adulticides are not applied where runoff is directed into bays or other bodies of water.

NCDOH is responsible for all public notification.

Adulticides are not applied directly to water or wetlands in order to avoid any potential contact with aquatic organisms. Waterbodies could be subject to drift of runoff from adulticides. However, amounts entering the water are not expected to exceed U.S. Environmental Agency (EPA) limits because the county uses ULV application techniques and the adulticides applied rapidly biodegrade.

All state and federal threatened and endangered species habitats are avoided during adulticide application. Habitat information is provided by NYSDEC and coordination with NYSDEC minimizes impacts on threatened and endangered species. U.S. Fish and Wildlife Service (USFWS) access restrictions and waterbody setback restrictions are followed.

8.2 Criteria and Procedures

8.2.1 Identifying Locations of Concern

Areas of concern for adulticide treatment are determined based on a combination of factors, the most important being the prevalence of WNV in mosquito populations, the size of populations, and the proximity of these populations to humans. The NCDOH considers the viral presence determined in mosquito trap analyses, human cases of WNV, nuisance complaints, and the dipping surveys, which can indicate the size of the future WNV- carrying mosquito population. Additionally, if the mosquito population is determined to be elevated in specific areas and causing public distress adulticide treatment may be utilized.

These components are geographically correlated with GIS software to reveal whether or not the areas positive for the virus are contiguous. If positive mosquito pools are adjacent, the NCDOH assumes that WNV activity is continuous across the area and has the potential to spread to the surrounding mosquito populations.

The decision-making process involved in choosing to apply adulticide is a screening process, where a series of factors related to the frequency and abundance of mosquitoes, coupled with location, time of year, weather, and other factors are utilized to make a best professional judgment about whether or not to apply adulticide. The logic and decision-making behind this process is illustrated in Figure 8-1 and 8-2.

8.2.2 Determining Appropriate Control Methods

Methods of control are determined based on the size and accessibility of the area of concern. Inland areas are sprayed with the truck-mounted fogger as well as by helicopter or a small plane at targeted locations.

8.2.3 Implementation of Controls

8.2.3.1 Public Notification

The NCDOH is required to provide 24 hours' notice to legislators immediately prior to a 24 hour public notification of adulticide application, In addition, the NCDOH updates its website with notices of spraying and encourages local news outlets to publicize spraying activity.

8.2.3.2 Time and Duration
Spraying must be conducted at times of low wind (less than 10 mph) and during sunset hours because mosquitoes are most active at dusk and the product breaks down quickly in bright sunlight.

8.2.3.3 Frequency
There is no threshold percentage of positive mosquitoes that, when reached or mosquito population identified warrants adulticiding. Refer to Figure 8-2 – Mosquito Control Decision Matrix for parameters evaluated when making the decision to spray.

Nassau County will never exceed five applications of adulticide in a single year in any given location.

Figure 8-1

Site Evaluation Performed In Response To Complaints		
Point Source **Pools, Fish Ponds, Artificial Containers**	**Localized** **Neighborhood complaint**	**Wide Spread** **Entire Community**
Identify problem Apply appropriate larval control	Identify Mosquito Species Determine breeding sites (Storm drains, SWB's, pools, gutters etc.) Apply appropriate larval control	Identify mosquito species Determine breeding sites (Storm drains, SWB's, pools, gutters etc. Apply appropriate larval control Refer to trap data Refer to the Mosquito Control Decision Matrix Perform landing count survey at dusk in the absence of trap data. If count is >12 mosquitoes/minute consider adult control

Figure 8-2

Nassau County - Mosquito Control Decision Matrix

Early Season (prior to July)	Mid Season (July - Sept)	Late Season (after September)
Single elevated trap site (aedes sp. >50, culex / other sp. > 100)		
Increase larval surveillance	Increase larval surveillance	Increase larval surveillance
Increase larval control	Increase larval control	Consider ground based adult control of
Consider aerial larvicide for *O. sollicitans*	Consider ground based adult control	targeted species if weather pattern favors
	Conduct aerial larvicide for *O. sollicitans*	continued activity
Persistent elevated trap site or multiple elevated trap sites (aedes sp. >50, culex / other sp. > 100)		
above actions plus…	*above actions plus…*	*above actions plus…*
Consider ground based adult control	Conduct ground based adult control	Conduct ground based adult control of
Conduct aerial larvicide for *O. sollicitans*	Consider aerial control of adult mosquitoes	targeted species if weather pattern favors
		continued activity
West Nile virus detection - single trap site		
Increase larval surveillance	Increase larval surveillance	Increase larval surveillance
Increase larval control	Increase larval control	Consider ground based adult control of
Consider ground based adult control	Consider ground based adult control	targeted species if weather pattern favors
		continued activity
West Nile virus detection -persistent or multiple trap sites		
above actions plus…	*above actions plus…*	*above actions plus…*
Conduct ground based adult control	Conduct ground based adult control	Conduct ground based adult control of
	Consider aerial control of adult mosquitoes	targeted species if weather pattern favors
		continued activity

Note : Detection of EEE, other non-endemic virus' or other extraordinary circumstances may require additional control activity
The final decision to conduct ground or aerial control of adult mosquitoes is left to the discretion of the NC Commissioner of Health.

9 Regulatory and Permitting Requirements

9.1 Pesticide Training and Certification

New York State requires all pesticide applicators to hold a Commercial Pesticide Certification in category 5B, Aquatic Insect and Miscellaneous Aquatic Organisms Control, and Public Health Control Certification in category 8 in order to apply pesticides. This certification is valid for three years following initial receipt, and it necessitates that all holders pursue 16 credits of continuing education. It allows staff to apply pesticides by either hand or truck application.

9.2 NYSDEC Aquatic Pesticide Permits

Nassau County holds aquatic pesticide permits authorizing the use of larvicide. Aerial lavicides are applied by a private contractor who holds a NYSDEC permit of aerial pesticide application.

10 Public Education and Community Outreach

The purpose of a public education program is fourfold:

- To increase public awareness of mosquito-borne diseases, mosquito breeding locations, and simple preventive measures that can be taken to reduce mosquito populations and minimize impacts on human health
- To provide information regarding routine mosquito control activities in Nassau County
- To provide timely and accurate information in the event of a WNV public health threat and subsequent pesticide treatments
- To provide information regarding possible health impacts due to exposure to pesticides.

10.1 Nassau County and New York State Mosquito-Related Resources

The phone number of the Nassau County Department of Health (516-572-1211) is the contact point for information on WNV activity. The department's website has a page detailing the threat that WNV presents to the county, including recommendations on how to prevent infection (http://www.nassaucountyny.gov/agencies/Health/westnile.html). It also outlines the mosquito surveillance activities of the NCDPW. Throughout the mosquito season, citizens can also visit the website to see a map of the county with towns highlighted where mosquitoes have tested positive for WNV. It also contains links to NYSDOH and the CDC for further information on WNV.

Mosquito-control activities are directed by the NCDPW, so all inquiries regarding application of larvicides or pesticides should be directed to the NCDPW (516-571-6900). Citizens are directed to contact the NCDPW to report an incident of pooled water or mosquito nuisance.

Appendix E lists NCDPW and NCDOH hotline numbers for reporting and obtaining information on WNV and mosquito activity, stagnant water locations, and mosquito control activities.

10.2 Community Notifications

Legislation passed in 2009 (Nassau County Legislature Amendment to Local Law No. 30-2000, Section 2) outlines notification procedures the NCDOH must follow for any planned adulticide spraying. It requires that the NCDOH notify members of the County Legislature when the department submits a request to NYSDOH to apply adulticide. Major news outlets must be notified 24 hours in advance of any planned adulticide spraying. Notice must also be posted on the NCDOH website at least 24 hours in advance of any spraying activity. Information released must include the timing, duration, location, and method of spraying (i.e., aerial or truck) as well as the name of the pesticide to be used, health concerns about this pesticide, safety recommendations for residents, and the NCDOH contact information (phone and website).

In the case of adulticide application that is cancelled and rescheduled, the legislator, media, and public must still be notified 24 hours in advance of any spraying.

The NCDOH has publicized spraying dates and locations on local sources such as News 12, the Long Island Newsday newspaper, and local radio stations. Media companies are not required to disseminate information regarding spraying but are encouraged to do so.

In the event of a public health emergency due to an outbreak of WNV, NCDOH notifies media outlets and publishes information on the Nassau County website.

10.3 Complaints, Requests, and Inquiries

Concerns about WNV in the community are received by the NCDOH and are followed up with information on WNV. The following simple methods of avoidance should be taken by county residents to avoid mosquito bites:

- Wear long sleeves, socks, and pants when outside
- Apply insect repellant
- Keep all doors and windows closed
- Maintain screens on doors and windows
- Remove standing water on residential property (e.g., tires filled with water).

Mosquito-nuisance inquires are received by the NCDPW. All complaints and inquiries received are logged and assigned for follow-up. Follow-up procedures for mosquito nuisance complaints generally involve a visit to the complainant's home, inspection of a specific situation or, more often, a neighborhood survey.

Surveys include but are not limited to streams, ponds, marshes, drainage ditches, standing water, swimming pools, artificial containers, street drains, and nearby storm water recharge basins. Property owners are notified if home when the visit occurs. Otherwise a visit notice and informational pamphlets are left at the residence. If appropriate, treatment is made by hand with a suitable larvicide. If a major breeding area is identified, follow-up inspections are scheduled. Following an inspection, conditions and control efforts are logged.

11 Annual Control Report and Plan Review

11.1 Annual Reporting

A Mosquito Surveillance and Control Report is generated each year that contains data on mosquito pools, human cases and vector control measures.

11.2 Changes to the Mosquito Control Plan from the Previous Year

Any changes made to the Mosquito Control Plan will be noted in this section the following year.

- The Decision Spraying Matrix, Figure 8-1 and associated text was updated to include adulticiding for the nuisance control of mosquitos.
- The inclusion of the Aedes albopictus, the Asian Tiger Mosquito was incorporated in the plan.
- Tables and Figures were updated to include data thru 2011.

11.3 Overall Plan Effectiveness

All components of the Mosquito Control Plan are reviewed every year to determine the overall effectiveness of mosquito control and surveillance in Nassau County.

11.4 Recommendations and Improvements

Recommendations and improvements stem from the Mosquito Control Plan review process and will be incorporated into the plan on a yearly basis. None have been reported at this time.

A

Historic Mosquito Surveillance and Mosquito-Borne Disease Data for Nassau County

Table A-1 Historic Mosquito Surveillance and Mosquito-Borne Disease Data for Nassau County

	2009	2010	2011
Human Cases	0	57	16
Number of areas larvicided by hand	DPW		
Number of Aerial Larvicide Treatments	0	1	0
Number of Aerial Adulticide Treatments	DPW		
Number of Sites dipped	DPW		
Number of pools sent to Wadsworth	569	586	560
Number of Positive Mosquito Pools	18	145	29

B Mosquito Species Found in Nassau County

Mosquitoes Trapped by Species in 2011		
Species	**Total**	**Percentage**
Culex pipiens-restuans	14534	42.5443%
Ochlerotatus sollicitans	7053	20.6457%
Aedes vexans	2556	7.4820%
Aedes albopictus	2252	6.5921%
Ochlerotatus cantator	1420	4.1567%
Ochlerotatus canadensis	986	2.8862%
Ochlerotatus trivittatus	846	2.4764%
Psorophora ferox	377	1.1036%
Coquillettidia perturbans	311	0.9104%
Ochlerotatus triseriatus	236	0.6908%
Anopheles quadrimaculatus	174	0.5093%
Ochlerotatus japonicus	85	0.2488%
Anopheles punctipennis	51	0.1493%
Culex salinarius	12	0.0351%
Uranotaenia sapphirina	12	0.0351%
Ochlerotatus grossbecki	9	0.0263%
Ochlerotatus excrucians	4	0.0117%
Unspecified species	3244	9.4959%
Total	34162	100.0000%
Total Trapnights	878	
Mosquitoes per Trap Night	38.91	

C

Stormwater Basin Pre-Treatment Locations in Nassau County

Table C-1 Nassau County Mosquito Control Pre-Treatment Locations

Code #	SWB#	Address
Northwest Nassau		
Code #	**SWB#**	**Address**
K21	123	193 Rockaway Av, Garden City
F18	91	63 Tanners Rd, Lake Success
B13	200	29 Wood Road, Great Neck (NW Corner of Parkwood Pool Lot)
B,C13	572	32 Carriage Road, Kings Point
E8	293	7 Woodland Dr., Sands Point
K16	44	87 Deepdale Pkwy, Roslyn Heights
K16	560	37 Carriage Rd, Roslyn Estates
K17, 18	134	1024 Willis Av, Albertson
L17	18	93 Oakridge La, Albertson
L17	151	20 Hilldale Rd, Albertson
L18	61	2 Bengyfield Dr, East Williston
M18	82	289 Roselle St, East Williston
M17	71	10 Schoolhouse Lane, Albertson (outlying area, not lake)
M16, 17	101	157 Parkway Dr, Albertson
P12	192	720 Northern Blvd, Old Brookville
K15	307	51 Intervale, Roslyn Estates
J14	327	47 The Serpentine, Roslyn Estates
L12, 13	597	Nassau Fine Arts Museum, Wm. Cullen Bryant Preserve, N/O Northern Blvd, Roslyn Harbor
N13	579	10 Tara Dr, East Hills
Southwest Nassau		
Code #	**SWB#**	**Address**
D25	122	238-27 115th Terrace, Elmont
F24	351	292 Travis Ave, Elmont
D25	117	2627 Ludlum Ave, Elmont
G22	121	30 Tunnel St, Floral Park
Northeast Nassau		
Code #	**SWB#**	**Address**
N18	118	202 Guinea Woods Rd, Old Westbury
N, P16	585	31 Foxhollow Lane, Old Westbury
M8	469	56 Knot Drive, Glen Cove
N5	547	20 Lattingtown Ridge Ct, Lattingtown
V9	206	301 Ross Lane, East Norwich
Y7	534	41 Woodland Dr, Oyster bay Cove
BB11	474	7 1st Street, Woodbury
CC11	306	1 Stratford Ave, Avery Rd, Woodbury
Y10	241	755 Syosset-Cold Spring Harbor Rod, Syosset
Z10	575	176 Belican Ct, Syosset
Z11	309	188 Syosset-Woodbury Rd, Syosset
Y11	270	7 Miller Blvd, Ira Rd, Syosset
Y11	88	17 4th Place, Ira Rd, Syosset
S3	603	10 Transwinds Dr, Bayville
U10	586	17 Serentine Lane, Muttontown

Northeast Nassau (continued)		
Code #	SWB#	Address
W, X12	Private	E/O Pondview Drive, Muttontown
V15	138	308 Nimitz St, Jericho
W18	234	204 10th Street, Hicksville
U18	128	136 Charlotte St, Duffy's Ave, Hicksville
R19	315	902 Linden Ave, Westbury
Y20	412	669 Ivy Ct E, Hicksville
AA16	346	74 Central Park Drive, Plainview, Permanent Water by North Culvert, Extensive floodplain on N & S ends
AA17	330	75 Herhard Rd, Plainview
BB13	478	81 Harvard Dr, Plainview
BB15	460	60 Skyline Dr, Plainview
BB16	Private	96 Palo Alto Dr, Plainview
BB15, 16	370	29 Washington Ave, Plainview
CC, DD15	372	1670 Old Country Rd, Plainview
BB17	297	110 Briarwood Drive, Plainview
Z17	223	53 Warwick Pl, Plainview
Z18	312	51 Floral Ave, Plainview
Southeast Nassau		
Code #	**SWB#**	**Address**
EE33		Tobay Beach Parking Lot, Ocean Parkway, Jones Island
EE25	300	8 Ashwood Pl, Massapequa
DD25	489	217 Philadelphia Ave, Massapequa Park
DD26	488	369 Pennsylvania Ave, Massapequa Park
CC21	467	43 Conklin St, Farmingdale
X20	34	28 Polaris Lane, Levittown
W20	23	115 Azalea Lane, Levittown
W20	43	60 Pelican Rd, Levittown
V20	42	6 Pintail Lane, Levittown
U24	85	2027 Central Dr, East Meadow
T23	353	292 Maple Ave, East Meadow
BB18	382	15 West Park Dr, Old Bethpage
To Monitor on a Monthly Basis		
Code #	**SWB#**	**Address**
D9	366	54 Barkers Point Rd, Sands Point
H19	462	82 Shelburne Lane, Manhasset Hills
J18	292	1029 Ceder Dr S, Manhasset Hills
G13	408	138 Bournedale Rd N, east end of Rd, Plandome Heights
J18	415	2 Hamilton Dr, Roslyn Estates
L11	349	700 Motts Cove Rd, Roslyn Harbor
N19	139	304 Mallard Rd, Carle Place
M10	215	55 Todd Dr N, Glen Head
S2	562	3 Spruce Court, Bayville
W12	569	96 Stirrup Lane, Muttontown
CC11	332	4 Maple Dr, Woodbury
AA17	261	87 Morton Blvd, Plainview
To Monitor on a Monthly Basis (continued)		
Code #	**SWB#**	**Address**
CC21	86	69 Jefferson Pl, Farmingdale

Table C-1 Nassau County Mosquito Control Pre-Treatment Locations

CC20	281	1 Jerome Dr, Farmingdale
U23	272	545 Tremont Pl, East Meadow (culvert)
R22	537	134 Glen Curtis Blvd, Uniondale
N29	500	2170 Maple St, Baldwin

Source: Nassau County Department of Public Works. November 15, 2007. SWB Pre-Treatment. .

D

Species of Concern for Aerial Larvicide Treatment in Nassau County and Breeding Locations with Aerial Pesticide Application Restrictions in Nassau County

Table D-1 Bird Species of Concern for Aerial Larvicide Treatment in Nassau County

Common Name	Scientific Name	Status
American oystercatcher	*Haematopus palliatus*	
Black skimmer	*Rynchops niger*	NYS Special Concern
Black-crowned night heron	*Nycticorax nycticorax*	
Cattle egret	*Bubulcus ibis*	
Common tern	*Sterna hirundo*	NYS Threatened
Forster's tern	*Sterna forsteri*	
Gull-billed tern	*Sterna nilotica*	
Glossy ibis	*Plegadis falcinellus*	
Great egret	*Ardea alba*	
Great blue heron	*Ardea herodias*	
Little blue heron	*Egretta caerulea*	
Least tern	*Sterna antillarum*	NYS Threatened
Piping plover	*Charadrius melodus*	NYS Endangered
Roseate tern	*Sterna dougallii*	NYS Endangered
Snowy egret	*Egretta thula*	
Tricolored heron	*Egretta tricolor*	
Yellow-crowned night-heron	*Nyctanassa violacea*	

Source: New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials. Article 15 Permit to Use an Aquatic Pesticide. 2008.

D Species of Concern for Aerial Larvicide Treatment in Nassau County and Breeding Locations with Aerial Pesticide Application Restrictions in Nassau County

Site Name	Quad*
Bannister Island	Lawrence
Big Crow Island	Freeport, Jones Inlet
Big Hassock	Lawrence
Black Banks Hassock	Lawrence
Boormans Island	Lawrence, Lynbrook
Cinder Island Group	Jones Inlet
Cuba Island Group	Freeport
Deep Creek Meadow	Jones Inlet
East Channel Islands	Lawrence
East Crow Island	Jones Inlet
False Channel Marsh	Jones Inlet, Freeport
Garrett Marsh	Lawrence
Goose Island	Amityville
Green Sedge Cedar Island Group	Lawrence
Hewlett Hassock	Lawrence
Ingraham Hassock	Jones Inlet
Jones Island	Jones Inlet
Lawrence Marsh	Lawrence
Line Island Group	West Gilgo Beach
Long Meadow Island	Jones Inlet
Meadow Island	Jones Inlet
Neds Island	Amityville
Neds Meadow	Freeport
Olivers Island	Freeport
Parsonage Island Group	Jones Inlet
Pine Marsh	Jones Inlet
Sanford Island	West Gilgo Beach
Smith Meadow	Jones Inlet, Freeport
West Meadow Island	Lawrence
Tobay Marsh Islands	West Gilgo Beach

Source: New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials. Article 15 Permit to Use an Aquatic Pesticide. 2008.
*USGS/NYSDOT Quadrangle Maps

E

Hotline Numbers for the Nassau County Mosquito Control Program

Table E-1 Hotline Numbers for the Nassau County Mosquito Control Program

	Hotline	Department
WNV Activity	(516) 572-1211	Nassau County Department of Health
Mosquito Nuisance Complaints	(516) 571-6900	Nassau County Department of Public Works
Stagnant Water Concerns		
Mosquito Control Activities		

APPENDIX B

PUBLIC EDUCATION AND OUTREACH MATERIALS

The materials in this Appendix are examples of the many written materials, pamphlets, brochures, or articles that can be readily viewed, downloaded, printed out, and obtained, at no charge, from a number of federal, state or local agency offices and/or their websites. They are suitable for a variety of uses including, but not limited to:

- General reading;
- Handouts or display boards at public events/meetings;
- Articles or announcements in newsletters or other periodicals;
- Regular mail inserts;
- E-mail distribution; and/or
- School programs

General Information About Mosquitoes

Almost everyone has had the unpleasant experience of being bitten by a mosquito. Mosquito bites can cause skin irritation through an allergic reaction to the mosquito's saliva - this is what causes the red bump and itching. But a more serious consequence of some mosquito bites may be transmission of certain serious diseases such as malaria, dengue fever and several forms of encephalitis, including West Nile virus.

Not only can mosquitoes carry diseases that afflict humans, but they also can transmit several diseases and parasites that dogs and horses are very susceptible to. These include dog heart worms, eastern equine encephalitis and West Nile virus.

There are about 200 different species of mosquitoes in the United States, all of which live in specific habitats, exhibit unique behaviors and bite different types of animals. Despite these differences, all mosquitoes share some common traits, such as a four-stage life cycle.

Different species of mosquitoes prefer different types of standing water in which to lay their eggs. The presence of beneficial predators such as fish and dragonfly nymphs in permanent ponds, lakes and streams usually keep these bodies of water relatively free of mosquito larvae. However, portions of marshes, swamps, clogged ditches and temporary pools and puddles are all prolific mosquito breeding sites. Other sites in which some species lay their eggs include:

-tree holes,
-old tires,
-buckets,
-toys,
-potted plant trays and saucers,
-plastic covers or tarpaulins and even
-places as small as bottle caps!

Some of the most annoying and potentially dangerous mosquito species, such as the Asian tiger mosquito, come from these sites.

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

FAQ: Mosquito Control

What are "larvicides" and "adulticides"?

Larvicides are products used to kill immature mosquitoes before they become adults. They can be either biological (such as toxin from specific bacteria that is lethal to mosquito larvae but not to other organisms) or chemical products, such as insect growth regulators, surface films, or organophosphates. Larvicides are applied directly to water sources that hold mosquito eggs, larvae or pupae. When used well, larvicides can help to reduce the overall mosquito burden by limiting the number of new mosquitoes that are produced.

Adulticides are products used to kill adult mosquitoes. Adulticides can be applied from hand-held sprayers, truck-mounted sprayers or using airplanes. Adulticides, when used well, can have an immediate impact to reduce the number of adult mosquitoes in an area, with the goal of reducing the number of infected mosquitoes that can bite people and possibly transmit West Nile virus.

Both larvicides and adulticides are regulated by the US Environmental Protection Agency (http://www.epa.gov/pesticides/) (http://www.cdc.gov/Other/disclaimer.html) .

What is CDC's position regarding the use of chemical mosquito control?

Chemical control measures are one part of a comprehensive and integrated mosquito management program. An integrated program is the most effective way to prevent and control mosquito-borne disease. An integrated mosquito management program should include several components:

1. surveillance (monitoring levels of mosquito activity, and where virus transmission is occurring),
2. reduction of mosquito breeding sites,
3. use of pesticides and biological methods to control both mosquito larvae and adult mosquitoes as indicated by surveillance results, and
4. community outreach and public education.

Control measures, including the decision to use chemical adulticides (pesticides to kill adult

Guidelines for Surveillance, Prevention, and Control of West Nile Virus in the US, 2013 [PDF - 69 pages] (/westnile/resources/pdfs/wnvGuidelines.pdf) provides detailed guidance about the use of control measures, including suggestions for a phased response and the actions that are possible at different levels of virus activity.

How are mosquitoes controlled during outbreaks?

The CDC recommends that control measures, including the decision to use chemical adulticides (pesticides to kill adult mosquitoes) should be based on surveillance data and the risk of human disease. CDC's West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control, updated for the first time since 2003, incorporates the most up-to-date understanding of how West Nile virus spreads between mosquitoes, birds, and people. The guidelines feature the development of procedures to protect people from West Nile virus including suggestions for a phased response and the actions that are possible at different levels of virus activity.

Are pesticides harmful to people?

Effect on human health is one of the primary factors considered in regulation of pesticides. Pesticides that can be used for mosquito control have been judged by the EPA not to pose an unreasonable risk to human health (http://www2.epa.gov/mosquitocontrol) (http://www.cdc.gov/Other/disclaimer.html) . People who are concerned about exposure to a pesticide, such as those with chemical sensitivity or breathing conditions such as asthma can reduce their potential for exposure by staying indoors during the application period (typically nighttime).

A published study, (MMWR, July 11, 2003) (http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5227a1.htm) examined illnesses in nine states associated with exposure to pesticides used to control mosquito populations from 1999-2002. This study found that "application of certain insecticides poses a low risk for acute, temporary health effects among person in areas that were sprayed and among workers handling and applying insecticides.

For more information on pesticides and health, consult the US Environmental Protection Agency (http://www.epa.gov/pesticides/) (http://www.cdc.gov/Other/disclaimer.html) which oversees the registration of these chemicals. The National Pesticide Information Center (NPIC) (http://npic.orst.edu/index.html) (http://www.cdc.gov/Other/disclaimer.html) can also provide information through a toll-free number, 1-800-858-7378.

What should I do if I think that I am having health problems because of pesticides used in my area?

If you are experiencing health problems for any reason it is important to see your health care provider promptly. If you are experiencing severe health problems go immediately to an Emergency Room.

How does pesticide spraying affect the environment?

A great deal of research must be done before pesticides can be used in the environment. The best source for finding out about the pesticides used in your area, and their effect on specific types of wildlife, is with the US Environmental Protection Agency (http://www.epa.gov/pesticides/) (http://www.cdc.gov/Other/disclaimer.html) , which oversees the registration of these products. The

National Pesticide Information Center (NPIC) (http://npic.orst.edu/index.html) (http://www.cdc.gov/Other/disclaimer.html) can also provide information through a toll-free number, 1-800-858-7378.

What training is required for workers who apply pesticides?

Each state has mandated training and experience requirements that must be met before an individual can commercially apply pesticides. In New York state, for example, certified pesticide apprentices must be at least 16 years of age, have completed an 8-hour core training course on safety issues and the use of pesticides, and have at least 40 hours of pesticide use experience in the field under the direct supervision of a certified pesticide applicator. In most states, continuing education hours must be completed to retain applicator licenses. In addition, these applicators must follow the instructions and precautions that are printed on the pesticide label. All pesticide products are required to have a label which provides information, including instructions on how to apply the pesticide and precautions to be taken to prevent health and environmental effects. All labels are required to be approved by U.S. Environmental Protection Agency (http://www.epa.gov/pesticides/) (http://www.cdc.gov/Other/disclaimer.html) .

Where can I get information regarding the safety of specific pesticides?

Questions concerning specific pesticides can be directed to the U.S. Environmental Protection Agency (http://www.epa.gov/pesticides/) (http://www.cdc.gov/Other/disclaimer.html) , as this agency has responsibility for registration of pesticides. Many issues are addressed on the EPA's Mosquito Control Web site.

The National Pesticide Information Center (NPIC) (http://npic.orst.edu/index.html) (http://www.cdc.gov/Other/disclaimer.html) provides pesticide information and questions about the impact of pesticide use on human health. NPIC is cooperatively sponsored by Oregon State University and the U.S. Environmental Protection Agency. NPIC can be reached toll-free: 1-800-858-7378.

How can I find out what types of pesticides are being used in my area?

Your local mosquito control program can give information about the type of products being used in an area. Mosquito control activities are most often handled at the local level, such as through county or city government. Check with your health department or in the "blue" (government) pages of the phone book for the contacts in your area.

Another resource to learn more about mosquito control is the American Mosquito Control Association (http://www.mosquito.org/) (http://www.cdc.gov/Other/disclaimer.html) .

npic
NATIONAL PESTICIDE INFORMATION CENTER

DEET

GENERAL FACT SHEET

What is DEET?

DEET is an insect repellent that is used in products to prevent bites from insects such as mosquitoes, biting flies, fleas and small flying insects. DEET is a colorless liquid that has a faint odor and does not dissolve easily in water. DEET was developed by the U.S. Army in 1946 for protection of soldiers in insect-infested areas. Insect repellents containing DEET have been used by the general public in the United States since 1957.

What are some products that contain DEET?

DEET has been used in a number of insect repellent products including liquid sprays, lotions, and sticks. It has been estimated that about 30% of the U.S. population uses one or more products that contain DEET every year.

If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 1-800-222-1222. If you wish to discuss a pesticide problem, please call 1-800-858-7378.

How does DEET work?

Scientists do not know exactly how DEET works on all insects. Some insects sense people by detecting the chemicals from our bodies and in the air that we breathe out. It has been shown that insects exposed to DEET are not able to locate a person or animal because they cannot detect them.

How might I be exposed to DEET?

There are four ways that people can be exposed to chemicals: contacting their skin, contacting their eyes, breathing them in, or eating them. DEET is often used directly on skin. DEET may also be inhaled when sprays are used around the body and in indoor spaces where the vapors can remain for some time. It may also be possible to swallow DEET if the hands are not washed after using DEET on skin. People have had adverse reactions to DEET when they applied it to parts of their body that contacted other skin surfaces, and when they applied it to skin that was under clothing. Exposure to DEET can be limited by reading the pesticide label and following all of the directions.

What are some signs and symptoms from a brief exposure to DEET?

When products containing DEET get into the eyes, they may cause irritation, pain and watery eyes. People that have left DEET products on their skin for extended periods of time have experienced irritation, redness, a rash, and swelling. People that have swallowed products containing DEET have experienced stomach upset, vomiting, and nausea. Very rarely, exposure to DEET has been associated with seizures in people. Most of these reactions have happened after drinking products with DEET in them or using the products in ways that do not follow label directions.

NPIC General Fact Sheets are designed to provide scientific information to the general public. This document is intended to promote informed decision-making. Please refer to the Technical Fact Sheet for more information.

Reports of pets being exposed to DEET in amounts that would make them sick are rare. Pets that have been overexposed to DEET have shown varying effects, including vomiting, shaking, excitement, lack of coordination, and seizures.

What happens to DEET when it enters the body?

When DEET was applied to the skin of volunteers by researchers, they found that a small amount of the DEET was taken into the body through the skin. When DEET and alcohol are applied to the skin, more DEET is taken into the skin compared with DEET alone. Drinking alcohol may also cause more DEET to be absorbed through the skin. Sunscreen products that contain DEET may cause more DEET to be taken into the body through the skin.

The DEET that is taken in to the body can be found in the blood up to 12 hours after it is applied to the skin. Once in the body, DEET is broken down by the liver and eliminated from the body mainly through the urine. All of the DEET that is taken in by the body is broken down into smaller chemicals before it is eliminated. Nearly all of the DEET that is taken in through the skin is eliminated by the body within 24 hours of applying it.

Is DEET likely to contribute to the development of cancer?

Researchers have not found any evidence that DEET causes cancer in animals or humans. DEET has been classified by the U.S. EPA as "Not Classifiable as a Human Carcinogen", which means that there is not enough evidence to say that it does or does not cause cancer.

Has anyone studied non-cancer effects from long-term exposure to DEET?

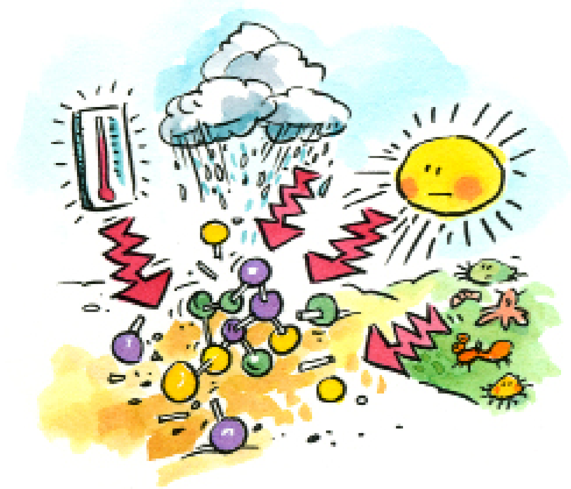
A trial was done on women to test the safety of using DEET to prevent malaria during pregnancy. Women used a product with 20% DEET on their legs and arms each day during their second and third trimesters of pregnancy. DEET crossed the placenta and was found in 8% of the cord blood samples. There was no increase in birth defects or problems with the survival in the young and there were no further problems in the first year of life.

Are children more sensitive to DEET than adults?

Limited information is available on childhood responses to DEET from experiments or poison center reports. Children have had adverse responses to DEET exposure, but most of these cases have resulted from improper use or accidents. Children involved in accidents have usually had less serious effects than teens and adults. Special instructions have been placed on products containing DEET for use on children.

The American Academy of Pediatrics (AAP) has recommended that DEET not be used on children younger than 2 months of age.[1] The AAP has also recommended that DEET should be applied no more than one time per day for children older than two months, and that products should be used on children that have the lowest DEET concentration available. The AAP has cautioned parents not to use DEET on the hands of children and to avoid applying it to areas around children's eyes and mouths.[1]

What happens to DEET in the environment?



When DEET gets into the soil, it can be broken down by microbes, including bacteria and fungi. In experiments where fungi and bacteria broke down DEET, the chemicals remaining were less toxic than DEET itself. DEET usually sticks to soils, but can move in other soils to some degree. DEET does not dissolve or mix very well in water.

Because DEET is used by so many people, it has been found in waste water and in places where waste water moves into other bodies of water.

When DEET is sprayed or evaporates, it will be in the air as a mist or vapor, and then begin to break down in the atmosphere. These times for breakdown will change, depending on environmental conditions like temperature, humidity and wind.

Can DEET affect birds, fish, or other wildlife?

Tests were done to find out if DEET could affect fish or insects that live in the water. For freshwater fish and insects, DEET was toxic at extremely high levels. For instance, the level of DEET that killed half of the fish or insects was about 75,000 times greater than the highest concentration found in waste water or streams. DEET is not considered to be very toxic to birds.

Where can I get more information?

For more detailed information see the DEET Technical Fact Sheet or call the National Pesticide Information Center, Monday - Friday, between 8:00 AM and 12:00 PM Pacific Time (11:00 AM to 3:00 PM Eastern Time) at 1-800-858-7378 or visit us on the web at http://npic.orst.edu. NPIC provides objective, science-based answers to questions about pesticides.

Other references cited in this fact sheet include:

1. *Follow Safety Precautions When Using DEET on Children;* American Academy of Pediatrics. http://www.healthychildren.org/English/safety-prevention/at-play/Pages/Insect-Repellents.aspx (accessed March 2008), updated June 2003.

Date Reviewed: July 2008

NPIC is a cooperative agreement between Oregon State University and the U.S. Environmental Protection Agency (U.S. EPA, cooperative agreement # X8-83458501). The information in this publication does not in any way replace or supercede the restrictions, precautions, directions, or other information on the pesticide label or any other regulatory requirements, nor does it necessarily reflect the position of the U.S. EPA.

OSU
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Prevent Your Exposure to Mosquitoes

Use the following tips to help protect yourself from exposure to mosquitoes.

- Use EPA-registered mosquito repellents when necessary and follow label directions and precautions closely.
- Tuck shirts into pants and pants into socks to cover gaps in your clothing where mosquitoes can get to your skin.
- Use head nets, long sleeves and long pants if you venture into areas with high mosquito populations, such as salt marshes.
- Stay indoors at sunrise, sunset and early in the evening when mosquitoes are most active, especially if there is a mosquito-borne disease warning in effect.
- Replace your outdoor lights with yellow "bug" lights, which tend to attract fewer mosquitoes than ordinary lights. The yellow lights are NOT repellents, however.

Use structural barriers

- Cover all gaps in walls, doors and windows to prevent mosquitoes from entering.
- Make sure window and door screens are "bug tight."
- Completely cover baby carriers and beds with netting.

Regulation of Skin-Applied Repellents

Registered Products

Before they can be marketed, most skin-applied repellents must be registered by EPA. EPA registration of skin-applied repellent products indicates that they have been evaluated and approved for human safety and effectiveness when applied according to instructions on the label.

You will see an EPA Registration Number on the product label (for example, 123456-1) of any EPA-registered product.

The Centers for Disease Control and Prevention (CDC) recommends the use of products containing EPA-registered active ingredients.

Unregistered Products

Some insect repellent products for sale in the United States do not currently require EPA registration. In the 1990s, EPA evaluated the active ingredients in these unregistered products for **safety**. We determined that the active ingredients posed minimal risk to human health in the percentages found in products on the market. Based on this minimal risk determination, we decided that products made from these ingredients should be exempt from registration. Note that products made from these ingredients have not been evaluated for **effectiveness**.

Examples of ingredients used in unregistered repellents are:

Citronella oil.
Cedar oil.
Geranium oil.
Peppermint and peppermint oil.
Soybean oil.

Illegal Products

Be aware that there are illegal products in the market that do not qualify for the exemption, nor are they registered. Repellents that do not bear an EPA registration number have not been evaluated by EPA, and EPA cannot advise consumers about the effectiveness of these products. If you find products without an EPA registration number and want to see if they might qualify as products that don't require registration, check the minimum risk pesticide Web page to see the criteria for such products. However, be aware that it is not simple to determine the status of products in many cases.

Remove Mosquito Habitats

An important part of mosquito control around your home is making sure that mosquitoes don't have a place to lay their eggs. Because mosquitoes need water for two stages of their life cycle, it's important to monitor standing water sources.

- Get rid of standing water in rain gutters, old tires, buckets, plastic covers, toys or any other container where mosquitoes can breed.
- Empty and change the water in bird baths, fountains, wading pools, rain barrels and potted plant trays at least once a week to eliminate potential mosquito habitats.
- Drain temporary pools of water or fill with dirt.
- Keep swimming pool water treated and circulating.

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FAQ: Insect Repellent Use & Safety

Which mosquito repellents work best?

CDC recommends the use of products containing active ingredients which have been registered with the U.S. Environmental Protection Agency (EPA) for use as repellents applied to skin and clothing.

Of the products registered with the EPA, those containing DEET, picaridin, IR3535, and some oil of lemon eucalyptus and para-menthane-diol products provide longer-lasting protection.

EPA registration means that EPA does not expect the product to cause adverse effects to human health or the environment when used according to the label.

How often should repellent be reapplied?

Repellents containing a higher percentage of the active ingredient typically provide longer-lasting protection. Regardless of what product you use, if you start to get mosquito bites, reapply the repellent according to the label instructions.

What precautions should I follow when using repellents?

Always follow the recommendations appearing on the product label. EPA recommends the following when using insect repellents:

- Apply repellents only to exposed skin and/or clothing (as directed on the product label). Do not apply repellents under your clothing.
- Never use repellents over cuts, wounds or irritated skin.
- Do not apply to eyes or mouth, and apply sparingly around ears. When using repellent sprays, do not spray directly on your face—spray on your hands first and then apply to your face.
- Do not allow children to handle or spray the product. When using on children, apply to your own hands first and then put it on the child. Avoid applying repellent to children's hands because children frequently put their hands in their eyes and mouths.
- Use just enough repellent to cover exposed skin and/or clothing. Heavy application does not give you better or longer lasting protection.
- After returning indoors, wash treated skin with soap and water or bathe. This is particularly important when repellents are used repeatedly in a day or on consecutive days.

- If you (or your child) get a rash or other reaction from a repellent, stop using the repellent, wash the repellent off with mild soap and water, and call a local poison control center for further guidance. If you go to a doctor, it might be helpful to take the repellent with you.

Can insect repellents be used on children?

Yes. Most products can be used on children. Products containing oil of lemon eucalyptus should not to be used on children under the age of three years. EPA does not recommend any additional precautions for using registered repellents on children other than those listed above.

Can insect repellents be used by pregnant or nursing women?

Yes. EPA does not recommend any additional precautions for repellent use by pregnant or nursing women.

Can I use an insect repellent and a product containing sunscreen at the same time?

Yes. People can, and should, use both a sunscreen and an insect repellent when they are outdoors. Follow the instructions on the package for proper application of each product. In general, the recommendation is to apply sunscreen first, followed by repellent.

Should I use combination sunscreen/insect repellent products?

It is not recommended to use a single product that combines insect repellent containing DEET and sunscreen. Repellent usually does not need to be reapplied as often as sunscreen. There are not specific recommendations for products that combine other active ingredients and sunscreen. Always follow the instructions on the label of whatever product you are using.

What is permethrin?

Permethrin is a repellent and insecticide. Certain products containing permethrin are recommended for use on clothing, shoes, bed nets, and camping gear. Permethrin-treated products repel and kill ticks, mosquitoes, and other arthropods. These products continue to repel and kill insects after several washings. Permethrin should be reapplied following the label instructions.

United States Environmental Protection Agency

Using Insect Repellents Safely and Effectively

For the safe and effective use of pesticide products, always read the product label before using the product.

Ensuring Safety

Remember these important points to use repellents safely:

Applying the Product

-Follow the label directions to ensure proper use.
-Apply repellents only to exposed skin and/or clothing. Do not use under clothing.
-Do not apply near eyes and mouth, and apply sparingly around ears. When using sprays, do not spray directly into face; spray on hands first and then apply to face.
-Never use repellents over cuts, wounds, or irritated skin.
-Do not spray in enclosed areas.
-Avoid breathing a spray product.
-Do not use it near food.

Other Safety Tips

-After returning indoors, wash treated skin and clothes with soap and water.
-Do not use any product on pets or other animals unless the label clearly states it is for animals.
-Most insect repellents do not work against lice or fleas.
-Store insect repellents safely out of the reach of children, in a locked utility cabinet or garden shed.
-Use other preventive actions to avoid getting bitten by mosquitoes and ticks.

Repellents and Children

We advise consumers to always read and follow label directions in using any pesticide product, including insect repellents.

Because children frequently put their hands in their eyes and mouths, EPA recommends that all repellent products have the following precautionary statements related to children on their labels:

> -Do not allow children to handle this product, and **do not apply to children's hands**. When using on children, apply to your own hands and then put it on the child.
> -After returning indoors, wash your child's treated skin and clothes with soap and water or bathe.

According to the label, **oil of lemon eucalyptus products should not be used on children under the age of three**. Other ingredients do not have an age restriction.

Questions often arise about use of DEET on children. DEET is approved for use on children with no age restriction. Also, there is no restriction on the percentage of DEET in the product for use on children, since data do not show any difference in effects between young animals and adult animals in tests done for product registration. There also are no data showing incidents that would lead us to believe there is a need to restrict the use of DEET.

Always store insect repellents safely out of the reach of children.

If you are concerned about using repellent products on children you may wish to consult a health care provider for advice or contact the National Pesticide Information Center (NPIC) or through their toll-free number, 1-800-858-7378.

Maximizing Effectiveness

Apply and re-apply a repellent according to the label instructions. Don't overuse the products, but be sure to apply the amount of repellent indicated by the label. If you don't follow the label directions, the product may not be as effective as you expect. The label on the insect repellent product is your guide to using these products safely and effectively. The effectiveness of the product can vary due to conditions such as:

> -Physical activity/perspiration.
> -Water exposure.
> -Air temperature.
> -How attractive you are to mosquitoes and ticks; every person is different.

Look for an EPA registration number (EPA Reg. No.) on the insect repellent product label. This registration number means the company provided EPA with technical information on the effectiveness of the product. The Centers for Disease Control and Prevention (CDC) recommends the use of products registered by EPA.

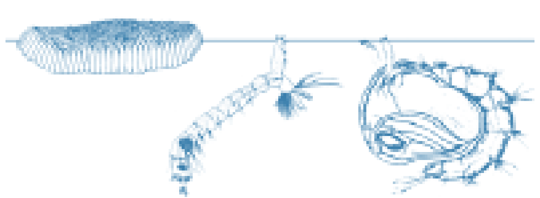
Meet the mosquito

Mosquitoes are flying, biting insects that develop in water during their immature stages. Some of the many species found in New York are considered pests and can transmit diseases to humans. The three most important mosquito groups are the *Anopheles* (carrier of malaria), *Culex* (carrier of viral encephalitis), and *Aedes* (pronounced "AY-dees"; carrier of yellow fever, dengue, and encephalitis). All are less than 0.5-inch (1.3 cm) long as adults.

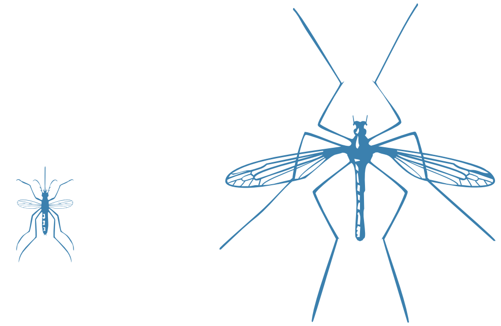
Although mosquitoes are usually a nuisance and sometimes dangerous to public health, most specialists agree that eradication is unrealistic. A more reasonable goal is population reduction and management below problem levels. *This goal relies greatly on public education and awareness.*

A mosquito's life: from water to air

Mosquitoes have four life stages: the egg, larva, pupa, and adult. Eggs are laid on the surface of water (*Culex* and *Anopheles* types) or damp soil that is soon to flood *(Aedes* type). Most eggs hatch within 48 hours. The larvae live in water and breathe at the surface through tubes. Larvae, or wrigglers, feed on organic debris and microorganisms in the water, then molt into pupae, a resting stage that remains in the water. During this time the mosquito develops into an adult. After two days the pupal skin splits and the adult emerges. The length of this life cycle varies by species from 4–30 days.



Mosquito life stages in water: egg raft, larvae with air tubes, and pupa. Larvae are commonly called "wrigglers" because of the way they squirm through water when disturbed or when seeking food.



Only the **female mosquito** has piercing mouthparts and feeds on blood. The mosquito is often confused with… … the harmless **crane fly,** which is more than twice the size of the mosquito and does not bite.

An adult female mosquito usually must take a blood meal before laying eggs. Females have elongated piercing-sucking mouthparts used to penetrate your skin and ingest blood from the host. A component of mosquito saliva prevents blood clotting and causes itching and swelling. Saliva is the means for disease movement into the host. Blood protein is used to produce and mature the eggs. Male mosquitoes feed on nectar, *not* on blood. Their mouthparts are not designed for piercing.

Public health concerns

Mosquito-borne illnesses have plagued humans throughout history. Modern vector control and monitoring programs have greatly reduced the incidence of yellow fever, malaria, and encephalitis viruses. Eastern equine encephalitis (EEE), St. Louis encephalitis (SLE), and West Nile encephalitis (WNE) remain significant diseases that have recently afflicted people in New York. Management includes intense surveillance for mosquito outbreaks and routine monitoring for diseases.

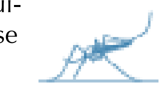
County-based vector control programs aim to use prevention to limit mosquito breeding. If encephalitis does break out in a community, outdoor activities must be restricted. The goal is to reduce the threat of disease *and* minimize pesticide applications for mosquito control.

An unusual outbreak of West Nile encephalitis in New York during 1999 has refocused our attention on vector-borne diseases. This and other encephalitis viruses not only endanger humans but can infect and kill horses. Birds that are infected can help spread the disease and may also die. The emergence of exotic diseases such as this may be linked to increased human travel and transport of goods throughout the world. New disease outbreaks are unpredictable and illustrate the need for public education and involvement.

Common mosquitoes

Three mosquitos are mentioned here, but this brochure focuses on *Culex* and how to manage it.

***Culex pipiens*—**Common house mosquito. *Culex* mosquitoes are persistent biters that feed at dusk, night, and dawn. *Culex* mosquitoes prefer birds as hosts, but because they are frequently found in homes, they bite humans and can transmit encephalitis. These mosquitoes breed in small pools of stagnant water containing organic debris and do not move far from breeding sites. *Culex pipiens* is the most important mosquito pest in urban and suburban areas. It matures from egg to adult in 7 days; adults generally live 10–60 days.



***Culex pipiens* is the most important mosquito pest in urban and suburban areas.**

***Aedes sollicitans*—**Salt marsh mosquito, found at the coast. *Aedes* mosquitoes are aggressive and painful biters that feed during daylight and prefer humans. *Aedes* will fly several miles from breeding sites (areas that flood) but usually do not enter buildings. Because these mosquitoes are associated with naturally occurring floodwaters, residents need only to be aware of outbreaks, then take measures to avoid being bitten. Counties on the coast have programs that manage salt marsh mosquitoes.

***Anopheles* species—**These mosquitoes are associated with permanent fresh waters with vegetation; eggs are laid on the surface of calm water. This mosquito is the only one that carries malaria. Although malaria does not normally occur in New York, several cases have been reported in recent years.

What can you do?

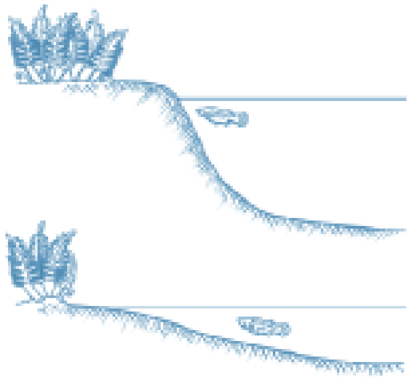
Culex pipiens, the most common mosquito around the home and around the world, is the primary carrier of encephalitis viruses. It has a very small home range and usually does not fly more than 300 feet from a breeding site. Because this mosquito breeds in small pools of standing water containing leaves or other debris, backyards can be the perfect habitat! Rain gutters, cups, cans, and birdbaths are "home, sweet home." When given a breeding site, mosquitoes will stay in the area. *To reduce Culex mosquito populations and the need for pesticides, you must regularly inspect your surroundings for potential breeding areas and disrupt these sites.*

Ways to "fight the bite"

Before you even consider spraying insecticides over your entire yard, take a preventative approach. Insecticides should be a last resort.

Prevent mosquito breeding

- Dump out standing water from containers in the yard, including recycling bins with bottle caps and cans, tires, boats, and tarps.
- Clean debris from rain gutters early in spring and check them regularly. If you are unable to clean them, ask your landscaper or pest control technician. A huge number of mosquitoes can result from clogged gutters.
- Clean, filter, and treat pools. Empty children's pools and turn them over when not in use. Keep pool covers clean by propping them up to drain water.
- Encourage natural enemies. For example, stock ornamental ponds with goldfish. Mosquitofish (a type of minnow, also known as *Gambusia)* devour mosquito larvae. Dragonflies and damselflies are mosquito predators.
- Construct goldfish ponds properly. Large goldfish are unable to reach sloping edges of ponds where mosquitoes breed, so be sure your pond has *vertical* sides. A pond fountain will also reduce mosquito breeding.



Sides of goldfish ponds should be steep (top). Gradual, sloping sides provide places for mosquitos to breed that large goldfish cannot reach (bottom).

- Change the water in birdbaths and fountains twice a week.

Protect yourself against Culex mosquitoes

- Cover up with loose-fitting, lightweight clothing from dusk to dawn.
- Use insect repellents properly, especially on children (never on their skin). Read the label and follow precautions.
- Keep household screens in good repair and do not prop open windows or doors.

Stay informed

- Attend public forums and educate yourself.
- Remember that electric insect "zappers" do not help to prevent mosquito problems. These devices generally kill more beneficial insects than pests.
- Recognize that light traps and carbon dioxide traps used by mosquito control programs are for monitoring purposes and cannot be used to reduce mosquito numbers.

These steps will help protect you from mosquitoes, disease, and risks associated with pesticides. *With greater public participation (i.e., you!), mosquito numbers can be reduced.*

Potential breeding sites shown in the cover illustration: rain gutter, rain barrel, umbrella, lawn chairs, kiddie pool, pool toys, recycling bin with cans, bird bath, potted plant saucer, dog bowl, watering can, and garden pond.

For more information

Your local Cornell Cooperative Extension office

Department of Health (New York State or your County)

American Mosquito Control Association: http://www.mosquito.org

Center for the Environment (Risk Analysis), Cornell www.cfe.cornell.edu/risk

Centers for Disease Control: (Vector-borne Illnesses Information): http://www.cdc.gov

Mosquito Integrated Pest Management: http://www-rci.rutgers.edu/~insects/ipm.htm

New York City Department of Health http://www.ci.nyc.ny.us/html/doh/home.html

Pesticide Information—Cornell University http://pmep.cce.cornell.edu

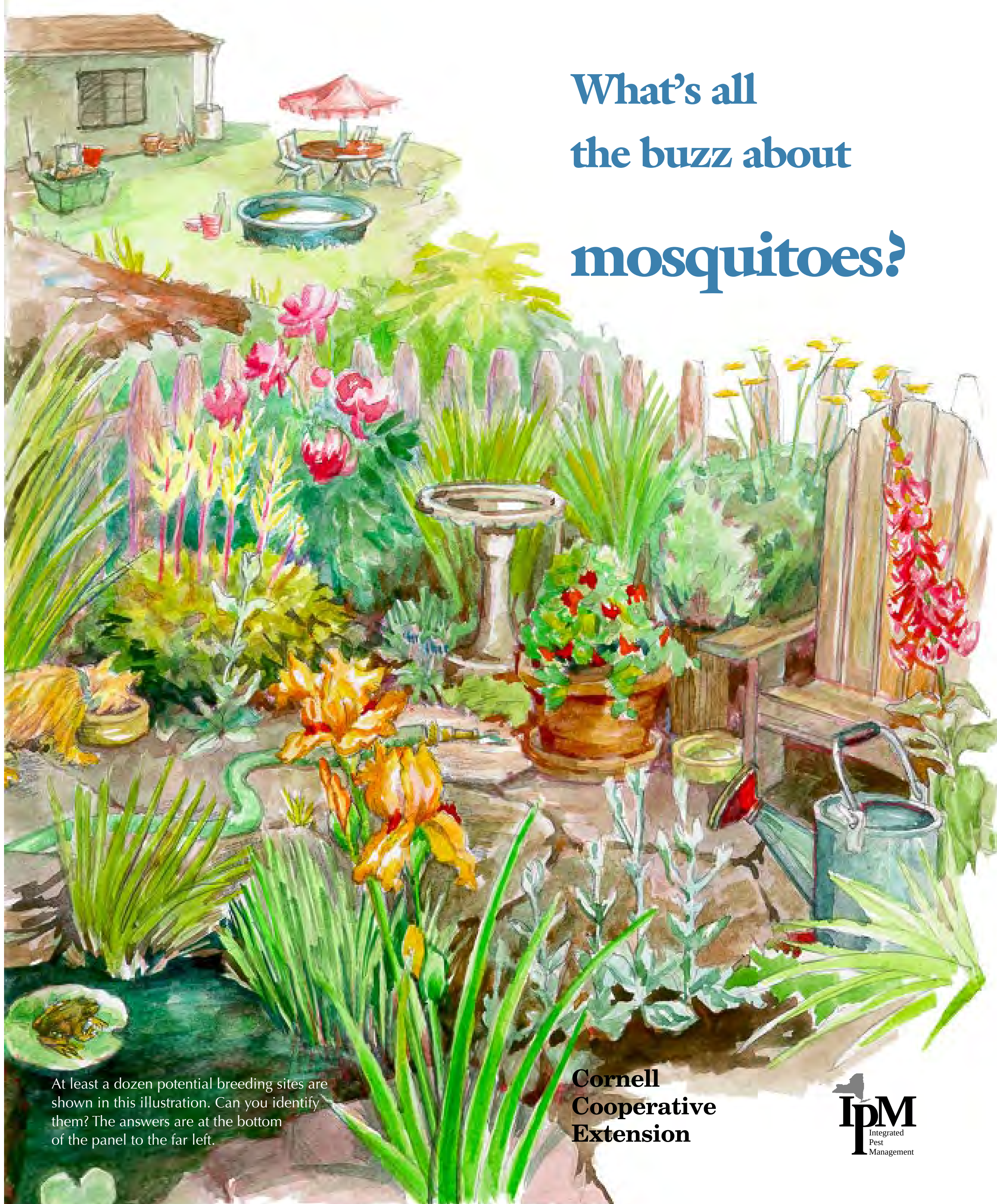
Olkowski, W., S. Daar, and H. Olkowski. 1991. *Common-Sense Pest Control.* Taunton Press, Newtown, CT.

The New York State IPM Program

We encourage people to adopt a sustainable approach to managing pests, using methods that minimize environmental, economic, and health risks. For more information: NYS Integrated Pest Management Program; 1-800-635-8356; NYSAES, Geneva, NY 14456; www.nysaes.cornell.edu/ipmnet/ny

For additional copies of this brochure (IPM No. 606), contact your local Cornell Cooperative Extension office or the NYS IPM Program.

Produced by the Community IPM Program, which is funded by Cornell University, Cornell Cooperative Extension, and the New York State Department of Environmental Conservation. Writing: Jody Gangloff; Production: Carrie Koplinka-Loehr; Artwork: Susan MacKay (cover) and Karen English-Loeb (ponds, mosquito); other drawings courtesy of USDA and NYSAES. Permission for the use of "Fight the Bite" granted by Kristine Smith, New York State Department of Health. Special thanks to Cornell University's Department of Entomology. Cornell Cooperative Extension provides equal program and employment opportunities. Printed on recycled paper. 17M 4/00 AP



What's all the buzz about mosquitoes?

At least a dozen potential breeding sites are shown in this illustration. Can you identify them? The answers are at the bottom of the panel to the far left.

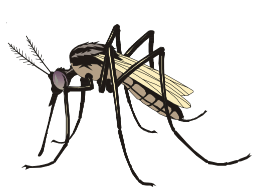
Cornell Cooperative Extension

IPM Integrated Pest Management

Health Canada Santé Canada

PMRA ARLA

Safety Tips on Using Personal Insect Repellents



April 2003

General Use Information for Personal Insect Repellents

- Always read the entire label carefully before using.
- Apply the repellent sparingly, and only on exposed skin surfaces or on top of clothing. Do not use under clothing. Heavy application and saturation are unnecessary for effectiveness. Repeat applications only as necessary.
- Do not get in eyes. If you do get repellent in your eyes, rinse immediately with water.
- Do not use the repellent on open wounds, or if your skin is irritated or sunburned.
- Avoid breathing spray mists and never apply sprays inside a tent. Use only in well-ventilated areas. Do not use near food.
- Wash treated skin with soap and water when you return indoors or when protection is no longer needed.

- Keep all insect repellent containers out of the reach of children.
- Always supervise the application on children.
- Avoid applying repellent to children's hands to reduce the chance of getting the repellent in their eyes and mouths.
- If you suspect that you or your child are reacting to an insect repellent, stop using the product immediately, wash treated skin and seek medical attention. When you go to the doctor, take the product container with you.
- If you are concerned that you are sensitive to a product, apply the repellent to a small area of skin on your arm and wait 24 hours to see if a reaction occurs.

Choosing A Product

- Choose a product that meets your needs. For example, if you plan to be outdoors for a short period of time, choose a product with a lower concentration of repellent and repeat application only if you need a longer protection time.
- Use only personal insect repellents that are registered in Canada. They have a registration number granted under the *Pest Control Products Act* and are labelled as insect repellents for use on humans. Never use a product labelled as an *insecticide* on your body.

There are five different active ingredients found in registered personal insect repellents in Canada. The active ingredient, its concentration, protection times and use instructions are all listed on each product label. If using a product containing DEET, please consult the new use guidelines in the next section of this Fact Sheet.

- **P-menthane 3,8-diol:** A product containing this active ingredient was recently registered in Canada and thus meets all the modern safety standards. It provides up to two hours of protection against mosquitoes. This product cannot be used on children under three years of age.
- **Soybean oil:** Registered products containing soybean oil provide between one to 3.5 hours of protection against mosquitoes, depending on the product. Products containing soybean oil were recently registered and thus meet all the modern safety standards.
- **Citronella and lavender:** Registered products containing citronella protect people against mosquito bites from 30 minutes to two hours. The registered lavender product repels mosquitoes for approximately 30 minutes. These products cannot be used on infants and toddlers under two years of age. Based on animal studies, citronella-based products appear to be potential skin sensitizers. Therefore, allergic reactions may occur in some individuals.
Products containing citronella and lavender are currently under re-evaluation by the PMRA. Re-evaluations involve a comprehensive review of the scientific data that support the registration of a pesticide using modern health protection standards.
- **DEET:** Using the latest health protection standards, DEET was re-evaluated in 2001 to ensure continued acceptable use and extra protection for children. DEET-based repellents at various concentrations offer different protection times. Examples of protection times based on DEET concentration are as follows:

Concentration of DEET	Protection time (approximate)
30%	6 hours
15%	5 hours
10%	3 hours
5%	2 hours

Updated Information on Using Insect Repellents that Contain DEET

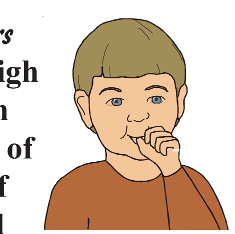
The following safety tips are based on the PMRA's re-evaluation of DEET. This re-evaluation involved a comprehensive review of the scientific data supporting its registration using the latest health protection standards, including special protection for children. The new use guidelines for using DEET on children were developed in consultation with the Canadian Paediatric Society.

For a complete explanation of the DEET re-evaluation process and its conclusions, please refer to Re-evaluation Decision Document RRD2002-01 *Personal insect repellents containing DEET (N,N-diethyl-m-toluamide and related compounds).*

Children under 6 months of age

- DO NOT use personal insect repellents containing DEET on infants. (Advice unchanged)

Children aged 6 months to 2 years



- **In situations where a high risk of complications from insect bites exist, the use of one application per day of DEET may be considered for this age group.**
- **The least concentrated product (10% DEET or less) should be used. (New advice.)**
- The product should be applied sparingly and not be applied to the face and hands.

Children between 2-12 years of age

- **The least concentrated product (10% DEET or less) should be used.**
- **Do not apply more than three times per day. (New advice)** Do not apply to the face and hands.
- Prolonged use should be avoided.

Adults and Individuals 12 Years of Age or Older:

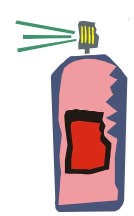
- **Products containing DEET at concentrations above 30% will no longer be acceptable for registration, based on a human health risk assessment that considered daily application of DEET over a prolonged period of time. Studies show that products with lower concentrations of DEET are as effective as the high concentration products, but they remain so for shorter periods of time. Products containing no more than a 30% concentration of DEET will provide adults with sufficient protection. (New advice)**

Re-apply after these protection time have elapsed if necessary.

Note: There is no indication that there is a hazard to the unborn or nursing child associated with the use of DEET by pregnant or lactating women. However, there are non-chemical methods to reduce mosquito bites (e.g., protective clothing, avoiding mosquito habitat and times of peak mosquito activity) which could be considered.

Use of Existing Products That Contain DEET at Concentrations Above 30%

Since no immediate health concerns were identified during the re-evaluation of DEET, retail sales of products that contain DEET at concentrations above 30% can continue until December 31, 2004. This phase-out will allow existing products to be used up, thereby preventing disposal problems. If you have any concerns regarding higher-concentration DEET products (cream, liquid or pump spray) you have around the home, you can dispose of them with your regular household garbage. Consult municipal authorities concerning the disposal of aerosol sprays. Otherwise, you may continue to use any products you have that contain a greater than 30% concentration of DEET on adults or children 12 years of age or older, occasionally and according to label directions (i.e., apply sparingly and only as required). These products should not be used for a prolonged period of time (e.g., daily use for several weeks).



Products Containing DEET and Sunscreens

Some personal insect repellent products contain sunscreen compounds. Because of the incompatible label instructions regarding methods of application, i.e., insect repellents should be applied sparingly while sunscreens should be applied liberally and frequently, the insect repellents/sunscreen combinations products should be used **solely as insect repellents**, and be applied according to the safe practices listed above. Since no immediate health concerns with DEET/sunscreen products were identified during the re-evaluation of DEET, retail sales of such products can continue until December 31, 2003. Any such products that you still have may be used as directed above, or disposed of as directed for products with more than 30% DEET.

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Pest Management Regulatory Agency
2720 Riverside Drive
Ottawa ON K1A 0K9

Pest Management Information Service
Telephone: 1-800-267-6315
From outside Canada: (613) 736-3799*
*Long distance charges apply.
Fax: (613) 736-3798
Internet: www.hc-sc.gc.ca/pmra-arla

Canada

The Sustainability Institute at Molloy College

Partnering for a Viable Long Island.

SPECIAL REPORT

Through this report The Sustainability Institute encourages Long Island consumers to seek out and ask for safer alternatives to chemicals to protect themselves from mosquitoes.

Why are Mosquitoes a Health Issue?

Mosquitoes can be more than just a nuisance. Several common species (such as Culex and Aedes) can carry the West Nile Virus, Eastern Equine Encephalitis and other diseases that impact humans. West Nile Virus can produce mild flu-like symptoms or more serious manifestations that can be fatal. West Nile Virus first appeared on Long Island in 1999. It has since become endemic across the U.S., causing 1,131 fatalities in a decade.

Here on Long Island, mosquitoes are a perennial problem. They breed in pools of standing water, and populations can increase dramatically after consistent rains like those our region has experienced this summer. Mosquitoes can live from two weeks to several months, and only need a small puddle to breed several hundred larvae. Their eggs hatch approximately five days after they are laid, so if water is left standing longer than that it can provide a breeding ground for multiple generations of mosquitoes. Female mosquitoes seek blood to fuel their egg production.

Some mosquito species fly only a few hundred feet from where they breed while others can fly for miles. Given such a large area of impact we must protect ourselves through preventative measures and repellents.

This report includes information about safer ways to protect yourself and your family from mosquitoes.

Take Action

Many County governments and the Center for Disease Control (CDC) recommend the following:

- **Remove standing water from children's toys stored outdoors, flower pots, garbage cans, old tires, or anything that collects water.**
- **Make sure gutters drain properly and keep gutters free of debris.**
- **Keep swimming pools chlorinated and covers free of stagnant water.**
- **Install window and door screens and keep in good repair.**
- **Wear long sleeves, pants, and mosquito repellent (always follow directions) when outdoors especially at dusk and dawn when mosquitoes are particularly active.**

The Sustainability Institute also recommends :

Reporting derelict swimming pools especially those with dirty water (such as those on foreclosed properties) to the County:

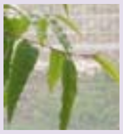
Nassau County Department of Public Works 516-572-1166 or Health Department Mosquito Surveillance 516-572-1211,

Suffolk County Mosquito Control (631) 852-4270.

Homeowners with backyard ponds should keep water aerated and moving, stock pond with fish that eat mosquito larvae, and construct ponds with steep walls giving less shelter to larvae.

Choose natural repellents that are safer for yourself and your family as detailed within this report.

Recommended Repellent



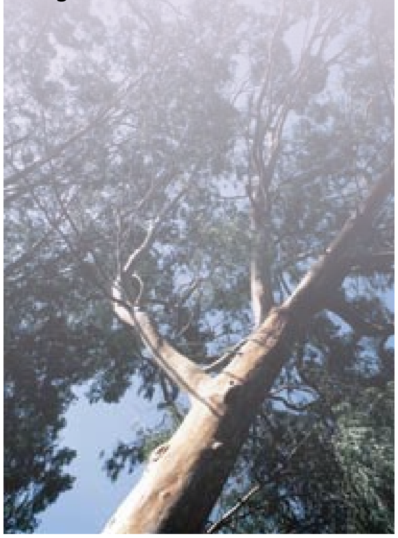
The Center for Disease Control (CDC) has recommended a bio-chemical product, oil of the Lemon Eucalyptus tree (Eucalyptus Citriodora) as a mosquito repellent to help avoid bites of disease carrying mosquitoes.

According to the Environmental Protection Agency (EPA):

Eucalyptus oil Is an extract from the leaves and twigs of Eucalyptus Citriodora also known as Corymbia Citriodora. The pesticide products using oil of lemon eucalyptus were registered in 2000 to repel mosquitoes and deer ticks.

There are several products now registered both as lotion and spray formulations. As with most plant oils, no adverse effects to humans are expected from the use of oil of lemon eucalyptus products when label directions are followed.

Products contain a range of 30 to 40 percent of the active ingredient.



Availability of Lemon Eucalyptus: Our Survey of Local Stores

In light of the growing interest in non-toxic mosquito repellents, especially among parents of young children, The Sustainability Institute at Molloy College researched the availability of Lemon Eucalyptus personal repellents at Long Island retail stores (see results on back page).

The product availability survey found three different brands of personal repellents that contain the active ingredient recommended by the CDC. Two of the products can be found at sporting goods and department stores that sell chemical pesticides. They are: Repel® Lemon Eucalyptus and Cutter® Lemon Eucalyptus.

The third repellent is found primarily at health food stores. It is: *Kiss My Face®* Swy Flotter. The cost of these items ranges from $6 to $10 for a 4 oz spray bottle.

The good news is that the products are available if you know what to search for and where to look. However, the bad news is that the availability of the products is inconsistent and many people may discover that the natural repellents are a challenge to find. Fortunately, these products are also available on the internet at well-known sites such as Amazon.com.

The websites for Repel and Cutter do not sell the products and instead send people to a list of chain stores, which our survey found, often don't carry the products.

Our survey of more than 50 Long Island stores found that either the Repel® or Cutter® Lemon Eucalyptus product was available at most Target stores, that were likely to carry the products, but only a few Walmart and Ace Hardware stores on Long Island actually carry the products despite both chains being listed on manufacturers' websites as selling the products. Some health food stores sell *Kiss My Face®* Swy Flotter. For the full results, see our website at si.molloy.edu.

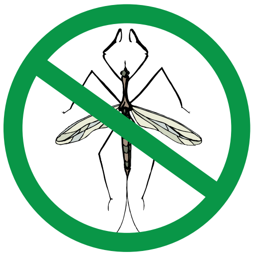
As informed consumers, Long Islanders can use our dollars to increase supply and placement of these products by asking store managers to stock their shelves with these less toxic products.

Note: there are other alternatives available at health food stores that are often made with citronella and other essential oils such as geraniol. These may also have some repellent effectiveness but since the CDC does not recommend them, the Sustainability Institute at Molloy College did not review their availability.

KISS MY FACE SWY FLOTTER

CUTTER® LEMON EUCALYPTUS

REPEL ® LEMON EUCALYPTUS



Keep Backyards Mosquito-Free Naturally

No one wants uninvited guests in their yard - especially mosquitoes. Your yard should be your sanctuary, where your children play and your pets romp. But, how can you keep your yard chemical free and non-toxic while eliminating mosquitoes?

One alternative is Garlic Barrier® and Mosquito Barrier® produced by Garlic Research Labs in California. These products have been proven effective in several tests including one by the Division of Malaria Control in Kenya, which showed that Mosquito Barrier is effective against both Anopheles and Culex adult mosquitoes.

The staff of the Sustainability Institute have, for several years, recommended the use of garlic juice as a way to rid yards of mosquitoes so that people can enjoy backyard barbecues and other activities. This recommendation was based on efficacy study results and positive feedback from many Long Islanders who found garlic juice very effective.

Two products we recommend are Garlic Barrier® and Mosquito Barrier® (see below), which can be difficult to find at local stores, however it is worth the effort to find them. They are easy to apply, non-toxic and effective.

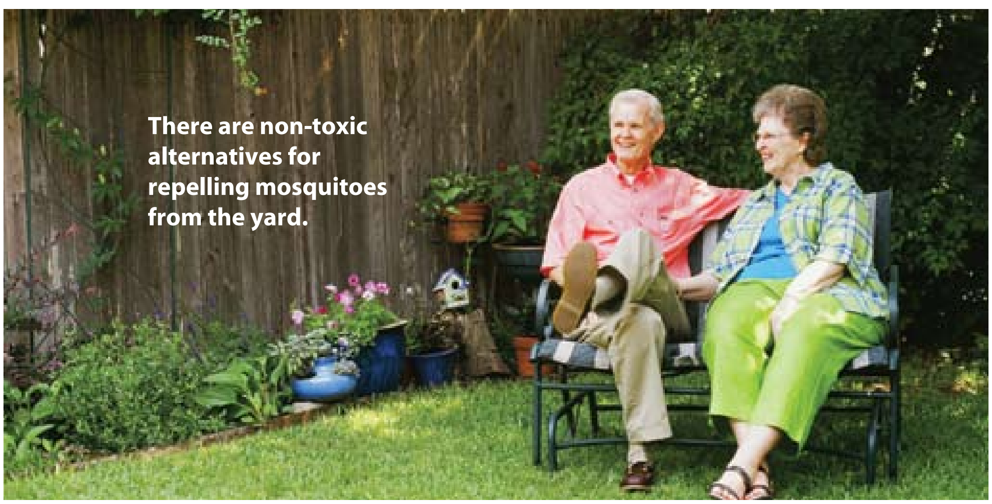
The application process requires a basic pump sprayer (two common brands are Hudson and Solo) or hose-end sprayer. The product should be sprayed onto both sides of the leaves on all types of trees and bushes in the area being treated. Particular attention should be given to greenery around the perimeter of the property.

HUDSON AND SOLO PUMP TYPE SPRAYERS

The treatment should last for about two weeks, but remember that the more often it rains the more frequently you will need to re-apply the treatment.

If you have an event planned, applying the product a few days before should provide the best results.

It is very common for people to ask if the yard will smell like garlic. Generally, humans only notice the smell for a few hours after application. Mosquitoes, however, have a very powerful sense of smell and find it overpowering, which causes them head in another direction.



There are non-toxic alternatives for repelling mosquitoes from the yard.

Garlic Barrier® and/or Mosquito Barrier® are available at:

- **Greener Country in Jericho, NY (516-470-1881)**
- **Marders Nursery in Bridgehampton, NY (631-537-3700)**
- **Professional Tree Surgeon Supply in Lindenhurst, NY (631-957-0301)**
- **Sag Harbor Garden Center in Sag Harbor (631-725-3345)**
- **Olsen's Nursery in Nesconset (631-265-8093)**
- **Online through www.gemplers.com (800-382-8473), or www.extremelygreen.com (781-953-4604)**

Other garlic products for yards are available:

- **Mosquito Beater Natural Granules, by Bonide (They also offer a liquid form that does not contain garlic)**
- **Mosquito Shield, by Gro-Well**
- **Dr. T's Mosquito & Gnat Scat Granules, by Woodstream**

Stores that carry Cutter® or Repel® Lemon Eucalyptus Products:

TARGET
Farmingdale
Copiague
Levittown
Bay Shore
Valley Stream
Riverhead
Commack South
South Setauket
Medford
(Out of 13 Target stores surveyed 9 had the products)

ACE HARDWARE
Bellmore
Rockville Centre
Port Washington
Nesconset
(Out of 18 Ace Hardware stores surveyed 4 had the products)

WALMART
Valley Stream
Centereach
(Out of 11 Walmart stores surveyed 2 had the products)

The Sustainability Institute at Molloy College
Partnering for a Viable Long Island.

The Sustainability Institute was created to catalyze Long Island to become a national leader in developing, promoting, and implementing sustainable solutions to environmental and quality-of-life challenges.

For further information please call 516.678.5000 ext. 7562

Other Safe Ways to Control Mosquitoes

For Large Yards or Parks

The Mosquito Magnet®

The Mosquito Magnet® is a patented device that works by releasing a continuous stream of carbon dioxide (CO_2) to draw mosquitoes to the trap. With patented "Counterflow™" technology, mosquitoes are vacuumed into a net where they dehydrate and die. The device can also be used with scientifically proven attractant scents such as octenol for added efficacy.

See www.mosquitomagnet.com/advice/how-it-works/how-it-works-independent-testing.

The Rush Hampton Mosquito Catcher®

We have gotten very positive feedback about the Rush Hampton Mosquito Catcher from some trusted sources. The catcher is an electric device that does not use propane. Therefore, it does not release any additional CO_2 into the atmosphere.

This product can be bought online and at Essco stores.

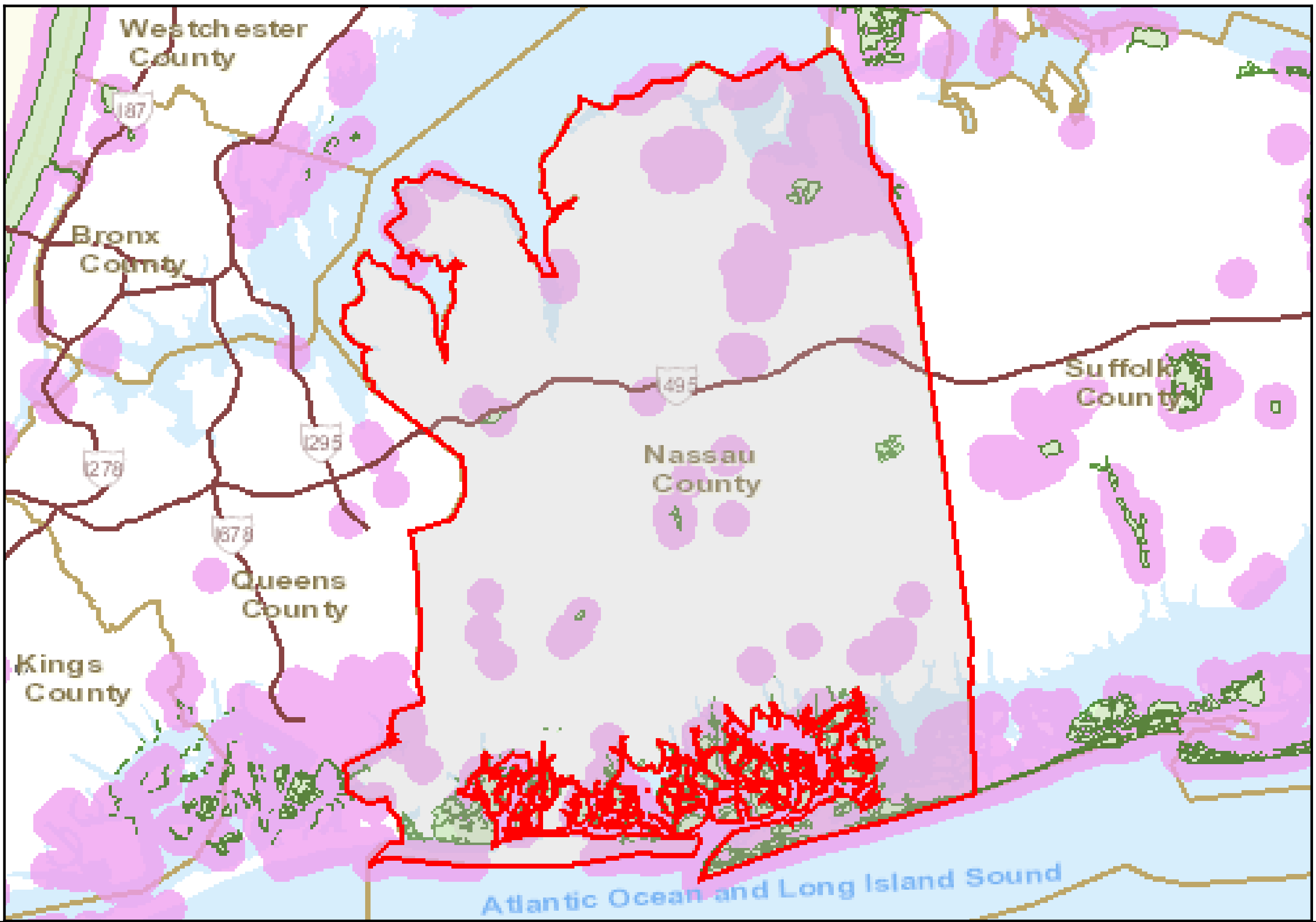
Some organic landscapers provide professional applications of garlic juice or other natural repellents. Please check with your landscaper, or visit our website for a list at si.molloy.edu

APPENDIX C

NYSDEC NATURAL HERITAGE PROGRAM PLANT SPECIES OF CONCERN IN NASSAU COUNTY

New York Nature Explorer
County Results Report

Criteria: County: Nassau



Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global

County: Nassau

Animal: Mammals

Northern Long-eared Bat *Myotis septentrionalis*	Bats	Historically Confirmed		Threatened	Threatened	S1	G1G2
Silver-haired Bat *Lasionycteris noctivagans*	Bats	Historically Confirmed				S2S3B	G3G4
Tri-colored Bat *Perimyotis subflavus*	Bats	Historically Confirmed				S1	G2G3

Animal: Birds

New York Nature Explorer

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Acadian Flycatcher *Empidonax virescens*	Flycatchers	Recently Confirmed	2000-2005	Protected Bird		S3B	G5
American Black Duck *Anas rubripes*	Ducks, Geese, Waterfowl	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S3B,SNRN	G5
American Crow *Corvus brachyrhynchos*	Crows and Jays	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S5	G5
American Goldfinch *Spinus tristis*	Finches and Crossbills	Recently Confirmed	2000-2005	Protected Bird		S5	G5
American Kestrel *Falco sparverius*	Hawks, Falcons, Eagles, Vultures	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
American Oystercatcher *Haematopus palliatus*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2000-2005	Protected Bird		S3	G5
American Redstart *Setophaga ruticilla*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
American Robin *Turdus migratorius*	Thrushes and Bluebirds	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
American Woodcock *Scolopax minor*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S5B	G5
Baltimore Oriole *Icterus galbula*	Blackbirds and Orioles	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Bank Swallow *Riparia riparia*	Swallows	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Barn Owl *Tyto alba*	Owls	Recently Confirmed	2000	Protected Bird		S1S2	G5
Barn Swallow *Hirundo rustica*	Swallows	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Belted Kingfisher *Megaceryle alcyon*	Kingfishers	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Black Rail *Laterallus jamaicensis*	Rails, Coots and Cranes	Possible but not Confirmed		Endangered		S1B	G3G4
Black Skimmer *Rynchops niger*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2012	Special Concern		S2	G5

New York Nature Explorer

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Black-and-white Warbler *Mniotilta varia*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Black-billed Cuckoo *Coccyzus erythropthalmus*	Cuckoos	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Black-capped Chickadee *Poecile atricapillus*	Chickadees and Titmice	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Black-crowned Night-Heron *Nycticorax nycticorax*	Pelicans and Cormorants	Recently Confirmed	2000-2005	Protected Bird		S3	G5
Blue Jay *Cyanocitta cristata*	Crows and Jays	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Blue-winged Warbler *Vermivora cyanoptera*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Boat-tailed Grackle *Quiscalus major*	Blackbirds and Orioles	Recently Confirmed	2000-2005	Protected Bird		S3B	G5
Brewster's Warbler *Vermivora cyanoptera x chrysoptera*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		SNA	GNA
Brown Creeper *Certhia americana*	Creepers	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Brown Thrasher *Toxostoma rufum*	Mockingbirds and Thrashers	Recently Confirmed	2000-2005	Protected Bird		S3S4B	G5
Brown-headed Cowbird *Molothrus ater*	Blackbirds and Orioles	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Canada Goose *Branta canadensis*	Ducks, Geese, Waterfowl	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S5	G5
Carolina Wren *Thryothorus ludovicianus*	Wrens	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Cattle Egret *Bubulcus ibis*	Pelicans and Cormorants	Recently Confirmed	2000-2005	Protected Bird		S2	G5
Cedar Waxwing *Bombycilla cedrorum*	Waxwings	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Chestnut-sided Warbler *Setophaga pensylvanica*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5

New York Nature Explorer

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Chimney Swift *Chaetura pelagica*	Hummingbirds and Swifts	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Chipping Sparrow *Spizella passerina*	Sparrows and Towhees	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Chuck-will's-widow *Antrostomus carolinensis*	Nightbirds	Historically Confirmed		Protected Bird		S1B	G5
Clapper Rail *Rallus longirostris*	Rails, Coots and Cranes	Recently Confirmed	2000-2005	Protected Bird		S2S3	G5
Common Grackle *Quiscalus quiscula*	Blackbirds and Orioles	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Common Loon *Gavia immer*	Loons	Recently Confirmed		Special Concern		S4	G5
Common Nighthawk *Chordeiles minor*	Nightbirds	Recently Confirmed	2000-2005	Special Concern		S2S3B	G5
Common Tern *Sterna hirundo*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2012	Threatened		S3B	G5
Common Yellowthroat *Geothlypis trichas*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Downy Woodpecker *Picoides pubescens*	Woodpeckers	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Eastern Bluebird *Sialia sialis*	Thrushes and Bluebirds	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Eastern Kingbird *Tyrannus tyrannus*	Flycatchers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Eastern Meadowlark *Sturnella magna*	Blackbirds and Orioles	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Eastern Phoebe *Sayornis phoebe*	Flycatchers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Eastern Screech-Owl *Megascops asio*	Owls	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Eastern Towhee *Pipilo erythrophthalmus*	Sparrows and Towhees	Recently Confirmed	2000-2005	Protected Bird		S5B	G5

New York Nature Explorer

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Eastern Wood-Pewee *Contopus virens*	Flycatchers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
European Starling *Sturnus vulgaris*	Starlings	Recently Confirmed	2000-2005			SNA	G5
Field Sparrow *Spizella pusilla*	Sparrows and Towhees	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Fish Crow *Corvus ossifragus*	Crows and Jays	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S4	G5
Forster's Tern *Sterna forsteri*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2012	Protected Bird		S1	G5
Gadwall *Anas strepera*	Ducks, Geese, Waterfowl	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S3	G5
Glossy Ibis *Plegadis falcinellus*	Pelicans and Cormorants	Recently Confirmed	2007	Protected Bird		S2	G5
Golden-crowned Kinglet *Regulus satrapa*	Kinglets	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Gray Catbird *Dumetella carolinensis*	Mockingbirds and Thrashers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Great Black-backed Gull *Larus marinus*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2000-2005	Protected Bird		S4	G5
Great Blue Heron *Ardea herodias*	Pelicans and Cormorants	Historically Confirmed		Protected Bird		S5	G5
Great Crested Flycatcher *Myiarchus crinitus*	Flycatchers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Great Horned Owl *Bubo virginianus*	Owls	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Green Heron *Butorides virescens*	Pelicans and Cormorants	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Gull-billed Tern *Gelochelidon nilotica*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2011	Protected Bird		S1	G5
Hairy Woodpecker *Picoides villosus*	Woodpeckers	Recently Confirmed	2000-2005	Protected Bird		S5	G5

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Harlequin Duck *Histrionicus histrionicus*	Ducks, Geese, Waterfowl	Historically Confirmed		Protected Bird		S1N	G4
Hermit Thrush *Catharus guttatus*	Thrushes and Bluebirds	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Herring Gull *Larus argentatus*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Horned Lark *Eremophila alpestris*	Larks	Recently Confirmed	2000-2005	Special Concern		S3S4B	G5
House Finch *Haemorhous mexicanus*	Finches and Crossbills	Recently Confirmed	2000-2005	Protected Bird		SNA	G5
House Sparrow *Passer domesticus*	Old World Sparrows	Recently Confirmed	2000-2005			SNA	G5
House Wren *Troglodytes aedon*	Wrens	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Indigo Bunting *Passerina cyanea*	Cardinals and Buntings	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Kentucky Warbler *Geothlypis formosa*	Wood-Warblers	Recently Confirmed	2000	Protected Bird		S2B	G5
Killdeer *Charadrius vociferus*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Laughing Gull *Leucophaeus atricilla*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2007	Protected Bird		S1	G5
Lawrence's Warbler *Vermivora chrysoptera x cyanoptera*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		SNA	GNA
Least Bittern *Ixobrychus exilis*	Pelicans and Cormorants	Recently Confirmed	2011	Threatened		S3B,S1N	G5
Least Tern *Sternula antillarum*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2012	Threatened		S3B	G4
Little Blue Heron *Egretta caerulea*	Pelicans and Cormorants	Recently Confirmed	2007	Protected Bird		S2	G5
Louisiana Waterthrush *Parkesia motacilla*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Mallard *Anas platyrhynchos*	Ducks, Geese, Waterfowl	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S5	G5
Mallard x Am. Black Duck Hybrid *Anas platyrhynchos x rubripes*	Ducks, Geese, Waterfowl	Recently Confirmed	2000-2005	Protected Bird - Game with open season		SNA	GNA
Marsh Wren *Cistothorus palustris*	Wrens	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Monk Parakeet *Myiopsitta monachus*	Parrots and Parakeets	Recently Confirmed	2000-2005			SNA	G5
Mourning Dove *Zenaida macroura*	Pigeons and Doves	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Mute Swan *Cygnus olor*	Ducks, Geese, Waterfowl	Recently Confirmed	2000-2005	Protected Bird		SNA	G5
Northern Bobwhite *Colinus virginianus*	Grouse, Pheasants, Turkeys	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S4	G4G5
Northern Cardinal *Cardinalis cardinalis*	Cardinals and Buntings	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Northern Flicker *Colaptes auratus*	Woodpeckers	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Northern Mockingbird *Mimus polyglottos*	Mockingbirds and Thrashers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Northern Parula *Setophaga americana*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S3S4B	G5
Northern Rough-winged Swallow *Stelgidopteryx serripennis*	Swallows	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Orchard Oriole *Icterus spurius*	Blackbirds and Orioles	Recently Confirmed	2000-2005	Protected Bird		S4B	G5
Ovenbird *Seiurus aurocapilla*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Peregrine Falcon *Falco peregrinus*	Hawks, Falcons, Eagles, Vultures	Recently Confirmed	2009	Endangered		S3B	G4
Pied-billed Grebe *Podilymbus podiceps*	Grebes	Recently Confirmed		Threatened		S3B,S1N	G5

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Pine Warbler *Setophaga pinus*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Piping Plover *Charadrius melodus*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2008	Endangered	Endangered/Threatened	S3B	G3
Prothonotary Warbler *Protonotaria citrea*	Wood-Warblers	Recently Confirmed		Protected Bird		S2B	G5
Purple Martin *Progne subis*	Swallows	Recently Confirmed	2000-2005	Protected Bird		S4B	G5
Red-bellied Woodpecker *Melanerpes carolinus*	Woodpeckers	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Red-breasted Nuthatch *Sitta canadensis*	Nuthatches	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Red-eyed Vireo *Vireo olivaceus*	Vireos	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Red-headed Woodpecker *Melanerpes erythrocephalus*	Woodpeckers	Recently Confirmed	2000-2005	Special Concern		S2?B	G5
Red-winged Blackbird *Agelaius phoeniceus*	Blackbirds and Orioles	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Ring-necked Pheasant *Phasianus colchicus*	Grouse, Pheasants, Turkeys	Recently Confirmed	2000-2005	Protected Bird - Game with open season		SNA	G5
Rock Pigeon *Columba livia*	Pigeons and Doves	Recently Confirmed	2000-2005			SNA	G5
Rose-breasted Grosbeak *Pheucticus ludovicianus*	Cardinals and Buntings	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Roseate Tern *Sterna dougallii*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	1989	Endangered	Endangered	S1B	G4
Ruby-throated Hummingbird *Archilochus colubris*	Hummingbirds and Swifts	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Rusty Blackbird *Euphagus carolinus*	Blackbirds and Orioles	Historically Confirmed		Protected Bird		S2B	G4
Saltmarsh Sharp-tailed Sparrow *Ammodramus caudacutus*	Sparrows and Towhees	Recently Confirmed	2000-2005	Protected Bird		S3B	G4

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Savannah Sparrow *Passerculus sandwichensis*	Sparrows and Towhees	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Scarlet Tanager *Piranga olivacea*	Cardinals and Buntings	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Seaside Sparrow *Ammodramus maritimus*	Sparrows and Towhees	Recently Confirmed	2000	Special Concern		S2S3B	G4
Short-eared Owl *Asio flammeus*	Owls	Recently Confirmed	2002	Endangered		S2	G5
Snowy Egret *Egretta thula*	Pelicans and Cormorants	Recently Confirmed	2007	Protected Bird		S2S3	G5
Song Sparrow *Melospiza melodia*	Sparrows and Towhees	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Spotted Sandpiper *Actitis macularius*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Swamp Sparrow *Melospiza georgiana*	Sparrows and Towhees	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Tree Swallow *Tachycineta bicolor*	Swallows	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Tricolored Heron *Egretta tricolor*	Pelicans and Cormorants	Recently Confirmed	2007	Protected Bird		S2	G5
Tufted Titmouse *Baeolophus bicolor*	Chickadees and Titmice	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Upland Sandpiper *Bartramia longicauda*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	1987	Threatened		S3B	G5
Veery *Catharus fuscescens*	Thrushes and Bluebirds	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Virginia Rail *Rallus limicola*	Rails, Coots and Cranes	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S5	G5
Warbling Vireo *Vireo gilvus*	Vireos	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
White-breasted Nuthatch *Sitta carolinensis*	Nuthatches	Recently Confirmed	2000-2005	Protected Bird		S5	G5

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
White-eyed Vireo *Vireo griseus*	Vireos	Recently Confirmed	2000-2005	Protected Bird		S4B	G5
Wild Turkey *Meleagris gallopavo*	Grouse, Pheasants, Turkeys	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S5	G5
Willet *Tringa semipalmata*	Gulls, Terns, Plovers, Shorebirds	Recently Confirmed	2000-2005	Protected Bird		S3B	G5
Willow Flycatcher *Empidonax traillii*	Flycatchers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Wood Duck *Aix sponsa*	Ducks, Geese, Waterfowl	Recently Confirmed	2000-2005	Protected Bird - Game with open season		S5	G5
Wood Thrush *Hylocichla mustelina*	Thrushes and Bluebirds	Recently Confirmed	2000-2005	Protected Bird		S5B	G4
Worm-eating Warbler *Helmitheros vermivorum*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S4B	G5
Yellow Warbler *Setophaga petechia*	Wood-Warblers	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Yellow-billed Cuckoo *Coccyzus americanus*	Cuckoos	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Yellow-breasted Chat *Icteria virens*	Wood-Warblers	Recently Confirmed	2000-2005	Special Concern		S2?B	G5
Yellow-crowned Night-Heron *Nyctanassa violacea*	Pelicans and Cormorants	Recently Confirmed	2009	Protected Bird		S2	G5
Yellow-throated Vireo *Vireo flavifrons*	Vireos	Recently Confirmed	2000-2005	Protected Bird		S5B	G5

Animal: Reptiles

Common Gartersnake *Thamnophis sirtalis*	Snakes	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Dekay's Brownsnake *Storeria dekayi*	Snakes	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Diamondback Terrapin *Malaclemys terrapin*	Turtles	Recently Confirmed	1990-1999	Game with open season		S3	G4

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Eastern Box Turtle *Terrapene carolina*	Turtles	Recently Confirmed	1990-1999	Special Concern		S3	G5
Eastern Hog-nosed Snake *Heterodon platirhinos*	Snakes	Recently Confirmed	1990-1999	Special Concern		S3	G5
Eastern Ribbonsnake *Thamnophis sauritus*	Snakes	Recently Confirmed	1990-1999	Game with no open season		S4	G5
Eastern Wormsnake *Carphophis amoenus*	Snakes	Recently Confirmed	2009	Special Concern		S2	G5
Italian Wall Lizard *Podarcis sicula*	Lizards	Recently Confirmed	1990-1999			SNA	G5
Milksnake *Lampropeltis triangulum*	Snakes	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Northern Watersnake *Nerodia sipedon*	Snakes	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Painted Turtle *Chrysemys picta*	Turtles	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Racer *Coluber constrictor*	Snakes	Recently Confirmed	1990-1999	Game with no open season		S4	G5
Ring-necked Snake *Diadophis punctatus*	Snakes	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Slider *Trachemys scripta*	Turtles	Recently Confirmed	1990-1999			SNA	G5
Snapping Turtle *Chelydra serpentina*	Turtles	Recently Confirmed	1990-1999	Game with open season		S5	G5
Spotted Turtle *Clemmys guttata*	Turtles	Recently Confirmed	1990-1999	Special Concern		S3	G5

Animal: Amphibians

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Atlantic Coast Leopard Frog *Lithobates kauffeldi*	Frogs and Toads	Extirpated				S1S2	GNR
Bullfrog *Lithobates catesbeianus*	Frogs and Toads	Recently Confirmed	1990-1999	Game with open season		S5	G5

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Eastern Spadefoot *Scaphiopus holbrookii*	Frogs and Toads	Recently Confirmed	1990-1999	Special Concern		S2S3	G5
Fowler's Toad *Anaxyrus fowleri*	Frogs and Toads	Recently Confirmed	1990-1999	Game with open season		S4	G5
Gray Treefrog *Hyla versicolor*	Frogs and Toads	Recently Confirmed	1990-1999	Game with open season		S5	G5
Green Frog *Lithobates clamitans*	Frogs and Toads	Recently Confirmed	1990-1999	Game with open season		S5	G5
Northern Two-lined Salamander *Eurycea bislineata*	Salamanders	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Pickerel Frog *Lithobates palustris*	Frogs and Toads	Recently Confirmed	1990-1999	Game with open season		S5	G5
Redback Salamander *Plethodon cinereus*	Salamanders	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Southern Leopard Frog *Lithobates sphenocephalus*	Frogs and Toads	Recently Confirmed	1990-1999	Special Concern		S1S2	G5
Spotted Salamander *Ambystoma maculatum*	Salamanders	Recently Confirmed	1990-1999	Game with no open season		S5	G5
Spring Peeper *Pseudacris crucifer*	Frogs and Toads	Recently Confirmed	1990-1999	Game with open season		S5	G5
Tiger Salamander *Ambystoma tigrinum*	Salamanders	Recently Confirmed	1994	Endangered		S1S2	G5
Wood Frog *Lithobates sylvaticus*	Frogs and Toads	Recently Confirmed	1990-1999	Game with open season		S5	G5

Animal: Fish

Atlantic Needlefish *Strongylura marina*	Needlefishes	Possible but not Confirmed				S2S3	G5
Atlantic Silverside *Menidia menidia*	Silversides	Possible but not Confirmed				S2S3	G5
Inland Silverside *Menidia beryllina*	Silversides	Possible but not Confirmed				S2S3	G5

Animal: Butterflies and Moths

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
A Hand-maid Moth *Datana ranaeceps*	Moths	Recently Confirmed	1991			S1S3	G3G4
Frosted Elfin *Callophrys irus*	Butterflies and Skippers	Recently Confirmed	2005	Threatened		S1S2	G3
Hessel's Hairstreak *Callophrys hesseli*	Butterflies and Skippers	Extirpated		Endangered		S1	G3G4
Red-banded Hairstreak *Calycopis cecrops*	Butterflies and Skippers	Recently Confirmed				SU	G5
Tawny Emperor *Asterocampa clyton*	Butterflies and Skippers	Recently Confirmed	1993			S2S4	G5

Animal: Dragonflies and Damselflies

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Comet Darner *Anax longipes*	Dragonflies	Possible but not Confirmed				S2S3	G5
Needham's Skimmer *Libellula needhami*	Dragonflies	Recently Confirmed	2008			S3	G5
Pine Barrens Bluet *Enallagma recurvatum*	Damselflies	Historically Confirmed	1954	Threatened		S1	G3
Rambur's Forktail *Ischnura ramburii*	Damselflies	Recently Confirmed	2009			S2S3	G5
Seaside Dragonlet *Erythrodiplax berenice*	Dragonflies	Recently Confirmed	2009			S2	G5

Animal: Bees, Wasps, and Ants

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Yellow Bumble Bee *Bombus (Thoracobombus) fervidus*	Bees	Recently Confirmed				S1	G4?

Animal: Beetles

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
American Burying Beetle *Nicrophorus americanus*	Carrion Beetles	Historically Confirmed	1956	Endangered	Endangered	SH	G2G3
Hairy-necked Tiger Beetle *Cicindela hirticollis*	Tiger Beetles	Recently Confirmed	2008			S1S2	G5

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Northeastern Beach Tiger Beetle *Cicindela dorsalis dorsalis*	Tiger Beetles	Extirpated	1939	Threatened	Threatened	SX	G3G4T2

Animal: Animal Assemblages

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Colonial Waterbird Nesting Area *Colonial Waterbird Nesting Area*	Animal Assemblages	Recently Confirmed	1998			S3	GNR
Gull Colony *Gull Colony*	Animal Assemblages	Recently Confirmed	2004			SNR	GNR

Animal: Other Animals

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Bald Eagle *Haliaeetus leucocephalus*	Other Animals	Historically Confirmed		Threatened		S2S3B,S2N	G5
Blue-gray Gnatcatcher *Polioptila caerulea*	Other Animals	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Broad-winged Hawk *Buteo platypterus*	Other Animals	Recently Confirmed	2000-2005	Protected Bird		S5B	G5
Cooper's Hawk *Accipiter cooperii*	Other Animals	Recently Confirmed	2000-2005	Special Concern		S4	G5
Double-crested Cormorant *Phalacrocorax auritus*	Other Animals	Recently Confirmed	2000-2005	Protected Bird		S3	G5
Northern Harrier *Circus cyaneus*	Other Animals	Recently Confirmed	2002	Threatened		S3B,S3N	G5
Osprey *Pandion haliaetus*	Other Animals	Recently Confirmed	2000-2005	Special Concern		S4B	G5
Red-tailed Hawk *Buteo jamaicensis*	Other Animals	Recently Confirmed	2000-2005	Protected Bird		S5	G5
Turkey Vulture *Cathartes aura*	Other Animals	Recently Confirmed	2000-2005	Protected Bird		S4B	G5

Plant: Flowering Plants

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Algae-like Pondweed *Potamogeton confervoides*	Other Flowering Plants	Historically Confirmed		Rare		S3	G4

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Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
American Bittersweet *Celastrus scandens*	Other Flowering Plants	Historically Confirmed		Rare		S3	G5
American Ipecac *Euphorbia ipecacuanhae*	Other Flowering Plants	Recently Confirmed		Endangered		S1	G5
American Strawberry-bush *Euonymus americanus*	Other Flowering Plants	Recently Confirmed	1992	Endangered		S1	G5
Barratt's Sedge *Carex barrattii*	Sedges	Recently Confirmed	1992	Endangered		S1	G4
Bayard's Adder's-mouth Orchid *Malaxis bayardii*	Orchids	Historically Confirmed		Endangered		S1	G1G2
Bead Pinweed *Lechea pulchella var. moniliformis*	Other Flowering Plants	Recently Confirmed	1987	Endangered		S1	G5T4
Bent Sedge *Carex styloflexa*	Sedges	Historically Confirmed	1930	Endangered		S1	G4G5
Bicknell's Sedge *Carex bicknellii*	Sedges	Historically Confirmed		Rare		S3	G5T5
Bird's-foot Violet *Viola pedata*	Other Flowering Plants	Historically Confirmed		Rare		S3	G5
Black-edge Sedge *Carex nigromarginata*	Sedges	Historically Confirmed		Threatened		S2	G5
Blackjack Oak *Quercus marilandica var. marilandica*	Other Flowering Plants	Recently Confirmed		Rare		S3	G5T4T5
Brown Bog Sedge *Carex buxbaumii*	Sedges	Historically Confirmed	1904	Threatened		S2	G5
Bushy Rockrose *Crocanthemum dumosum*	Other Flowering Plants	Recently Confirmed	2003	Threatened		S2	G3
Bushy St. John's-wort *Hypericum densiflorum*	Other Flowering Plants	Recently Confirmed	2000	Endangered		S1	G5
Butternut *Juglans cinerea*	Other Flowering Plants	Historically Confirmed				S4	G4
Button Sedge *Carex bullata*	Sedges	Recently Confirmed	1986	Endangered		S1	G5

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Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Button-bush Dodder *Cuscuta cephalanthi*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Carolina Sedge *Carex caroliniana*	Sedges	Possible but not Confirmed		Endangered		SH	G5
Coast Flatsedge *Cyperus polystachyos var. texensis*	Sedges	Historically Confirmed		Endangered		S1S2	G5T5
Coast Violet *Viola brittoniana*	Other Flowering Plants	Extirpated	1925	Endangered		S1	G4G5
Coastal Goldenrod *Solidago latissimifolia*	Asters, Goldenrods and Daisies	Historically Confirmed	1928	Endangered		S1	G5
Collins' Sedge *Carex collinsii*	Sedges	Historically Confirmed	1927	Endangered		S1	G4
Comb-leaved Mermaid-weed *Proserpinaca pectinata*	Other Flowering Plants	Extirpated		Threatened		S2	G5
Creeping St. John's-wort *Hypericum adpressum*	Other Flowering Plants	Extirpated	1928	Threatened		S2	G3
Crested Fringed Orchis *Platanthera cristata*	Orchids	Extirpated	1950	Endangered		S1	G5
Cross-leaf Milkwort *Polygala cruciata var. aquilonia*	Other Flowering Plants	Historically Confirmed		Rare		S3?	G5T4
Culver's-root *Veronicastrum virginicum*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G4
Curly-heads *Clematis ochroleuca*	Other Flowering Plants	Possible but not Confirmed				SX	G4
Cut-leaved Evening-primrose *Oenothera laciniata*	Other Flowering Plants	Historically Confirmed	1910	Endangered		S1	G5
Dark-green sedge *Carex venusta*	Sedges	Historically Confirmed		Endangered		S1	G4
Downy Lettuce *Lactuca hirsuta*	Asters, Goldenrods and Daisies	Historically Confirmed	1906	Endangered		S1	G5?
Dragon's Mouth Orchid *Arethusa bulbosa*	Orchids	Historically Confirmed		Threatened		S2	G5

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Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Dune Sandspur *Cenchrus tribuloides*	Grasses	Recently Confirmed	2011	Threatened		S2	G5
Dwarf Glasswort *Salicornia bigelovii*	Other Flowering Plants	Recently Confirmed	2011	Threatened		S2S3	G5
Dwarf Umbrella-sedge *Fuirena pumila*	Sedges	Recently Confirmed		Rare		S3	G4
Early Frostweed *Crocanthemum propinquum*	Other Flowering Plants	Recently Confirmed	2010	Threatened		S2S3	G4
Eastern Grasswort *Lilaeopsis chinensis*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G5
Emmons' Sedge *Carex albicans var. emmonsii*	Sedges	Historically Confirmed		Rare		S3	G5T5
Engelmann's Spikerush *Eleocharis engelmannii*	Sedges	Historically Confirmed		Endangered		S1	G4G5
Erect Knotweed *Polygonum erectum*	Other Flowering Plants	Historically Confirmed				S2S3	G5
False China-root *Smilax pseudochina*	Other Flowering Plants	Recently Confirmed	1992	Endangered		S1	G4G5
False Lettuce *Lactuca floridana*	Asters, Goldenrods and Daisies	Historically Confirmed	1924	Endangered		S1	G5
Fascicled False Foxglove *Agalinis fasciculata*	Other Flowering Plants	Recently Confirmed		Rare		S3	G5
Featherfoil *Hottonia inflata*	Other Flowering Plants	Historically Confirmed	1921	Threatened		S2	G4
Few-flowered Nutrush *Scleria pauciflora var. caroliniana*	Sedges	Recently Confirmed	1997	Endangered		S1	G5T4T5
Fibrous Bladderwort *Utricularia striata*	Other Flowering Plants	Possible but not Confirmed		Threatened		S2	G4G5
Five-angled Field-dodder *Cuscuta pentagona*	Other Flowering Plants	Recently Confirmed		Rare		S3	G4G5
Flax-leaf Whitetop *Sericocarpus linifolius*	Asters, Goldenrods and Daisies	Recently Confirmed	1997	Threatened		S2	G5

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Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Fly-poison *Amianthium muscaetoxicum*	Other Flowering Plants	Extirpated	1926			SX	G4G5
Fringed Boneset *Eupatorium torreyanum*	Asters, Goldenrods and Daisies	Recently Confirmed	2001	Threatened		S2	G5T4T5
Georgia Bulrush *Scirpus georgianus*	Sedges	Recently Confirmed	2006	Endangered		S1	G5
Glaucous Rattlesnake-root *Prenanthes racemosa var. racemosa*	Asters, Goldenrods and Daisies	Extirpated	1909			SX	G5T4
Globe-fruited Ludwigia *Ludwigia sphaerocarpa*	Other Flowering Plants	Recently Confirmed	2004	Threatened		S2	G5
Golden Club *Orontium aquaticum*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G5
Golden Corydalis *Corydalis aurea*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G5
Golden Dock *Rumex fueginus*	Other Flowering Plants	Recently Confirmed	1992	Endangered		S1	G5
Green Milkweed *Asclepias viridiflora*	Other Flowering Plants	Recently Confirmed	2010	Threatened		S2	G5
Green Parrot's-feather *Myriophyllum pinnatum*	Other Flowering Plants	Historically Confirmed	1903	Endangered		S1	G5
Gypsy-wort *Lycopus rubellus*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Hairy Fimbry *Fimbristylis puberula var. puberula*	Sedges	Extirpated	1924			SX	G5T5
Hairy Skullcap *Scutellaria elliptica var. elliptica*	Other Flowering Plants	Extirpated	1905			SX	G5T5
Heart Sorrel *Rumex hastatulus*	Other Flowering Plants	Historically Confirmed	1914	Endangered		SH	G5
Hiddenfruit Bladderwort *Utricularia geminiscapa*	Other Flowering Plants	Possible but not Confirmed		Rare		S3	G4G5
Hyssop-skullcap *Scutellaria integrifolia*	Other Flowering Plants	Historically Confirmed	1929	Endangered		S1	G5

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				State	Federal	State	Global
Illinois Pinweed *Lechea racemulosa*	Other Flowering Plants	Recently Confirmed		Rare		S3	G5
Knotted Spikerush *Eleocharis equisetoides*	Sedges	Extirpated		Threatened		S2	G4
Large Calyx Goosefoot *Chenopodium berlandieri var. macrocalycium*	Other Flowering Plants	Historically Confirmed		Endangered		S1S2	G5T4
Large Grass-leaved Rush *Juncus biflorus*	Rushes	Recently Confirmed		Endangered		S1	G5
Large Marsh-pink *Sabatia dodecandra var. dodecandra*	Other Flowering Plants	Extirpated	1905			SX	G5?T4T5
Large Twayblade *Liparis liliifolia*	Orchids	Possible but not Confirmed		Endangered		S1	G5
Large Yellow-eyed-grass *Xyris smalliana*	Other Flowering Plants	Extirpated		Threatened		S2	G5
Little-leaf Tick-trefoil *Desmodium ciliare*	Other Flowering Plants	Recently Confirmed	1997	Threatened		S2S3	G5
Long-tubercled Spikerush *Eleocharis tuberculosa*	Sedges	Historically Confirmed		Threatened		S2	G5
Low Nutrush *Scleria verticillata*	Sedges	Historically Confirmed		Endangered		S1	G5
Lowland Yellow Loosestrife *Lysimachia hybrida*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Marsh Straw Sedge *Carex hormathodes*	Sedges	Recently Confirmed	2001	Threatened		S2S3	G4G5
Mexican Seaside Goldenrod *Solidago sempervirens var. mexicana*	Asters, Goldenrods and Daisies	Historically Confirmed		Endangered		S1	G5T5?
Midland Sedge *Carex mesochorea*	Sedges	Recently Confirmed	1985	Threatened		S2	G4G5
Mitchell's Sedge *Carex mitchelliana*	Sedges	Recently Confirmed	1992	Endangered		S1S2	G4
Mock Bishop's-weed *Ptilimnium capillaceum*	Other Flowering Plants	Historically Confirmed		Rare		S3	G5

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				State	Federal	State	Global
Muhlenberg's Sedge *Carex muehlenbergii var. enervis*	Sedges	Historically Confirmed		Rare		S3	G5T5
Narrow-leaf Feverwort *Triosteum angustifolium*	Other Flowering Plants	Historically Confirmed	1929			SX	G5
Narrow-leaf Sea-blite *Suaeda linearis*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Narrow-leaved Bush-clover *Lespedeza angustifolia*	Other Flowering Plants	Recently Confirmed	1992	Threatened		S2	G5
Narrow-leaved Sedge *Carex amphibola*	Sedges	Historically Confirmed		Endangered		S1	G5
Northern Blazing-star *Liatris scariosa var. novae-angliae*	Asters, Goldenrods and Daisies	Historically Confirmed		Threatened		S2	G5?T3
Northern Bog Aster *Symphyotrichum boreale*	Asters, Goldenrods and Daisies	Historically Confirmed	1865	Threatened		S2	G5
Northern Dwarf Huckleberry *Gaylussacia bigeloviana*	Other Flowering Plants	Historically Confirmed		Endangered		S1S2	G5T4T5
Northern Gama Grass *Tripsacum dactyloides*	Grasses	Recently Confirmed		Threatened		S2	G5
Nuttall's Lobelia *Lobelia nuttallii*	Other Flowering Plants	Extirpated		Rare		S3	G4G5
Nuttall's Milkwort *Polygala nuttallii*	Other Flowering Plants	Recently Confirmed		Threatened		S2	G5
Oakes' Evening-primrose *Oenothera oakesiana*	Other Flowering Plants	Recently Confirmed	2011	Threatened		S2	G4G5Q
Orange Fringed Orchid *Platanthera ciliaris*	Orchids	Historically Confirmed	1934	Endangered		S1	G5
Orange Milkwort *Polygala lutea*	Other Flowering Plants	Possible but not Confirmed	1916	Endangered		S1	G5
Ovate Spikerush *Eleocharis ovata*	Sedges	Recently Confirmed		Endangered		S1S2	G5
Pale Duckweed *Lemna valdiviana*	Other Flowering Plants	Recently Confirmed	2004	Endangered		S1	G5

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Pencil-flower *Stylosanthes biflora*	Other Flowering Plants	Extirpated	1886			SX	G5
Persimmon *Diospyros virginiana*	Other Flowering Plants	Recently Confirmed	2005	Threatened		S2	G5
Pickering's Reedgrass *Calamagrostis pickeringii*	Grasses	Recently Confirmed		Rare		S3	G5
Pinebarren Death Camas *Stenanthium leimanthoides*	Other Flowering Plants	Historically Confirmed	1950			SX	G4Q
Pink Milkwort *Polygala incarnata*	Other Flowering Plants	Extirpated	1936			SX	G5
Pink Wild Bean *Strophostyles umbellata*	Other Flowering Plants	Historically Confirmed	1904	Endangered		S1	G5
Possum-haw *Viburnum nudum var. nudum*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5T5
Prairie Wedgegrass *Sphenopholis obtusata*	Grasses	Historically Confirmed	1926	Endangered		S1	G5
Primrose-leaf Violet *Viola primulifolia*	Other Flowering Plants	Recently Confirmed		Threatened		S2	G5
Purple Milkweed *Asclepias purpurascens*	Other Flowering Plants	Recently Confirmed		Threatened		S2S3	G5?
Rattlebox *Crotalaria sagittalis*	Other Flowering Plants	Recently Confirmed	1991	Endangered		S1	G5
Red Milkweed *Asclepias rubra*	Other Flowering Plants	Possible but not Confirmed	1911			SX	G4G5
Red Pigweed *Chenopodium rubrum*	Other Flowering Plants	Recently Confirmed	1992	Threatened		S2	G5
Red-rooted Flatsedge *Cyperus erythrorhizos*	Sedges	Recently Confirmed		Rare		S3	G5
Reflexed Sedge *Carex retroflexa*	Sedges	Historically Confirmed		Threatened		S2S3	G5
Reticulate Nutrush *Scleria muehlenbergii*	Sedges	Historically Confirmed		Endangered		S1	G5

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Reticulated Nutrush *Scleria reticularis*	Sedges	Extirpated		Rare		S3	G4
Retrorse Flatsedge *Cyperus retrorsus var. retrorsus*	Sedges	Recently Confirmed	2003	Endangered		S1	G5T5
Roland's Sea-blite *Suaeda rolandii*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G1G2
Rose Coreopsis *Coreopsis rosea*	Asters, Goldenrods and Daisies	Extirpated		Rare		S3	G3
Rough Avens *Geum virginianum*	Other Flowering Plants	Extirpated		Threatened		S2	G5
Rough Hedge-nettle *Stachys hyssopifolia*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G4G5
Rough Panic Grass *Dichanthelium scabriusculum*	Grasses	Historically Confirmed		Endangered		SH	G4
Rough Rush-grass *Sporobolus clandestinus*	Grasses	Historically Confirmed	1925	Endangered		S1	G5
Round-leaf Boneset *Eupatorium rotundifolium*	Asters, Goldenrods and Daisies	Historically Confirmed		Endangered		SH	G5
Rush Bladderwort *Utricularia juncea*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Rusty Flatsedge *Cyperus odoratus*	Sedges	Recently Confirmed		Rare		S3	G5
Salt-marsh Spikerush *Eleocharis uniglumis var. halophila*	Sedges	Historically Confirmed		Threatened		S2	G4Q
Salt-meadow Grass *Leptochloa fusca ssp. fascicularis*	Grasses	Recently Confirmed	1995	Endangered		S1	G5T5
Saltmarsh Aster *Symphyotrichum subulatum var. subulatum*	Asters, Goldenrods and Daisies	Recently Confirmed	2004	Threatened		S2	G5T5
Sandplain Gerardia *Agalinis acuta*	Other Flowering Plants	Recently Confirmed	2007	Endangered	Endangered	S1	G1
Sandplain Wild Flax *Linum intercursum*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G4

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				State	Federal	State	Global
Scarlet Indian-paintbrush *Castilleja coccinea*	Other Flowering Plants	Possible but not Confirmed		Endangered		S1	G5
Scirpus-like Rush *Juncus scirpoides*	Rushes	Historically Confirmed		Endangered		S1	G5
Screw-stem *Bartonia paniculata ssp. paniculata*	Other Flowering Plants	Extirpated		Endangered		S1	G5T5
Sea-pink *Sabatia stellaris*	Other Flowering Plants	Recently Confirmed	2003	Threatened		S2	G5
Seabeach Amaranth *Amaranthus pumilus*	Other Flowering Plants	Recently Confirmed	2004	Threatened	Threatened	S2	G2
Seabeach Knotweed *Polygonum glaucum*	Other Flowering Plants	Recently Confirmed	2011	Rare		S3	G3
Seaside Bulrush *Bolboschoenus maritimus ssp. paludosus*	Sedges	Recently Confirmed	2011	Threatened		S2	G5
Seaside Gerardia *Agalinis maritima var. maritima*	Other Flowering Plants	Historically Confirmed		Threatened		S2S3	G5T5
Seaside Mallow *Kosteletzkya virginica*	Other Flowering Plants	Extirpated	1867			SX	G5
Seaside Plantain *Plantago maritima var. juncoides*	Other Flowering Plants	Historically Confirmed		Threatened		S2S3	G5T5
Sessile Dodder *Cuscuta compacta*	Other Flowering Plants	Recently Confirmed		Rare		S3	G5
Short-fruit Rush *Juncus brachycarpus*	Rushes	Historically Confirmed		Endangered		S1	G4G5
Silvery Aster *Symphyotrichum concolor var. concolor*	Asters, Goldenrods and Daisies	Historically Confirmed	1928	Endangered		S1	G5T5
Slender Blue Flag *Iris prismatica*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G4G5
Slender Bunchflower *Melanthium latifolium*	Other Flowering Plants	Extirpated				SX	G5
Slender Crabgrass *Digitaria filiformis*	Grasses	Historically Confirmed	1925	Endangered		S1	G5

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Slender Knotweed *Polygonum tenue*	Other Flowering Plants	Historically Confirmed		Rare		S3	G5
Slender Marsh-pink *Sabatia campanulata*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Slender Nutrush *Scleria minor*	Sedges	Historically Confirmed		Endangered		S1	G4
Slender Pinweed *Lechea tenuifolia*	Other Flowering Plants	Recently Confirmed	1992	Threatened		S2	G5
Slender Saltmarsh Aster *Symphyotrichum tenuifolium var. tenuifolium*	Asters, Goldenrods and Daisies	Historically Confirmed		Rare		S3	G5
Slender Spikegrass *Chasmanthium laxum*	Grasses	Extirpated	1936	Endangered		S1	G5
Small Floating Bladderwort *Utricularia radiata*	Other Flowering Plants	Recently Confirmed	2004	Threatened		S2	G4
Small White Snakeroot *Ageratina aromatica var. aromatica*	Asters, Goldenrods and Daisies	Recently Confirmed	1991	Endangered		S1	G5T5
Small Whorled Pogonia *Isotria medeoloides*	Orchids	Historically Confirmed	1918	Endangered	Threatened	S1	G2?
Small-flowered Pearlwort *Sagina decumbens ssp. decumbens*	Other Flowering Plants	Possible but not Confirmed		Endangered		S1	G5T5
Smartweed Dodder *Cuscuta polygonorum*	Other Flowering Plants	Recently Confirmed	1990	Endangered		S1	G5
Smooth Bur-marigold *Bidens laevis*	Asters, Goldenrods and Daisies	Historically Confirmed		Threatened		S2	G5
Smooth Tick-trefoil *Desmodium laevigatum*	Other Flowering Plants	Possible but not Confirmed	1906	Endangered		SH	G5
Soapwort Gentian *Gentiana saponaria*	Other Flowering Plants	Historically Confirmed	1928	Endangered		S1	G5
Southern Bluets *Houstonia purpurea var. calycosa*	Other Flowering Plants	Historically Confirmed	1897	Endangered		SH	G5T5
Southern Yellow Flax *Linum medium var. texanum*	Other Flowering Plants	Historically Confirmed	1936	Threatened		S2	G5T5

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Spearwort *Ranunculus pusillus*	Other Flowering Plants	Extirpated	1905			SX	G5
Spotted Pondweed *Potamogeton pulcher*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G5
Spring Ladies'-tresses *Spiranthes vernalis*	Orchids	Historically Confirmed		Endangered		S1	G5
St. Andrew's Cross *Hypericum hypericoides ssp. multicaule*	Other Flowering Plants	Recently Confirmed	1990	Endangered		S1	G5T4
Stargrass *Aletris farinosa*	Other Flowering Plants	Recently Confirmed	2010	Threatened		S2	G5
Stiff Cowbane *Oxypolis rigidior*	Other Flowering Plants	Historically Confirmed	1961	Endangered		SH	G5
Stiff Tick-trefoil *Desmodium obtusum*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G4G5
Stiff Yellow Flax *Linum striatum*	Other Flowering Plants	Recently Confirmed		Rare		S3	G5
Stiff-leaf Goldenrod *Oligoneuron rigidum var. rigidum*	Asters, Goldenrods and Daisies	Historically Confirmed	1899	Threatened		S2	G5T5
Straw Sedge *Carex straminea*	Sedges	Historically Confirmed		Endangered		S1	G5
Swamp Aster *Eurybia radula*	Asters, Goldenrods and Daisies	Historically Confirmed	1886	Endangered		SH	G5
Swamp Cottonwood *Populus heterophylla*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G5
Swamp Lousewort *Pedicularis lanceolata*	Other Flowering Plants	Historically Confirmed	1903	Threatened		S2	G5
Swamp Smartweed *Persicaria setacea*	Other Flowering Plants	Historically Confirmed	1938	Endangered		S1S2	G5
Swamp Sunflower *Helianthus angustifolius*	Asters, Goldenrods and Daisies	Historically Confirmed	1951	Threatened		S2	G5
Sweetbay Magnolia *Magnolia virginiana*	Other Flowering Plants	Recently Confirmed	1998	Endangered		S1	G5

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Terrestrial Starwort *Callitriche terrestris*	Other Flowering Plants	Possible but not Confirmed		Threatened		S2S3	G5
Thicket Sedge *Carex abscondita*	Sedges	Historically Confirmed		Endangered		S1	G4G5
Thickleaf Orach *Atriplex dioica*	Other Flowering Plants	Possible but not Confirmed		Endangered		S1	G5
Tiny Blue-curls *Trichostema setaceum*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Tooth-cup *Rotala ramosior*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G5
Trailing Bush-clover *Lespedeza repens*	Other Flowering Plants	Recently Confirmed		Rare		S3	G5
Trinerved White Boneset *Eupatorium album var. subvenosum*	Asters, Goldenrods and Daisies	Historically Confirmed		Threatened		S2S3	G5T4
Troublesome Sedge *Carex molesta*	Sedges	Historically Confirmed		Threatened		S2S3	G4
Twisted Spikerush *Eleocharis tortilis*	Sedges	Extirpated	1903			SX	G5
Variable Sedge *Carex polymorpha*	Sedges	Historically Confirmed	1927			SX	G3
Velvety Bush-clover *Lespedeza stuevei*	Other Flowering Plants	Historically Confirmed	1918	Threatened		S2	G4?
Violet Bush-clover *Lespedeza frutescens*	Other Flowering Plants	Possible but not Confirmed		Rare		S3	G5
Violet Wood-sorrel *Oxalis violacea*	Other Flowering Plants	Historically Confirmed		Threatened		S2S3	G5
Virginia Bunchflower *Melanthium virginicum*	Other Flowering Plants	Historically Confirmed	1871	Endangered		SH	G5
Virginia False Gromwell *Onosmodium virginianum*	Other Flowering Plants	Extirpated		Endangered		S1	G4
Virginia Ground-cherry *Physalis virginiana var. virginiana*	Other Flowering Plants	Historically Confirmed	1894	Endangered		SH	G5T5

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Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Virginia Snakeroot *Endodeca serpentaria*	Other Flowering Plants	Historically Confirmed	1915	Threatened		S2	G4
Virginia Three-seeded Mercury *Acalypha virginica*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Walter's Sedge *Carex striata var. brevis*	Sedges	Historically Confirmed		Rare		S3	G4G5T4?
Water-horehound *Lycopus amplectens*	Other Flowering Plants	Historically Confirmed		Threatened		S2	G5
Water-thread Pondweed *Potamogeton diversifolius*	Other Flowering Plants	Historically Confirmed		Endangered		S1	G5
Weak Rush *Juncus debilis*	Rushes	Recently Confirmed	2004	Endangered		S1	G5
Weak Stellate Sedge *Carex seorsa*	Sedges	Historically Confirmed				S4	G5
Whip Nutrush *Scleria triglomerata*	Sedges	Recently Confirmed	1992	Endangered		S1	G5
White Milkweed *Asclepias variegata*	Other Flowering Plants	Historically Confirmed	1928	Endangered		S1	G5
White-edge Sedge *Carex debilis var. debilis*	Sedges	Recently Confirmed	1987	Threatened		S2	G5T5
Whorled Milkweed *Asclepias verticillata*	Other Flowering Plants	Historically Confirmed		Rare		S3	G5
Wild Comfrey *Cynoglossum virginianum var. virginianum*	Other Flowering Plants	Historically Confirmed		Endangered		SH	G5T5
Wild Lupine *Lupinus perennis*	Other Flowering Plants	Historically Confirmed		Rare		S3	G5
Wild Pink *Silene caroliniana ssp. pensylvanica*	Other Flowering Plants	Recently Confirmed	2008	Threatened		S2	G5T4T5
Woodland Agrimony *Agrimonia rostellata*	Other Flowering Plants	Historically Confirmed	1928	Threatened		S2	G5
Woodland Rush *Juncus subcaudatus*	Rushes	Recently Confirmed	1986	Endangered		S1	G5

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Yellow Flatsedge *Cyperus flavescens*	Sedges	Recently Confirmed	2002	Endangered		S1	G5
Yellow Giant-hyssop *Agastache nepetoides*	Other Flowering Plants	Historically Confirmed	1928	Threatened		S2S3	G5
Yellow Harlequin *Corydalis flavula*	Other Flowering Plants	Historically Confirmed		Rare		S3	G5

Plant: Conifers

Atlantic White Cedar *Chamaecyparis thyoides*	Conifers	Recently Confirmed	1992	Threatened		S2	G4
Virginia Pine *Pinus virginiana*	Conifers	Historically Confirmed		Endangered		S1	G5

Plant: Ferns and Fern Allies

Blunt-lobe Grape Fern *Botrychium oneidense*	Ferns	Historically Confirmed		Threatened		S2S3	G4
Carolina Clubmoss *Pseudolycopodiella caroliniana*	Clubmosses	Recently Confirmed	1992	Endangered		S1	G5T4
Woolly Lip-fern *Cheilanthes lanosa*	Ferns	Possible but not Confirmed		Endangered		SH	G5

Natural Community: Uplands

Coastal Oak-Heath Forest *Coastal oak-heath forest*	Forested Uplands	Recently Confirmed	2010			S3	G4
Coastal Oak-Laurel Forest *Coastal oak-laurel forest*	Forested Uplands	Recently Confirmed	2008			S3	G3G4
Hempstead Plains Grassland *Hempstead Plains grassland*	Open Uplands	Recently Confirmed	1999			S1	G1Q
Maritime Beach *Maritime beach*	Open Uplands	Recently Confirmed	2011			S3S4	G5
Maritime Dunes *Maritime dunes*	Open Uplands	Recently Confirmed	2011			S3	G4

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status		Conservation Rank	
				State	Federal	State	Global
Maritime Shrubland *Maritime shrubland*	Open Uplands	Recently Confirmed	2007			S4	G4
Oak-Tulip Tree Forest *Oak-tulip tree forest*	Forested Uplands	Recently Confirmed	1987			S2S3	G4
Pitch Pine-Oak Forest *Pitch pine-oak forest*	Forested Uplands	Recently Confirmed	2010			S4	G4G5

Natural Community: Freshwater Nontidal Wetlands

Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Coastal Plain Pond Shore *Coastal plain pond shore*	Open Mineral Soil Wetlands	Recently Confirmed	2001			S2	G3G4
Vernal Pool *Vernal pool*	Forested Mineral Soil Wetlands	Recently Confirmed	2008			S3S4	G4

Natural Community: Tidal Wetlands

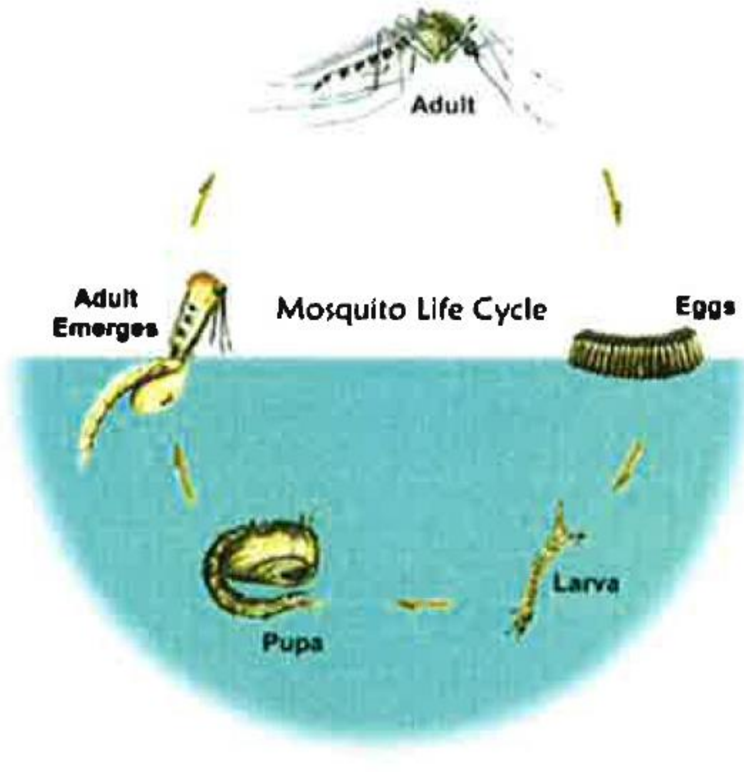
Common Name	Subgroup	Distribution Status	Year Last Documente	Protection Status State	Protection Status Federal	Conservation Rank State	Conservation Rank Global
Brackish Interdunal Swales *Brackish interdunal swales*	Intertidal Wetlands	Recently Confirmed	2011			S1S2	G3G4
High Salt Marsh *High salt marsh*	Intertidal Wetlands	Recently Confirmed	2001			S3S4	G4
Low Salt Marsh *Low salt marsh*	Intertidal Wetlands	Recently Confirmed	2011			S3S4	G4
Salt Panne *Salt panne*	Intertidal Wetlands	Recently Confirmed	2001			S3	G3G4

This list only includes records from the databases of the NY Natural Heritage Program, the second NYS Breeding Bird Atlas Project, and the NY Amphibian and Reptile Atlas Project. This list is not a definitive statement about the presence or absence of all plants and animals, including rare or state-listed species, or of all significant natural communities.

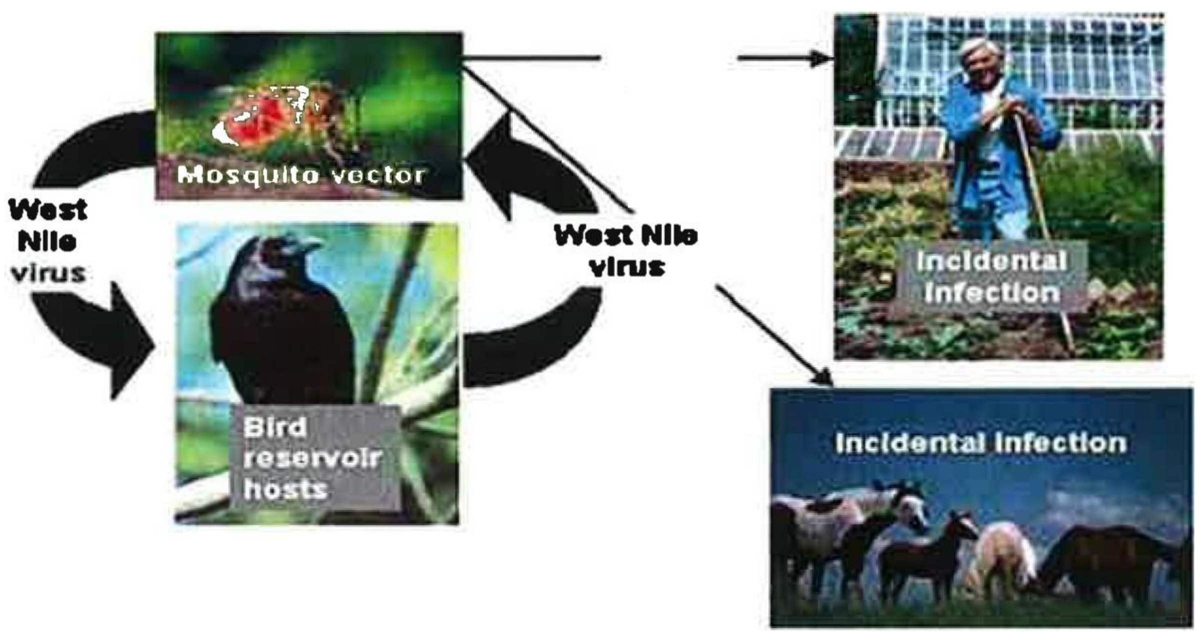
APPENDIX D

MOSQUITO SURVEILLANCE PHOTOS, MAPS

Mosquito Life Cycle



West Nile Virus Transmission Cycle



Children's toys can hold water and breed mosquitoes.

Ornamental/fish ponds may breed mosquitoes.

“Dipper” containing mosquito larvae (approximately ¼ inch long).

Mosquito Rearing Chamber;
used to allow larvae to mature into adult mosquitoes which can then be identified.

CDC Light Trap with dry ice attractant

CDC Light Trap

The gravid trap imitates the stagnant water scenario the mosquito instinctively seeks to lay eggs.

BG-Sentinel Trap

This storm water recharge basin (SWB), also known as a sump, holds water all year long. These basins sometimes become a dumping ground for old tires and debris, which can collect water and serve as ancillary breeding sites for mosquitoes.
DPW makes a special effort to remove these items on a regular basis.

WNV Program worker cutting back brush used as refuge by adult mosquitoes.

This floodwater ditch, filled with sand and debris, is in need of maintenance to prevent mosquito breeding.

This ditch is well maintained, allowing tidal flows to move in and out, enabling killifish to swim in and eat the mosquito larvae.

Swimming pool cover holding stagnant water and leaves.

DPW Vehicle equipped for spraying activities.

APPENDIX E

ZIKA ACTION PLAN

NASSAU COUNTY DEPARTMENT OF HEALTH

ZIKA ACTION PLAN

APRIL 2016

In compliance with 10 NYCRR 40-2.24 and the Declaration of an Imminent Threat to Public Health for Zika Virus Disease by Howard A. Zucker, M.D., J.D., Commissioner of the New York State Department of Health, the Nassau County Department of Health will implement the following Zika Action Plan.

A. Planning Requirements for Human Disease Monitoring and Reporting of Zika virus:
Nassau County Department of Health has adopted and will implement a Zika Action Plan (ZAP) that will perform monitoring of human cases as well as educate the public and healthcare providers regarding Zika virus in various ways to reduce the risk of exposure.

A. 1. (a), (b), (c). Disease Monitoring, Organization of Data, Electronic Data:
Initial Screening: When a health care provider requests Zika testing, Zika surveillance staff or designee must obtain the information on the "'Telephone Contact" form (attachment A). Enter initial information in the NYSDOH data base (CDMS) and print an authorization ticket. The health care provider is required to respond to all questions on the telephone contact form (attachment A) which includes potential sexual exposures of a pregnant female. Indicated laboratory testing will not be delayed if the resident meets the testing criteria. In the event the health care provider cannot provide the completed exposure questions on a pregnant female then the subsequent Information can be obtained on patient interview when positive Zika tests have been reported and the resident has been informed. The information will be entered in CDESS. (I.e. Investigation Procedures) Fax the ticket and the Wadsworth Infectious Disease Requisition to the HCP with directions to complete the laboratory requisition, write a prescription for Zika testing for serum and urine and give all three items to the patient to bring to the site for testing.

Line List & Run List: All residents for whom Zika testing is indicated will be documented on a line list and a run list. The following information will be documented on the line list: assigned reference number, initials, date of birth, town, male or female, pregnancy status, onset of symptoms, weeks pregnant, comments for abnormal findings on ultrasound if pregnant, date of test, laboratory results, travel country and dates, convalescent testing date, health care provider contact information phone and fax number and case determination. This line list will be updated each working day and secure file transferred to designated staff.
A corresponding run list will be maintained that will contain the following information: assigned reference number, name, and date of birth, female or male, pregnancy status, symptomatic, asymptomatic, initial laboratory results, and case status. This run list is to be maintained on an excel spread sheet for sorting purposes by assigned number or name. The run list will be updated each working day and secure file transferred to designated staff.

ECLRS / CDESS, Investigation Procedures: Each working day, Zika surveillance staff or designated staff will review Arbo-virus and Zika laboratory results. All laboratory results will be printed and attached to the Zika Surveillance form. (Attachment B). Initial laboratory results will be faxed to the health care provider. The laboratory results will be transferred and mapped to the CDESS investigation. Enter all health data retrieved from initial screening on the CDESS investigation form.

*When Zika laboratory results are positive, phone contact to the health care provider is required. The provider will be informed of the results and the potential need for further testing and a copy of the positive laboratory and result will be faxed. If the positive laboratory result is consistent with Zika Virus disease confirmation, Zika surveillance staff will contact the individual for investigation following notification of the positive laboratory result by the health care provider. The CDESS supplemental will be completed upon phone interview with the patient. All identified risk factors will be entered in CDESS (I.e. travel, sexual partner travel and symptomatic, blood transfusion etc.). A paper copy of all cases and investigations are to be filed in numerical order by assigned number and the assigned number is to correspond to the line list and the run list.

A.2.a),b) Planning Requirements for Providing Education about Zika virus:
Zika virus disease (Zika) is a disease caused by the Zika virus, which is spread to people primarily through the bite of an infected *Aedes* species mosquito. The most common symptoms of Zika are fever, rash, joint pain, and conjunctivitis (red eyes). The illness is usually mild with symptoms lasting for several days to a week after being bitten by an infected mosquito. People usually don't get sick enough to go to the hospital, and they very rarely die of Zika. For this reason, many people might not realize they have been infected. However, Zika virus infection during pregnancy can cause a serious birth defect called microcephaly, as well as other severe fetal brain defects. Zika virus was first discovered in 1947. In 1952, the first human cases of Zika were detected and since then, outbreaks of Zika have been reported in tropical Africa, Southeast Asia, and the Pacific Islands. Zika outbreaks have probably occurred in many locations. Before 2007, at least 14 cases of Zika had been documented, although other cases were likely to have occurred and were not reported. Because the symptoms of Zika are similar to those of many other diseases, many cases may not have been recognized.

In May 2015, the Pan American Health Organization (PAHO) issued an alert regarding the first confirmed Zika virus infection in Brazil. On February 1, 2016, the World Health Organization (WHO) declared Zika virus a Public Health Emergency of International Concern (PHEIC). Local transmission has been reported in many other countries and territories. Zika virus will likely continue to spread to new areas. As there is no treatment for Zika virus disease, education, surveillance, remediation and prevention of infection are the primary goals of Nassau County's Zika Action Plan.

Individuals under investigation / Cases: Each individual for whom Zika testing is indicated will be educated on Zika Virus disease. Education will include signs and symptoms, modes of transmission and prevention in accordance with the CDC guidance. Each individual under surveillance will be directed to the CDC website for update information. (http://www.cdc.gov/zika/about/index.html). Those individuals who are pregnant will be counseled in accordance with the CDC guideline. Education will include guidance for pregnant women with male sex partners who have lived in or traveled to an area with Zika virus. Highlighted will be the proper and consistent use condoms or abstinence from sex during the pregnancy. http://www.cdc.gov/zika/pregnancy/protect-yourself.html. If a pregnant woman is concerned that her male partner may have or had Zika virus infection, she should talk to her healthcare provider. http://www.cdc.gov/zika/transmission/sexual-transmission.html.

Public Education: Nassau County Department of Health Web site will provide information on Zika virus via the link to the CDC. (http://www.cdc.gov/zika/about/index.html) Other modes available for use are: media, press releases or press conferences, town halls, scheduled seminars, public service announcements, countywide mailings to residents. Educational packets which include information regarding Zika Virus disease, recommendations for prevention, travel alerts and personal protection, and proper use of condoms will be distributed to Woman Infant and Children (WIC) for pregnant females and the Peri-natal network as a target group. Education packets will be distributed at health fairs and all community events.

Healthcare Providers: Nassau County Department of Health maintains an email contact list for Hospitals, Medical Societies, Infection Prevention Practitioners and Urgent Care Centers. New York State Health Advisories, CDC Health Advisories and Nassau County Health Advisories are transmitted electronically to the agencies for distribution. Nassau County will disseminate Health Advisories/Alerts and materials through email to appropriate agencies when appropriate. Electronic copies of educational packets will be available for transmission to health care providers upon request.

A.2.c) Educational Efforts:

Educational efforts will include an initial press release issued at the beginning of mosquito season (mid-May) and will include the following: a brief description of Nassau County's mosquito control program, guidance on reducing mosquito habitats, eliminating standing water, trash cleanup and how to contact Nassau County for additional guidance and resources. Public Education will also include methods of personal protection from mosquito bites and a link to the CDC Zika web page. Subsequent press releases will be issued throughout the mosquito season. County agencies and elected officials will also distribute educational pamphlets and flyers to the public.

B.1 a) Enhanced Human Disease Monitoring and Control

Local Transmission Surveillance or Positive Zika Pool:

Upon notification of a positive Zika virus pool, NCDOH will consider a Code Red (reverse 911) notification to residents in proximity to the positive pool(s). Zika virus disease information and prevention information will be included in the message. Highlighted in the Code Red (reverse 911) notification will be prevention information for the pregnant female and the general public. Included in the message will be when to notify your Health Care Provider for testing and what actions should be taken if you develop symptoms consistent with Zika Virus Disease. Prevention message to protect others will be addressed. NCDOH contact information number will be announced. NCDOH will consider public notification by press release / conference. A Health Advisory / Alert will be electronically transmitted to medical societies, hospitals, Infection Preventionists and urgent care centers. A call center will be considered with educational information on Zika Virus disease, transmission, prevention and guidance for pregnant females and the general public will be available for use in the call center.

Syndromic Surveillance will be conducted for a Zika Positive Pool: In the event that Zika infected mosquitos are identified in a pool(s) in Nassau County, Zika Surveillance staff will query Syndromic Surveillance for Rash and Fever in the associated zip code each working day. Data will be sorted by symptoms and zip code. If there evidence of an increase of fever and rash in the corresponding zip code, Zika Surveillance staff will contact the identified Emergency Department(s) or Infection Preventionist to report the discharge or admission diagnosis of the individuals. If discharged and Zika Virus is suspected, individuals will be interviewed and recommended to seek medical care / testing pending NYSDOH approval. If admitted, and Zika Virus is suspected, the hospital will be requested to submit a blood sample and urine sample to Wadsworth Laboratory for testing, in compliance with NYSDOH and CDC handling and shipment guidelines.

Case investigation should reveal an identifiable source or risk factor. In the event that Zika Surveillance is notified or investigated an individual with symptoms consistent with Zika and without identifiable risk factors, (I.e. travel to endemic country, sexual contact with travel to an endemic country, etc.) Zika Surveillance staff will review the positive mosquito pool list by zip code and town. Environmental Health will GIS the suspect's address to the positive pool list to determine the likelihood of potential exposure. Zika Surveillance will then notify NYSDOH for authorization for Zika testing to confirm case status and possible local transmission. Zika Surveillance Staff will contact the testing laboratory to request that the samples be submitted to Wadsworth Laboratory for testing in compliance with NYSDOH and CDC handling and shipment guidelines. If local transmission is confirmed NCDOH will issue public notification by press release / conference. Included in the message will be when to notify your Health Care Provider for testing and what actions should be taken if you develop symptoms consistent with Zika Virus Disease; prevention message to protect others will be addressed.
A Health Advisory / Alert will be electronically transmitted to medical societies, hospitals, Infection Preventionists and urgent care centers. If a locally acquired case is identified, the call center will be activated to address the public's concerns. Educational information on Zika Virus

disease, transmission, prevention and guidance for the general public and pregnant females will be available for use in the call center.
If a case of local transmission is identified, the Zika Surveillance Officer will conduct an in-depth investigation as to local risk and source. Risk factors include: sexual transmission, outdoor group activities, identified mosquito bites and location where bite(s) occurred. Mosquito Control and NYSDOH will be notified and the action plan will be discussed. ZRRT will be activated. ZRRT activation will consist of a home visit conducted in conjunction with NYSDOH and NCDOH staff. Disease Control staff will interview the individuals utilizing the questions on page 2 of the ZRRT home visit form. ZRRT forms will be compiled in a file. Individuals that meet criteria for testing or who are symptomatic will be referred to their health care provider for testing and the health data will be placed in CDESS and an investigation will be initiated. Education packets on Zika virus disease, transmission, prevention and testing will be given to the interviewed individual.
The call center will be activated to address the public's concerns. Educational information on Zika Virus disease, transmission, prevention and guidance for pregnant females will be available for use in the call center.

Active Surveillance for a case of Zika locally acquired: If a case of local transmission is identified, the Zika Surveillance Officer will conduct active surveillance each work day. Zika surveillance staff will coordinate surveillance with Infection Preventionists for each hospital. Zika staff will contact the Infection Preventionist or the Emergency Department at each hospital to query if there were any patients who presented with symptoms consistent with Zika Virus Disease and to report the discharge or admission diagnosis of the individuals. If the patient was discharged and Zika is suspected, individuals will be interviewed and recommended to seek medical care and Zika testing. If admitted and Zika Virus is suspected, Zika surveillance staff will request the hospital obtain a blood sample and urine sample, and submit to Wadsworth Laboratory for testing in compliance with NYSDOH and CDC handling and shipment guidelines. NYSDOH will be notified regarding approvals for testing.

B.2. a),b) Enhanced Education: Local Transmission
A press release/conference will be conducted if local transmission is identified in Nassau County. In addition, a Health alert / Advisory will be issued and electronically transmitted to medical societies, hospitals, Infection Preventionists and Urgent Care Centers. Information on Zika Virus testing and reporting will be outlined in the alert and the press release / conference. Highlighted will be the pregnant female with prevention strategies; when to contact a health provider and criteria for testing and what preventative actions should be taken if an individual develops symptoms to prevent further transmission. Bureau of Communicable Disease Control contact information for reporting or medical consultation will be included. The call center will be activated to address the public's concerns. Educational information on Zika Virus disease, transmission, prevention and guidance for the general public and pregnant females will be available for use in the call center.

The Commissioner of Health will collaborate regarding on going media / press reporting with Nassau County Department of Health Public Information Officer, NYSDOH will be informed.

Emergency Preparedness and the Medical Reserve Corps will offer educational presentations to the public regarding Zika Virus disease and prevention. Educational packets will be available for distribution at emergency preparedness events.

Immunization staff will distribute educational packets to each health care provider practice assigned an AFIX and at all community affairs attended. Educational packets will be electronically transmitted in English and Spanish to WIC and the Peri-natal network for distribution.

Disease Control Attachments: A-Initial Telephone Contact Form; B-Internal Report Form; Introduction Letters for Residents; Educational Materials for Health Care Providers and Residents. See Attachment List (Pg. 11)

B.3.a) - Mosquito Surveillance:

Background: The Nassau County Departments of Health and Public Works have been administering and operating a mosquito surveillance and control program since 1996. This has resulted in the compilation of a significant amount of data resulting in the identification of larval habitats, population and geographic distribution of adult mosquitos by species, identification of virus in the mosquito population, seasonal variation of species, effective source reduction strategies and adult reduction strategies. Nassau County plans and operates its surveillance and control program in consultation with other regional local health departments, academic institutions and NY State Department of Health officials. The Nassau County Department of Health conducts media interviews, issues press releases and educates the public on mosquito borne diseases, the county's mosquito control plan and what residents can do to protect themselves against mosquitos.

- Known breeding habitats including salt marshes, recharge basins, storm water basins, ponds, streams and other surface waters are surveyed for larval activity.
- Complaints of mosquito activity, stagnant water, abandoned swimming pools, etc., trigger targeted inspections for breeding habitats and larval activity.
- Adult mosquito surveillance is conducted at 42 sites strategically situated (in a variety of habitats – see attached map) throughout the county.
- Trapping adult mosquitos is typically performed from mid-May through the end of September.
- Trapping is done using the CDC Light, Gravid and BG-Sentinel traps.
- Trapped mosquitos are identified and separated by species into pools at the NCDOH laboratory. Pools are logged into NCDOH and NYSDOH databases.

- Pools of mosquitos are packaged in labeled glass tubes and Styrofoam containers with dry ice. They are shipped to Wadsworth laboratory via overnight delivery with the appropriate documentation.
- Results of virus testing and incidence of human disease are used to determine appropriate actions for additional surveillance and control activity, including adulticiding.

B.3.b) – Aedes albopictus Surveillance: Charts and Graphs attached.

- Historic data indicates that more than 90% of the Aedes albopictus have been trapped in six locations.
- These prevalent locations will be monitored using BG traps beginning in June regardless of the activity indicated in light traps at these locations.
- BG traps will be deployed at any of the remaining 36 trap locations after Aedes albopictus have been detected in the light trap.
- Pools of twenty (20) or more Aedes albopictus will be shipped to Wadsworth laboratory for virus testing.

B.3.c) – Surveillance after Zika detection in a mosquito pool or a locally acquired human case:

- If Zika is detected in a mosquito pool, the frequency of trapping at that site will be increased to a minimum of weekly. Additional suitable locations for traps in that immediate area will be identified to perform additional trapping and assess the effectiveness of mosquito control performed in response to the positive Zika result.
- In the case of a locally acquired human case of Zika, the area within at least 200 yards of the case will be assessed for breeding habitats, larval activity and suitable locations for traps that may identify the presence of Aedes albopictus and that may assess the effectiveness of mosquito control performed in response to the positive Zika result.
- The total number of mosquito pools submitted to Wadsworth laboratory for virus testing will not exceed sixty (60) pools per week unless specifically authorized by the New York State Department of Health.

B.4.a) - Mosquito Control: Nassau County control methods incorporate habitat reduction and elimination, larviciding, and adulticiding. Some habitat reduction and larviciding is conducted preemptively based on historic data and site history. The use of larvicide and adulticide must comply with NYSDEC regulations, product labels and all applicable pesticide laws. The Department has the authority, pursuant to Section 12, Article F of the Nassau County Administrative Code, to enter upon lands without hindrance for the purpose of draining and treating land and eliminating breeding places of mosquitoes.

- Habitat reduction is performed through maintenance of ditches to improve shoreline drainage, reduce the size and number of puddles, improve tidal flow and facilitate habitat for killifish that feed on mosquito larvae.

- Storm water recharge basins are inspected to check for standing water, debris and overgrown vegetation. Basins are cleaned, vegetation is cut back and the basin floor is reconditioned to maximize drainage.
- Complaints of mosquito activity, standing water, abandoned properties, etc., trigger an investigation that will include source reduction and larviciding where necessary.
- Larviciding is conducted when County inspectors locate a breeding habitat. This may occur during routine surveys of historically active areas or based upon a complaint. Larviciding is conducted by hand, backpack sprayer for larger areas or by helicopter for vast unpopulated areas.
- Adulticiding is performed according to the Nassau County Mosquito Control Decision Matrix (attached). The matrix considers the totality of time of year (season), results of mosquito trapping (population and virus activity), prevalence of human disease, current weather conditions and forecasted weather. The county has been divided into 51 operational zones for adulticiding. One or more zone may be treated at night by truck sprayer. If multiple zones have to be treated that exceed the capacity of truck sprayers, aerial application of adulticide will be performed. The decision/authorization to adulticide is made by the County Executive based on recommendations from the Department of Health.
- Nassau County law requires a minimum of 48 hours' notice to the County Legislature and 24 hours' public notice prior to the application of adulticide.
- All larviciding and adulticiding is conducted in compliance with NYSDEC regulations.
- See attached chart for sprayers/foggers used by Nassau County.

B.4.b) – Individual Home Visits for Mosquito Control:

- Individual home visits are currently conducted based on a complaint of stagnant water, overgrown vegetation or other conditions conducive to mosquito breeding habitat.
- In the case of a locally acquired Zika case or mosquito pool positive for Zika virus, home visits will be conducted within a minimum of 200 yards of the potential source.
- Each home visit will be documented by the county inspector and will include information on access to the property, identification of breeding habitats, actions taken to eliminate breeding habitats, education of the resident of the property (County produced informational pamphlets will be distributed) and recommendations for additional action (County follow-up).

B.4.c) – Mosquito Control Days:

- The Nassau County Department of Health will issue press releases, provide media interviews and make public service announcements to encourage residents to check their property for standing water, clogged gutters, junk piles, yard waste, children's toys, etc. that could providing breeding environments for mosquitos. Residents will be advised to call the county to report areas of concern outside of their own property or to obtain additional information regarding mosquito control measures. These press releases will be issued after each heavy rainfall. The Department will continue to partner with local meteorologist about reminding viewers/listeners to dump standing water after rainfall.

- The County will partner with community and civic groups to actively clean up public areas which may harbor breeding habitats.
- The Nassau County Department of Health web site will provide educational information on mosquito control and mosquito borne diseases.
- Nassau County Department of Health has a vast network of community-based agencies and will partner with these agencies to promote mosquito controls days.
- Educational brochures on mosquito control will be distributed at all community events attended by Department staff.

B.4.d) – Zika Virus Positive Pool:

- <u>Detection of a single Zika virus positive pool</u>: Conduct larval surveillance and control and eliminate habitats at least 200 yards around the detection site. Enhance education (door to door) of residents to improve source reduction and minimize contact between vectors and residents. Conduct ground based adult mosquito control at least 200 yards around the detection site; backpack spraying where appropriate and permitted. Initiate enhanced surveillance at the detection site to determine the effectiveness of control efforts.
- <u>Detection of multiple Zika virus positive pools</u>: Conduct community education and outreach utilizing multimedia to minimize contact between vectors and residents and to achieve source reduction on private property. Identify the operational areas where adult control is required and determine the appropriate method of adulticide application. Initiate enhanced surveillance at the detection site to determine the effectiveness of control efforts. Repeat adult control measures based on the results of enhanced surveillance and maintain or expand surveillance as required.

B.4.e) – Zika Rapid Response Teams (ZRRTs): County Environmental Health ZRRTs will be activated when a locally acquired case or positive mosquito pool is detected. Home visits will be performed within a minimum of 200 yards of a locally acquired case or positive mosquito pool. The home visit will be conducted by a ZRRT and will include completion of a form (attached) which documents contact information; symptom, pregnancy and travel history; authorization to enter the property; results of mosquito breeding and control activity on the property. The residents of the home will also be educated regarding ZIKA disease and mosquito control to prevent exposure.

B.5.a),b)&c) – Zika Rapid Response Team (ZRRT) Staffing: The primary, secondary and tertiary teams for <u>Environmental Health</u> will be drawn from the following staff depending on availability. The size and number of teams will be scaled according to the response requirements.

a) Direction and Coordination of Surveillance and Control Activities – Donald Irwin, Director of Environmental Health; Bryan Matthews, Director of the Bureau of Environmental Investigation; Angela Pettinelli, P.E., Public Health Engineer III.
b) Field Supervision of Surveillance and Control Activities – Bryan Matthews, Director of the Bureau of Environmental Investigation; John Ochwat, Sanitarian II, Anthony Falco, Mosquito Control Supervisor.
c) Surveillance and Source Reduction Activities (non-chemical) - John Ochwat, Sanitarian II; Paul Franciotti, Sanitarian I; Three (3) Seasonal Public Health Aides.
d) Surveillance, Larviciding and Adulticiding – Anthony Falco, Mosquito Control Supervisor; Ten (10) NC DPW Staff (DEC certified pesticide applicators – see attached chart).
e) Additional Sanitarians from the Division of Environmental Health will be utilized if the response needs to be scaled up.
f) Staff provided by NY State will be integrated into ZRRTs as necessary.

Nassau County Zika Rapid Response Teams have been identified as follows:

Primary Team –	**Educators: Mary Ellen Laurain, *Angela Pettinelli**
	Epidemiologists: Holly Marrano
	Site Inspectors: John Ochwat, Anthony Falco
Secondary Team –	**Educators: Cynthia Cirillo, Carolyn McCummings**
	Epidemiologists: Terry Cafiero
	Site Inspectors: *Bryan Matthews, Henry Blank
Tertiary Team –	**Educators: Nina Scollo, Bonnie Sollog**
	Epidemiologists: Jacob Estanis
	Site Inspectors: *Don Irwin, Edward Goss

*Team Leaders

ATTACHMENT LISTING

1. Telephone Contact Form (Attachment A)
2. Zika Surveillance Form (Attachment B – Confidential Case Report)
3. Introduction Letter – No Local Transmission (3 Pages)
4. Introduction Letter – Local Transmission (3 Pages)
5. ZIKA Disease Educational Materials for Health Care Providers and Residents
    a) MMWR Vol 65, April 8, 2016 (4 pages)
    b) MMWR Vol 65, April 15, 2016 No. 14 (3 Pages)
    c) MMWR Vol 65, April 1, 2016 No. 12 (3 Pages)
    d) MMWR Vol 65 February 26, 2016 No. 7 (6 Pages)
    e) CDC CS263326B – Measuring Head Circumference
    f) CDC CS262037-A – Sick with Chikungunya, Dengue, or ZIKA?
    g) CDC CS263974-A – Zika and Sex: Information for Pregnant Women
    h) CDC Condom Dos and Don'ts
6. Mosquito Control Educational Materials
    a) Nassau County ZIKA Virus Pamphlet (2 Pages): available in seven languages (English, Spanish, Italian, Haitian Creole, Korean, Chinese and Farsi)
    b) CDC CS258303 – Help Control Mosquitoes...(2 Pages)
7. Mosquito Surveillance
    a) Chart 1; Chart 2 – Mosquito Pool Data; Aedes albopictus "Hotspots"
    b) Chart 3; Graph 1 – Aedes albopictus trapped by year, 2004-2015
    c) Graph 2 – Aedes albopictus trapped by month, 2012-2015.
8. Nassau County Mosquito Control Matrix – April 2016
9. Nassau County NYSDEC Certified Pesticide Applicators
10. Nassau County Treatment Equipment – Sprayers/Foggers
11. Nassau County ZRRT Home Visit Form (2 Pages)

TELEPHONE CONTACT INFORMATION FOR ZIKA CALLS   DATE OF CALL: ___/___/___

PATIENT LAST NAME: ______________________ FIRST NAME: ______________

ADDRESS: ______________ *CITY: ______________ *STATE: ______ *ZIP: ______

TELEPHONE: (   ) __________ - __________ DATE OF BIRTH: ____/____/________

AGE: ______MALE: ______FAMALE: ___

***IF PREGNANT: LMP_____ DUE DATE ______ WEEKS PREGNANT__________

NO SYMPTOMS: ______

DATE OF FIRST SYMPTOM: ___/__/ ___

SIGNS/SYMPTOMS: FEVER ______ RASH______ CONJUNCTIVITIS_____
MUSCLE/JOINT PAIN _________

ULTRASOUND FINDINGS IF DONE: ____

PATIENT TRAVEL? Y / N / LOCATION: ______________

EXACT DATES OF TRAVEL REQUIRED FOR TESTING: ____________________________

IS THE PATIENT A SEXUAL CONTACT OF A MALE WHO RESIDED OR TRAVELED TO A COUNTRY WITH ZIKA TRANSMISSION. IF YES, WAS THERE UNPROTECTED SEX SINCE SEXUAL CONTACT'S RETURN. ______ WAS THE SEXUAL CONTACT SYMPTOMATIC? _________
INFANT WITH MICROCEPHALY OR INTRACRANIAL CALCIFICATIONS? _____

EVIDENCE OR HISTORY OF GUILLAIN-BARRE SYNDROME? ______ WHEN? ____

DONATE OR RECEIVE BLOOD/ BLOOD PRODUCTS, SPERM DONATION, TISSUE/ORGAN DONATION?

EVER DIAGNOSED WITH OR VACCINATED FOR: WITH DENGUE, JAPANESE ENCEPHALITIS, TICKBORNE ENCEPHALITIS OR YELLOW FEVER

LIVED IN OR FREQUENTLY VISITED COUNTRIES WITH ZIKA TRANSMISSION?

TREATING PHYSICIAN FULL NAME: ________________________________

TEL #: ____FAX #: ____________________

Attachment A

NASSAU COUNTY DEPARTMENT OF HEALTH
DIVISION OF DISEASE CONTROL/ BUREAU OF COMMUNICABLE DISEASE CONTROL

CONFIDENTIAL CASE REPORT

COUNTY OF RESIDENCE (CIRCLE ONE):
NASSAU / OTHER:

PATIENT INFORMATION *LAST NAME:______________________ *FIRST NAME:______________

(PARENT NAME IF CHILD):______________________

* ADDRESS:______________ *CITY: ________________ *STATE:_____ *ZIP:______

TELEPHONE: (_____)______ - __________ DATE OF BIRTH: ___/___/______ AGE: _____YR /MON

*OCCUPATION (INDICATE ONE)	RACE (INDICATE ONE)	ETHNICITY (INDICATE ONE)	*GENDER (INDICATE ONE)	PREGNANT (INDICATE ONE) MANDATORY INFO
___ FOOD SERVICE RESTAURANT	___ WHITE	___ HISPANIC / LATINO	___ MALE	___ YES LMP____
___ DAY CARE	___ AFRICAN AMERICAN / BLACK	___ NON-HISPANIC / NON-LATINO	___ FEMALE	___ NO EDC_____
___ HEALTH CARE/NURSING HOME	___ AMERICAN INDIAN / ALASKAN NATIVE	___ UNKNOWN		___ GESTATIONAL AGE
___ STUDENT/SCHOOL	___ ASIAN/PACIFIC ISLANDER			
___ INMATE	___ OTHER			
___ OTHER:__________	___ UNKNOWN			
___ UNKNOWN				

*HOSPITALIZED? ___ YES ___ NO ___ ER ONLY ADMISSION DATE ___/___/______

DISCHARGE DATE ___/___/______

NAME OF HOSPITAL ______________ CHART #: __________

DISEASE INFORMATION **DISEASE REPORTED:** R/O Zika

ZIKA VIRUS TESTING INFORMATION: MANDATORY

NO SYMPTOMS: ________
OR

DATE OF FIRST SYMPTOM: ___/___/___ DATE OF REPORT: ___/___/___

SIGNS/SYMPTOMS: FEVER ______ RASH______ CONJUNCTIVITIS_____ MUSCLE/JOINT PAIN ________

ULTRASOUND FINDINGS IF DONE: ______________________________

TREATING PHYSICIAN: ______________________TEL #: ______________FAX #: ______________

PATIENT TRAVEL? Y / N / LOCATION: ____________ EXACT DATES OF TRAVEL______________________

IS THE PATIENT A SEXUAL CONTACT OF A MALE WHO RESIDED OR TRAVELED TO A COUNTRY WITH ZIKA TRANSMISSION. IF YES, WAS THERE UNPROTECTED SEX SINCE SEXUAL CONTACT'S RETURN? _____
WAS THE SEXUAL CONTACT SYMPTOMATIC? __________

Other questions for the Health Care Provider requesting Zika testing on their patient. Did your patient ever and if so when:

a. **have Guillain-Barre?**
b. **donate blood/blood products, sperm or tissue/organ?**
c. **receive blood/blood products, sperm or tissue/organ?**
d. **evidence of microcephaly in infant, intracranial calcifications or other abnormality**
e. **ever diagnosed with or vaccinated for: with Dengue, Japanese Encephalitis, Tickborne Encephalitis or yellow fever**
f. **lived in or frequently visited countries with Zika transmission?**

Edward P. Mangano
COUNTY EXECUTIVE

Lawrence E. Eisenstein M.D., F.A.C.P.
Commissioner

NASSAU COUNTY
DEPARTMENT OF HEALTH

200 County Seat Drive
Mineola, New York,11501
VOICE: 516 227-9639
FAX: 516 227-9669

Dear Resident:

According to the Centers for Disease Control and Prevention (CDC), Zika virus disease is a disease caused by Zika virus that is spread to people primarily through the bite of an infected *Aedes* species mosquito. The most common symptoms of Zika are fever, rash, joint pain, and conjunctivitis (red eyes). The illness is usually mild with symptoms lasting for several days to a week after being bitten by an infected mosquito. People usually don't get sick enough to go to the hospital. Once a person has been infected, he or she is likely to be protected from future infections.

In May 2015, the Pan American Health Organization (PAHO) issued an alert regarding the first confirmed Zika virus infection in Brazil and on Feb 1, 2016, the World Health Organization (WHO) declared Zika virus a public health emergency of international concern (PHEIC). On April 13, 2016 the CDC concluded that Zika causes microcephaly and other birth defects.

Local transmission has been reported in many other countries and territories. **There has been no local transmission in Nassau County or the United States.**

Included in this packet is informational materials that will assist you in understanding Zika virus disease, how it is transmitted and most importantly, how to prevent infection.

Steps to prevent mosquito bites:

When in areas with Zika and other diseases spread by mosquitoes, take the following steps:

- Wear long-sleeved shirts and long pants.
- Stay in places with air conditioning or that use window and door screens to keep mosquitoes outside.
- Sleep under a mosquito bed net if you are overseas or outside and are not able to protect yourself from mosquito bites.
- Use Environmental Protection Agency (EPA)-registered insect repellents. When used as directed, EPA-registered insect repellents are proven safe and effective, even for pregnant and breast-feeding women.

    Always follow the product label instructions.

    Reapply insect repellent as directed.

    Do not spray repellent on the skin under clothing.

    If you are also using sunscreen, apply sunscreen before applying insect repellent.

- If you have a baby or child:

    Do not use insect repellent on babies younger than 2 months of age.

    Dress your child in clothing that covers arms and legs, or

    Cover crib, stroller, and baby carrier with mosquito netting.

    Do not apply insect repellent onto a child's hands, eyes, mouth, and cut or irritated skin.

    Adults: Spray insect repellent onto your hands and then apply to a child's face.

- Treat clothing and gear with permethrin or purchase permethrin-treated items.

    Treated clothing remains protective after multiple washings. See product information to learn how long the protection will last.

    If treating items yourself, follow the product instructions carefully.

    Do NOT use permethrin products directly on skin. They are intended to treat clothing.

If you have Zika, protect others from getting sick.

Even if they do not feel sick, travelers returning to the United States from an area with Zika should take steps to prevent mosquito bites for 3 weeks so they do not spread Zika to uninfected mosquitos.

During the first week of infection, Zika virus can be found in the blood and passed from an infected person to another mosquito through mosquito bites. An infected mosquito can then spread the virus to other people.

- To help prevent others from getting sick, avoid mosquito bites during the first week of illness.
- Zika virus can be spread during sex by a man infected with Zika to his sex partners.

We do not know how long the virus is present in the semen of men who have had Zika.

We do know that the virus can stay in semen longer than in blood.

- To help prevent spreading Zika from sex, you can use condoms the right way every time you have sex. This includes vaginal, anal, and oral (mouth-to-penis) sex. Not having sex is the best way to be sure that someone does not get sexually transmitted Zika virus.

If you are a man who lives in or has traveled to an area with Zika

- If your partner is pregnant, either use condoms the right way every time you have vaginal, anal, and oral (mouth-to-penis) sex or they should not have sex during the pregnancy.

Even if they do not feel sick, travelers returning to the United States from an area with Zika should take steps to prevent mosquito bites for 3 weeks so they do not spread Zika to uninfected mosquitoes.

If you are concerned about getting Zika from a male sex partner

- You can use condoms the right way every time you have vaginal, anal, and oral (mouth-to-penis) sex. Condoms also prevent HIV and other STDs. Not having sex is the best way to be sure that you do not get sexually transmitted Zika virus.

Pregnant women should talk to a doctor or healthcare provider if they or their male sex partners recently traveled to an area with Zika, even if they don't feel sick.

Information for travelers

- **Traveling?** Visit CDC's Travelers Health website at wwwnc.cdc.gov/travel/page/zika-information to see if the country you plan to visit has any travel health notices.

Even if they do not feel sick, travelers returning to the United States from an area with Zika should take steps to prevent mosquito bites for 3 weeks so they do not spread Zika to uninfected mosquitoes.

Please review the materials in the packet and visit the CDC website for updates and other information.

http://www.cdc.gov/zika/about/index.html

Sincerely,

Nassau County Department of Health

Edward P. Mangano
COUNTY EXECUTIVE

Lawrence E. Eisenstein M.D., F.A.C.P.
Commissioner

NASSAU COUNTY
DEPARTMENT OF HEALTH
200 County Seat Drive
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  Cover crib, stroller, and baby carrier with mosquito netting.

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  Treated clothing remains protective after multiple washings. See product information to learn how long the protection will last.

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  Do NOT use permethrin products directly on skin. They are intended to treat clothing.

If you have Zika, protect others from getting sick.

Even if they do not feel sick, travelers returning to the United States from an area with Zika should take steps to prevent mosquito bites for 3 weeks so they do not spread Zika to uninfected mosquitos.

During the first week of infection, Zika virus can be found in the blood and passed from an infected person to another mosquito through mosquito bites. An infected mosquito can then spread the virus to other people.

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We do not know how long the virus is present in the semen of men who have had Zika.

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If you are a man who lives in or has traveled to an area with Zika

- If your partner is pregnant, either use condoms the right way every time you have vaginal, anal, and oral (mouth-to-penis) sex or they should not have sex during the pregnancy.

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- You can use condoms the right way every time you have vaginal, anal, and oral (mouth-to-penis) sex. Condoms also prevent HIV and other STDs. Not having sex is the best way to be sure that you do not get sexually transmitted Zika virus.

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http://www.cdc.gov/zika/about/index.html

Sincerely,

Nassau County Department of Health

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 65
April 8, 2016

Survey of Blood Collection Centers and Implementation of Guidance for Prevention of Transfusion-Transmitted Zika Virus Infection — Puerto Rico, 2016

Amber M. Vasquez, MD[1,2]; Mathew R.P. Sapiano, PhD[2]; Sridhar V. Basavaraju, MD[2]; Matthew J. Kuehnert, MD[2]; Brenda Rivera-Garcia, DVM[3]

Since November 2015, Puerto Rico has reported active mosquito-borne transmission of Zika virus (*1*). Because of the potential for Zika virus to be transmitted through transfusion of blood components, and because a high percentage of persons infected with Zika virus are asymptomatic (*2*), the Food and Drug Administration (FDA) recommended that blood collections cease in areas of the United States affected by active vector-borne transmission of Zika virus until laboratory screening of blood donations or pathogen reduction technology (PRT)* for treatment of blood components can be implemented (*3*). To inform efforts to maintain the safety and availability of the blood supply in Puerto Rico, CDC, in collaboration with the Puerto Rico Department of Health, conducted a rapid assessment of blood collection and use on the island. A total of 139,369 allogeneic red blood cell (RBC) units,† 45,243 platelet units, and 56,466 plasma units were collected in or imported to Puerto Rico during 2015, and 135,966 allogeneic RBC units, 13,526 therapeutic platelet units,§ and 25,775 plasma units were transfused. Because of the potential for local Zika virus transmission in areas with a competent mosquito vector (*4*), other areas of the United States should develop plans to ensure local blood safety and adequacy. Blood collection organizations and public health agencies should collaborate to maintain the safety and availability of local blood supplies in accordance with FDA guidance.

Before this survey, no estimates of blood collection and use in Puerto Rico were available. The survey, conducted during February 10–24, 2016, included all blood collection centers performing local collections and importing blood components from the mainland United States for routine clinical use, as well as hospitals performing transfusions in Puerto Rico during 2015. The survey was based on a modified version of the 2015 National Blood Collection and Utilization Survey administered by CDC on behalf of the U.S. Department of Health and Human Services (*5*), in which U.S. territories have previously not been included. The survey included questions about donor blood collection methods and product types, importation of blood products for routine use, blood use, and extent of PRT implementation for platelets and plasma. Questionnaires were electronically distributed to the laboratory manager or medical director of each facility and were self-administered. Total collections and transfusions of whole blood, whole blood derived (WBD) RBC, platelet, plasma, and cryoprecipitate units (including total numbers of blood components imported from the continental United States), as well as RBC, platelet, and plasma units collected via apheresis¶ methods were tabulated. Estimates of transfusion were weighted for nonresponse using inpatient surgical volume (the average number of surgical procedures performed annually at a hospital) as a proxy for the amount of blood used annually, and 95% confidence intervals were estimated.

All 12 (100%) blood collection centers and 51 (91.1%) of 56 hospitals performing transfusions responded to the survey. During 2015, a total of 82,381 whole blood units were reported to have been collected in Puerto Rico. These whole blood units yielded WBD components, including 80,431 allogeneic RBC units, 32,753 individual platelet units, 47,055 plasma units, and 4,615 cryoprecipitate units. RBCs, platelets,

* Chemical and/or ultraviolet light treatment to achieve reduction of risk for transfusion-transmitted infection. PRT is currently approved by the Food and Drug Administration (FDA) only for plasma and platelets derived from apheresis methods. It is not FDA-approved for red blood cells.

† Allogeneic blood components are collected from donors for transfusion into another person.

§ A unit of platelets prepared for transfusion from pooled individual whole blood derived platelet units.

¶ A medical technology that involves the withdrawal of blood from a donor, removal of one or more blood components (e.g., plasma or platelets), and transfusion of the remaining blood back into the donor.

and plasma collections using apheresis methods were reported in much fewer numbers than those derived from whole blood (Table 1). PRT was used only to treat apheresis platelets, and constituted 1,403 (25.6%) of the 5,467 apheresis platelet collections. An additional 52,411 RBC units, 7,023 apheresis platelet units, 7,906 plasma units, and 2,651 cryoprecipitate units were imported from the continental United States for routine use in 2015. A total of 135,966 allogeneic RBC units, 13,526 therapeutic platelet units, and 25,775 plasma units were transfused in 2015 (Table 2). Only 511 (36.4%) of the 1,403 PRT-treated platelet units were transfused by hospitals in 2015.

Discussion

No blood transfusion-transmitted cases of Zika virus infection have been confirmed in Puerto Rico or the U.S. mainland (*4*); however, Zika virus nucleic acid was detected retrospectively in 2.8% of asymptomatic blood donors during a 2013–2014 Zika virus disease outbreak in French Polynesia (*6*), and transfusion-transmitted Zika virus infection has been reported in Brazil (*7*), where substantial Zika virus transmission is occurring. Because a large percentage of persons infected with Zika virus are asymptomatic (*2*), the risk for transfusion-transmitted Zika virus infection in Puerto Rico and other areas of the United States and its territories is of concern.

In Puerto Rico, the majority of whole blood units and blood component units collected during 2015 were collected locally, placing a large proportion of the local blood supply at potential risk for transfusion-transmitted Zika virus infection. Whereas PRT is FDA-approved for plasma and apheresis platelets, and could be used to treat portions of the blood supply in accordance with FDA guidance, a lower than expected proportion of the platelet supply was derived from apheresis methods in Puerto Rico compared with the continental United States, where in 2013, 95% of all platelets were collected via apheresis (*5*); this difference might have been related to cost of implementation of apheresis methods in Puerto Rico. In addition, PRT is not FDA-approved for whole blood or RBCs, the most commonly transfused WBD component. These factors resulted in a risk for critical blood shortages as local blood collections in Puerto Rico were recommended to cease on March 1, 2016, in accordance with FDA guidance, until a nucleic acid screening test could be implemented for blood collections under investigational protocols beginning on April 4, 2016 (*8*).

The results of this survey were used to guide a federally supported coordinated effort to address the blood supply and safety challenges in Puerto Rico, which included importation of all blood components from the continental United States at a volume sufficient to meet the demand projected from the 2015 estimates, beginning on March 5, 2016 (*9*). Local collections resumed in Puerto Rico on April 2, 2016, after FDA approved blood donations in the United States to be screened for Zika infection using an investigational nucleic acid test developed by Roche Molecular Systems (Branchburg, New Jersey) (*8*). In addition, efforts to implement PRT for apheresis platelets and plasma collections in Puerto Rico are currently under way, and evaluation trials to determine safety and efficacy of investigational PRT for RBCs are in planning stages.

The findings in this report are subject to at least three limitations. First, survey data were self-reported by facilities and could not be independently verified. Second, although the survey response rate was high, results were limited by missing responses to some questions, leading to uncertainty regarding the estimates. Finally, although English language assistance was available to respondents, each of whom was contacted directly by a Spanish-speaking team member to ensure receipt of the survey and inquire about the need for assistance, the survey instrument was written in English, which might have

TABLE 1. Number of units of blood and blood components collected by all 12 of the country's blood collection centers or imported from the continental United States for routine clinical use — Puerto Rico, 2015

Component type	No. of units collected	No. of units imported	Total units
Whole blood collections	**82,381**	**0**	**82,381**
Red blood cells (RBCs)			
Apheresis* RBCs	5,280	16,575	21,855
Allogeneic WBD RBCs	80,431	35,836	116,267
Autologous WBD RBCs	396	0	396
Directed WBD RBCs	851	0	851
Total RBC collections	**86,958**	**52,411**	**139,369**
Platelets			
Apheresis platelets	5,467	7,023	12,490
Apheresis platelets prepared using pathogen reduction technology (PRT)†	1,403	0	1,403
Individual WBD platelets§	32,753	0	32,753
Total platelet collections	**38,220**	**7,023**	**45,243**
Plasma			
Apheresis plasma	1,505	2	1,507
WBD plasma	47,055	7,904	54,959
Total plasma collections	**48,560**	**7,906**	**56,466**
Plasma prepared using PRT	0	0	0
Other			
Individual cryoprecipitate	4,615	2,651	7,266

Abbreviation: WBD = whole blood derived.

* A medical technology that involves the withdrawal of blood from a donor, removal of one or more blood components (e.g., plasma or platelets), and transfusion of the remaining blood back into the donor.

† Chemical and/or ultraviolet light treatment to achieve reduction of risk for transfusion-transmitted infection. PRT is currently approved by the Food and Drug Administration (FDA) only for plasma and platelets derived from apheresis methods. It is not FDA-approved for red blood cells.

§ WBD platelets were reported as individual units. These units are pooled to result in a standard adult dose. The average pool size for whole blood derived platelets was 5.8 individual doses.

TABLE 2. Weighted estimates of the number of units of blood and blood components transfused and number of hospitals (N = 56) responding to the survey — Puerto Rico, 2015

Component type	No. of units transfused*	No. of hospitals responding	(95% CI)
Whole blood units			
Allogeneic†	0	27	—
Directed§	0	28	—
Autologous¶	22	28	(0–68)
Red blood cells			
Allogeneic	135,966	47	(110,856–161,075)
Directed	2,338	32	(0–6,288)
Autologous	357	36	(29–684)
Platelets			
Whole blood derived (WBD**)	22,054	31	(4,768–39,339)
Apheresis†† platelets	9,724	44	(5,590–13,857)
Apheresis platelets prepared using pathogen reduction technology (PRT)§§	511	44	(0–1,278)
Plasma			
Total	25,775	46	(15,935–35,615)
Plasma prepared using PRT	0	23	—

Abbreviation: CI = confidence interval.
* Weighted for nonresponse in a population of 56 hospitals.
† Collected from donors for transfusion into another person.
§ Donations intended for a specific recipient.
¶ Donations by individuals for their own use, often for an elective procedure or planned transfusion.
** WBD platelets were reported as individual units. These units are pooled to result in a standard adult dose. The average pool size for whole blood derived platelets was 5.8 individual doses.
†† A medical technology that involves the withdrawal of blood from a donor, removal of one or more blood components (e.g., plasma or platelets), and transfusion of the remaining blood back into the donor.
§§ Chemical and/or ultraviolet light treatment to achieve reduction of risk for transfusion-transmitted infection. PRT is currently approved by the Food and Drug Administration (FDA) only for plasma and platelets derived from apheresis methods. It is not FDA-approved for red blood cells.

Summary

What is already known about this topic?

Because of the potential for transfusion-associated transmission of Zika virus, the Food and Drug Administration (FDA) has recommended deferral of blood donors in affected U.S. areas until blood donations can be screened by nucleic acid testing or blood products can be subjected to FDA-approved pathogen reduction technology (PRT). FDA has recommended that whole blood and blood components for transfusion be obtained from U.S. areas without active Zika virus transmission.

What is added by this report?

Puerto Rico is experiencing active Zika virus transmission and also performs local blood collections. Therefore, Puerto Rico is the first U.S. area to need to comply with FDA guidance. Historically, Puerto Rico has also imported blood from the U.S. mainland for routine purposes. Outsourcing of blood components from unaffected areas might not be feasible if there is widespread Zika virus transmission in heavily populated areas of the continental United States. Therefore, local blood collections should be maintained through the use of nucleic acid screening or PRT.

What are the implications for public health practice?

Importation of blood products from nonaffected areas might serve a role in prevention of transfusion-transmitted Zika virus. An approved laboratory test for blood donor screening and implementation of PRT are critical for compliance with FDA guidance and to ensure a safe and sustainable blood supply. Blood collection organizations and public health organizations need to collaborate to prepare for blood safety and adequacy challenges that might arise if Zika virus transmission spreads in the United States.

affected the interpretation of questions by staff members in blood collection centers and hospitals; the impact on the survey findings is not known.

The risk for transfusion-transmitted Zika virus infection presents a current challenge to the safety and availability of the blood supply in Puerto Rico and an emerging threat to other areas of the United States, where Zika virus might spread via mosquito-borne transmission, particularly given the risk for clinical complications associated with infection, including Guillain-Barré syndrome and congenital abnormalities in infants born to women infected during pregnancy (*10*). Because of the high rate of asymptomatic infection (*2*), blood donor screening without a laboratory test is insufficient for identifying infected donors in areas with active transmission. Interventions to prevent transfusion-transmitted Zika virus infection in areas of the United States that do not have active mosquito-borne transmission include donation deferral for those who have had Zika virus infection (deferral for 4 weeks after symptom resolution) or symptoms suggestive of Zika virus infection during the past 4 weeks, those who have had sexual contact with a person with Zika virus infection or who has traveled to, or resided in, an area with active Zika virus transmission during the prior 3 months, and those who have traveled to areas with active transmission of Zika virus during the past 4 weeks (*3*). In areas with current mosquito-borne Zika virus transmission, importation of blood components from unaffected areas is recommended until nucleic acid testing is implemented or PRT, as applicable, is adopted.

Outsourcing of blood components from unaffected areas might not be feasible if there is widespread Zika virus transmission in heavily populated areas of the continental United States. Therefore, it is important to maintain local blood collections in the continental United States. The availability of safe blood is a critical need for health care, and collaboration between blood collection organizations and health departments is essential to comply with FDA guidance, including implementation of laboratory testing of blood donations or use of PRT with plasma units and apheresis platelets.

Acknowledgments

Yvonne Cruz, Division of STD Prevention, CDC; Joaquin Rueda, Division of Global Migration and Quarantine, CDC; participating blood collection organizations and health care facilities, Puerto Rico.

[1]Epidemic Intelligence Service, CDC; [2]Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [3]Puerto Rico Department of Health.

Corresponding author: Amber M. Vasquez, avasquez@cdc.gov, 404-718-1613.

References

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Male-to-Male Sexual Transmission of Zika Virus — Texas, January 2016

D. Trew Deckard, PA-C[1]; Wendy M. Chung, MD[2]; John T. Brooks, MD[3]; Jessica C. Smith, MPH[2]; Senait Woldai, MPH[2]; Morgan Hennessey, DVM[4,5]; Natalie Kwit, DVM[4,5]; Paul Mead, MD[4]

Zika virus infection has been linked to increased risk for Guillain-Barré syndrome and adverse fetal outcomes, including congenital microcephaly. In January 2016, after notification from a local health care provider, an investigation by Dallas County Health and Human Services (DCHHS) identified a case of sexual transmission of Zika virus between a man with recent travel to an area of active Zika virus transmission (patient A) and his nontraveling male partner (patient B). At this time, there had been one prior case report of sexual transmission of Zika virus (*1*). The present case report indicates Zika virus can be transmitted through anal sex, as well as vaginal sex. Identification and investigation of cases of sexual transmission of Zika virus in nonendemic areas present valuable opportunities to inform recommendations to prevent sexual transmission of Zika virus.

Epidemiologic Investigation

In January 2016, 2 days after returning to Dallas, Texas, from a 1-week visit to Venezuela, patient A developed subjective fever, pruritic rash on his upper body and face, and conjunctivitis lasting 3 days. Both 1 day before and 1 day after his symptom onset (Day 0), patient A had condomless insertive anal sex with patient B. Patient A reported that during and after illness he experienced no symptoms of prostatitis or dysuria, and noted no macroscopic hematospermia.

On Day 7, patient B developed a subjective fever, myalgia, headache, lethargy, and malaise; a few days later, he developed a slightly pruritic rash on his torso and arms, small joint arthritis of his hands and feet, and conjunctivitis. All symptoms resolved after 1 week. On Day 11, while still symptomatic, patient B visited his primary care provider for evaluation. Suspecting Zika virus infection, the provider obtained serum specimens from patient B on Day 11 (4 days after patient B's illness onset), and from both patients A and B on Day 14 (14 and 7 days after respective illness onsets). On Day 24, semen, urine, and saliva specimens were collected from both patients (24 and 17 days after respective illness onsets).

Patient A had traveled regularly to Central and South America for many years. During his recent trip to Venezuela, he reported that multiple persons in the area he visited were experiencing symptoms consistent with Zika virus disease; autochthonous transmission of Zika virus had been confirmed in Venezuela in late November 2015.* Patient B had not recently traveled outside of the United States and had never traveled to countries with active autochthonous Zika transmission. Neither patient had a history of prior known arboviral infection nor had they received yellow fever or Japanese encephalitis vaccinations. The men had been mutually monogamous for more than 10 years and had no major medical illnesses or history of sexually transmitted infections. Neither patient reported ulcerative anal or genital lesions.

Laboratory Investigation

Samples of all clinical specimens were sent by DCHHS to CDC. Patient A's serum from 14 days after illness onset and patient B's serum from 4 days after illness onset contained no detectable Zika virus RNA using reverse transcription polymerase chain reaction (RT-PCR) testing (Table) (*2*). Sera from both patients demonstrated positive immunoglobulin M (IgM) responses by capture ELISA for Zika virus and dengue virus, but not for chikungunya virus (Table) (*2*). Plaque-reduction neutralization tests (*3*) indicated that patient A had been infected with Zika virus, dengue virus serotype 1, or both, but that patient B had been infected only with Zika virus. Urine and saliva specimens collected from patients A and B at 24 and 17 days after respective illness onsets had no detectable Zika virus by RT-PCR.

* Pan American Health Organization and World Health Organization Regional Office of the Americas. Epidemiological alert. Neurological syndrome, congenital malformations, and Zika virus infection. Implications for public health in the Americas — 1 December 2015.

TABLE. Reverse transcription polymerase chain reaction (RT-PCR) and serologic testing of serum from patients A and B — Texas, January 2016

Patient	Days after symptom onset	ZIKV RT-PCR	ZIKV IgM*	DENV IgM	CHIK IgM	ZIKV PRNT†	DENV-1 PRNT†	DENV-2 PRNT†
Patient A	14	Negative	Positive	Positive	Negative	>20,480	>20,480	5,120
Patient B	4	Negative	ND	ND	ND	160	<10	<10
Patient B	7	Negative	Positive	Positive	Negative	2,560	10	<10

Abbreviations: CHIKV = chikungunya virus; DENV-1 or 2 = dengue virus serotype type 1 or 2; IgM = immunoglobulin M; ND = not done; PRNT = plaque-reduction neutralization test; ZIKV = Zika virus.
* IgM antibody capture-enzyme linked immunosorbent assay.
† Serum dilution-plaque reduction neutralization test, titers of neutralizing antibodies to ZIKV, DENV-1, and DENV-2.

Semen specimens collected at 24 and 17 days from each man were tested for Zika virus by RT-PCR both by CDC and DCHHS using the same two sets of primers (*2*). At CDC, neither sample had detectable Zika virus with either primer set after 37 cycles. At DCHHS, which pretreated the thawed semen samples with dithiothreitol (used to induce liquefaction of viscous specimens and potentially increase detection of RT-PCR targets), patient B's specimen was negative. Patient A's specimen had Zika virus detected at 35 cycles with one primer set but produced no signal after 37 cycles with the other primer set. Patient A's semen results were thus deemed equivocal.

Environmental Investigation

Although Dallas is within the geographic range of the Zika virus mosquito vectors *Aedes aegypti* and *Ae. albopictus*, seasonal winter temperatures in the area during the week of the traveler's return were not permissive for *Aedes* activity. Maximum area temperatures during the week of the traveler's return were <12°C (<54°F)[†] and thus not suitable for overwintering *Aedes* eggs to hatch and resulting larvae to survive. BG-Sentinel (Biogents AG, Regensberg, Germany) and gravid mosquito traps placed around the residential areas of patients A and B in January yielded only *Culex* but no *Aedes* mosquitoes.

Discussion

In addition to the present case report, at least five other cases of sexually transmitted Zika virus infection supported by laboratory evidence have now been reported in the published literature; all were male-to-female transmissions involving vaginal sex. All of the male travelers had symptoms consistent with Zika virus infection and could have transmitted infections to their sex partners a few days before or after as well as during the time symptoms appeared (*3–5*). In this case report, patient B's potential exposures occurred both before and just after initial appearance of symptoms in the traveler, which is the time when blood viremia appears to be highest (i.e., as clinical signs and symptoms of infection emerge).[§]

Transmission of Zika virus to patient B by *Ae. aegypti* or *albopictus* was unlikely based on environmental conditions. Even if these mosquito species had been present and active, the time from exposure to illness in patient B (i.e., 6–8 days) was shorter than the minimum estimated time required for *Aedes* to become infectious had a mosquito ingested a Zika virus-infected blood meal from patient A (i.e., *Ae. aegypti* extrinsic incubation period is a minimum estimated duration of 10 days) (*6,7*), and for patient B once infected to have then developed illness (i.e., 3–12 days).

Studies investigating seminal shedding of infection-competent Zika virus, including its incidence, pattern (e.g., intermittent shedding or a steady decay), and duration are ongoing. At the time of Patient B's clinical presentation, there had been only one published report describing testing of semen from a man with Zika virus infection (*8*); studies of semen from two additional men have since been reported (*9,10*). Zika virus has been detected by RT-PCR and isolated in culture from the semen of two men at least 2 weeks after onset of illnesses (*8,10*) and possibly up to 10 weeks after illness in one of these cases (*8*). One report described Zika virus detectable in semen by RT-PCR 62 days after illness onset; culture was not performed (*9*). In two men, Zika virus was no longer detectable in their blood by RT-PCR when the semen specimens were analyzed (*8,9*). None of the three men provided follow-up semen specimens to determine when Zika virus was no longer detectable. Notably, all men in the five case reports and the three semen studies, as well as patient A, experienced symptomatic illness. In the report of the sexual transmission case that occurred in 2008 (*1*) and of the man with culturable Zika virus in semen in 2013 (*8*), symptoms also included hematospermia.

Identifying and characterizing cases of sexually transmitted Zika virus infection in areas experiencing intense autochthonous vector-borne Zika virus transmission is challenging. Reports of sexual transmission identified in areas where autochthonous transmission is not occurring offer unique and important opportunities to learn about this emerging mode of transmission and rapidly inform and refine interim prevention recommendations. Such cases highlight the need for clinicians to remain vigilant for and continue reporting any suspected cases of Zika virus infection to their state or

Summary

What is already known about this topic?

Although Zika virus is spread primarily by *Aedes* species mosquitoes, published case reports have documented sexual transmission from infected men to their female sex partners through vaginal sex.

What is added by this report?

This is the first report of transmission of Zika virus from an infected man to a sex partner through anal sex.

What are the implications for public health practice?

Sexual transmission through both vaginal and anal sex is an emerging mode of Zika virus infection that might contribute to more illness than was anticipated when the outbreak was first recognized. Cases of sexually transmitted Zika virus infection should be reported to public health agencies and can help inform recommendations to prevent Zika virus infections.

† National Weather Service Climate Prediction Center. Temperature data for Dallas-Ft. Worth, Texas. 2016. http://www.cpc.ncep.noaa.gov/products/tanal/temp_analyses.php.

§ http://www.who.int/bulletin/online_first/16-171207.pdf.

local health departments, including suspected infections in symptomatic persons without travel history, but who report unprotected sexual contact with a person who has traveled to an area with active Zika virus transmission.

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[1]Medical office of Steven M. Pounders, MD, Dallas, Texas; [2]Acute Communicable Disease Epidemiology Division, Dallas County Health and Human Services, Texas; [3]Division of HIV/AIDS Prevention, National Center for HIV, Hepatitis, TB and STD Prevention, CDC; [4]Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC, Ft. Collins, Colorado; [5]Epidemic Intelligence Service, CDC.

Corresponding author: John T. Brooks, MD, zud4@cdc.gov, 404-639-3894.

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Update: Interim Guidance for Prevention of Sexual Transmission of Zika Virus — United States, 2016

Alexandra M. Oster, MD[1]; Kate Russell, MD[2]; Jo Ellen Stryker, PhD[1]; Allison Friedman, MS[3]; Rachel E. Kachur, MPH[3]; Emily E. Petersen, MD[4]; Denise J. Jamieson, MD[4]; Amanda C. Cohn, MD[5]; John T. Brooks, MD[1]

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CDC issued interim guidance for the prevention of sexual transmission of Zika virus on February 5, 2016 (*1*). The following recommendations apply to men who have traveled to or reside in areas with active Zika virus transmission* and their female or male sex partners. These recommendations replace the previously issued recommendations and are updated to include time intervals after travel to areas with active Zika virus transmission or after Zika virus infection for taking precautions to reduce the risk for sexual transmission. This guidance defines potential sexual exposure to Zika virus as any person who has had sex (i.e., vaginal intercourse, anal intercourse, or fellatio) without a condom with a man who has traveled to or resides in an area with active Zika virus transmission. This guidance will be updated as more information becomes available.

Zika virus can be sexually transmitted from a man to his sex partners. Zika virus infection is of particular concern during pregnancy. The first documented case of sexual transmission of Zika virus was in 2008 (*2*); transmission was from a man to a woman, and sexual contact occurred a few days before the man's symptom onset. The first case of sexual transmission associated with the current outbreak was reported in early February (Dallas County Health and Human Services, unpublished data, 2016). In late February 2016, CDC reported two additional confirmed cases of sexual transmission of Zika virus from men returning from areas with active Zika virus transmission to their sex partners in the United States; these transmissions occurred in early 2016 (*3*). As of March 18, 2016, CDC has reported three additional cases, for a total of six confirmed cases of sexual transmission in the United States associated with this outbreak.† Another recent report described a case of sexual transmission that occurred in Italy in 2014 (*4*). In addition, there have been two reports of replication-competent Zika virus isolated from semen at least 2 weeks after onset of illness; blood plasma specimens collected at the same time as the semen specimens tested negative for Zika virus by reverse transcription–polymerase chain reaction (RT-PCR) (*5,6*). Semen collected from a third man with Zika virus infection had virus particles detectable by RT-PCR at 62 days after fever onset; RT-PCR of blood at that time was negative (*7*). Because serial semen specimens were not collected for these three cases, the duration of persistence of infectious Zika virus in semen remains unknown.

All reported cases of sexual transmission involved vaginal or anal sex with men during, shortly before onset of, or shortly after resolution of symptomatic illness consistent with Zika virus disease. It is not known whether infected men who never develop symptoms can transmit Zika virus to their sex partners. Sexual transmission of Zika virus from infected women to their sex partners has not been reported. Sexual transmission of many infections, including those caused by other viruses, is reduced by consistent and correct use of latex condoms.

Recommendations for Men and Their Pregnant Partners

Men who have traveled to or reside in an area with active Zika virus transmission and their pregnant sex partners should consistently and correctly use condoms during sex (i.e., vaginal intercourse, anal intercourse, or fellatio) or abstain from sex for the duration of the pregnancy. This course is the best way to avoid even a minimal risk of sexual transmission of Zika virus, which could have adverse fetal effects when contracted during pregnancy. Pregnant women should discuss their male sex partner's history of travel to areas with active Zika virus transmission and history of illness consistent with Zika virus disease§ with their health care provider; providers can consult CDC's guidance for evaluation and testing of pregnant women (*8*).

Updated Recommendations

Recommendations for men and their nonpregnant sex partners. Men and their nonpregnant sex partners (couples) who want to reduce the risk for sexual transmission of Zika virus should use condoms consistently and correctly during sex or abstain from sex. Based on expert opinion and limited but evolving information about the sexual transmission of Zika virus, the recommended duration of consistent condom use or abstinence from sex depends on whether men had confirmed infection or

* http://www.cdc.gov/zika/geo/index.html.
† http://www.cdc.gov/zika/geo/united-states.html.
§ Clinical illness consistent with Zika virus disease includes one or more of the following signs or symptoms: acute onset of fever, maculopapular rash, arthralgia, or conjunctivitis.

clinical illness consistent with Zika virus disease and whether men are residing in an area with active transmission (Box). The rationale for selection of these timeframes is available elsewhere (*8*).

Several factors could influence a couple's level of concern about sexual transmission of Zika virus. The risk for acquiring mosquito-borne Zika virus in areas with active transmission depends on the duration and extent of exposure to infected mosquitoes and the steps taken to prevent mosquito bites.¶ According to currently available information, most Zika virus infections appear to be asymptomatic, and when illness does occur, it is usually mild with symptoms lasting from several days to a week; severe disease requiring hospitalization is uncommon (*9*). Transmission of Zika virus is of particular concern during pregnancy. Couples who do not desire pregnancy should use available strategies to prevent unintended pregnancy, including use of the most effective contraceptive methods that can be used correctly and consistently (*10*). In addition, couples should be advised that correct and consistent use of condoms reduces the risk for sexually transmitted infections.

Zika Virus Testing and Sexual Transmission

At present, Zika virus testing for the assessment of risk for sexual transmission is of uncertain value, because current understanding of the duration and pattern of shedding of Zika virus in the male genitourinary tract is limited. Therefore, neither serum nor semen testing of men for the purpose of assessing risk for sexual transmission is currently recommended.

Zika virus testing is recommended for persons who have had possible sexual exposure to Zika virus and develop signs or symptoms consistent with Zika virus disease.** A pregnant woman with possible sexual exposure to Zika virus should be tested if either she or her male partner developed symptoms consistent with Zika virus disease (*8*). CDC urges health care providers to report cases of suspected sexual transmission of Zika virus to local and state health departments.

¶ http://www.cdc.gov/zika/prevention.
** http://www.cdc.gov/zika/hc-providers/diagnostic.html.

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BOX. Recommendations for prevention of sexual transmission of Zika virus for couples in which a man has traveled to or resides in an area with active Zika virus transmission

Couples in which a woman is pregnant

- Couples in which a woman is pregnant should use condoms consistently and correctly or abstain from sex for the duration of the pregnancy.

Other couples concerned about sexual transmission*

- Couples in which a man had confirmed Zika virus infection or clinical illness consistent with Zika virus disease should consider using condoms or abstaining from sex for at least 6 months after onset of illness.
- Couples in which a man traveled to an area with active Zika virus transmission but did not develop symptoms of Zika virus disease should consider using condoms or abstaining from sex for at least 8 weeks after departure from the area.
- Couples in which a man resides in an area with active Zika virus transmission but has not developed symptoms of Zika virus disease might consider using condoms or abstaining from sex while active transmission persists.

* Couples who do not desire pregnancy should use the most effective contraceptive methods that can be used correctly and consistently in addition to condoms, which also reduce the risk for sexually transmitted infections. Couples planning conception have a number of factors to consider, which are discussed in more detail in the following: Petersen EE, Polen KN, Meaney-Delman D, et al. Update: interim guidance for health care providers caring for women of reproductive age with possible Zika virus exposure—United States, 2016. MMWR Morb Mortal Wkly Rep 2016. Published online March 25, 2016.

[1]Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC; [2]Epidemic Intelligence Service and Influenza Division, National Center for Immunization and Respiratory Diseases, CDC; [3]Division of STD Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC; [4]Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; [5]Office of the Director, National Center for Immunization and Respiratory Disease, CDC.

Corresponding author: Alexandra M. Oster, AOster@cdc.gov, 404-639-6141.

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Update: Interim Guidelines for Health Care Providers Caring for Infants and Children with Possible Zika Virus Infection — United States, February 2016

Katherine E. Fleming-Dutra, MD[1]; Jennifer M. Nelson, MD[2,3]; Marc Fischer, MD[4]; J. Erin Staples, MD, PhD[4]; Mateusz P. Karwowski, MD[2,5]; Paul Mead, MD[4]; Julie Villanueva, PhD[6]; Christina M. Renquist, MPH[7]; Anna A. Minta, MD[2,8]; Denise J. Jamieson, MD[9]; Margaret A. Honein, PhD[7]; Cynthia A. Moore, MD, PhD[7]; Sonja A. Rasmussen, MD[10]

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CDC has updated its interim guidelines for U.S. health care providers caring for infants born to mothers who traveled to or resided in areas with Zika virus transmission during pregnancy and expanded guidelines to include infants and children with possible acute Zika virus disease (*1*). This update contains a new recommendation for routine care for infants born to mothers who traveled to or resided in areas with Zika virus transmission during pregnancy but did not receive Zika virus testing, when the infant has a normal head circumference, normal prenatal and postnatal ultrasounds (if performed), and normal physical examination. Acute Zika virus disease should be suspected in an infant or child aged <18 years who 1) traveled to or resided in an affected area within the past 2 weeks and 2) has ≥2 of the following manifestations: fever, rash, conjunctivitis, or arthralgia. Because maternal-infant transmission of Zika virus during delivery is possible, acute Zika virus disease should also be suspected in an infant during the first 2 weeks of life 1) whose mother traveled to or resided in an affected area within 2 weeks of delivery and 2) who has ≥2 of the following manifestations: fever, rash, conjunctivitis, or arthralgia. Evidence suggests that Zika virus illness in children is usually mild (*2*). As an arboviral disease, Zika virus disease is nationally notifiable. Health care providers should report suspected cases of Zika virus disease to their local, state, or territorial health departments to arrange testing and so that action can be taken to reduce the risk for local Zika virus transmission. As new information becomes available, these guidelines will be updated: http://www.cdc.gov/zika/.

Zika virus is primarily transmitted to humans through the bite of *Aedes* species mosquitoes, most commonly *Aedes aegypti* and possibly *Aedes albopictus* (*3*). Zika virus was first detected in the Region of the Americas (Americas) in Brazil in the spring of 2015 (*4*) and had spread to 26 countries and territories in the Americas as of February 17, 2016 (http://www.cdc.gov/zika/geo/active-countries.html). In October 2015, a marked increase in the number of infants with microcephaly was reported in Brazil (*5*). Because of the temporal and geographic occurrence of Zika virus infection in pregnant women before the reported increase in microcephaly, a possible association with prenatal Zika virus infection was postulated (*5*). Laboratory evidence from a limited number of cases with microcephaly has supported this potential association (*6,7*). Other documented modes of Zika virus transmission include intrapartum transmission from a mother with viremia to her infant, sexual transmission, and laboratory exposures (*8–11*). Additionally, blood transfusion (*10*) and organ or tissue transplantation pose theoretical risks for transmission. There is no reported evidence of transmission through breastfeeding, although Zika virus RNA has been found in breast milk (*9*).

Although the exact incubation period of Zika virus disease has yet to be determined, evidence from case reports and experience from related flavivirus infections indicate that the incubation period likely is 3 days to 2 weeks (*12*). Symptomatic disease is generally mild and characterized by two or more of the following: acute onset of fever, rash, arthralgia, or nonpurulent conjunctivitis (*2,13*). The rash associated with Zika virus disease has been described as pruritic (*13*) and maculopapular (*14*).

The spectrum of Zika virus disease in neonates infected in the perinatal period is unknown. Perinatal transmission of Zika virus infection to infants from mothers infected near the time of delivery has been reported in two cases; one of these infants was asymptomatic, and the other had thrombocytopenia and a diffuse rash (*9*). Mother-to-infant transmission of dengue virus, a related flavivirus, during the perinatal period has resulted in findings in the newborn ranging from no symptoms to severe illness (including fever, thrombocytopenia, and hemorrhage), most often with fever onset during the first week of life (*15*). Similarly West Nile virus, another mosquito-borne flavivirus, has been transmitted during the perinatal period from three mothers to their infants, with each infant having one of the following manifestations: rash, viral encephalitis, and viral meningitis (*16*). The clinical features that might be observed in infants who acquire Zika virus during the perinatal period are currently unknown.

Available evidence regarding the spectrum of Zika virus disease in infants and children who are infected through mosquito bites indicates that most children are asymptomatic or have mild illness, similar to the findings seen in adults infected with Zika virus disease. In the outbreak in Yap Island, Micronesia, in 2007, among persons with clinical illness (age range = 1–76 years), fever, macular or papular rash, arthralgia, and conjunctivitis were the most common signs and symptoms (*2*). In that outbreak, children aged 0–19 years had lower attack rates of confirmed and probable Zika virus disease than did adults aged 20–59 years (*2*). Additional published data are available for 10 children, aged 3–16 years (*17–22*) with Zika virus disease in Africa, Asia, South America, and the Pacific. All 10 children had fever, but none had rash, two had conjunctivitis, and three had arthralgia. Vomiting was reported in two children (*17,22*), and diarrhea was reported in two children (*22*). Among eight recent travel-related cases among children in the United States, all had rash and at least one other sign or symptom (fever, arthralgia, nonpurulent conjunctivitis) (CDC, unpublished data, 2016).

Deaths from Zika virus infection appear to be rare in persons of all ages. One death was reported in a female aged 15 years with sickle cell disease (hemoglobin SC), who experienced 4 days of fever, myalgia, abdominal pain and jaundice (*18*). A blood sample collected 5 days after illness onset was positive by reverse transcription–polymerase chain reaction (RT-PCR) for Zika virus RNA and negative for dengue, chikungunya, and yellow fever viruses (*18*). This patient died from complications of sickle cell disease after developing severe acute respiratory distress syndrome, hemothorax, and splenic sequestration (*18*). An additional death was reported in a female aged 16 years whose symptoms included headache, nausea, and petechiae; blood samples obtained 7 days after illness onset were positive by RT-PCR for Zika virus RNA (*23*). No further information was reported (*23*).

Guillain-Barré syndrome has been reported following Zika virus infection, although a causal link has not been established. Overall Guillain-Barré syndrome incidence appears to increase with increasing age (*24*). However, it is unclear how often Guillian-Barré syndrome after Zika virus infection has occurred in children (*10*). In French Polynesia, among 38 reported cases of Guillian-Barré syndrome after Zika virus infection, none occurred among children (*25*). One report from Brazil refers to six patients, aged 2–57 years, with neurologic syndromes (four with Guillain-Barré and two with acute disseminated encephalomyelitis) after laboratory-confirmed Zika virus infection; however, no further data were reported (*13*).

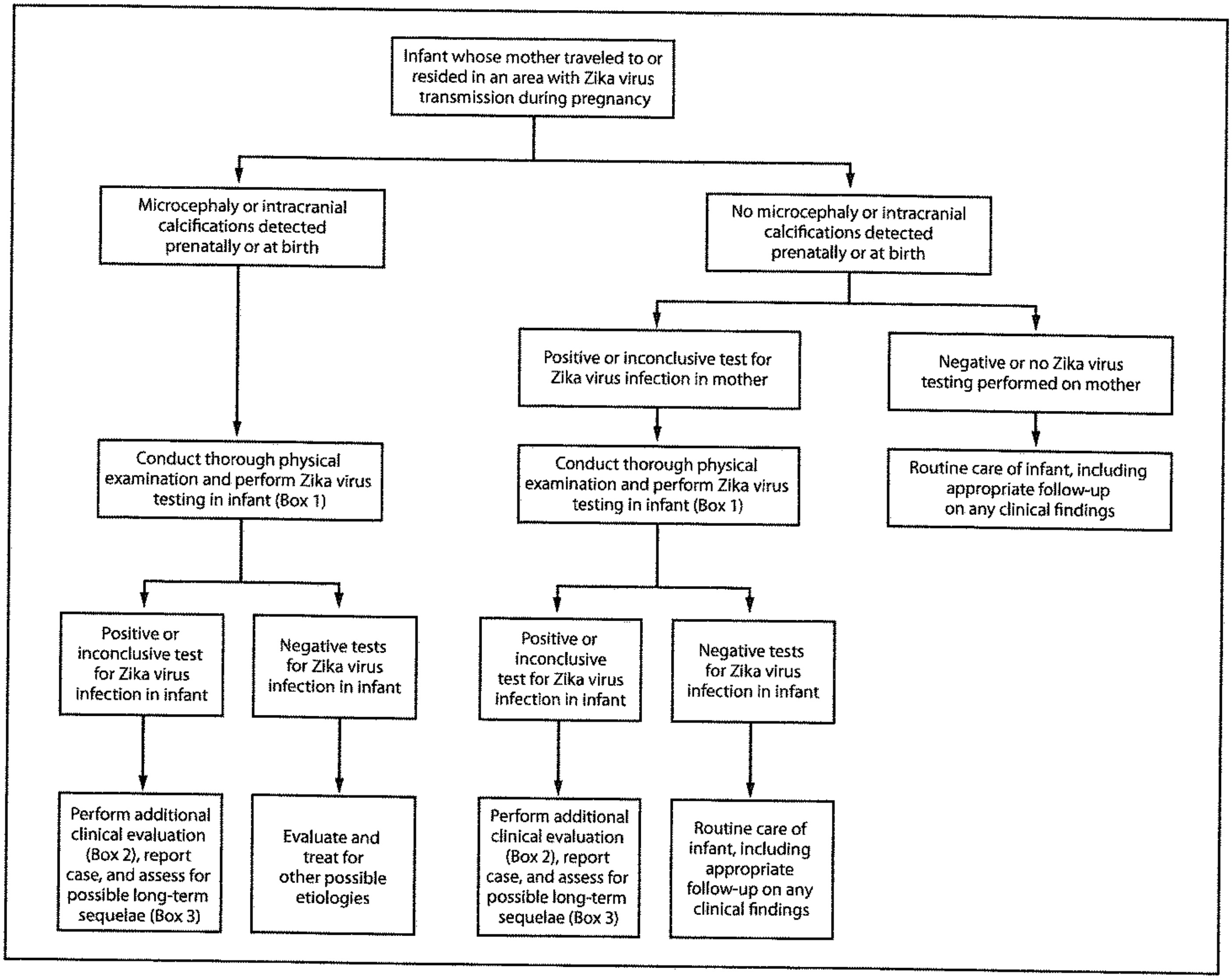
Updated Recommendations for the Evaluation and Testing of Infants with Possible Congenital Zika Virus Infection

Congenital infections result from intrauterine transmission from mother to fetus during pregnancy. Testing of infants with possible congenital Zika virus infection who were born to mothers who traveled to or resided in areas affected by Zika virus during pregnancy should be guided by 1) whether the infant had microcephaly or intracranial calcifications detected prenatally or at birth and 2) the mother's Zika virus testing results. The results of previous prenatal ultrasounds and maternal Zika virus testing should be reviewed, and a thorough newborn physical examination, with assessment of head (occipitofrontal) circumference, length, and weight, should be performed (*26,27*). The evaluation of infants with microcephaly or intracranial calcifications or infants whose mothers have positive or inconclusive test results for Zika virus infection remains the same as described in the recommendations released on January 26 (Figure) (Box 1,2,3) (*1*). Infants without microcephaly or intracranial calcifications whose mothers have negative Zika virus test results or who were not tested for Zika virus should receive routine care (Figure). Because information on the effects of congenital Zika virus infection is limited, health care providers should exercise clinical judgment in the assessment of newborns with abnormalities other than microcephaly or intracranial calcifications who were born to mothers who traveled to or resided in an area with active Zika virus transmission during pregnancy. For these infants, health care providers should consider testing the mother before testing the infant. These guidelines will be updated as additional information becomes available.

Guidelines for Evaluation and Management of Infants and Children Aged <18 Years with Possible Acute Zika Virus Disease

Acute Zika virus disease should be suspected in an infant or child aged <18 years who 1) traveled to or resided in an affected area within the past 2 weeks and 2) has two or more of the following manifestations: fever, rash, conjunctivitis, or arthralgia. Acute Zika virus disease should also be suspected in an infant in the first 2 weeks of life 1) whose mother traveled to or resided in an affected area within 2 weeks of delivery and 2) who has two or more of the following manifestations: fever, rash, conjunctivitis, or arthralgia. Arthralgia can be difficult to detect in infants and young children and can manifest as irritability, walking with a limp (for ambulatory children), difficulty moving or refusing to move an extremity, pain on palpation, or pain with active or passive movement of the affected joint. Infants and older children can acquire Zika virus through mosquito-borne transmission. Infants can also be infected perinatally if the mother became infected with Zika virus during travel to or residence in an area with Zika virus transmission within 2 weeks of delivery. Infants whose mothers reported illness consistent with Zika virus disease near the time of delivery should be monitored for signs and symptoms of Zika virus disease. If an infant shows signs and symptoms of acute Zika virus disease within the first 2 weeks of life, both the mother and infant should be tested for Zika virus infection. Persons might be exposed to Zika virus infection through sexual contact with a person who has traveled to or resided in an area affected by Zika virus (*11*).

FIGURE. Interim guidelines for the evaluation and testing of infants whose mothers traveled to or resided in an area with ongoing Zika virus transmission* during pregnancy†,§,¶



Adapted from: Staples, JE, Dziuban EJ, Fischer M, et al. Interim guidelines for the evaluation and testing of infants with possible congenital Zika virus infection—United States, 2016. MMWR Morb Mortal Wkly Rep 2016;65:63–7.

* Areas with Zika virus transmission are listed on the CDC website at http://wwwnc.cdc.gov/travel/page/zika-travel-information.

† Microcephaly defined as occipitofrontal circumference less than the third percentile for gestational age and sex based on standard growth curves *(26,27)*, not explained by other etiologies.

§ Laboratory evidence of Zika virus infection includes 1) detectable Zika virus, Zika virus RNA, or Zika virus antigen in any clinical specimen; or 2) positive Zika virus IgM with confirmatory neutralizing antibody titers that are ≥4-fold higher than dengue virus neutralizing antibody titers in serum or cerebrospinal fluid. Testing is considered inconclusive if Zika virus neutralizing antibody titers are <4-fold higher than dengue virus neutralizing antibody titers.

¶ For infants, perform reverse transcription–polymerase chain reaction (RT-PCR) testing for Zika virus RNA and Zika virus and dengue virus IgM and neutralizing antibodies on serum collected from the umbilical cord or directly from infant within 2 days of birth, if possible. If cerebrospinal fluid is obtained for other reasons, test for Zika virus RNA, Zika virus IgM and neutralizing antibodies, and dengue virus IgM and neutralizing antibodies. Consider histopathologic evaluation of the placenta and umbilical cord with Zika virus immunohistochemical staining on fixed tissue and Zika virus RT-PCR on fixed and frozen tissue. More information on laboratory testing for Zika virus infection is available at http://www.cdc.gov/zika/state-labs/index.html.

Evaluation of infants and children for acute (symptom onset within the past 7 days) Zika virus infection should include testing of serum and, if obtained for other reasons, cerebrospinal fluid (CSF) specimens for evidence of Zika virus RNA using RT-PCR. If Zika virus RNA is not detected and symptoms have been present for ≥4 days, serum may be tested for Zika virus immunoglobulin M (IgM) and neutralizing antibodies, and dengue virus IgM and neutralizing antibodies (Box 1). Laboratory evidence of Zika virus infection in an infant or child would include, in any clinical specimen, detectable Zika virus in culture, Zika virus RNA or antigen, or a clinical specimen positive for Zika virus IgM with confirmatory neutralizing antibody titers ≥4-fold higher than dengue virus neutralizing antibody titers (*1*). If Zika virus antibody titers are <4-fold higher than dengue virus neutralizing antibody titers, test results for Zika virus are

BOX 1. Recommended Zika virus laboratory testing for infants and children when indicated*,†,§

For possible congenital Zika virus infection

- Test infant serum for Zika virus RNA, Zika virus immunoglobulin M (IgM) and neutralizing antibodies, and dengue virus IgM and neutralizing antibodies. The initial sample should be collected either from the umbilical cord or directly from the infant within 2 days of birth, if possible.
- If cerebrospinal fluid is obtained for other studies, test for Zika virus RNA, Zika virus IgM and neutralizing antibodies, and dengue virus IgM and neutralizing antibodies.
- Consider histopathologic evaluation of the placenta and umbilical cord with Zika virus immunohistochemical staining on fixed tissue and Zika virus reverse transcription-polymerase chain reaction (RT-PCR) on fixed and frozen tissue.
- If not already performed during pregnancy, test mother's serum for Zika virus IgM and neutralizing antibodies, and dengue virus IgM and neutralizing antibodies.

For possible acute Zika virus disease

- If symptoms have been present for <7 days, test serum (and, if obtained for other reasons, cerebrospinal fluid) for Zika virus RNA by RT-PCR
- If Zika virus RNA is not detected and symptoms have been present for ≥4 days, test serum (and, if obtained for other reasons, cerebrospinal fluid) for Zika virus IgM and neutralizing antibodies, and dengue virus IgM and neutralizing antibodies

Adapted from: Staples, JE, Dziuban EJ, Fischer M, et al. Interim guidelines for the evaluation and testing of infants with possible congenital Zika virus infection—United States, 2016. MMWR Morb Mortal Wkly Rep 2016;65:63–7.

* Indications for testing for congenital infection include 1) an infant with microcephaly or intracranial calcifications born to a woman who traveled to or resided in an area with Zika virus transmission while she was pregnant, or 2) an infant born to a mother with a positive or inconclusive test result for Zika virus infection.

† Indications for testing during acute disease include: Infants and children aged <18 years who 1) traveled to or resided in an affected area within the past 2 weeks and 2) have ≥2 of the following manifestations: fever, rash, conjunctivitis, or arthralgia. Infants in the first 2 weeks of life 1) whose mothers have traveled to or resided in an affected area within 2 weeks of delivery and 2) have ≥2 of the following manifestations: fever, rash, conjunctivitis, or arthralgia.

§ More information on laboratory testing for Zika virus infection is available at http://www.cdc.gov/zika/state-labs/index.html.

BOX 2. Recommended clinical evaluation and laboratory testing for infants with possible congenital Zika virus infection

For all infants with possible congenital Zika virus infection, perform the following:

- Comprehensive physical examination, including careful measurement of occipitofrontal circumference, length, weight, and assessment of gestational age.
- Evaluation for neurologic abnormalities, dysmorphic features, splenomegaly, hepatomegaly, and rash or other skin lesions. Full body photographs and photographic documentation of any rash, skin lesions, or dysmorphic features should be performed. If an abnormality is noted, consultation with an appropriate specialist is recommended.
- Cranial ultrasound, unless prenatal ultrasound results from third trimester demonstrated no abnormalities of the brain.
- Evaluation of hearing by evoked otoacoustic emissions testing or auditory brainstem response testing, either before discharge from the hospital or within 1 month after birth. Infants with abnormal initial hearing screens should be referred to an audiologist for further evaluation.
- Ophthalmologic evaluation, including examination of the retina, either before discharge from the hospital or within 1 month after birth. Infants with abnormal initial eye evaluation should be referred to a pediatric ophthalmologist for further evaluation.
- Other evaluations specific to the infant's clinical presentation.

For infants with microcephaly or intracranial calcifications, additional evaluation includes the following:

- Consultation with a clinical geneticist or dysmorphologist.
- Consultation with a pediatric neurologist to determine appropriate brain imaging and additional evaluation (e.g., ultrasound, computerized tomography scan, magnetic resonance imaging, and electroencephalogram).
- Testing for other congenital infections such as syphilis, toxoplasmosis, rubella, cytomegalovirus infection, lymphocytic choriomeningitis virus infection, and herpes simplex virus infections. Consider consulting a pediatric infectious disease specialist.
- Complete blood count with platelet count and liver function and enzyme tests, including alanine aminotransferase, aspartate aminotransferase, and bilirubin.
- Consideration of genetic and other teratogenic causes based on additional congenital anomalies that are identified through clinical examination and imaging studies.

Adapted from: Staples, JE, Dziuban EJ, Fischer M, et al. Interim guidelines for the evaluation and testing of infants with possible congenital Zika virus infection—United States, 2016. MMWR Morb Mortal Wkly Rep 2016;65:63–7.

BOX 3. Recommended long-term follow-up for infants with possible congenital Zika virus infection

For all infants with possible congenital Zika virus infection, recommended long-term follow-up:

- Report case to state, territorial, or local health department and monitor for additional guidance as it is released.
- Consider conducting additional hearing screen at age 6 months. Refer any child with developmental delay for an audiologic evaluation. Ensure that appropriate follow-up of abnormal newborn hearing screening has occurred.
- Carefully evaluate occipitofrontal circumference and developmental characteristics and milestones throughout the first year of life, in consultation with appropriate medical specialists (e.g., pediatric neurology, developmental and behavioral pediatrics, physical and speech therapy).

Adapted from: Staples, JE, Dziuban EJ, Fischer M, et al. Interim guidelines for the evaluation and testing of infants with possible congenital Zika virus infection—United States, 2016. MMWR Morb Mortal Wkly Rep 2016;65:63–7.

considered inconclusive (*1*). More information on laboratory testing can be found at http://www.cdc.gov/zika/state-labs/index.html. Health care providers should notify their local, state or territorial health department of suspected Zika cases to arrange testing and so that action can be taken to decrease the risk for local transmission in areas with *Aedes* species mosquitoes.

Illness associated with Zika virus is usually mild in children, and treatment of Zika virus infection involves supportive care. Nonsteroidal anti-inflammatory drugs (NSAIDs) should be avoided until dengue virus is ruled out as the cause of illness, because of the potential for hemorrhagic complications of dengue fever, and should be avoided in all children aged <6 months (*28,29*). Aspirin should not be used in children with acute viral illnesses because of its association with Reye's syndrome (*30*). The decision to obtain additional laboratory tests, diagnostic studies, and infectious disease consultation should be based on clinical judgment as guided by findings from a complete history and physical examination. Information on long-term outcomes among infants and children with acute Zika virus disease is limited (*10*); until more evidence is available to inform recommendations, routine pediatric care is advised for these infants and children.

Guidelines for Breastfeeding for Mothers with Zika Virus Infection

Zika virus RNA has been identified in breast milk, but attempts to culture the virus have been unsuccessful (*9*). No cases of Zika virus infection associated with breastfeeding have been reported. CDC encourages mothers with Zika virus infection and living in areas with ongoing Zika virus transmission to breastfeed their infants. Current evidence suggests that the benefits of breastfeeding outweigh the theoretical risks of Zika virus transmission through breast milk.

Prevention of Zika Virus Infection in Infants and Children

Prevention of mosquito bites is the primary means of preventing Zika virus infection in persosns of all ages traveling to or residing in areas with local Zika virus transmission. Mosquito bite prevention includes using air conditioning or window and door screens when indoors, wearing long-sleeved shirts and long pants, using permethrin-treated clothing and gear, and using insect repellents. When used as directed on the product label, most Environmental Protection Agency–registered insect repellents can be used to protect children aged ≥2 months against mosquito bites. Oil of lemon eucalyptus should not be used in children aged <3 years (http://wwwnc.cdc.gov/travel/yellowbook/2016/the-pre-travel-consultation/protection-against-mosquitoes-ticks-other-arthropods). Mosquito netting can be used to cover infants in carriers, strollers, or cribs to protect them from mosquito bites. Information on the safe use of insect repellents in children is available at http://www.epa.gov/insect-repellents/using-insect-repellents-safely-and-effectively.

Persons with Zika virus infection should take steps to prevent mosquito bites for at least the first week of illness to decrease the risk for human-to-mosquito-to-human transmission. Health care providers should educate parents and caregivers about mosquito bite prevention in infants and children if they are traveling to or residing in areas affected by Zika virus; mosquitoes also carry other viruses in addition to Zika. More information about prevention of Zika virus infection can be found at http://www.cdc.gov/zika/prevention/index.html.

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[1]Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [2]Epidemic Intelligence Service, CDC; [3]Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease and Health Promotion, CDC; [4]Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC;[5]Division of Environmental Hazards and Health Effects, National Center for Environment Health, CDC; [6]Division of Preparedness and Emerging Infections, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [7]Division of Congenital and Developmental Disorders, National Center on Birth Defects and Developmental Disabilities, CDC; [8]Division of Parasitic Diseases and Malaria, Center for Global Health, CDC; [9]Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; [10]Division of Public Health Information Dissemination, Center for Surveillance, Epidemiology, and Laboratory Services, CDC

Corresponding Author: Katherine E. Fleming-Dutra, eocbirthdef@cdc.gov.

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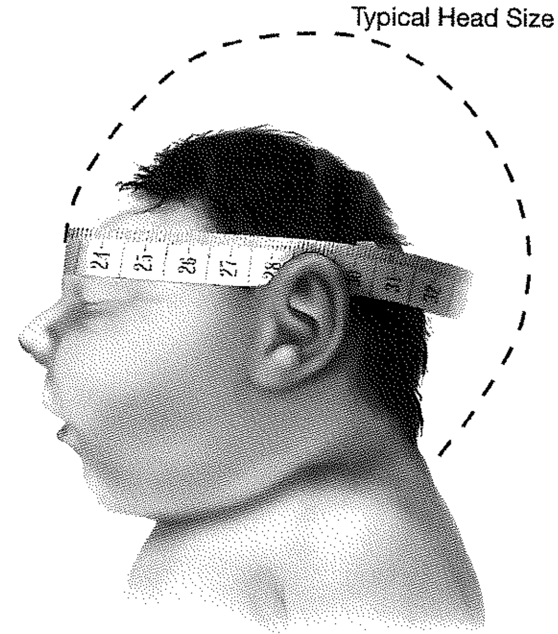
CDC's Response to **Zika**

MEASURING HEAD CIRCUMFERENCE

Baby with Typical Head Size

Baby with Microcephaly



Baby with Severe Microcephaly

- Use a measuring tape that cannot be stretched
- Securely wrap the tape around the widest possible circumference of the head
  - Broadest part of the forehead above eyebrow
  - Above the ears
  - Most prominent part of the back of the head
- Take the measurement three times and select the largest measurement to the nearest 0.1 cm
- Optimal measurement at 24-36 hours after birth when molding of the head has subsided

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

For more information: www.cdc.gov/zika

Sick with CHIKUNGUNYA, DENGUE, or ZIKA?

Protect yourself and others from mosquito bites during the first week of illness.

Protect family and friends

- During the first week of illness, chikungunya, dengue, or Zika virus can be found in the blood.
- A mosquito that bites you can become infected.
- An infected mosquito can bite a family member or neighbor and make them sick.

Watch for these symptoms

See your doctor if you develop a fever with any of the following symptoms:

- Muscle or joint pain
- Headache, especially with pain behind the eyes
- Rash
- Conjunctivitis (red eyes)

Protect yourself from mosquito bites

- Wear long-sleeved shirts and long pants.
- Use door and window screens to keep mosquitoes outside.
- Use insect repellent.

For more information:

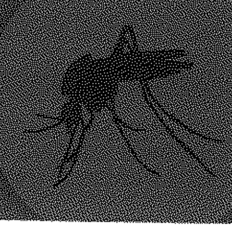
www.cdc.gov/chikungunya
www.cdc.gov/dengue
www.cdc.gov/zika

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

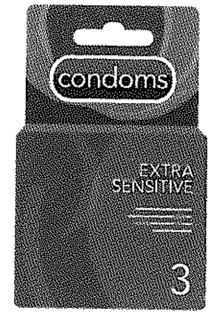
CS262037-A

CDC's Response to **Zika**

Zika and Sex: Information for Pregnant Women Living in Areas with Zika



What we know



- Zika virus can be spread by a man with Zika to his sex partners.
- In known cases of sexual transmission, the men had Zika symptoms. From these cases, we know the virus can be spread when the man has symptoms, before symptoms start and after symptoms end.
- The virus stays in semen longer than in blood.

What we don't know

- How long Zika virus can stay in the semen of infected men or spread though sex.
- If men infected with Zika who never develop symptoms can have Zika virus in their semen or spread Zika through sex.
- If a woman can spread Zika virus to her sex partners.

What you should know about Zika and sex

Because of the link between Zika and birth defects,
take steps to prevent infection during your pregnancy.

If you have vaginal, anal, or oral sex (mouth-to-penis), use a condom from start to finish, every time you have sex during the pregnancy.

OR

Don't have sex during your pregnancy.

If you think your male partner may have or had Zika, tell your doctor or healthcare provider

- If he has taken steps to prevent mosquito bites.
- If you had sex without a condom.

www.cdc.gov/zika

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

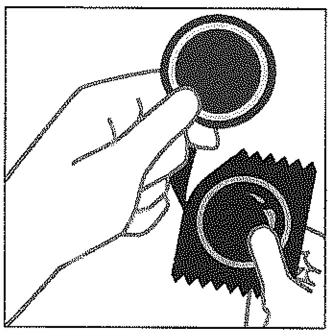
CS263974-A
March 31, 2016

The Right Way To Use A Male Condom

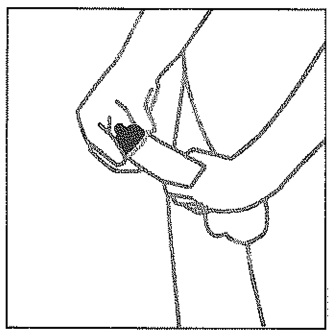
Condom Dos and Don'ts

- **DO** use a condom every time you have sex.
- **DO** put on a condom before having sex.
- **DO** read the package and check the expiration date.
- **DO** make sure there are no tears or defects.
- **DO** store condoms in a cool, dry place.
- **DO** use latex or polyurethane condoms.
- **DO** use water or silicone-based lubricant to prevent breakage.
- **DO** remember that condoms come in many sizes and thicknesses, so find a brand that works best for you and your partner.
- **DON'T** store condoms in a car or keep them in your wallet.
- **DON'T** use nonoxynol-9 (a spermicide), as this can cause irritation.
- **DON'T** use oil-based products like baby oil, lotion, petroleum jelly, or cooking oil because they will cause the condom to break.
- **DON'T** use more than one condom at a time.
- **DON'T** reuse a condom.
- **DON'T** flush condoms as they may clog the toilet.

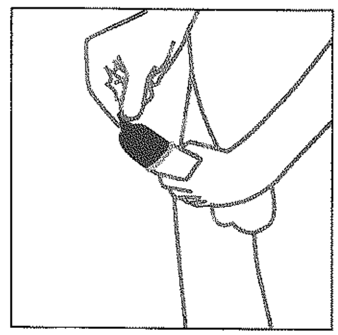
How To Put On and Take Off a Male Condom



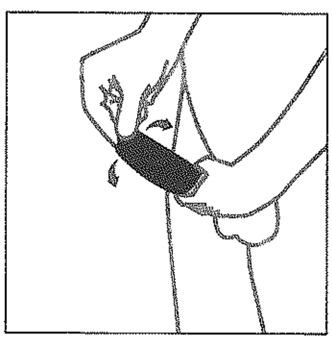
Carefully open and remove condom from wrapper.



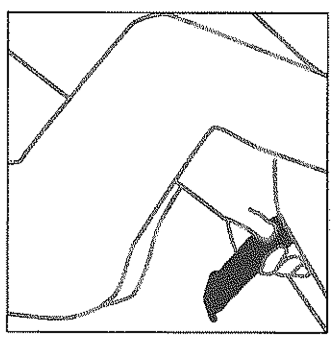
Place condom on the head of the erect, hard penis. If uncircumcised, pull back the foreskin first.



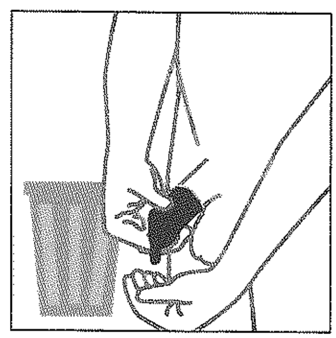
Pinch air out of the tip of the condom.



Unroll condom all the way down the penis.



After sex but before pulling out, hold the condom at the base and withdraw the penis.



Carefully remove the condom and throw it in the trash.

For more information please visit
www.cdc.gov/condomeffectiveness

CDC

What can YOU do to win this battle.

Because the *Aedes albopictus* can easily and rapidly increase its population, we need YOUR help! Together, as a team, Nassau County and you can combat the growth of mosquitoes, which can have serious and dangerous implications for your health and well-being. It is important that we take measures to eliminate these breeding grounds and stop the cycle BEFORE it begins.

Here are some steps YOU can take to eliminate mosquitoes:

- ☑ Eliminate standing water from containers such as flowerpot saucers, watering cans, buckets, old tires, recycling bins, and gutters.
- ☑ Store children's toys indoors or in a manner that prevents water accumulation.
  Note: some toys have inner compartments that can hold water.
- ☑ Change the water and clean bird baths.
- ☑ Empty water that collects in folds of tarps used to cover woodpiles, boats, pools, lawn furniture, etc.
- ☑ Clear leaves and debris to allow water to flow freely from drainage ditches and roof gutters.
- ☑ Filter ornamental ponds using a circulation pump or stock the pond with fish.
- ☑ Drain or fill-in puddles and areas of your yard that remain wet and soggy for more than a week.
- ☑ Maintain lawns groomed to prevent overgrowth.

Protect Yourself

- ☑ Wear shoes and socks, long pants and a long-sleeved shirt when outdoors for long periods of time, or when mosquitoes are more active.
- ☑ Check window and door screens and repair as needed to ensure that mosquitoes cannot enter.

For travel advisory and more information on Zika Virus and the *Aedes albopictus* at the Centers for Disease Control and Prevention website: www. cdc.gov

For complaints concerning mosquitoes or standing water, contact the

Nassau County Department of Public Works at 516.571.6900

For questions regarding mosquito surveillance, contact the

Nassau County Department of Health at 516.227.9698

NASSAU COUNTY EXECUTIVE

ED MANGANO

WWW.NASSAUCOUNTYNY.GOV

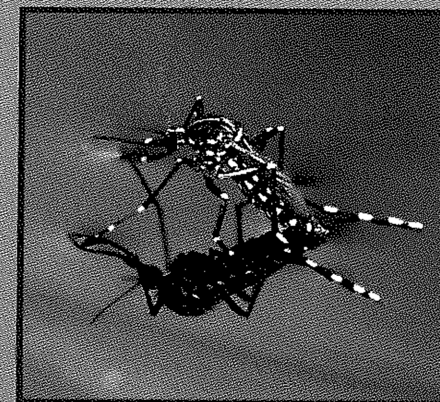
Follow Ed Mangano on Facebook, Twitter and www.nassaucountyny.gov or download the NassauNow App for iiPhone and Android

April 2016

PROTECT YOURSELF

from

ZIKA VIRUS



Aedes albopictus

Zika virus is a disease that is spread to people primarily through the bite of an infected Aedes mosquito. The *Aedes albopictus* is a species, known as the Asian Tiger Mosquito, that can transmit the Zika Virus.

NASSAU COUNTY
MOSQUITO CONTROL PROGRAM

NASSAU COUNTY EXECUTIVE

ED MANGANO

WWW.NASSAUCOUNTYNY.GOV

What is Zika Virus?

Zika virus is a disease that is spread to people primarily through the bite of an infected *Aedes* species mosquito. The most common symptoms of Zika are fever, rash, joint pain, and conjunctivitis (red eyes).

The illness is usually mild with symptoms lasting for several days to a week. People usually don't get sick enough to go to the hospital, and they rarely die of Zika.

Zika virus has been linked to a serious birth defect of the brain called microcephaly in babies of mothers who had the virus while pregnant.

Learning about the virus and ways to prevent infection is important. Steps you take can help protect you from other mosquito-borne diseases too.

What to do if you are pregnant or couples planning pregnancy.

Pregnant women and couples planning to get pregnant can protect themselves and their unborn children from Zika virus by taking the following precautions:

- Consider postponing travel to the areas where Zika virus transmission is ongoing.
- Consult with your doctor or other health care provider and strictly follow steps to avoid mosquito bites if you plan to travel to these areas.
- Pregnant women should discuss their male partner's potential exposures to mosquitoes and history of Zika-like illness.

How does Zika virus spread?

Zika virus can be spread from a pregnant woman to her fetus and has been linked to a serious birth defect of the brain called microcephaly in babies of mothers who had Zika virus while pregnant.

Zika virus can be spread by a man to his sex partners. The virus is present in semen longer than in blood.

While sexual transmission of Zika virus is possible, it is spread to people primarily through the bite of an infected Aedes species mosquito.

The mosquitoes typically lay eggs in and near standing water in things like buckets, animal dishes, flower pots, gutters and old tires. They are aggressive daytime biters, prefer to bite people, and live indoors and outdoors near people. Mosquitoes become infected when they feed on a person already infected with the virus. Infected mosquitoes can then spread the virus to other people through bites.

Important Facts on the Asian Tiger Mosquito

Scientific Name: *Aedes albopictus*
Appearance: Black with striking white markings on the body.

Characteristics: Aggressive, quick biter; not easy to swat.

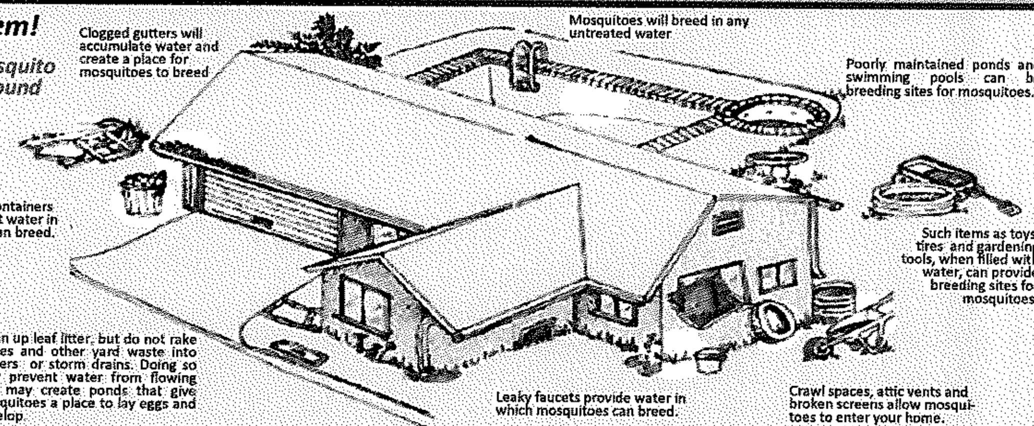
The Asian Tiger Mosquito is a day-time biter, unlike other mosquito species that usually come out in the evening,

Favorite Meal: Human blood needed for the female to lay her eggs.

Peak feeding times: daytime biter, with peak feeding activity at dawn and dusk.

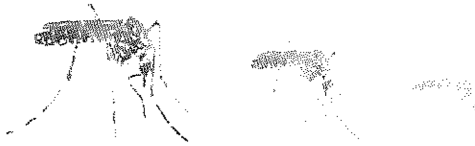
Eliminate them!

(by removing mosquito breeding sites around your home!)



Help Control Mosquitoes that Spread Dengue, Chikungunya, and Zika Viruses

Bzzzz.



Aside from being itchy and annoying, the bite of an infected female mosquito (*Aedes aegypti or Aedes albopictus*) can spread dengue, chikungunya, or Zika viruses. People become infected with dengue, chikungunya, or Zika after being bitten by an infected mosquito.

- Female mosquitoes lay several hundred eggs on the walls of water-filled containers. Eggs stick to containers like glue and remain attached until they are scrubbed off. When water covers the eggs, they hatch and become adults in about a week.
- Adult mosquitoes live inside and outside.
- They prefer to bite during the day.
- A few infected mosquitoes can produce large outbreaks in a community and put your family at risk of becoming sick.

Protect Yourself, Your Family, and Community from Mosquitoes

1. Eliminate standing water in and around your home:

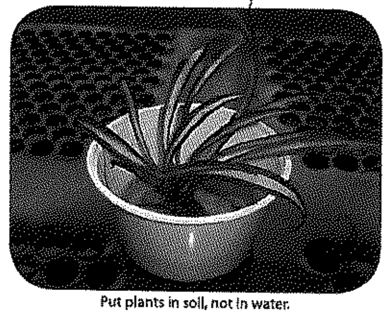
- **Once a week**, empty and scrub, turn over, cover, or throw out items that hold water, such as tires, buckets, planters, toys, pools, birdbaths, flowerpots, or trash containers. Check inside and outside your home.
- Tightly cover water storage containers (buckets, cisterns, rain barrels) so that mosquitoes cannot get inside to lay eggs.
- For containers without lids, use wire mesh with holes smaller than an adult mosquito.

2. If you have a septic tank, follow these steps:

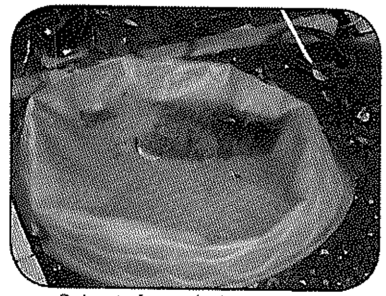
- Repair cracks or gaps.
- Cover open vent or plumbing pipes. Use wire mesh with holes smaller than an adult mosquito.

3. Keep mosquitoes out of your home:

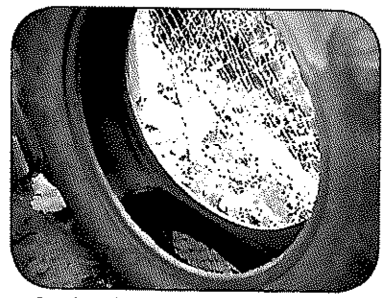
- Use screens on windows and doors.
- Repair holes in screens.
- Use air conditioning when available.



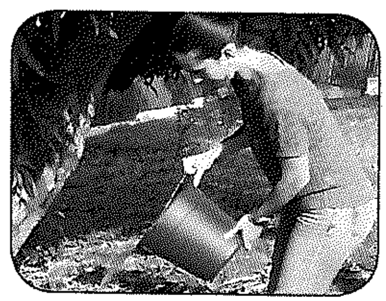
Put plants in soil, not in water.



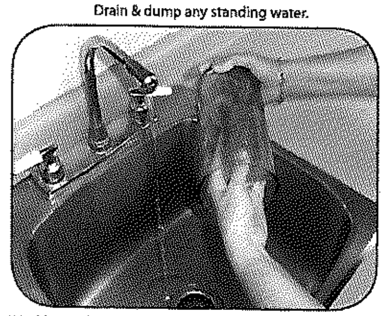
Drain water from pools when not in use.



Recycle used tires or keep them protected from rain.



Drain & dump any standing water.



Weekly, scrub vases & containers to remove mosquito eggs.

4. Prevent mosquito bites:

- Use an Environmental Protection Agency (EPA)-registered insect repellent with one of the following active ingredients. All EPA-registered insect repellents are evaluated to make sure they are safe and effective.

Active ingredient Higher percentages of active ingredient provide longer protection	**Some brand name examples***
DEET	Off!, Cutter, Sawyer, Ultrathon
Picaridin, also known as **KBR 3023, Bayrepel**, and **icaridin**	Cutter Advanced, Skin So Soft Bug Guard Plus, Autan (outside the United States)
IR3535	Skin So Soft Bug Guard Plus Expedition, SkinSmart
Oil of lemon eucalyptus (OLE) or **para-menthane-diol** (PMD)	Repel

* Insect repellent brand names are provided for your information only. The Centers for Disease Control and Prevention and the U.S. Department of Health and Human Services cannot recommend or endorse any name brand products.

  - Always follow the product label instructions.
  - Reapply insect repellent every few hours, depending on which product and strength you choose.
  - Do not spray repellent on the skin under clothing.
  - If you are also using sunscreen, apply sunscreen first and insect repellent second.
- Treat clothing and gear (such as boots, pants, socks, and tents) with permethrin or purchase permethrin-treated clothing and gear.
  - Treated clothing remains protective after multiple washings. See product information to find out how long the protection will last.
  - If treating items yourself, follow the product instructions carefully.
  - Do **not** use permethrin products, intended to treat clothing, directly on skin.
- Wear long-sleeved shirts and long pants.

Keep rain barrels covered tightly.

Weekly, empty standing water from fountains and bird baths.

Keep septic tanks sealed.

Install or repair window & door screens.

For more information, visit:
www.cdc.gov/dengue, www.cdc.gov/chikungunya, www.cdc.gov/zika

CHART 1

Total Number of Pools Collected and Virus Testing Results

	Pools Submitted	Positive for WNV	Positive for EEE	Positive for Other Arbovirus
2012	833	81	0	5*
2013	666	40	0	0
2014	855	107	0	0
2015	614	61	0	0

* FLAV, flanders virus

Number of Ae. Albopictus Pools Collected and Virus Testing Results

	Pools Submitted	Positive for WNV	Positive for EEE	Positive for Other Arbovirus
2012	180	7	0	1*
2013	95	0	0	0
2014	58	1	0	0
2015	35	1	0	0

* FLAV, flanders virus

CHART 2

Nassau County Mosquito Surveillance Data - Aedes albopictus summary

2011 - 2015, Five year Aedes albopictus "hotspots" (sites with A. albopictus numbers greater than 5 % of years total)

West Hempstead - SWB 66; 2011, 2012, 2013, 2014, 2015

Roosevelt - SWB 471; 2011, 2013, 2014, 2015

Massapequa Park - SWB 300; 2011, 2012, 2013, 2015

Bethpage - SWB 412; 2012, 2013,2014

Valley Stream - SWB 199; 2011, 2015

Westbury - SWB 315; 2012, 2014

Farmingdale - SWB 86; 2011

Hicksville - SWB 234; 2012

Wantagh - SWB 173; 2013

Massapequa - Massapequa Preserve; 2015

CHART 3

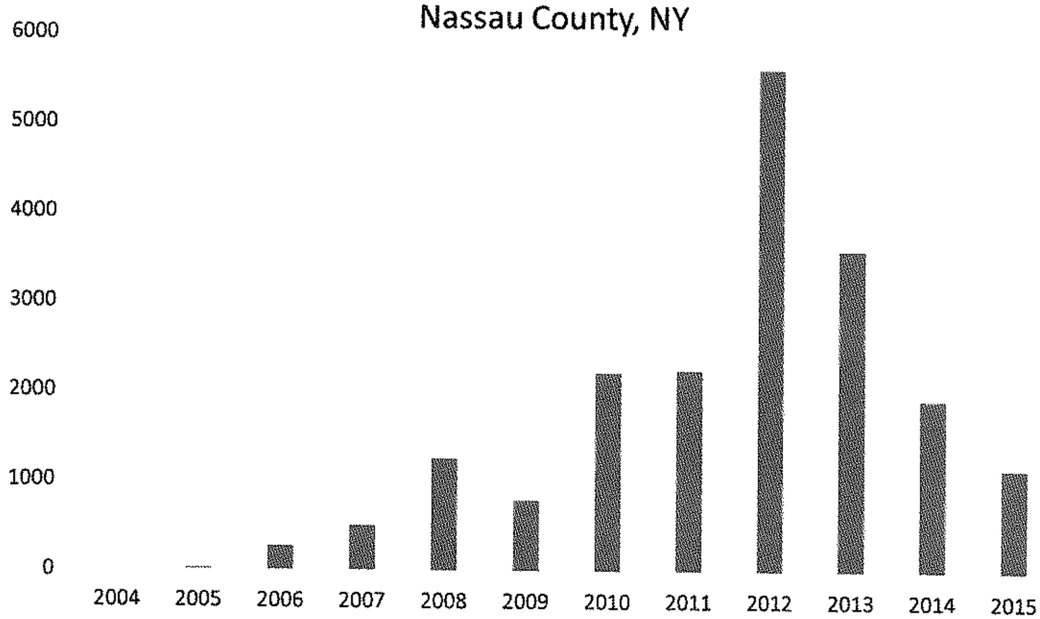
Aedes albopictus - Nassau County, NY

Year	Number Trapped	Percent of all Mosquitos Trapped
2004	0	0
2005	21	0.1
2006	272	1.2
2007	505	2.4
2008	1257	6.6
2009	796	3.5
2010	2221	7.75
2011	2253	6.59
2012	5620	14.12
2013	3599	9.22
2014	1925	2.51
2015	1157	3.48

4.79 Yearly Average

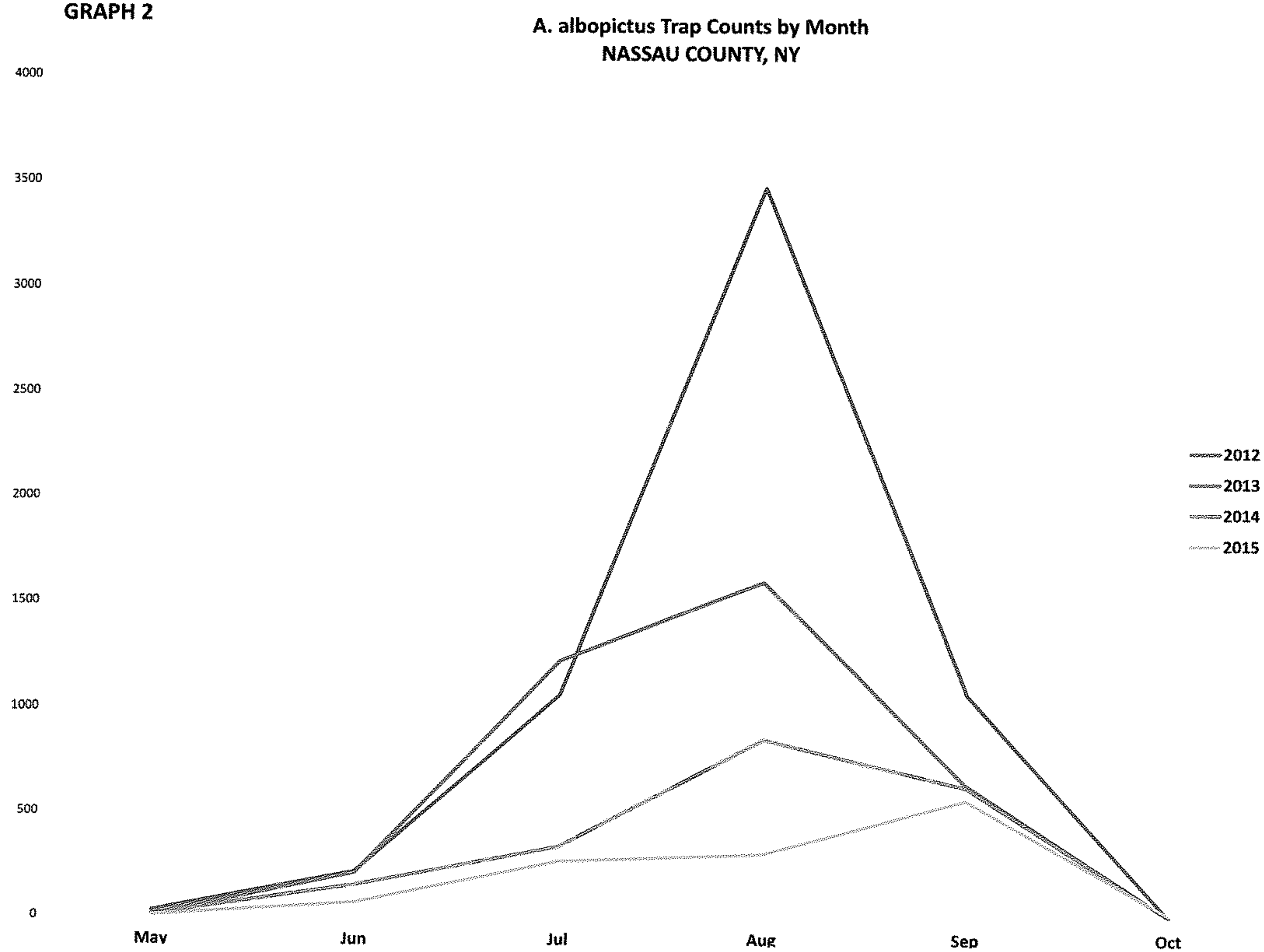
7.28 Average 2010-2015

GRAPH 1 Aedes albopictus Number Trapped
Nassau County, NY



BG-Sentinel Traps have been used consistently since 2010.

GRAPH 2


A. albopictus Trap Counts by Month
NASSAU COUNTY, NY
4000
3500
3000
2500
2000
1500
1000
500
0
May
Jun
Jul
Aug
Sep
Oct
2012
2013
2014
2015

Nassau County - Mosquito Control Decision Matrix

Early Season (prior to July 15)	Mid Season (July 15 - Sept 15)	Late Season (after September 15)
Single elevated trap site (aedes sp. >50, culex / other sp. > 100)		
Increase larval surveillance Increase larval control Consider aerial larvicide for *O. sollicitans*	Increase larval surveillance Increase larval control Consider ground based adult control Conduct aerial larvicide for *O. sollicitans*	Increase larval surveillance Consider ground based adult control of targeted species if weather pattern favors continued activity
Persistent elevated trap site or multiple elevated trap sites (aedes sp. >50, culex / other sp. > 100)		
above actions plus... Consider ground based adult control Conduct aerial larvicide for *O. sollicitans*	*above actions plus...* Conduct ground based adult control Consider aerial control of adult mosquitoes	*above actions plus...* Conduct ground based adult control of targeted species if weather pattern favors continued activity
West Nile virus detection - single trap site		
Increase larval surveillance Increase larval control	Increase larval surveillance Increase larval control Consider ground based adult control	Increase larval surveillance Consider ground based adult control of targeted species if weather pattern favors continued activity
West Nile virus detection -persistent or multiple trap sites		
above actions plus... Consider ground based adult control	*above actions plus...* Conduct ground based adult control Consider aerial control of adult mosquitoes	*above actions plus...* Conduct ground based adult control of targeted species if weather pattern favors continued activity
note : detection of EEE, other non-endemic virus' or other extraordinary circumstances may require additional control activity		

Arboviruses transmitted by Aedes albopictus

Zika, Dengue, Chikungunya or Yellow Fever virus detection
Single confirmed locally acquired case or positive mosquito pool

Perform larval surveillance and control, eliminate larval habitats up to 200 yards around detection site
Conduct community education aimed at preventing or minimizing contact between vectors and residents (source reduction, disposing/emptying water holding containers).
Conduct ground based adult mosquito control up to 200 yards around detection site.
Initate/maintain adult mosquito surveillance at detection site to estimate mosquito abundance and evaluate control efforts.

Zika, Dengue, Chikungunya or Yellow Fever virus detection
Outbreak; clusters of confirmed locally aquired human cases or multiple positive mosquito pools

Conduct community education and outreach aimed at preventing or minimizing contact between vectors and residents (source reduction, disposing/emptying water holding containers).
Divide the outbreak area into operational management areas where adult control measures can be applied within a few days and repeated as needed to reduce mosquito density.
Increase adult mosquito surveillance within operational management areas to estimate mosquito abundance and evaluate control efforts.

NASSAU COUNTY
NYS Certified Pesticide Applicators

NAME	Applicator ID	Categories	Expiration Date	Titles
Anthony Falco	C1830984	3A, 5B, 6A, 8	1/21/2017	Mosquito Control Supervisor
Tom Annos	T1872456	8	9/21/2017	Assistant to the Superintendent
Mike Asselta	T1872455	8	9/21/2017	Equipment Operator III
Damian Cardalena	T1872489	8	9/21/2017	HWY Maintenance Supervisor
Henry Blank	C1831947	8 5B	4/21/2017	Mosquito Control Inspector I
Rich Carbone	T1872484	8	9/21/2017	HWY Maintenance Supervisor
Edward Goss	C1831946	8 5B	3/21/2017	Mosquito Control Inspector I
Carole Marano	C1872490	8	9/21/2017	*(Prov) Mosquito Control Inspector I*
John Mangual	T1884475	8	9/21/2017	HWY Maintenance Supervisor
Rob Peek III	C1872484	8	9/21/2017	Equipment Operator III
Harry Vanager	C1831962	8 5B	11/21/2017	Mosquito Control Inspector I
Business REG #	**OO285**		**10/31/2017**	

MOSQUITO CONTROL
NASSAU COUNTY, NY

SPRAYERS/FOGGERS

Name	Model	In Use	Information
Guardian ulv	55 ES	8	*Truck Mounted Adult Control Low Volume for county wide adulticiding*
Maruyama Backpack Sprayer	MM 300 Liquid & Granule Applications *Gas Powered*	7	*Used for larviciding in large hard to reach areas.*
Pioneer Eco- Backpack Sprayer	Electric/Battery	3	*Used for localized barrier control, larviciding application and Adulticiding small areas. SWB's Yards etc.*
North Fork Helicopter	Contracted For Nassau County		Used for large tracks of land either to Larvicide or Adulticide when needed

NASSAU COUNTY DEPARTMENT OF HEALTH
ZIKA RAPID RESPONSE TEAM
HOME VISIT INFORMATION

ADDRESS:

CONTACT NAME: **Phone #:** **AGE (18+ yrs - Y/N):**

PROPERTY OWNER NAME:

PERMISSION TO ENTER PROPERTY

I hereby grant permission for representatives of the County of Nassau and/or New York State to enter the property at the above address to identify potential mosquito breeding habitats and conduct appropriate control measures.

Verbal Permission was Granted (Y or N)

Agency Official's Signature **Print Name** **Date**

MOSQUITO HABITAT SURVEY

LOCATION OR ITEM	STANDING WATER/BREEDING (Y/N)	ACTION TAKEN

Completed by: **Signature** **Phone:**

ZRRT Questions	Yes	No	Unk
Since 1/1/2015, did you travel to an area with active Zika virus transmission?			
Since 1/1/2015, did you have sexual contact without barrier with a man who traveled to/from these areas after his return?			
During or within 4 weeks of this travel or sexual contact did you have a fever, rash, joint pain or conjunctivitis?			
During or within 4 weeks of travel or sexual contact did you have paralysis in your legs that spread to the upper body?			
Are you or is your sexual contact pregnant?			
Did you travel to an area with active Zika activity at any point during your (or your partners) pregnancy? (omit if not preg.)			
If you are/were pregnant, did a prenatal ultrasound show any other abnormality? (omit if not preg.)			
If yes, what was the abnormality? (omit if not preg.)			
Was your baby diagnosed after birth with a small brain/head (microcephaly) or another abnormality? (omit if not preg.)			
Since your return from travel have you donated blood, blood products (plasma, platelets), sperm, or tissue/organs?			
Since your return from travel have you received any blood, blood product (plasma, platelets), sperm, or tissue/organ?			
Have you ever lived in or frequently visited countries with Zika transmission?			
Do you have a healthcare provider who can order/prescription for Zika virus testing if indicated?			
Do you or did anyone in your household attend any outdoor activities in the last 4 weeks, BBQ's, parties, fairs etc?			
If yes, where was the outdoor activity?			
If the outdoor activity was in the surrounding area, can you give me the address and or contact information.			
Did you or anyone in your household sustain any mosquito bites within the past 4 weeks?			
Where were the mosquito bites sustained (address)?			
Is anyone in the household pregnant?			
Does anyone else in the household have any symptoms of fever, rash, joint pain or conjunctivitis?			
What is the name of pregnant individual that resides in the household?			
During or within 4 weeks of this outdoor activity did you have a fever, rash, joint pain or conjunctivitis?			
During or within 4 weeks of this outdoor activity did any household member have a fever, rash, joint pain or conjunctivitis?			
During or within 4 weeks of this outdoor activity did you have any body weakness or paralysis?			
During or within 4 weeks of this outdoor activity did any household member have any body weakness or paralysis?			
Are you aware of any individual in the surrounding area with fever, rash, joint pain or conjunctivitis?			
If yes, can you give me the address or contact information?			
Provide Individual with Educational Packet and Department of Health Contact Information. Advise the resident to call the Department of Health if any symptoms develop and review prevention strategies.			

Completed by (print name): Phone:

Signature:

APPENDIX F

OFFICIAL TRANSCRIPT AND WRITTEN COMMENTS

In the Matter of:

NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS

MEETING OF

February 16, 2017

EXCEL

REPORTING, INC.

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info@excelcourtreporters.com
www.excelcourtreporters.com

PUBLIC HEARING

of the

NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS

RE: Draft Generic Environmental Impact Statement

Nassau County Mosquito Control Program

February 16, 2017

11:41 a.m. - 12:30 p.m.

LEGISLATIVE CHAMBER

Theodore Roosevelt Executive & Legislative Bldg.

1550 Franklin Avenue

Mineola, New York

A P P E A R A N C E S:

SEAN SALLIE, Senior Planner

Also Present:

STEPHANIE J. VALDER, Stenographer

I N D E X O F S P E A K E R S:

Proceedings

MR. SALLIE: Okay. I think we're going to open up the public hearing today. Let the record reflect the time is now 11:41 a.m. on Thursday, February 16th.

This is a public hearing to accept comment on the Draft Generic Environmental Impact Statement for the Nassau County Mosquito Control Program.

Good morning. My name is Sean Sallie. I am a senior planner with the Nassau County Department of Public Works.

This portion of our -- this public meeting is devoted as the official public hearing on the Draft Generic Environmental Impact Statement prepared for the Nassau County Mosquito Control Program. This hearing is a requirement of the New York State Environmental Quality Review Act, commonly known as SEQRA. The DGEIS was prepared by the County, with the assistance of D&B Engineers and Architects.

As stated in the official notice of completion published in the Environmental Notice Bulletin and in Newsday on or about February 1st, the Nassau County Department of Public Works, and

Proceedings

the Department of-- the Nassau County Department of Health worked together to suppress the mosquito populations that can impact public health, for example, West Nile Virus, Zika Virus, et cetera. To achieve this goal, the County's Mosquito Control Program employs Integrated Pest Management by focusing on long-term suppression or prevention, with a minimal impact on health, environment and non-target organisms. IPM incorporates all reasonable measures to prevent mosquito problems by properly identifying species, monitoring population dynamics, and using physical, biological or chemical population control methods, to reduce mosquitoes to acceptable levels. Control measures emphasize prevention and proceed from the most environmentally-friendly measures, such as education of residents, water management and trappings in detention ponds and sumps, to chemical controls, including the application of larvicides and adulticides. Chemical controls are only used if other measures prove to be insufficient.

The purpose of the public hearing this

Proceedings

morning is to provide an opportunity for interested parties and the public to provide comments on the Draft Generic Environmental Impact Statement documents. Comments can be articulated here at the hearing, or they can be conveyed in writing via regular mail or via e-mail, anytime during the public comment period which extends beyond today's hearing and ends on March 17th, 2017.

Comments made here at the hearing are being recorded by our stenographer. All relevant and substantive comments, verbal and written, will be compiled and carefully reviewed.

Responses to comments will be provided in the Final Generic Environmental Impact Statement, expected to be completed approximately two or four weeks after the close of the public comment period, so some time in late April, very early May of this year.

Individuals wishing to comment on the DGEIS will be invited up to the podium to make their statement. In the interest of time and to provide an opportunity for all speakers, this process will not be a Q and A session or a dialogue. The purpose of the hearing is essentially to record your comments for the record. Answers or responses to your comments and, or questions will be provided in the Final Generic Environmental Impact Statement.

We will call up those wishing to comment in order that speaker request forms were received. If you wish to comment and haven't yet submitted a speaker registration form, the forms are available on the table to my left, to your right. And please feel free to fill out a form and we'll be sure to call you up. I'll actually spin the microphone around, so you're sort of speaking to the dais and to the stenographer.

We will keep this hearing open for roughly a half hour as is required. We will surely keep it open later than that, if we receive more public coming in to comment.

So I do have one speaker registration form submitted. Mr. Neal Lewis representing the Sustainability Institute at Molloy College.

Mr. Lewis, would you like to come up?

(Stepping up.)

MR. LEWIS: So thank you.

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I'll restate my name for the record, Neal Lewis. I'm the Executive Director of the Sustainability Institute at Molloy College, a life-long Nassau County resident.

I do have some past experiences that are relevant, I do think I should probably point out. I served on a committee. I'm a little bit bad at estimating time, but it was at least a good decade ago, that was looking at the issue of managing mosquitos for Nassau County. It was created I believe by the County Executive at the time.

And I did go on a site visit to the -- we had a machine, I forget what it was called. But the County had been using the machine to clean out the ditches on the part of the South Shore of Nassau County. And so I was involved in that, and involved in a number of meetings that took place discussing the questions of the program that the County has. So I put that out there.

I want to also point out that basically, you know, I support what the County does in this area. I think it's a very extensive

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program. It's one that's largely, you know, thankless in the sense that people only really pay attention when we have a bad mosquito problem in the summer. And they don't necessarily appreciate the tremendous amount of work that goes into all the different things that are detailed in the plan here that have to do with maintaining the surveying, and trapping and suppression efforts. And I know that there's a fairly limited staff at the Department of Public Works that takes on these, you know, hundreds of individual tasks. And so I do want to start by acknowledging what I think is a pretty extensive effort.

I also think that the fact that the plan is being adopted on an annual basis is an improvement over years ago. And the decision matrix that was made seems to make a lot of sense.

I am an environmental activist and I do believe the emphasis should be on prevention. And I am concerned about the use of various chemical pesticides. However, I think you have to recognize that when you're talking about

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mosquitos, you're talking about disease vectors. And I don't agree with some of my colleagues who sometimes minimize that concern and do think that as long as substantial effort is put on monitoring and preventing the problem, then, as the decision matrix attempts to layout, then in the circumstance where you do have a serious disease concern, it's appropriate to use the least toxic spraying methods and do it in a manner that minimizes any potential negative public impact.

With that said, I do want to make some suggestion to beef up the prevention side of the equation. And I recognize that some of what I say is labor intensive. And I recognize therefore it's tough to do all that with limited government budgets. There may be some roles for other levels of government to assist the County DPW, or some volunteer efforts that might fit into some of this.

I wanted to speak to a few minor points that I maybe disagree with. So on page 17 and page 124, it talks about bird baths and then it talks about bug zappers. I think that those are

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two things that get too much attention. First of all, I think if a bird bath does not have any leave debris in it, it's unlikely to present a mosquito problem. The Mosquito larvae is going to be dropped in a place where there is some food source for the larvae.

I guess I should say at this point that I'm an attorney and I'm not expert. This is just what I've come to understand, in my years being involved in the issue. I just think that, you know, I hear it on the radio all the time, people always emphasize the bird baths. And the problem is if you emphasize something that's a minimal concern, you're lacking emphasis on the things that are bigger concerns. So I question that emphasis on bird bath. I think they get a bad rap.

The thing that's more important in the homes is the rain gutters. That I believe is mentioned on 213. You talk about cleaning out gutters and eaves. This I think required -- this should get a lot more focus. I do think that that's a major breeding ground at the homes throughout the County. And I would like to see that receive greater emphasis, understanding these are private homes and there's limits to what the County can do.

The other point in this respect is that the mosquitos we're talking about, many times like the Culex and whatnot, they don't travel very far. So even a home that is very well maintained, that doesn't have any old tires, or children's toys or the gutters are being properly cleaned out on a regular basis, they can still have a mosquito problem because of their neighbors. And this is particularly true if the neighbor has:

A pool and the pool is in a derelict condition where the pool maybe has a top on it, and the top is now filled with leaves, and puddled water and it's an ideal breeding ground;

Or if we're talking about an abandoned home where the whole list of problems that we're trying to encourage homeowners to address could be taking place, particularly the abandoned pool. So you have an abandoned home because it's owned by the bank, a foreclosed home I guess we should call it, and you have a pool in the backyard.

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And the pool can be an amazing breeding ground for the mosquitos, which is really unfair to all the neighbors living near that, because how could they do anything about it.

I do think that raises some legal questions, and that the plan should address the question of whether banks should be required to submit documentation to the County to say that all the properties they own have been checked by a professional, and that any standing water's been removed. And it should be indicated whether or not, in that document that I would recommend it being a new procedure, that they demonstrate that they've taken care of a pool, either by draining it or by using larvicides and other things that can be done.

So I wanted to put that on the table. I think the whole issue of foreclosed or derelict homes presents just, you know, so much good things can be done on so many houses. And then you can have this one foreclosed house that's overwhelming and causing such a major problem.

And I think there is reference to stored boats in the plan. And I would raise sort of a similar concern, because of how stored boats can become a major breeding ground if they're not stored properly. It's become very common for people to wrap boats, which is less of an issue. But if it's a boat that's not being maintained with that more modern approach of fully wrapping it, and maybe it's a boat that, you know, that's in disrepair, or someone is looking to get rid of it or whatever, it could be a huge breeding ground for mosquitos.

So again I think that there could be a little bit more emphasis there. Although I don't have a specific suggestion like my one in regards to the banks with foreclosure.

So now the recommendations to the public regarding bug zappers, there is documentation out there which says that not only bug zappers don't particularly work very well because they kill other insects rather than mosquitos, mosquitos seems to be kind of clever and are not really drawn to the light as much as they are to carbon dioxide, so they're drawn to humans sitting near the bug zapper. So the bug zapper can also be counterproductive, because the light can draw them in from a distance. But then as they get closer to the bug zapper, they make a turn and go to the person. So you can actually be -- it's counterproductive. It can encourage a mosquito into your yard. And then it's not going to kill the mosquitos, it's going to -- the mosquitos are going to go to the person if there's people in the yard at that time. So I would encourage that you remove the bug zapper from the list of things that are recommended.

The -- I want to suggest some things that should be recommended that are not. First of all, I think, you know, in terms of what can the government do, one of the areas that government has a responsibility, I believe is when there's large public events. And many of them may not be County events. Many times it's town and village events.

But on Long Island, we do have a tradition of a lot of, you know, concerts and things like that, that are done outdoors at parks, right at the perfect time for mosquitos just as it's getting dark. And I believe that there are some things that could be used that

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would be part of a mosquito control strategy, when you have large public events.

So one of the things that we've been recommended for years is garlic spray. And there is some research that supports that. I should say that from the Sustainability Institute's point of view, we put out a newsletter on our website. We usually update it in the summer. And but I did check this morning. It is still on our website and it's available, if anybody wanted to go to the Molloy College website, the Sustainability Institute and then you would find the newsletter. And I could also try submitting that as a document in the time that's allowed for public comments to this process.

But in that document we recommend that garlic spray be used. And there is some evidence of muncipalities using it in larger context like I'm suggesting, where if you're about to have a public concert at a park or such, the park could be sprayed with the mosquito -- with the mosquito-suppressing garlic spray, which will present no threats to humans. It will largely chase the mosquitos out of the yard for a while, because the smell overwhelms the mosquitos. Although the humans, for the most part, won't really notice the smell. And it, like I said, there is some data to support its efficacy.

There is also some machines that are different than bug zappers that have been used. And I know that there's issues of cost and such. But again, I think if you're inviting a large number of people to a public event at the time that mosquitos are most active, it does, I think raise some concerns about whether an action should be taken to try and make sure that efforts are underway to minimize the potential for mosquitos, you know, infecting people that are there, in the event that they're breeding disease. We know that they are disease vectors.

So there's a mosquito magnet and a couple other brands of machines that are seen as being more efficacious than bug zappers. And there's one that I know that is electric based, some that use carbon dioxides, which raises some global warming concerns. But you know, there's always this balancing of interests that we have to go through.

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The other part of the public responsibility, I believe is with catch basins. I know we use some of these terms interchangeably. And I want to make sure I'm using it right.

So when you're walking down the street, and you look down at the street, and you see where the storm water goes, I believe that would be the catch basin. Am I correct? Okay.

So catch basins, sometimes it's the County's responsibility. If you look at them -- I was a dog owner for many, many years while living in an apartment. So I would be walking my dog quite regularly and always cleaned up after him.

But nonetheless as you walk your dog, you look down and it says Nassau County on most of the catch basins in Nassau County. That does not necessarily mean that it's Nassau County's responsibility, but it does sort of suggest that it is.

I also know that one of the committees I was on, we worked on the Environmental Bond Act. There was a lot of money for catch basin inserts. And part of what was done there was contracts were developed with villages and other governments in exchange for receiving the Bond Act Funding. They made the commitment to do the cleaning out of the catch basins.

So whether it's the County that should be doing the cleaning out or whether it's another municipality that should be doing the cleaning out, it should be discussed in this plan, because I believe these are major breeding grounds for mosquitos.

I can recall many a time -- it's been a few years since my dog passed. But I can recall many a time walking past a catch basin, and you look in it and you can see the grass growing out of the catch basin. So that means that basin had not been cleared in many, many, many, many years. And they should be cleared annually and certainly during the time when mosquitos are breeding, because you have debris, you have water, you have all the potential for mosquito breeding. So I recommend that.

And then again, in terms of the government's role I want to come back to what I

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mentioned earlier, which is I did go on the tour of the ditches in Nassau County. The report really only devotes a couple of paragraphs to this. It says that there was originally only some 1,000 miles. And then they were reconditioned in the 1970s of some 700 miles. It doesn't mention what took place when I went there, which was the purchasing of this machine and whether or not it worked. There's no comments about any of that.

I remember the day we went there, it happened to be more than 100 degrees. And I foolishly showed up with a shirt and tie on. And so I remembered it and it's imprinted in my head. And it was pretty amazing what the machine was doing. It wasn't like -- it really looked like as if it was recutting the ditches completely. The ditches were just that filled up with debris, all sorts of drift woods and all sorts of things. And you could see that they were having a big impact.

So I know there is a debate amongst environmentalists about the ditches. I know that in Suffolk they've largely gone the opposite direction of saying just let nature be nature.

You know, nature never really planned for 3 million people to be living on a barrier island, you know, which is largely what all of Long Island is. So, you know, I think that I'm on this side of believing that the ditches should be maintained. I believe that they're a major breeding ground for mosquitos if they're not maintained. And people who live in the most South Shore parts of Nassau County would benefit greatly if they were maintained.

I get it. There's a controversy, as I said, in the plan about that. I do think there should be a little more information explaining what the decision that was made, was made. It says in the beginning that it's being maintained. The word maintained is used. So I think some clarification there could go along way, why the decision that they're not being maintained was made. I get it. It could be labor intensive and expensive.

It should say -- since it mentions 1977, it should also mention what was done about a decade or so ago and what the experience with

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that was, so the people would have context for why the final decisions that were made, were made.

I think that's most of my comments. With regards to storm water recharge basins, there was an effort to stock them with fish. And I know the document here makes reference to killifish and Gambusia. I think those are the salt water ones. But I think there was a different species, but I don't really recall specifically.

I still think that that should be mentioned. Maybe I missed it in my quick read. But we do have a lot of storm water recharge basins that have water in them pretty much all year round.

The document does say that the DEC doesn't want just releasing fish into the salt water areas. But I suspect they wouldn't have a problem with what I'm describing for the storm water recharge basins. So those, I think there should be a map of how many of them are maintaining water year round, which is really not their original design, but some of them do that nonetheless. And I think they should be stocked with fish as part of the strategy.

Lastly, just in regards to this is a plan that's both the DPW, but it also speaks to the Department of Health's role in regards to surveillance and then there's that element of advising the public from the public health perspective. And I understand that many, many a person's going to use DEET-based products. In our materials and our research, we found that the CDC had done research and found that lemon eucalyptus products can be effective as personal repellants. And so this is what we recommend. I know there's a brand, Cutter, and there's a brand Repel.

I don't have stock in any of those companies. But I do recommend those products, because they could be sprayed right onto the skin. Whereas with DEET, if you read the warning labels carefully, most people do not do what the warning labels say. They spray it onto their skin, even though the warning label says spray it onto your clothing. And people that go camping, and such, spray it onto their clothing and then get into a sleeping bag, and they wake up with a reaction, be it an allergic reaction or otherwise, and end up in an emergency room. That does happen.

And so I think the safer alternatives should be one of the items that is mentioned in the documents that advise the public, especially since CDC did give its stamp of approval to that product.

And I thank you. And I know I -- the timer wasn't on, so I'll use that an excuse.

(Laughter.)

MR. LEWIS: I know that I went over. I appreciate you're allowing me to do so.

And once again, I do want to acknowledge the fact that a lot of work goes into keeping Long Island, and keeping Nassau County in particular safe from mosquitos. And it's un -- it's sort of a thankless job. People only know about the work when the spraying becomes an issue.

But in fact, you know, it's a pretty extensive effort and I want to commend the people that do all this hard work. So thank you.

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(Stepping up.)

MR. SALLIE: Thank you, Mr. Lewis.

Okay. I do not have any other speaker forms at the moment. Again, if anyone would like to speak or provide a comment on the DGEIS, please feel free to grab a speaker registration form to my left on the table. And hand that in and we'll be happy to accept your comment.

Just another note, the Draft Generic Environmental Impact Statement is available online, on the Nassau County Department of Public Work's homepage. There's a link bar on the left side of the page entitled mosquito control. If you click that link, all of the mosquito control SEQRA documents are included:

The scoping document;

The positive declaration;

The notice of completion;

And the draft EIS itself. I just wanted to make note of that.

Is there anyone who would like to speak at this point?

(No response.)

MR. SALLIE: Okay. We'll keep the

hearing open, again, for a little while longer in case anyone arrives and we'll go from there.

Thank you.

(Whereupon, a recess was taken at 12:07 p.m. and the hearing continued at 12:30 p.m.)

MR. SALLIE: Okay. The time is 12:30. And seeing no one in the audience, we are going to close the public hearing, the Nassau County Mosquito Control Program Draft Generic Environmental Impact Statement.

As stated earlier, the public comments received today will be incorporated into a final generic environmental impact statement. Those comments, including or in addition to the comments that are received via e-mail and regular mail, will be responded to in the final generic environmental impact statement. That document will be, once accepted, will be available on the County Department of Public Work's website, followed by a findings of significance -- a findings statement, excuse me. So stay tuned.

Again, the time is 12:30 and we are closing the public hearing.

Thank you.

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(The public hearing was concluded at 12:30 p.m.)

* * *

C E R T I F I C A T I O N

I, STEPHANIE J. VALDER, do hereby certify that the within transcript is a true, accurate and complete transcript of the proceedings which took place in the above matter.

Stephanie J. Valder

STEPHANIE J. VALDER

Errata Sheet

NAME OF CASE: NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS

DATE OF DEPOSITION: 02/16/2017

NAME OF WITNESS: MEETING OF

Reason Codes:

1. To clarify the record.
2. To conform to the facts.
3. To correct transcription errors.

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Meredith Byers

From: Michael Ryder <villageclerk@hewlettharbor.org>
Sent: Monday, February 06, 2017 8:41 AM
To: Perrakis, John P
Cc: mweiss@harborgroupcomms.com; deputyclerk@hewlettharbor.org
Subject: village of Hewlett Harbor

Follow Up Flag: Follow up
Flag Status: Flagged

Mr. Perrakis –

It is good to see that Nassau County is taking a proactive public health position suppressing mosquito populations.

On that note… I respectfully request that the Village of Hewlett Harbor be considered for spraying and treatment due to the increased number of mosquitos that appeared in our Village last spring and thru the end of the summer.

If you have any questions please don't hesitate to call.

Thanks again for taking this mosquito treatment initiative.

Regards,

Michael Ryder
Village Clerk
516-374-3806x301
Vilageclerk@hewlettharbor.org