APPENDIX A

SCVC History

Suffolk County Vector Control & Wetlands Management Long Term Plan & Environmental Impact Statement

Task 4 Suffolk County Vector Control Current Operations
History of Suffolk County Vector Control

Prepared for

Suffolk County Department of Public Works
Suffolk County Department of Health Services
Suffolk County, New York

CASHIN ASSOCIATES, P.C.

November 2004

SUFFOLK COUNTY VECTOR CONTROL AND WETLANDS MANAGEMENT LONG - TERM PLAN AND ENVIRONMENTAL IMPACT STATEMENT

PROJECT SPONSOR

Steve Levy
Suffolk County Executive

Department of Public Works
Charles J. Bartha, P.E.
Commissioner
Richard LaValle, P.E.
Chief Deputy Commissioner
Leslie A. Mitchel
Deputy Commissioner

Department of Health Services
Brian L. Harper, M.D., M.P.H.
Commissioner
Vito Minei, P.E.
Director, Division of Environmental Quality

PROJECT MANAGEMENT

Project Manager: Walter Dawydiak, P.E., J.D.
Chief Engineer, Division of Environmental Quality, Suffolk County Department of Health Services

Suffolk County Department of Public Works, Division of Vector Control
Dominick V. Ninivaggi
Superintendent
Tom Iwanejko
Principal Environmental Entomologist
Mary E. Dempsey
Biologist

Suffolk County Department of Health Services, Office of Ecology
Martin Trent
Acting Chief
Kim Shaw
Bureau Supervisor
Robert M. Waters
Bureau Supervisor
Laura Bavaro
Senior Environmental Analyst
Phil DeBlasi
Environmental Analyst
Jeanine Schlosser
Principal Clerk

SUFFOLK COUNTY LONG TERM PLAN CONSULTANT TEAM

Cashin Associates, P.C.	**Hauppauge, NY**
Subconsultants	
Cameron Engineering, L.L.P.	Syosset, NY
Integral Consulting	Annapolis, MD
Bowne Management Systems, Inc.	Mineola, NY
Kamazima Lwiza, PhD	Stony Brook University, Stony Brook, NY
Ducks Unlimited	Stony Brook, NY
Steven Goodbred, PhD & Laboratory	Stony Brook University, Stony Brook, NY
RTP Environmental	Westbury, NY
Sinnreich, Safar & Kosakoff	Central Islip, NY
Bruce Brownawell, PhD & Laboratory	Stony Brook University, Stony Brook, NY
Anne McElroy, PhD & Laboratory	Stony Brook University, Stony Brook, NY
Andrew Spielman, PhD	Harvard School of Public Health, Boston, MA
Richard Pollack, PhD	Harvard School of Public Health, Boston, MA
Masahiko Hachiya, PhD	Harvard School of Public Health, Boston, MA
Wayne Crans, PhD	Rutgers University, New Brunswick, NJ
Susan Teitelbaum, PhD	Mount Sinai School of Medicine, NY
Zawicki Vector Management Consultants	Freehold, NJ
Michael Bottini, Turtle Researcher	East Hampton, NY
Robert Turner, PhD & Laboratory	Southampton College, NY
Christopher Gobler, PhD & Laboratory	Southampton College, NY
Jerome Goddard, PhD	Mississippi Department of Health, Jackson, MS
Sergio Sanudo, PhD & Laboratory	Stony Brook University, Stony Brook, NY
Robert Cerrato, PhD	Stony Brook University, Stony Brook, NY
Suffolk County Department of Health Services, Division of Environmental Quality	Hauppauge, NY

Primary research for this report was conducted by Cashin Associates (personnel including David Tonjes, PhD, and Michael Tumbarello), Suffolk County Department of Public Works, Division of Vector Control (personnel including Mary Dempsey) and Suffolk County Department of Health Services (personnel including Mara Hogan). It was edited and revised in response to comments by Cashin Associates (personnel including ____). Review was provided by Cashin Associates (personnel including David Tonjes, PhD), Suffolk County Department of Public Works, Division of Vector Control, and Suffolk County Department of Health Services (personnel including Amy Juchatz). Additional comments have been received from _____.

Table of Contents

List of Tables

List of Figures

LIST OF ABBREVIATIONS AND ACRONYMS

Bti	Bacillus thuringiensis israelensis
CE	California Encephalitis
DDT	dichlorodiphenyltrichloroethane
EDF	Environmental Defense Fund
EEE	Eastern equine encephalitis
FINS	Fire Island National Seashore
IPM	Integrated Pest Management
NYSDEC	New York State Department of Environmental Science
NYSDOH	New York State Department of Health
OMWM	Open Marsh Water Management
SCVC	Suffolk County Vector Control
SEQRA	State Environmental Quality Review Act
USFWS	United States Fish and Wildlife Services

History of Suffolk County Mosquito Management

1 Pre-World War II

Organized vector control on Long Island began in 1900, and consisted of larval control methods. Pyrethrum (an extract from chrysanthemums) and oil were applied in the marshes to kill larval mosquitoes ("wrigglers") by spraying thin films of larvicide over mosquito breeding grounds. The efficacy of this method was less than total, however, and in the early 1900s, large tracts of land in Long Island and New York City were deemed to be valueless due to chronically heavy mosquito infestations. Although these areas were adjacent to more heavily populated areas, they were not able to be used for agriculture, recreation or habitation (SCCCME, 1937).

At this time the subject of vector control was being widely researched and discussed by scientists, physicians, and sanitary experts. Much insight into the nature and habits of mosquitoes, and possible ways to exterminate them, was being obtained, fostered by projects such as the Panama Canal. Local efforts were also conducted, however. For example, it was found that the *Anopheles* mosquito was responsible for the dissemination of malaria (North Shore Association, 1902). Malaria was a significant problem on the North Shore of Long Island. As a result, in the summer of 1900, the first, and quite possibly the most important practical demonstration of the use of ditching and draining salt water marshes to exterminate mosquitoes occurred along the north shore of Long Island at Lloyds Neck. This demonstration was executed by WJ Matheson, under the direction of Professor L.O. Howard, Chief of the Division of Entomology of the United States Department of Agriculture. They demonstrated that an area that was previously infested by a large number of mosquitoes can be almost entirely freed of them by a simple and inexpensive method of ditching and draining nearby salt water marshes. The same type of extermination method was used the following summer on Centre Island (Nassau County). But due to the sodden condition of the land, unusually long rainy season during the previous April and May, and lack of co-operation of land owners, the complete extermination of the mosquitoes in the area was not accomplished. However, the results obtained from this experiment were, nonetheless, encouraging. Under natural conditions, large numbers of mosquitoes bred in the area. After ditching and the application of oil to areas not suitable for ditching, only a few mosquitoes were found to breed on the island, and only in areas were experimenters were not allowed access to work (North Shore Association, 1902).

These first experiments paved the way for the North Shore Improvement Association (a local citizen response to mosquito infestation on Long Island) to compose a report that included plans for the extermination of mosquitoes on the North Shore of Long Island. Written in 1902, the report summarized the attempts to control mosquitoes at Lloyds Neck and Centre Island. These techniques were collected in a formal plan, "Measures of Relief Against Mosquitoes, the Practicability and Efficiency of Which Have Been Demonstrated" (North Shore Improvement Association, 1902). The plan called for:

- The elimination of mosquito breeding places by drainage and filling.

- In salt marshes, choosing one of three tactics: 1) drain them; 2) keep them inundated with salt water; or 3) treat them to prevent accumulations of brackish water between extreme tides.
- Straightening the banks of streams so as to regulate the flow of water and remove and areas where pooling of stagnant water may occur and provide breeding areas for mosquitoes. This could also be supplemented by piping or ditching.
- Confining springs to definite banks, and either filling or draining areas containing numerous small accumulations of spring water.
- Freeing the banks of ponds and other bodies of water that cannot be drained or filled of vegetation so as to let all areas of water be accessible to fish and therefore disrupting the mosquito breeding process.
- Maintenance of certain kinds of fish, such as the goldfish, sunfish, sticklebacks and minnows, which may entirely prevent mosquito breeding.
- Keeping rain barrels, cisterns, and tanks free of standing water through "reasonable vigilance" on the part of the public authorities and homeowners.
- Covering cesspools, drains, and catch basins, wherever practical.
- Periodic use of petroleum on open waters to provide relief when no other treatment is possible.

This report was used as an impetus for individual communities in Nassau and Suffolk Counties to systematically construct and maintain ditches on nearby fresh and salt water marshes. In some instances, where ditching had not been successful in eliminating the mosquito threat, systematic oiling of marshes was conducted. In these situations, the local community would apply a thin layer of oil to coat the top of marshes, which would then kill off any mosquito larvae breeding in that location. Although these efforts brought some measure of success locally, incidences of malaria still occurred.

In 1914, Suffolk and Nassau Counties held formal discussions in order to establish a joint mosquito extermination commission. However, in 1915 Suffolk County withdrew from these talks. Nassau County citizens established the Nassau County Mosquito Extermination Commission in 1916. The creation of this organization was based on the measure of successes that were achieved by local vector control efforts, coupled with the continued high levels of malaria. This commission was responsible for establishing the first countywide vector control program in New York State. The Commission was empowered under the new State Public Health Laws which enabled Nassau County to have the power to enter without hindrance upon any or all lands within the county to perform whatever action it deems necessary for vector control purposes. The law further declared that any person who "obstructs or interferes with, molests, or damages" any of the commission's work shall be guilty of a misdemeanor. This law also enabled towns in Suffolk County to provide for the establishment of districts for the extermination of mosquitoes at the same time. Furthermore, the laws stated that each county would have to assess taxes on its citizens to fund any countywide mosquito programs (SCCCME, 1937).

The first full year in operation of the Nassau County Mosquito Extermination Commission resulted in a significant drop in malaria cases across Nassau County, so that

only 51 cases of malaria were reported across Nassau County by 1917. By 1921 and 1922, only a few cases of malaria were reported, and in 1922 the disease was considered to be eradicated from Nassau County (SCCCME, 1937).

The situation differed drastically in Suffolk County, where in 1916 vector control was initiated only in certain sections of the County. Vector control efforts were largely implemented by owners of large private estates, and at resorts. These efforts were sporadic and disjointed at best, leaving little in the way of demonstrable results. In fact, the perception was that the County's mosquito problem was continuing to grow, rendering large tracts of land useless and of no value. Reports on mosquito control in Suffolk County did not document malaria cases. Anecdotal evidence appears to show a continuing, appreciable problem at this time. It is not clear when malaria was eliminated in the county as a routine health problem; certainly by 1940 malaria was considered to be a problem belonging to the past (SCCCME, 1947). During the early to mid-1920s, public demand for effective vector control increased. This was due to reports of effective vector control being achieved in Nassau County and in New Jersey. In 1925 the Suffolk County Citizens' Committee on Mosquito Elimination was formed (SCCCME, 1937).

In order to for the committee to have a comprehensive picture of the mosquito situation, they formed the Gorgas Memorial Commission to conduct a countywide survey of marsh infestation by mosquitoes. The survey was completed in December, 1928. The Gorgas Memorial Commission recommended that a county commission needed to be developed to coordinate a systematic, organized effort to combat the mosquito problem Suffolk County was experiencing. The Citizens' Committee then spent several years gathering public and political support for the formation of a county vector control commission. Ultimately, the original vector control law, which had been passed by the New York State Legislature to create the Nassau County Mosquito Extermination Commission, was amended in 1934 to allow for the creation of the Suffolk County Mosquito Extermination Commission.

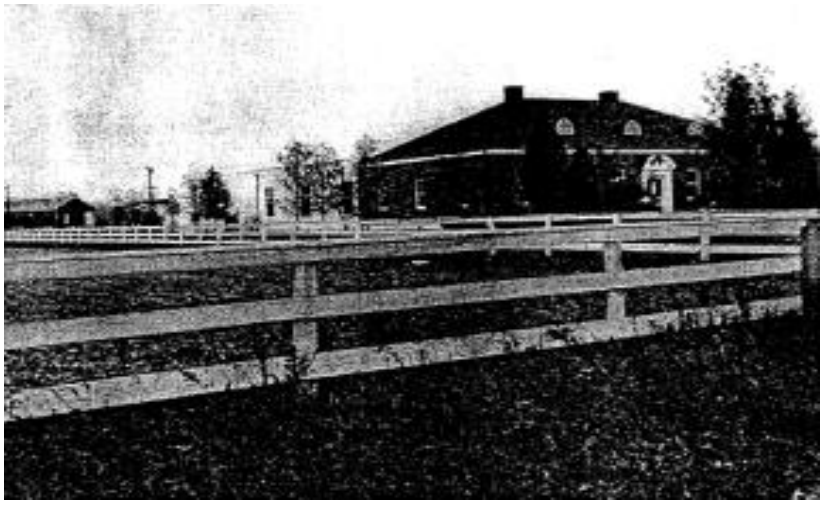

Figure 1 - Suffolk County Mosquito Extermination Commission Headquarters at Yaphank in 1945.

After the Suffolk County Citizens' Committee on Mosquito Elimination was enacted, widespread ditching, drainage and oiling of marshes began across Suffolk County. According to the 1937 yearly Suffolk County Citizens' Committee on Mosquito Elimination report on vector control progress, there was overall improvement, especially in the Fire Island region. It was noted that "the work on Fire Island beaches in the vicinity of Saltaire, Ocean Beach, and Point-of-Woods was further improved so that for the first time in many years, according to village authorities, almost complete relief from mosquito annoyance was felt". This is a marked contrast to previous years when it was said to be virtually impossible to emerge from behind screened doors any time of the day or night. However, some breeding occurred in the Town of Brookhaven due to a breakdown in vector control caused by a shortage of Works Progress Administration (WPA) funded workers who were working a multitude of other projects in the Town of Brookhaven. This breeding of mosquitoes led to considerable annoyances throughout the Town of Brookhaven and in areas several miles to the east. In response to this situation, Suffolk County secured a few WPA laborers in the late summer and early fall to combat the mosquito infestation. While the number of workers was described as being far from adequate to cover the area thoroughly, the commission believed positive results were obtained (SCCCME, 1937).

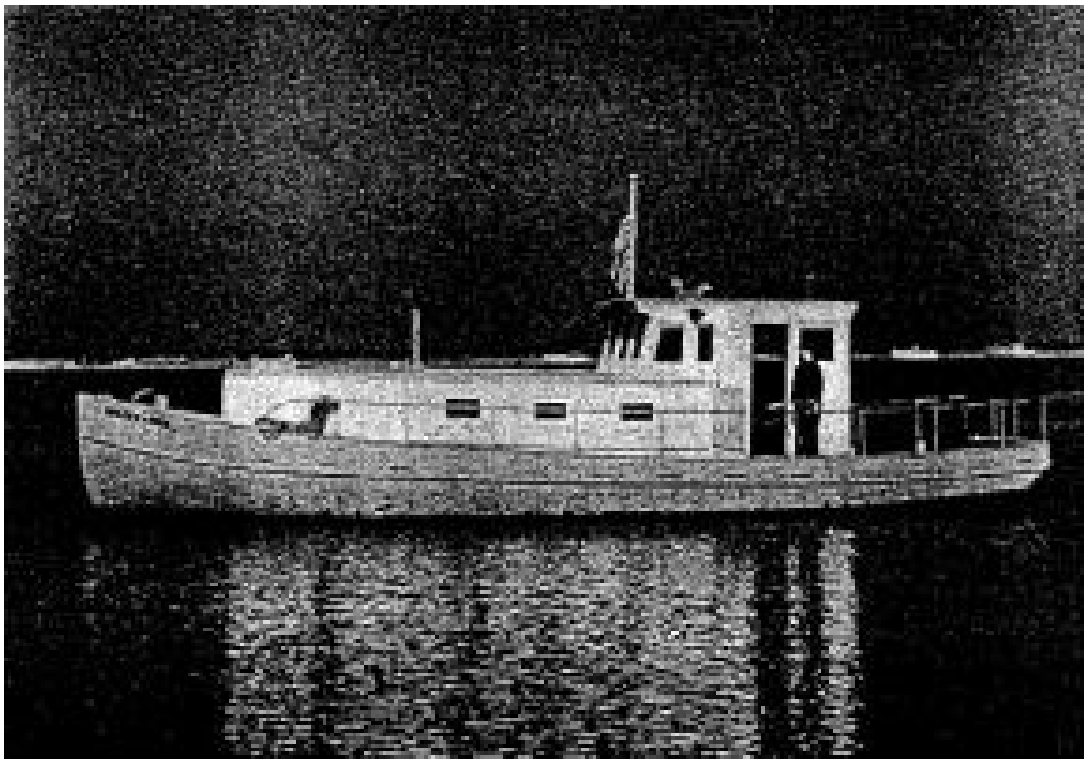

Figure 2 - Large power boat that carried men and equipment to work areas inaccessible from the mainland.

In 1938, WPA funds for vector control were withdrawn, leaving Nassau and Suffolk Counties to assume the entire financial burden of continuing vector control on Long Island. This made it necessary for both counties to lay out a schedule of work that would

effectively cover their respective county and do so at the highest degree of efficiency. Complicating matters, the 1938 hurricane caused a large number of trees to be overturned in marshlands, making it more difficult for Nassau and Suffolk County vector control workers to access existing breeding grounds. Additionally, these fallen trees created holes in the ground that filled with standing water, creating new mosquito breeding grounds. However, the respective county reports show a fairly consistent degree of control over mosquito breeding on Long Island in the late 1930s (SCCCME, 1937, 1938, 1939).

In the early 1940s, vector control was not able to prevent complaints from being received from citizens throughout Nassau and Suffolk Counties. This was due to many workers being drafted by the Army to fight in World War II. At one point, some patrol groups were made up entirely of school boys. Other crews were operating at about 60 percent capacity due to the inability to obtain labor and a lack of interest in the work by any available laborers. Combined with adverse action of the elements (such as large amounts of rainfall and warm weather), Nassau and Suffolk Counties were susceptible to significant mosquito breeding. The height of these problems occurred in 1942, when ditches that were not maintained resulted in a dysfunctional system of ditches and draining that required extensive work to repair, requiring the use of ditching machines. However, with World War II underway, the equipment needed to conduct repairs was not able to be provided to Long Island due to the need for spare parts in the war effort (SCCCME, 1943).

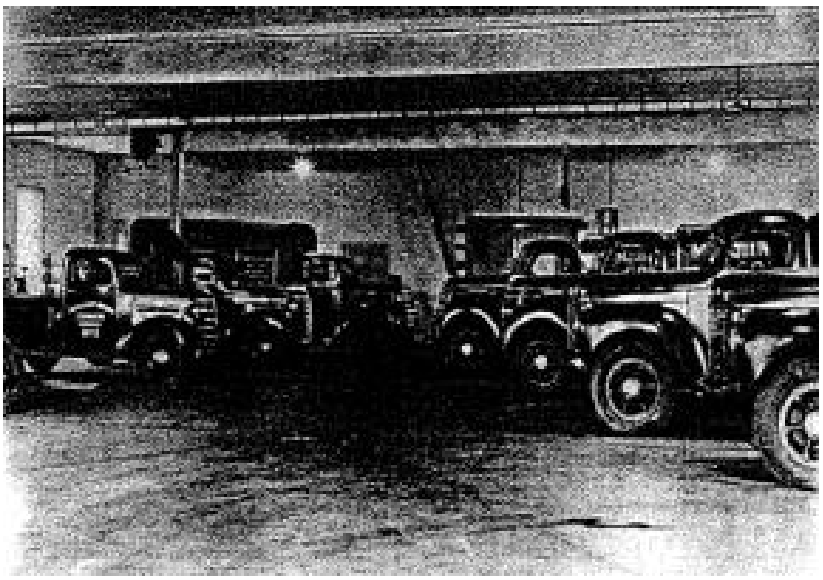

Figure 3 - Tank trucks that performed application of larvicide in the 1930's and 40's.

As a result, mosquitoes, although not at levels experienced prior to the formation of the Extermination Commissions, continued to be a problem for Nassau and Suffolk Counties through the war. The limited vector control efforts that were possible did keep breeding of mosquitoes from becoming a widespread epidemic as it was in years past (SCCCME, 1943).

2 1945-1970: DDT and the Birth of EDF

Between 1944 and 1945, the Suffolk County Citizens' Committee on Mosquito Elimination conducted studies seeking a more ideal pest control spray to replace pyrethrum based pesticides, which were expensive, and required a great deal of labor to apply to a large area of land through the use of tanker truck and hose. In the Suffolk County Citizens' Committee on Mosquito Elimination's annual report of 1945, it was reported that dichlorodiphenyltrichloroethane (DDT) had been determined to be a more suitable, alternative pesticide. According to the studies performed in the previous year, it was determined that $1/25^{th}$ of a pound of DDT, dissolved in two quarts of fuel oil, could be applied to an acre of marshland to control adult mosquitoes across that area. Applying DDT at that rate would create an ideal pesticide that would be deadly to mosquitoes, and according to the available research, be harmless to plants and higher animals (because of the lesser amounts of oil being used as the pesticide carrier and oil was correctly deemed to have non-target organism impacts). Data from one test season of spraying DDT showed it resulted in marked decreases in both fresh water and salt water mosquitoes. Because airplanes and amphibious vehicles would be available with the end of the war, DDT applications would be more economical than pyrethrum applications. Thus, DDT would be a more cost effective and safer alternative for mosquito control in Suffolk County (SCCCME, 1945). Additionally, in 1956, the federal government approved the use of malathion (an organophosphate insecticide) for pest control. According to Vector Control's records, the earliest mention of its use in Suffolk County for mosquito pest control was in 1959.

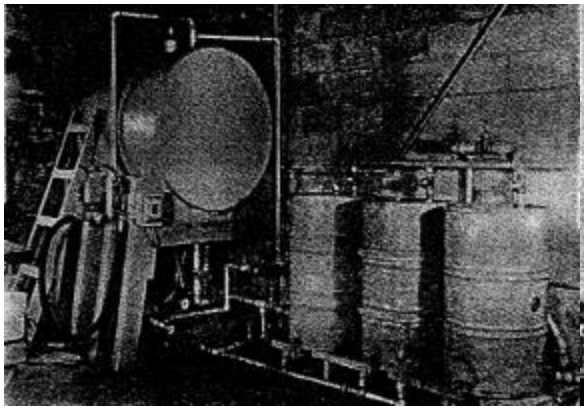

Figure 4 - Mixing equipment for DDT Preparation.

Figure 5 - Storage tanks for DDT in 1945.

Even with the introduction of Malathion, the use of DDT as the primary tool for mosquito control continued for the next twenty years. Over that period of time it was effective in controlling mosquito presence in neighborhoods, but, as time went on, environmental impacts were perceived. The loss of natural resources associated with DDT use came to a head in 1966 when a massive fish kill occurred in Yaphank, New York. This event brought together twenty scientists and a lawyer in a court action that was intended to improve the lives of most Long Islanders and the wildlife that share space or put Long Islanders next to USFWS, 1999).

Figure 6 - Airplane spraying DDT in salt marsh areas in 1945

In 1966, a Patchogue attorney, Victor J. Yannacone, brought suit against the Suffolk County Citizens' Committee on Mosquito Elimination to stop the spraying of DDT pesticide in local marshes. Sounding the alarm at the same time was the Brookhaven Town Natural Resources Committee, an informal group composed of scientists and bay men. This group was also called to action in concern to what was perceived to be occurring to other species, as measured by the disappearance of birds, crabs and butterflies. Yannacone was successful in parts of the action, with a State Supreme Court judge ordering the Suffolk County Citizens' Committee on Mosquito Elimination to show cause why it should not stop spraying the chemical. A Brookhaven naturalist and member of the Brookhaven Town Natural Resources Committee Dennis Puleston painted seven water color paintings to show the trial judge how DDT was destroying the health of Long Island's environment. Justice Jack Stanislaw acknowledged the impact of such testimony, but ruled against the suit, and in favor of Suffolk County (Environmental Defense, 2004). Nonetheless, in 1966 the Suffolk County Legislature ordered the Commission to stop using DDT to kill mosquitoes, the first county in the nation to ban the use of DDT. New York State followed with its own ban in 1970, and in 1972, the US Environmental Protection Agency banned DDT nationwide (RISE, 2003). This was widely touted as resulting in population rebounds for top-of-the-food-chain raptors, such as osprey, bald eagles, and peregrine falcons (RISE, 2003).

In 1967, the scientists involved in this action incorporated as the Environmental Defense Fund (EDF). EDF (today, Environmental Defense) was organized as a public membership, non-profit, tax-exempt organization of scientists, lawyers, and citizens. Its

stated purpose was to provide a link between law and environmental science, to make possible a well-informed effort to minimize the deleterious impact of man's economic existence and growth on the environment. Its earliest official headquarters were located in Stony Brook, New York; these were moved to East Setauket, New York in 1970. EDF gradually expanded from a collection of local volunteers to a national organization with a paid staff of lawyers, scientists, and economists. Grants from the Ford Foundation and the Rachel Carson Fund of the National Audubon Society, in addition to public contributions, provided early funding, most of which was used to finance litigation, initiated in 1968, protesting against the use of the pesticides DDT and dieldrin. Publicity resulting from these cases, together with advertising and direct mail campaigns, contributed to the growth in membership from 20,000 in 1971 to over 56,000 in 1975. Regional offices were opened in Washington, DC, and Berkeley, California (1970), and then in New York City (1971), and in Denver, Colorado (1973) – all from the springboard of Suffolk County DDT use for mosquito control (Environmental Defense, 2004).

3 1970-1980: Vector Control Budget Problems

In the mid to late 1960s, New York State began to offer aid to approved vector control programs. These programs were to consist of vector and or pathogen surveillance and effective control measures. Nassau and Suffolk Counties received aid that consisted of 50 percent of the first $100,000 spent on vector control measures, with a maximum annual state contribution of $50,000 per county or municipality.

From that point through the 1970s, vector control on Long Island enjoyed some degree of subsidy from the State and was generally reviewed as being successful in keeping mosquito nuisances at bay. However, the subsidy that was received was minimal and to save revenue, Suffolk County abolished the Suffolk County Citizens' Committee on Mosquito Elimination in 1974 and incorporated it into the Division of Public Health. The Suffolk County Charter was also amended by transferring the committee's functions and authority to the Suffolk County Department of Health Services (Suffolk County, 1974). From this point forward, the committee was known as the Bureau of Vector Control.

This trend of reorganization and down-sizing of vector control programs was common through the 1980s, as the number of vector control programs in operation across the State of New York dropped drastically (Suffolk County 1985). There were two factors that were responsible for the decline of vector control at this time. One was that the criteria for state aid had become more stringent in 1984, making it harder for municipalities to have their vector control programs approved by the state for funding. The new requirements stated that money would now be provided only if there was one human case or one virus isolate of Eastern equine encephalitis (EEE), or if there was a cluster of human cases of California Encephalitis. In addition, the State would now only reimburse the programs of surveillance and control in a defined area around these occurrences. Further complicating matters, the State also reduced the maximum amount of aid they would provide per county or municipality from $50,000 to $44,000 (Suffolk County, 1985). The recession of the late 1980s together with the devolution of government programs from the federal level to the State and local level under the Reagan administration, in addition to movements fostered by the tax revolts in California leading to limits on government spending and tax rates, left many municipalities with budget crises and mounting potential deficits. As a result, vector control programs were often victims of this funding crunch. New York City, for example, ended its mosquito control program in the early 1990s (Brand, 1993). On Long Island, Suffolk County maintained a reduced vector control program; but, after several years of downsizing, Nassau County's vector control program was eliminated in 1992 (Brand, 1993). Nassau County had established the first County-wide mosquito control program New York State, and it was highly regarded as an efficient and exemplary program.

As a result of these eliminations, reports of mosquito infestations increased in sections of Nassau County throughout the mid-1990s. The large salt marshes near Jamaica Bay and Jones Beach State Park became prime active breeding areas for mosquitoes. Heavy mosquito infestations were also reported in adjacent areas as ditches were allowed to deteriorate over the years (Haberstroh, 2003).

4 1980-1990: Biological Control and Eastern Equine Encephalitis

The budget problems of the 1980s and 1990s, however, did not stop Suffolk County from continuing vector control. According to Suffolk County Vector Control work programs in the 1980s, water management was considered the bureau's primary method of vector control (Suffolk County, 1980, 1981, 1985, 1987). This method included the inspection and maintenance of existing ditches and the construction of additional ditches as warranted, as well as the introduction of mosquito-eating fish to locations that include permanent standing water. Pesticides were only used as a last resort when all other efforts failed. Yet complaints still were raised about the county's use of more dangerous chemical pesticides rather than using biological pesticides.

In 1981, the Suffolk County Department of Health Services responded to these complaints by introducing Bti (*Bacillus thuringiensis israelensis*) on a trial basis to test its effectiveness as a biological control against mosquitoes. Bti is a naturally occurring bacterium which produces a crystal that is fatal to mosquitoes when eaten. Bti is usually assessed as being harmless to other organisms in mosquito environs (Suffolk County, 1980).

This organism was first isolated in 1977 from dead mosquito larvae in Israel. Although similar to a strain that has been used for caterpillar control since the early 1900's, the new variety was found to be very effective and very specific against mosquitoes. Bti is grown commercially in fermentation tanks, but only a dormant spore, not live bacteria, are used in the finished product (Puglisi, 2003).

Based on the success experienced during the trial applications, the Suffolk County Department of Health Services decided on the widespread use of Bti in areas that were not able to be treated by chemical pesticides (such as federal wetlands or on lands of the National Park System). In 1982, Bti was used to control mosquito breeding in sensitive areas such as Fire Island and the William Floyd Estate. Additionally, Suffolk County also halted the use of what was considered to be a much more harmful pesticide, pyrethrum, in the same year (Suffolk County, 1981).

In 1984, the State ruled the pesticide Abate (in use in Suffolk County for almost 20 years at that point) should not be used any longer due to human health/environmental concerns. This led to Bti being the most frequently used form of mosquito control (Suffolk County, 1985). This situation led to more widespread nuisance claims across Suffolk County throughout the mid-1980s. The reason for this is that efficacy studies found that Bti was only 70 percent effective. Coupled with the fact that Bti only lasts for less than 24 hours, mosquitoes were then able to breed to adulthood with more regularity.

In 1988, a synthetic form of Pyrethrum was selected for use. It was anticipated to be less harmful. Scourge is the trade name of this pesticide product; it is used to control mosquitoes in outdoor residential and recreational areas. It contains resmethrin, piperonyl butoxide, and a petroleum distillate. Resmethrin is a man-made pesticide, similar to a natural group of pesticides called pyrethrins which comes from plants.

Piperonyl Butoxide does not directly kill insects but acts to increase the ability of resmethrin to kill insects. These pesticide products are also used in pet shampoos, sprays, and in products used in horse stables (United States Army, 2004).

By 1992, Suffolk County's budget was experiencing a major deficit and in order to rectify the situation, the county legislature determined that streamlining county government would be an effective way to accomplish this. As a result, Suffolk County Vector Control was transferred from the Suffolk County Department of Health Services to the Department of Public Works. According to Suffolk County Resolution 562, passed on September 11th, 1992, the transfer was perceived as a provision for flexibility in the assignment of staff who are responsible for workloads which are either seasonal in nature or have periods of peak activities. Since many of the job titles utilized in Vector Control at the time were consistent with those utilized in Suffolk County's Department of Public Works, employees could be easily interchanged when workloads varied.

In 1995, another significant change in Suffolk County's vector control methods occurred. Methoprene (trade name Altosid), a biologically based larvicide effective in the later stages of larvae development, was introduced into the vector control program as an additional measure of defense to prevent mosquito breeding and ultimately, pesticide spraying. In May of that year, Altosid was applied on a trial basis in both Manorville and Riverhead areas with impressive results (Suffolk County, 1996). Altosid is a juvenile growth hormone, which prevents the mosquito from molting from the larval stage to adult. Altosid is highly specific to mosquitoes and can remain effective for seven to ten days. Altosid has the environmental advantage of not immediately killing the mosquito larvae, which means the larvae remain available to play their part in aquatic food webs (predators on the larvae are not affected by methoprene). Altosid is effective on all mosquito species and affects larval stages two through four (Suffolk County, 2003).

In 1998, Suffolk County incorporated Vectolex, a new bacterial pesticide with live *Bacillus sphaericus* as its active ingredient, into its larval control program. Vectolex is effective against only certain mosquito species, but unlike Bti, it is a true biological control agent. Vectolex introduces a live bacterium into the mosquito breeding site, and this bacterium can recycle and maintain itself in the field. As a result, Vectolex can be effective against mosquito larvae for several weeks after application, if conditions are favorable. This product is intended to provide cost-effective, long term control in areas that continually hold water and breed mosquitoes, such as drainage ditches and catch basins (Suffolk County, 2003).

Suffolk County had maintained its mosquito control program, primarily because of outbreaks of encephalitis throughout the 1980s and 1990s. According to a historical brief completed by Suffolk County for state funding in 1994, isolates of California Encephalitis (CE) were discovered in 1988 and 1989 with one being reported in Bayview and the other in Riverhead. Additionally, isolates of EEE were also discovered in 1990 at Riverhead (1 isolate), 1993 in the Manorville-Riverhead area (5 isolates) and in 1994 at Manorville (6 isolates). To provide an adequate response to these reports, increases in the County's vector control staff were authorized by County Executive Robert Gaffney

during this time period. These were considered the only significant investments in vector control on Long Island before the West Nile Virus outbreak in 1999 (Fagin, 2000).

Because of the continuing nature of its program, Suffolk County was able to evolve its mosquito control efforts away from adulticiding with malathion. Suffolk County implemented bacterial and biological controls, partly in response to criticisms of its Reliance on aerial pesticide spraying (Brand, 1993).

5 1999-Today: West Nile Virus

In 1999, the first North American outbreak of West Nile Virus occurred in New York City. In the New York metropolitan area (where the virus was confined to in 1999), 61 people were documented as having become infected with the virus, and seven people died. Many others were frightened by the threat of contracting this possibly deadly disease. Public interest in and support for vector control activities was spurred. For instance, the New York City Department of Health and Mental Hygiene initiated a new program of vector control, using more modern tools for control measures such as larval control with *Bacillus sphaericus* and *Bacillus thuringiensis israelensis*, or methoprene. The City also conducted widespread adulticide sprays, primarily using malathion. Nassau County also reconstituted its vector control efforts, creating a unit in its Department of Health (Senay, 2003).

West Nile Virus was not the only illness that struck in the late 1990s. In the summer of 1999, two 11 year-old boys who attended the Baiting Hollow Boy Scout Camp in Suffolk County came down with malaria. An investigation by Suffolk County Health Department representatives revealed that both boys attended the camp between August 1 and August 7. Mosquito trapping by the county confirmed the presence of anopheline mosquitoes, the insect vector for malaria (CDC, 2000).

Not having traveled outside the United States, the boys could only have acquired the disease from the bite of a Suffolk County *Anopheles* mosquito. And the mosquito could only have become infected by biting, about two weeks before, someone as close as half a mile away who had harbored in his or her bloodstream the mature male and female stages, called gametocytes, of the malaria parasite—in this case, *Plasmodium vivax*. Someone experiencing a relapse of the disease years after the initial infection can host malaria parasites in the bloodstream for days or weeks, never experiencing symptoms. In this case, investigators never found that human source, but it was believed to be a visitor or immigrant from a malarious country (Drexler, 2002).

The West Nile Virus has spread across the country since 1999. In 2002, there were nearly 4,000 reported cases of West Nile Virus human infection and 284 deaths, with the virus reaching 44 states. There were also 23 cases nationwide that West Nile was passed on through a blood transfusion and four cases in which organ recipients contracted the virus (Senay, 2003).

In early 2000, New York State released its West Nile Virus Response Plan (Fagin, 2000). The plan called for the use of Integrated Mosquito Management - a primary emphasis on surveillance and source reduction (citizens reducing mosquito breeding opportunities around their own homes), water management and other environmental controls, larviciding, and, as a last resort, adulticidal control with pesticides. The decision when and where to use adulticides was proposed to stay a function of a risk assessment process under the direction of the local county health departments (NYSDOH, 2000).

Concerns have been raised about the impacts of ditch construction and continued maintenance on wetland ecology. Suffolk County Vector Control, along with the New York State Department of Environmental Conservation (NYSDEC) (which is the government body charged with wetlands management), the US Fish and Wildlife Service (USFWS), and Ducks Unlimited (a private conservation organization) founded the Long Island Wetlands Initiative in 1997. The group intended to combine the resources of these organizations to address wetlands restoration needs – including investigations of alternatives to ditch maintenance. One widespread technique offered as such an alternative is known as Open Marsh Water Management (OMWM). The utility of this technique has been recognized by NYSDEC (Niedowski, 2000) and USFWS (1999).

6 Evolution to Integrated Mosquito Management

In response to a growing concern of high cancer rates in Long Island communities, Suffolk County legislators passed a law in 1996 requiring all county employees to implement integrated pest management (IPM) practices on land that is owned or leased by the county (Suffolk County, 2003).

That ruling further enforced Suffolk County's Vector Control Program objectives since Suffolk County has conducted mosquito control using the IPM approach since the 1960s. The current IPM approach to mosquito control concentrates on stopping the mosquito at the larval stage. Larval mosquito breeding sites can be readily identified and are relatively small in area. By contrast, the adults can fly many miles and cause problems over wide area. Water management exploits the fact that the larvae are vulnerable to removal of the water they need to survive. Biological control uses fish and other predators to eat the larvae. Larval control targets mosquito larvae using highly specific materials, such as bacterial pesticides and insect growth regulators. Larval control materials have been determined by regulators to have little impact on non-target species. These materials are deemed to be safe for the applicator. Treating the breeding area does not involve exposure of the general public, since the material is applied to the water in swamps, marshes and other non-residential areas. However, when larvae do manage to escape and adult mosquitoes begin to bite humans, adult control with pesticides is the only option of last recourse (Suffolk County, 2003).

Under IPM, no one control technique is the best for all situations, and that all have their advantages and drawbacks. Water management is desirable because this technique provides long term control and reduces the need for pesticides. However, water management may not be appropriate in some environmentally sensitive wetlands, where removal of water could affect protected species as well as mosquitoes. The most important biological control is the use of fish that eat mosquito larvae, and this also

Figure 7 – Photo of specialized tracked vehicle clearing blocked mosquito ditches. These machines are capable of traveling over the marsh surface without damaging the fragile wetland vegetation.

provides long

term control. However, introducing fish to areas where they do not normally occur could impact other species. Once introduced, fish are hard to remove from an area if they cause problems. Larval control has the fewest environmental drawbacks because these materials are highly specific for mosquito larvae and do not persist in the environment. However, it can be difficult to deliver larvicide to all breeding sites before adults emerge, especially if the breeding areas are remote and heavily vegetated. Some breeding sites are off limits to all larval control methods for legal reasons, such as the Fire Island National Seashore (FINS) wilderness area. While adult control within a residential community is the least desirable mosquito control technique, Suffolk County uses adulticides when other techniques have been unable to prevent a severe infestation or there is a threat of mosquito-borne disease (Suffolk County, 2003).

7 21st century developments

Concerns over the impact of OMWM on Long Island's salt marshes have limited OMWM demonstration projects. A few examples of limited OMWM, where the mosquito ditches are plugged so as to create some open water behind the plugs, have been employed on Long Island. One of the first was at Seatuck National Wildlife Refuge in 1986 (Lent et al., 1990). Other major efforts were at the National Park Service William Floyd Estate in 2000 (Haberstroh, 2000), and at the Wertheim National Wildlife Refuge (James-Pirri et al., 2004).

Local environmental groups continue to pressure the County to reduce its use of pesticides for mosquito control purposes. The Peconic Baykeeper (an environmental advocacy group affiliated with the Water Keeper Alliance) charged that a fish kill in Flanders on August 7, 2002, was related to the application of mosquito control pesticides in the area. An investigation by NYSDEC did not concur, although the County was issues a violation for not adhering to a 150-foot buffer to the salt marsh in this instance (Rothfield, 2002). The County denied the claim, stating the residues measured by the bay keeper in some fish have multiple sources, and are not the chemicals used by Suffolk County Vector Control (SCVC) for mosquito control (Lambert, 2002).

The Peconic Baykeeper has since filed numerous lawsuits against the County for its vector control activity. The organization has followed two separate legal tactics. One is to accuse the County of not following the proper procedures in adopting its Annual Plans of Work. The Baykeeper sued over the 2002 and 2003 Plans (work in 2004 has been authorized through an extension of the 2003 Plan) (Freedman, 2003). A New York State Supreme Court judge, who originally denied the lawsuits concerning the 2002 Plan, did rule against the County for failing to correctly implement the State Environmental Quality Review Act SEQRA) regulations regarding the 2003 Plan in June, 2004. The County's appeal was denied in July. The Baykeeper has also filed suit alleging violations of the federal Clean Water Act. NYSDEC has noted it finds these claims without merit.

As a reaction to public concerns about the potential impacts of West Nile Virus (and other mosquito-borne diseases) and the controls used to reduce mosquito populations, and public and regulator questions about the impact of wetland management for mosquito control purposes, Suffolk County issued a Request for Proposals for a Long-Term Plan (and Environmental Impact Statement on the Plan) for vector control and wetlands management. This report is part of that overall planning study, which was funded in 2003 and is scheduled to be completed in December 2005.

Suffolk County Vector Control Pre-1945 - 2003

	PRE-1945	1945-1970	1970-1980	1980-1999	1999-2003
WATER MANAGEMENT/ SOURCE REDUCTION	1900: Ditching Began ---------- 1930s: Extensive Ditching	Ditch Maintenance		Ditch Maintenance and Open Marsh Water Management Demonstrations	Open Marsh Water Management Demonstrations
LARVAL CONTROL	Oil with Pyrethrum	DDT	Abate	Bti, Methoprene, and Altosid	
ADULT CONTROL				Malathion and Pyrethroids	
MANAGEMENT	1926: Suffolk County Citizens Committee on Mosquito Elimination		Suffolk County Department of Health Services	Suffolk County Department of Health Services and Department of Public Works	Suffolk County Department of Public Works
DISEASE CONCERNS	Malaria			Eastern Equine Encephalitis	Eastern Equine Encephalitis and West Nile Virus

References:

Brand, R. (1993, November 6). The Mosquito Coast Plan to Renew Insect Control after Encephalitis Discovered. *Newsday*, pp. 7

CDC, (2000) Probable Locally Acquired Mosquito-Transmitted *Plasmodium Vivax* Infection --- Suffolk County, New York, 1999. MMWR 2000; 49(22); 495-8

Drexler, M. 2002. *Secret Agents: The Menace of Emerging Infections.* Joseph Henry Press, Washington, D.C. 44 pp.

Environmental Defense, (2004). *Who We Are: Origin and History.* Retrieved September 12, 2004, from the Environmental Defense Web Site: http://www.environmentaldefense.org/aboutus.cfm?subnav=originandhistory

Fagin, D. (2000, February 19). New State Plan to Fight Mosquitoes. *Newsday*, pp. A-3

Freedman, M. (2003, April 23). Suing to Stop Toxic Spraying. *Newsday*, pp. A-22

Haberstroh, J. (2000, March 18). On the Waters. *Newsday*, pp. A-35

James-Pirri, MJ, RM Erwin, and DJ Prosser. 2004. *US Fish and Wildlife Service (Region 5) Salt Marsh Study: Year 3 Study Report.* US Fish and Wildlife Service, Newington, NH.277 pp.

Jones, B. (2002, August 27). Attack on West Nile Under Way. *Newsday*, pp. A-3

Lambert, B. (2002, May 29). Environmental Group Protests Mosquito Controls in Suffolk. *Newsday*, pp. B-2

Lent, RA, T. Hruby, DP Cowan, and TS Litwin. 1990. *Open Marsh Water Management on Great South Bay, Islip, New York*. Seatuck Foundation, Islip, NY.

Morris County, (2003). *Mosquito Control Products.* Retrieved September 7, 2004, from the Morris County Mosquito Extermination Commission Web Site: http://www.morrismosquito.org/products/products.html

NYSDOH. 2000. *New York State West Nile Virus Plan Guidance Document*. NYSDOH, Albany, NY. 64 pp. + appendices.

Niedowski, N. 2000. *New York State Salt Marsh Restoration and Monitoring Guidelines*. New York State Department of State, Albany, NY. 135 pp.

North Shore Improvement Association, (1902). *Reports on Plans for the Extermination of Mosquitoes on the North Shore of Long Island between Hempstead Harbor and Cold Spring Harbor*. New York, New York.

Puglisi Sadie, (2003). *Phasing Out Pesticides.* Retrieved August 16, 2004, from Grounds Maintenance Magazine Web Site: http://grounds-mag.com/mag/grounds_maintenance_phasing_pesticides/

RISE (2003). *On Target with IPM.* Retrieved August 16, 2004, from RISE (Responsible Industry for a Sound Environment) Web Site: http://www.westnilevirusfacts.org/ontarget_ipm.html

Rothfield, M. (2002, January 28). Pushing for Pesticide-Use Study. *Newsday*, pp. A-15

Senay, Emily, (2003). *West Nile Virus Heads West.* Retrieved August 16, 2004, from CBS News - The Early Show Web Site: http://www.cbsnews.com/stories/2003/07/31/earlyshow/contributors/emilysenay/main566140.shtml

Suffolk County Citizens' Committee on Mosquito Elimination, (1937). *Report of the Suffolk County Citizens' Committee on Mosquito Elimination.* Yaphank, New York.

Suffolk County Citizens' Committee on Mosquito Elimination, (1938). *Report of the Suffolk County Citizens' Committee on Mosquito Elimination.* Yaphank, New York.

Suffolk County Citizens' Committee on Mosquito Elimination, (1939). *Report of the Suffolk County Citizens' Committee on Mosquito Elimination.* Yaphank, New York.

Suffolk County Citizens' Committee on Mosquito Elimination, (1943). *Report of the Suffolk County Citizens' Committee on Mosquito Elimination.* Yaphank, New York.

Suffolk County Citizens' Committee on Mosquito Elimination, (1945). *Report of the Suffolk County Citizens' Committee on Mosquito Elimination.* Yaphank, New York.

Suffolk County Citizens' Committee on Mosquito Elimination, (1947). *Report of the Suffolk County Citizens' Committee on Mosquito Elimination.* Yaphank, New York.

Suffolk County, (2003). *Mosquito Control*. Retrieved August 19, 2004, from the Suffolk County Government's Vector Control Web Site: http://www.co.suffolk.ny.us/webtemp5.cfm?dept=9&id=75

Suffolk County. (1974). Suffolk County Bureau of Vector Control Annual Plan of Work - 1975. Suffolk County Department of Health Services, Yaphank, NY. 10 pp.

Suffolk County. (1980). Suffolk County Bureau of Vector Control Annual Plan of Work - 1981. Suffolk County Department of Health Services, Yaphank, NY. 10 pp.

Suffolk County. (1981). Suffolk County Bureau of Vector Control Annual Plan of Work - 1982. Suffolk County Department of Health Services, Yaphank, NY. 10 pp.

Suffolk County. (1985). Suffolk County Bureau of Vector Control Annual Plan of Work - 1986. Suffolk County Department of Health Services, Yaphank, NY. 10 pp.

Suffolk County. (1987). Suffolk County Bureau of Vector Control Annual Plan of Work - 1988. Suffolk County Department of Health Services, Yaphank, NY. 10 pp.
Suffolk County. (1996). Suffolk County Bureau of Vector Control Annual Plan of Work - 1997. Suffolk County Department of Health Services, Yaphank, NY. 15 pp.

United States Army, (2004). *Pesticide and Mosquito Control Using Scourge*. Retrieved September 7, 2004, from the United States Army Medical Department Great Plains Medical Command Web Site:
http://www.gprmc.amedd.army.mil/Pmo/p_and_mos_control.htm

USFWS. 1999. *Concerns and Issues about Mosquito Control on National Wildlife Refuges in the Northeast*. USFWS. 53 pp.