CHAPTER 3.U

ALTERNATIVES

A. INTRODUCTION

The City Environmental Quality Review (CEQR) process requires that alternatives to the *Mosquito-Borne Disease Control Program* be identified and evaluated as part of the environmental review process. The alternatives analysis should present reasonable options for reducing or eliminating project-generated significant adverse impacts, while substantively meeting project goals and objectives; demonstrate a reasonable range of options to the *Mosquito-Borne Disease Control Program*; and compare potential significant adverse impacts under alternative approaches for meeting project objectives. The range of alternatives to be considered is determined by the nature of the specific action and its potential significant adverse impacts, as disclosed by the technical impact assessments. Described below are alternatives to the proposed *Mosquito-Borne Disease Control Program* which were either initially considered by the New York City Department of Health (NYCDOH) or suggested during the public scoping process.

Each alternative is described to the extent that its significant adverse impacts can be compared with the *Mosquito-Borne Disease Control Program*. Therefore, the level of detail in the analysis is dependent on the extent to which the significant adverse impacts identified as a result of the implementation of the *Mosquito-Borne Disease Control Program* differ from those of the alternative.

The *Mosquito-Borne Disease Control Program* will be designed to control mosquito populations at the site of the presence of viral infection and to reduce the potential for human exposure to mosquito-borne viruses. This section includes a description of the alternatives to the *Mosquito-Borne Disease Control Program*, an assessment of the potential environmental impacts associated with the alternatives (in comparison to expected impacts from the *Mosquito-Borne Disease Control Program*), a discussion of potential limitations to the adoption of the alternatives (where applicable), and an evaluation of whether (and/or the extent to which) the alternatives would likely reduce the potential for controlling a mosquito-borne disease outbreak.

One of the goals of the *Mosquito-Borne Disease Control Program* is to protect public health by reducing the potential for the spread of viruses in mosquitoes that have been identified as vectors of human diseases. The Proposed Action is one component of an integrated pest management program that NYCDOH has proposed to prevent and reduce human health risk from mosquito-borne diseases. NYCDOH has proposed adulticiding to help achieve the control of adult mosquitoes carrying viruses known to potentially harm humans in a timely response to surveillance data. The alternatives presented herein are evaluated in comparison to the *Mosquito-Borne Disease Control Program*, including the capability of such alternatives to provide a quick and effective response to control adult mosquitoes in portions of the City (or the whole City) where surveillance has indicated a potential threat to public health.

It is unlikely, based on examination of the available literature and information/experience supplied by mosquito control experts, efficiently and effectively to control mosquito vectors of disease using any of these alternatives alone. In many cases, they do not provide the flexibility to reduce significantly the adult mosquito population at numerous potential geographic locations in the relatively short period of time after surveillance data indicates a threat to public health. Adulticides can be used to depress adult mosquito populations in targeted areas in an attempt to significantly reduce the number of infected adult mosquitoes, break the virus cycle of transmission and, therefore, reduce the potential for a public health threat.

Some of the alternatives may be used in addition to the application of larvicides and adulticides to supplement the effectiveness of controlling adult mosquito populations. However, in the case of a public health threat indicated via surveillance, these alternative methods of control will not wholly substitute for an adulticiding plan and the significant reduction of adult mosquitoes.

B. ALTERNATIVES

Consistent with CEQR, in addition to the No Action Alternative which is required for all environmental impact statements (EISs), under the State Environmental Quality Review Act (SEQRA) (6NYCRR Section 617.14(f)(5)) this section analyzes alternative control plans and technologies to the *Mosquito-Borne Disease Control Program.* Due to the variety of alternatives considered, the alternatives in this section are grouped into the following categories:

- No Action;
- Biological Control;
- Alternative Technologies;
- Unauthorized Programs;
- Program Alternatives; and
- Open Marsh Water Management (OMWM).

The No Action Alternative describes the future condition if the *Mosquito-Borne Disease Control Program* is not implemented and the *Routine Surveillance and Control Program (Routine Program)* continues as the complete mosquito control program. The Biological Control Alternatives would employ biological control measures (e.g., introducing additional organisms—fish, birds, and insects—that consume mosquito larvae or adult mosquitoes in the environment). Alternative Technologies include the installation of mechanical devices throughout the City to catch and kill adult mosquitoes (e.g., Mosquito Magnets? and bug zappers). The Unauthorized Programs Alternative includes actions performed by NYCDOH without obtaining the required approvals beforehand (such as applying larvicides in every potential mosquito breeding location in New York City, including private properties, or mandating the installation of window screens for every City residence). Program Alternatives consist of alternatives that would include most of the elements of the *Mosquito-Borne Disease Control Program,* but would add, eliminate, or change one or more of the program elements (e.g., adding adulticide applications during daylight periods, eliminating buffer zones near water-bodies, including applications of new U.S. Environmental Protection Agency (USEPA) and New York State registered insecticides in the future). The OMWM Alternative would involve altering wet-lands in the City to provide circulation and flow in these habitats to eliminate potential standing-water mosquito breeding grounds.

For each of the alternatives there is a discussion of successful past uses elsewhere, if any, for control of mosquito-borne diseases; and the limitations of use. The potential environmental consequences and benefits of employing these alternatives are also discussed.

NO ACTION ALTERNATIVE

The No Action Alternative examines environmental conditions that would exist if the *Mosquito-Borne Disease Control Program* were not implemented. In this Environmental Impact Statement (EIS), the No Action Alternative is considered to be NYCDOH's *Routine Program*, which was subject to the CEQR and SEQRA processes and received a Negative Declaration on April 12, 2000. The *Routine Program* involves education and research; routine surveillance of humans, vectors (mosquitoes), and vertebrates (animals); and larviciding of probable mosquito breeding sites (e.g., storm drains/catch basins throughout the City, NYCDEP Water Pollution Control Plants [WPCPs], and stagnant water) to reduce larvae of potential mosquito-borne pathogens or affect residents of the Rockaways.

Under this alternative, NYCDOH would continue their *Routine Program.* Application of larvicides—by hand and/or backpack, except in areas with limited access where applications will be sprayed by truck and/or by air—will be focused on areas of standing water. The larvicides used are registered with the USEPA and the New York State Department of Environmental Conservation (NYSDEC) for use against mosquito larvae. These include chemical larvicides, including products based on methoprene, and bacterial products, such as *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* (Bs).

Source reduction of potential mosquito breeding sites would also be included as part of the No Action Alternative. This would include the removal or covering of tires, and the removal or elimination of open containers of stagnant water on public properties (and, where identified, on private properties consistent with the New York City Board of Health (BOH) resolution to reduce such areas that may pose a public health threat); and regular inspection of non-compliance and removal of objects preventing the natural flow of natural waterbodies. Non-compliance to the BOH regulations would possibly result in violations and/or fines.

During 2000, NYCDOH gained additional knowledge on the efficiency and effectiveness of the *Routine Program*, and is revising its application, surveillance, and control methods accordingly. The future *Routine Program* to be implemented under the No Action Alternative would incorporate these revised procedures. If NYCDOH chooses to make significant changes to the *Routine Program* that could result in potential significant adverse environmental impacts, these changes would be subject to an environmental review required by SEQRA and CEQR.

BIOLOGICAL ALTERNATIVES

These alternatives would involve the reduction of mosquito larvae and adult mosquitoes using biological control organisms such as larvivorous fish, bats, dragonflies and birds. Under these alternatives, natural predators of mosquito larvae and adult mosquitoes would be considered for introduction to control mosquito populations. In such cases, there would be concern about these newly introduced species outcompeting indigenous species and creating an ecological imbalance in the environment. The United States Fish and Wildlife Service (USFWS), Migratory Bird Treaty Act (MBTA), Endangered Species Act (ESA), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and NYSDEC (Article 11) all regulate and generally prohibit the introduction of non-indigenous wildlife.

Any discretionary actions that may have potential significant adverse environmental impacts would be addressed on a case-by-case basis by NYCDOH.

Fish and Amphibians

In areas where mosquito populations need to be controlled, larvivorous fish have been shown to be an effective method of mosquito control. Releasing fish into mosquito larvae habitats is a common and extensively used control method (Kent *et al.*, 1999). A number of mosquito abatement districts in the United States propagate and distribute mosquitofish (CDC, 1993). In a World Health Organization survey, the greatest number of countries using fish were in Africa. Some control programs in the Mediterranean region have been using fish for at least 40 years (Schreiber *et al.*, 2001).

Frog tadpoles have been advocated for use to control mosquito larvae; however, further work on culturing and field tests are needed before they can be accepted in a biological control program (Schreiber *et al.*, 2000).

Under a NYSDEC Fish Stocking Permit, the City currently stocks *Gambusia affinis* (i.e., mosquitofish) to control mosquito larvae populations in New York City Department of Environmental Protection (NYCDEP) operated WPCPs. Under the *Routine Program*, the City will utilize larvivorous fish in these and possibly other closed waterbodies. The City is also permitted by NYSDEC to stock fathead minnows—a native New York species—in the WPCPs; however, these fish have not yet been needed since the use and reproduction of *Gambusia* has been successful. *Gambusia* is not a species native to New York, and it would not likely be permitted by NYSDEC for stocking in open waters (i.e., natural waterbodies with free connections to rivers, estuaries, or the ocean). *Gambusia* is very aggressive and fecund, giving it the potential to replace commercially important or native fish species. (Mass. GEIR, 1998).

In Napa County, California (Maffei, 1999), mosquitofish are released in a variety of mosquito breeding sources, which include backyard sources, ornamental ponds and watering troughs, flood control ditches, storm drains, and swamp areas. They are not released in creeks, rivers, and streams.

Some pools of water where mosquitoes breed, however, would not support fish populations. These small ponds would not be stocked with mosquito-eating fish. Other NYCDOH control measures such as source reduction measures or the application of larvicides would help prevent mosquitoes breeding in these locations.

Other Insectivorous Organisms

Dragonflies are also predators of mosquitoes which could be introduced to control the adult mosquito population. Dragonfly larvae (i.e., naiads) could be introduced to help control mosquito larvae; however, some dragonfly naiads take 1 to 5 years to mature. Naiads are available for purchase from supply houses from late March through November, but are tenacious creatures that feed among their own kind, and are not selective in the consumption of other organisms.

The study of the use of dragonflies to control mosquitoes is not new. A collection of essays in 1890 on mosquitoes, dragonflies, and related economic and feasibility control factors, stated that, “An attempt to destroy flies and mosquitoes by the artificial propagation of dragonflies or any other insect would be unprofitable, unadvisable, and impractical” (Lamborn, 1890). Dragonflies normally occur in permanent waters where some targeted mosquito species may not be present. They also normally occur at low densities, and no controlled field studies have been done in which naiads have performed well as biological control agents (Mass. GEIR, 1998).

Predacious aquatic beetles could also be introduced to control mosquitoes. Larvae and adult stages of these beetles are effective predators of larvae and adult mosquitoes, respectively. Mass production of these insects has never been developed (Mass. GEIR, 1998).

Additionally, mosquito larvae predators such as hydra and flatworms have been examined in laboratories as potential control agents (Mass. GEIR, 1998). Other biological control organisms which can be introduced into mosquito breeding sites (e.g., tire piles) to eat mosquito larvae include indigenous planktonic arthropods (e.g., Copepods) (CDC, 1993).

Insect parasites, such as some nematode species, may be effective in killing mosquitoes. These organisms, however, are difficult to produce and have storage limitations (Rose, 2001).

Insectivorous Birds

Many native bird species (e.g., warblers, orioles, grosbeaks, woodpeckers, swallows, and vireos) eat insects. Under United States Code, Title 16 (Conservation), Chapter 7 (Protection of Migratory Game and Insectivorous Birds), Subchapter I, Sections 701 and 702, "the Migratory Bird Treaty Act (MBTA) prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, of any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit (50 CFR 21.11). Certain exceptions apply to employees of the Department of the Interior to enforce the MBTA and to employees of Federal agencies, State game departments, municipal game farms or parks, public museums, public zoological parks, accredited institutional members of the American Association of Zoological Parks and Aquariums (now called the American Zoo and Aquarium Association) and public scientific or educational institutions" (http://www4.law.cornell.edu/uscode/16/ch7.html#PC7). In the past, captive breeding programs (e.g., NYCDEP's Peregrine Falcon repopulation program) were implemented to restore low-breeding bird populations; however, no programs exist at this time (USFWS Region 5 NE Region, 2001).

The list of migratory birds protected by the MBTA appears in Title 50 of the Code of Federal Regulations, Section 10.13. Some species also appear on the list of endangered species under the Endangered Species Act (ESA) (Title 50 of the Code of Federal Regulations, Parts 10.13 and 17.11). In addition, some species are also included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Title 50 of the Code of Federal Regulations, Parts 10.13 and 23.23).

Under these laws, NYCDOH may not be able to introduce additional populations of existing bird species or introduce any non-native species to control mosquito populations. Under stringent regulations (i.e., special waiver), USFWS does issue Scientific Collecting Permits (USFWS Region 5 NE Region, 2001). A proposal for this type of activity requires including, but is not limited to, disclosure of the bird species planned for removal from one habitat to be released in another, how it would be caught, and when and where this would take place. If submitted, there is no guarantee for approval of this permit.

However, even absent the difficulties in importing additional bird species to control adult mosquitoes, the literature and consultation with mosquito control experts suggest that the role of avian predators has been greatly exaggerated except in isolated situations. Normally, birds do not specialize solely on pest species, and their impact upon such populations is only minimal (Elzinga, 1987).

Insectivorous Mammals

Under this alternative, mammals such as bats would be introduced in the City to control adult mosquito populations. Bat boxes and the necessary habitats/dwellings would need to be provided by

NYCDOH or other City agencies. At NYCDOH's discretion, this alternative could also include building bat boxes to supplement the existing bat population in known areas of high densities of adult mosquitoes.

Most bats feed on flying insects (Elzinga, 1987). Food items identified from 2,200 fecal pellets of the big brown bat collected in West Virginia included 13.2 percent dipterans (flies and mosquitoes). Beetles composed the largest group of insects in the pellets, along with bees and ants, mayflies, moths, and grasshoppers (Mitchell, 1993). Mitchell (1993) noted in a study on the diet of little brown bats in New Hampshire (Anthony and Kunz, 1977) that insectivorous bats are "selective opportunists" and seasonal variations in diet are also known to exist. Most bats are generalists in their taking of prey.

Introduction of bats to urban New York City is not without concern. Certain bat species are known vectors of rabies, and introducing mass numbers of bats to control adult mosquitoes may result in other unintended human health impacts. During the 2000 surveillance campaign against West Nile virus, three bats tested positive for West Nile virus, and it is not known (a) if they ingested infected mosquitoes or were bitten by infected mosquitoes or (b) whether the bats would help prevent or aid the spread of West Nile virus.

Human Vaccination Alternative

An alternative approach to vaccinate humans was proposed in the early 1940s in California to control mosquito-borne pathogens other than West Nile virus. Presently, there is no human vaccination available to implement this alternative, and for many mosquito borne viruses no human vaccines have been developed. In past studies, it was expected to be feasible in about three to four years (Epidemiology and Control of Mosquito-Borne Arboviruses in California, 1943-1987), but those predictions did not come true. Ultimately, the most effective long term prevention strategy may be vaccination, and research on the development of both human and equine vaccines is strongly recommended (CDC, 2001), but is outside the scope of this EIS and the authority of NYCDOH.

ALTERNATIVE TECHNOLOGIES

Alternative technologies are considered when potential significant adverse impacts could be reduced by adopting an alternative technology, and/or the alternative technology would be less costly and efficient in meeting the objectives of the project. Alternative Technologies that were identified for adult mosquito control include Mosquito Magnets? and bug zappers.

Studies performed using electrocuting devices have shown that female mosquitoes comprised only 0.42 percent to 4.1 percent of the insects killed by these machines (Surgeoner *et al.*, 1977; Nasci, 1983).

Mosquito Magnet?

Mosquitoes are attracted to carbon dioxide. A Mosquito Magnet? emits carbon dioxide that attracts biting insects (mosquitoes, black flies, and no-see-ums) within a one-acre area. The mosquitoes are vacuumed into a net and die within 24 hours. A Mosquito Magnet? device is powered by a 20-pound propane tank that needs to be replaced every three weeks. Similar to the Mosquito Magnet? , is the Insectivoro? which uses chemicals to attract insects. This device uses ultraviolet light and fan-powered suction to attract insects. The insects fly into this trap and collect in a pan.

Bug Zappers

"Bug zappers" are typically electronic devices with bright lights that are intended to electrocute night flying insects. Approximately 1.75 million bug zappers are sold in the U.S. each year. Bug Zappers kill insects indiscriminately (Rose, 2001). Approximately 95 percent of the species caught in these units are non-target and are commonly beneficial insects (e.g., moths). Mosquitoes generally consist of approximately 5-6 percent of the catch. Only half (or even less than half) of the mosquitoes killed by such devices are female mosquitoes (Mitchell, 1993, Mass. GEIR, 1998).

UNAUTHORIZED PROGRAMS

As discussed above, Unauthorized Programs would include programs that would allow NYCDOH to conduct mosquito control activities when needed without seeking prior approvals. The following section describes the options under the Unauthorized Programs Alternative.

Additional Larviciding Actions

This alternative would include not only the larviciding efforts under the *Routine Program*, but also potential larviciding actions on every property within New York City, including residential backyards and any observed stagnant pool of water. Such actions would be commonly undertaken before the detection of any mosquito-borne viruses on these properties, and likely would require residents to report on the condition of their landlord's or adjacent properties for the City to be fully aware of the intermittent pools of water. This approach might reduce the number of mosquito larvae as compared to the *Routine Program* (No Action Alternative); however, mosquito generation rates are very high and it is difficult to gain access to these locations to treat all such sites in time to significantly reduce breeding populations.

Household Prevention Measures

Under this alternative, window screens would be required in every New York City residence. Window screens would prevent the majority of insects such as mosquitoes from entering apartments, thus reducing human exposure to mosquitoes and the number of bites in this environment. However, such mechanisms would not protect people who spend time outdoors, especially during the summer and warm weather, which is also when adult mosquitoes are most active. In addition, many work sites with open bays such as garages and loading areas are not protected.

Other prevention measures include the addition of screen doors and weather stripping where needed to reduce the potential for intruding adult mosquitoes.

Strengthening the Immune System

This alternative was raised during the public scoping process. Since persons with compromised immune systems may be one of the groups most highly susceptible to encephalitis, under this alternative it was suggested that New York City residents should maintain a lifestyle rich in exercise and a balanced diet. Citizens would also be encouraged to treat their maladies with natural remedies (e.g., eating garlic). This alternative would require a significant amount of public education. Tourists and non-residents, however, would not likely receive this information, and their health would continue to be threatened by mosquito-borne diseases in the City.

Access Approvals

Under this alternative NYCDOH would need to request specific approvals for access into Federally owned properties, such as Gateway National Recreation Area, the only National Park within New York City boundaries. Approvals to larvicide and adulticide would be requested if surveillance shows

virus positive cases in proximity to the Park boundaries. Other properties with restricted use or prohibited access would also be included under this alternative.

PROGRAM ALTERNATIVES

Under this set of alternatives, the *Mosquito-Borne Disease Control Program* would be implemented; however, Program Alternatives or modifications to this Program (e.g., operational decisions and product application decisions) that NYCDOH has not chosen at this time would be employed. This could include not observing buffer zones around waterbodies; utilizing newly registered adulticiding products in the future; applying additional carriers in adulticide products; spraying naled by truck, and changing the times of application.

Use of Additional Carriers

Currently the *Mosquito-Borne Disease Control Program* does not include the use of additional carriers—chemical compounds added to adulticides to increase effectiveness of product. The Program currently proposes the use of ultra low volume (ULV) applications of adulticides (i.e., using the least amount of product with still proven effectiveness to cover a large area). For the proposed *Mosquito-Borne Disease Control Program*, NYCDOH would only add carriers to the adulticides if required by the product label. Under this alternative, NYCDOH would consider the addition of carriers (e.g., mineral oils) to ULV adulticides, which would result in a greater amount of inert materials applied per acre.

New Products

Another Program Alternative would be to apply USEPA registered and New York State (NYS) registered adulticides that become available after this EIS is complete. Application of these new adulticides would be based on research and experience of other municipalities and states that manage effective mosquito control programs.

Timing of Application Change

For the proposed *Mosquito-Borne Disease Control Program*, the application of adulticides would occur near dusk, overnight, or at dawn. Under this Program Alternative, NYCDOH would apply adulticides during daytime periods also, although such programs may be limited due to the tendency of adulticides to degrade in sunlight (and the potential thermal effects from buildings and the ground, which would raise the applied products away from ground/near ground level).

Elimination of Buffer Zones

As part *of the Mosquito-Borne Disease Control Program*, NYCDOH is proposing to maintain a 100-foot buffer around waterbodies during application of adulticides by truck and a 300-foot buffer around waterbodies during application of adulticides by means of aircraft. Under this alternative, such buffer zones would not be included in the program.

Alternative Applications

Naled application by truck and thermal fogging are alternative application methods for controlling adult mosquitoes. However, spraying naled by truck and thermal fogging of adulticides are not currently envisioned in the *Mosquito-Borne Disease Control Program*. Thermal fogs have been shown to have effectiveness similar to ULV applications; however, they require fuel oil carriers, and naled applications by truck may cause irritation to individuals in the immediate environment after application.

OPEN MARSH WATER MANAGEMENT (OMWM) ALTERNATIVE

Source reduction is the approach of this alternative. Three types of OMWM modifications can be made for marsh areas—tidal ditches, ponds, and pond radials (short ditches)—which are either slightly above or slightly below the spring tide line. All of these are variations of ditch digging to provide tidal flow and circulation to reduce salt marsh mosquito breeding sites.

The New York City Department of Parks and Recreation has initiated a Salt Marsh Restoration Program in an effort to increase the circulation of water around coastal wetland areas. Once an area is restored, water is able to flush in and out, and standing water no longer remains. This also provides habitats for native estuarine species (e.g., *Fundulus* [killifish]) to enter previously inaccessible marshlands where they can consume mosquito larvae.

Another wetlands mitigation plan—wetland restoration and enhancement—for the College Point Industrial Park was proposed in February 2000 by the New York City Economic Development Corporation (EDC). The New York District of the U.S. Army Corps of Engineers (ACOE) has tentatively scheduled habitat restoration in Bayswater State Park, Dubos Point, and Brant Point. NYCDEP has started work on projects, such as at the Gowanus Canal, where circulating water pumps are being employed for dead-end inlets to increase the flow of water and reduce stagnated areas. Projects such as these will enhance water circulation, open the flow of water in degraded wetlands, and/or allow native fish to reach potential mosquito breeding sites.

C. PROBABLE IMPACTS OF ALTERNATIVES

This section discusses the potential significant adverse impacts, if any, expected under each alternative. Areas of analysis include: Natural Resources, Public Health, Land Use, Infrastructure, Water Quality, Hazardous Materials/Contaminated Materials, Socioeconomic Conditions, Open Space, Cultural Resources, Visual Resources, Transportation, Air Quality, Noise, Waterfront Revitalization Program (WRP), and Energy.

This section also discusses the limitations that may arise if these alternatives were employed.

Almost all of these alternatives would generally not result in significant adverse impacts on land use, infrastructure, water quality, hazardous materials/contaminated materials, open space, cultural resources, visual resources, transportation, air quality, noise, the WRP, or energy. Where a potential impact could occur in one of these study areas, it is identified below. Most of the impact discussions are related to potential significant adverse impacts on natural resources, public health, and socioeconomics.

NO ACTION ALTERNATIVE

In the No Action Alternative, surveillance and larviciding activities would continue to be employed. The No Action Alternative would not meet the *Mosquito-Borne Disease Control Program*'s goals and objectives of controlling the adult mosquito population when virus-positive adult mosquitoes are identified. Under this alternative, only the mosquito breeding and overall larvae population would be controlled because NYCDOH would apply only larvicides. Employing only the *Routine Program* would not control the adult mosquito population as needed to prevent the spread of West Nile virus and other mosquito-borne pathogens.

The annual cost of the *Routine Program* for NYCDOH would be approximately $5.6 million (year 2000 dollars). Of this total, approximately $1 million is in direct salaries for NYCDOH staff

employed to run such operations, and the remainder of $4. 6 million per year is in indirect costs and direct expenses related to these actions.

Under this alternative, however, there would be the potential for greater adverse impacts to public health as compared to the *Mosquito-Borne Disease Control Program.* If NYCDOH decides not to undertake adulticiding under the *Mosquito-Borne Disease Control Program*—in addition to the *Routine Program*—the potential for infected adult mosquitoes to spread pathogens to humans and impact public health would be greater. The number of severe West Nile virus (or other viruses resulting from mosquito-borne pathogens) cases and the number of mildly symptomatic and asymptomatic cases would be expected to be greater under this alternative when compared to the those expected with the *Mosquito-Borne Disease Control Program.*

BIOLOGICAL ALTERNATIVES

In some locales, these methods have had limited success. The numbers of mosquitoes consumed from the implementation of these methods may not be adequate to prevent virus transmission and protect public health. Therefore, these methods may not achieve the goals and objectives set forth in the *Mosquito-Borne Disease Control Program.*

The cost of implementing biological control alternatives would be dependent upon the organism or group of organisms selected.

Some limitations of employing biocontrol alternatives include cost of introducing additional populations or new species; compliance with the Migratory Bird Treaty Act, Endangered Species Act, CITES, and NYSDEC permit regulations which describe the limitations of introducing species; providing habitat for these animals; supply and maintenance of sufficient levels of animal populations; protection of introduced species; and protection of indigenous species from exposure (i.e., predation) to introduced populations of species.

NYCDOH would be required to apply for NYSDEC Special Licensing permits under ECL Article 11. These permits would include, but not be limited to, Permit for Releasing Wildlife, License to Collect or Possess Wildlife, Endangered Species License if endangered species were released, and a special license from the United States Fish and Wildlife Service if migratory bird species were introduced.

Biological control alternatives involve the introduction of animal species (e.g., fish, birds, insects, and mammals) to control mosquito populations. This might have potential significant adverse impacts on natural resources and native populations. Further long-term research and field studies are needed to evaluate the potential impacts of employing any of the biological alternatives that include introducing living organisms into the environment to control populations of existing, native species. As in the cases of the introduced European Starling and plants such as *Phragmites* (Common Reed), native species are outcompeted and the introduced species thrive, in some cases to pest or invasive status. Due to the great number of unknown factors (e.g., habitat and breeding site loss, competition among species for food and resources) that could contribute to the depletion of native populations from the introduction of additional native or non-native species, the Biological Alternatives presented below are unlikely to be employed as stand-alone alternatives to the *Mosquito-Borne Disease Control Program*, which requires immediate action to reduce infected adult mosquitoes, break mosquito-borne virus cycles and reduce threats to public health at numerous locations throughout the City over time.

Fish and Amphibians

Under the *Routine Program*, NYCDOH in concert with NYCDEP stocks *Gambusia* in all of NYCDEP's WPCPs. Under this alternative, additional fish would have to be stocked in numerous freshwater environments throughout the City. This may not be feasible due to limitations on property access, plus the public resistance and legal impediments to introducing additional populations of native and non-native species into the environment.

To employ this alternative, NYCDOH would have to compile an inventory of potential mosquito-breeding freshwater habitats in the City in which to release fish for mosquito larvae control. Introducing fish may be effective in contained and very localized areas (such as in NYCDEP WPCPs under the *Routine Program*); however, a City-wide action would not likely achieve the goals set forth in the *Mosquito-Borne Disease Control Program.* The *Mosquito-Borne Disease Control Program* would control the adult mosquito population in addition to the larval population.

Amphibians, such as tadpoles, would not be able to be introduced into the numerous and varied locations where mosquitoes breed. They also could not be introduced en masse to various locations throughout the City in a short time period, and the effect of introducing large quantities of frogs into non-natural environments could have significant effects on the localized ecosystems.

"*Gambusia* are indiscriminate feeders that may eat tadpoles, zooplankton, aquatic insects, and other fish eggs and fry" (Rose, 2001). Since *Gambusia* is not a native New York species, introducing them into natural aquatic habitats could have potential significant adverse impacts on the ecosystem.

There are mosquito breeding sites which are too small to maintain fish populations (e.g., temporary pools or isolated containers). In this case, fish would not be used as a supplemental control measure.

Introducing fish or amphibians to any waterbodies—enclosed or open—in the City would only control a small portion of mosquito larvae populations. Infected adult mosquito populations, which fish would be unable to control at all the breeding sites throughout the City would continue to exist. The freshwater pockets that can appear in the form of puddles and water in containers cannot be stocked with fish or amphibians to control the breeding of mosquitoes. In addition, introducting fish and amphibians would not reduce infected adult mosquito populations (identified by surveillance programs). The unknown ecological effects of introducing fish into an environment with other living organisms could also disrupt predator-prey relationships. Thus, this alternative (as a stand-alone measure) would likely fail to reduce the potential for humans to contract mosquito-borne diseases as effectively as the use of adulticides, and there could be increased public health and ecological impacts from these alternatives as compared to the proposed project.

Other Insectivorous Organisms

Introduction of dragonflies in other regions have shown that these predators do not kill a sufficient number of adult mosquitoes to reduce the mosquito population and thereby control the spread of mosquito-borne pathogens such as West Nile virus. States that have purchased dragonflies in their mosquito control programs include Massachusetts, New Hampshire, and Maine (Mass. GEIR, 1998). However, dragonflies were never seriously used in these mosquito control programs (Kenney, 2001). These efforts have been part of larger nuisance control programs, not for controlling outbreaks of mosquito-borne diseases. Given the potential for mosquito-borne pathogens to appear in any region of the City, it would be impractical to flood the City with dragonflies or other insectivorous organisms to control potential localized outbreaks.

As stated above, some dragonfly species take 1 to 5 years to mature into adults. Long-term research and field studies are needed to evaluate how these organisms could fit into a mosquito-control program (Schreiber et al., 2001). Until then, there are many unknown factors that could have significant adverse impacts on indigenous populations and disrupt existing predator-prey relationships.

Detrimental effects on young fish have been reported when predators such as hydra and flatworms were introduced and reached high densities (Mass. GEIR, 1998). Careful control of release rates must be considered when introducing populations of flatworms to control mosquito eggs and larvae. These worms are natural components of aquatic communities and help control a portion of the aquatic larval stages of mosquitoes; however, additional studies are needed to find the appropriate release intervals before their actual effectiveness can be evaluated (Schreiber et al., 2001).

Although some of the insects mentioned above are effective at controlling a portion of the mosquito population in natural environments, data on managing invertebrate predators for adult mosquito control is not encouraging (Mass. GEIR, 1998).

Introducing other insectivorous organisms is extraordinarily difficult to employ on a short-term notice, and would only control a small portion of mosquito larvae populations. An identified infected adult mosquito population would not be significantly reduced by the introduction of such organisms. The unknown ecological effects of introducing these organisms into an environment with other living organisms could also disrupt predator-prey relationships. Thus, this alternative (as a stand-alone measure) would likely fail to reduce the potential for humans to contract mosquito-borne diseases as effectively as the use of adulticides, and there could be increased public health and ecological impacts from these alternatives as compared to the proposed project.

Insectivorous Birds

As stated above, under the Migratory Bird Treaty Act, it is illegal to breed and release additional native and non-native bird species without a Captive Breeding Permit from USFWS.

Birds that forage on insects are recognized as beneficial biological mosquito control agents (Mitchell, 1993). A variety of bird species are insectivorous. However, most of these species do not feed exclusively on mosquitoes. “No evidence exists that any main species can effectively control a species of insect pest upon which it feeds when the pest is at or near peak abundance” (Schreiber *et al.*, 2001). Some non-scientific studies have shown purple martins to consume thousands of mosquitoes per day. However, according to James R. Hill, III, Founder and Executive Director of the Purple Martin Conservancy Association, and contrary to the public conception, the number of mosquitoes that martins eat is extremely insignificant and introducing martins is not an effective method for controlling mosquitoes (Grossmann, 1990). In-depth studies have shown that mosquitoes comprise 0 to 3 percent of the diet of purple martins (Mitchell, 1993; Johnston, 1965; Grossman, 1990). The diet of martins generally consists of larger insects which are possible predators of mosquitoes (e.g., dragonflies). Mosquitoes and martins generally do not fly at the same height or at the time of year when mosquito breeding occurrences are at their peak. Purple martins (like most bird species) do not fly at night—the time period of the greatest mosquito activity. Therefore, minimal contact between these species is expected (Mitchell, 1993). The use of these birds alone to minimize the spread of mosquito-borne diseases would not protect public health.

The Toledo Area Sanitary District maintained martin houses in Lucas County, Ohio from 1953 to 1967. This project was terminated in 1967 because the district could find no way to show what effect, if any, the martins had upon mosquito populations (Kale, 1968).

In addition to USFWS laws and treaties, ECL Article 11 (NYSDEC) requires a permit for introduction of birds. If birds are used as biological control agents of adult mosquitoes, some of the limitations of their use include controlling the bird population so that it does not extirpate indigenous species, and providing sufficient habitat for the birds.

In a recent United States Geological Survey study (2000), bird-to-bird transmission of West Nile virus was observed. Further research is needed to evaluate factors associated with birds as possible vectors of the virus. If the virus is amplified in the bird population, it would not be prudent to encourage breeding bird programs.

Increasing bird populations would not achieve the goal—protecting public health—of the proposed project, given their potential to spread mosquito-borne diseases and relative ineffectiveness in reducing adult mosquito populations. Thus, this alternative (as a stand-alone measure) would likely fail to reduce the potential for humans to contract mosquito-borne diseases as effectively as the use of adulticides, and there could be increased public health and ecological impacts from this alternative, as compared to the proposed project.

Insectivorous Mammals

Some insectivorous mammals, such as bats, prey on a diversity of insects. Mosquitoes comprise only a portion of their diets. This is shown in several studies of the foraging habits of bats. One study on the feeding strategies of little brown bats in New Hampshire revealed from fecal analysis that beetles were the preferred food item (Hamilton, 1933). This is due to a beetle's hard-bodied form which is easily detected by echolocation (i.e., the sounding method, comparable to radar, that bats employ to detect prey at night). It is difficult for bats to differentiate among Dipterans (e.g., flies, mosquitoes); thus, pursuit of Dipterans may not be worth the investment of time and energy. It was also observed in this study that all available insects 0.12 to 0.4 inches in body length were accepted as food items (Anthony and Kunz, 1976). In a study of the food habits of bats in Indiana, Whitaker (1972) analyzed the stomach contents of little and big brown bats. This study revealed that a small number of mosquitoes—0.7 percent—were found in the stomachs of 23 eastern pipistrelle bats (Mitchell, 1993). Whitaker (1992) found that the primary food items of the evening bat in Indiana consisted of beetles, moths, and leafhoppers (Mitchell, 1993). Bats are "selective opportunists" and there may be short-term and seasonal specializations by diet due to prey availability and energy requirements (Mitchell, 1993, Anthony and Kunz, 1976).

During the 1920s, bat towers were constructed in Texas with the intent to control mosquitoes possibly carrying the malaria virus with high numbers of insectivorous bats. Remains from the bat roost guano showed that moths were the primary food items. Evidence was revealed against the notion that colonial bats are effective in mosquito control (Storer, 1926).

Maintenance of bat boxes and habitats for the additional bat population, as well as the potential impacts on native species from the introduction of additional bats into the City, would be significant concerns related to this alternative. The City maintains a conservative approach to treatment of people exposed to rabies. Installation and maintenance of bat boxes to encourage the growth of existing bat populations would be contrary to the City's position to protect the public from contracting rabies. There are also many unknown factors related to the possibility of bats as reservoirs of mosquito-borne diseases. Further research is needed to examine how viruses affect bat populations.

Potential significant adverse impacts may be associated with introducing new populations of bats or encouraging the growth of existing bat populations. In addition, if this alternative were employed, previously discussed ecological impacts on predator-prey relationships, habitat, and food resources

could occur. Evidence from available research on bats consuming mosquitoes demonstrates that this alternative would not significantly reduce the adult mosquito population to break mosquito-borne virus cycles, and this alternative (as a stand-alone measure) could result in increased public health and ecological impacts, as compared to the proposed project.

Human Vaccination Alternative

At the present time, vaccinations for many mosquito-borne diseases do not exist. While such studies are expected to continue in the future, this is not an alternative that NYCDOH can presently consider for control of mosquito-borne diseases. The CDC (2001) has recommended the support of research to develop human and equine vaccines for mosquito-borne diseases. Should human vaccine against West Nile virus and other mosquito-borne viruses become available in the future, NYCDOH will investigate the potential benefits from such future programs. This is included in the additional research component of the *Routine Program*. However, at this time, no vaccines against the West Nile virus and many other emerging diseases are available. The CDC Epidemic/Epizootic West Nile virus in the United States: Revised Guidelines for Surveillance, Prevention, and Control, states, "Ultimately, the most effective prevention strategy may be vaccination. It is important to support research on the development of both human and equine vaccines" (CDC, 2001).

ALTERNATIVE TECHNOLOGIES

Alternative technologies include devices such as Mosquito Magnets? and Bug Zappers which are used to attract insect pests.

Mosquito Magnet?

These devices work by exhausting carbon dioxide with an octanol mosquito bait (an additive to carbon dioxide that increases the attraction of mosquitoes to the magnet) as a method for attracting mosquitoes in search of a blood meal. These devices need to be installed with protective fencing and require the use of propane tanks. This alternative would be difficult to employ on a City-wide basis, and would have limited use in crowded urban areas where this is already a plethora of carbon dioxide sources.

Burning propane gas at many sources throughout the City would also need to be examined with respect to the total amount of additional nitrogen oxides (one of the precursors to ozone) during the summer periods. Disposal of used equipment, including propane tanks and nets, would also be of concern if employed City-wide. This alternative would also increase the demand for energy sources. Each Mosquito Magnet? installed would need a replacement propane tank every three weeks, which would involve additional trips by NYCDOH staff to maintain such units. These machines do not use natural gas.

Limitations of this alternative would include the maintenance, supply, and protection of these units. Fire department and safety issues associated with installation of propane tanks must also be taken into consideration. There would also be many logistical issues related to selecting the placement of these devices City-wide, such as storage of the replacement tanks and how many would be needed have full coverage of the City. Operation of a large number of these devices has the potential to result in significant adverse air quality impacts.

Mosquito Magnets? are used at some NYCDEP WPCPs. It would be at the discretion of NYCDOH to install additional units in isolated areas of the City. If units were installed City-wide, they could be subject to vandalism and replacement. These units are typically applied at 1 unit every acre. If placed

at locations throughout the City, they would likely be situated in parks near waterbodies or known places of high mosquito populations.

The reliance on Mosquito Magnets? for mosquito control throughout the City of New York is infeasible because the units rely on carbon dioxide as the means for attracting mosquitoes, and there are a plethora of such sources throughout the City that would interfere with the operation of Mosquito Magnets? . Deploying such units on short-term notice at numerous potential locations throughout the City is also impractical, and would only control a small portion of adult mosquito populations. Thus, this alternative (as a stand-alone measure) would likely fail to reduce the potential for humans to contract mosquito-borne diseases as effectively as the use of adulticides, and there could be increased public health impacts from this alternative, when compared to the proposed project.

Bug Zappers

Bug zappers use ultraviolet light to attract insects through an electrified wire. In addition to attracting mosquitoes, however, these devices attract and kill many non-target, beneficial insects. Kansas State University researchers have shown that upon impact of mosquitoes on electrified-wire, bug-zappers can spread bacteria or viruses from the insects up to six feet away. They also attract mosquitoes from large distances and increase their density in the vicinity of the traps, indicating that more often than not people are bitten by mosquitoes in the vicinity of the traps than away from them (Tippin, 1999). In the absence of adulticide spraying activities, the goals of the *Mosquito-Borne Disease Control Program* to decrease West Nile virus and other mosquito-borne pathogens would not be achieved with installation of these devices.

Studies have shown that four million bug zappers (average sales in U.S. over four years) operating for 40 nights each summer, would kill approximately 71 billion non-target insects each year (Horticulture & Home Pest News, 1996). This method of trapping insects would be inefficient and would not, without other mosquito-control measures, constitute an adequate method of mosquito control.

Bug zappers catch many species of insects other than mosquitoes. Therefore, these units may actually be harmful since they can destroy far more beneficial insects than mosquitoes.

One other key limitation of a bug zapper is that it requires a power source (i.e., an outlet). Problems associated with the location and possible vandalism of deployed bug zappers would also be significant.

As the primary method of control, bug zappers (and Alternative Technologies in general) will not be efficient enough to meet the goals and objectives of the *Mosquito-Borne Disease Control Program*. These units require power sources and studies have shown that mosquitoes are only a small percentage of the creatures killed by such devices. Deploying such units on a short-term notice at numerous potential locations throughout the City is also impractical, and would only control a small portion of adult mosquito populations. Thus, this alternative (as a stand-alone measure) would likely fail to reduce the potential for humans to contract mosquito-borne diseases as effectively as the use of adulticides, and there could be increased public health impacts from this alternative, as compared to the Proposed Action.

UNAUTHORIZED PROGRAMS

Additional Larviciding Actions

The concept of this alternative would be to larvicide at all locations throughout the City, regardless of ownership and access impediments. This would include larviciding properties owned by New York

State and Federal entities (e.g., national parks), which may be restricted. This alternative would be vastly larger in scale and scope compared to the BOH resolution which allows NYCDOH to take action where obvious neglect on reducing standing water has been observed on private property.

In 2000, New York City residents were encouraged to report standing water—breeding grounds for mosquitoes. The City and NYCDOH worked on the elimination of such breeding areas where possible. Under this alternative, to eliminate standing water breeding grounds for mosquitoes, the City would need to require residents to report on their landlords' or neighbors' properties, and the City would need to take immediate actions to address any potential breeding grounds. Given the capacity for some of the species that are known carriers of mosquito-borne viruses, such as West Nile virus, to breed in relatively short time periods (e.g., right after rainfall events), this alternative would require a City-wide effort to reduce all exposed water sources (including cups of water and puddles on private properties and all the parks in New York City) within a few days after every rain event, which is impractical. In addition, this alternative would not address the potential infection of uninfected adult mosquitoes already present in an area, where surveillance may show infections of mosquito-borne viruses in host animals.

The limitations of implementing only an increased larviciding program would be the failure to control adult mosquito populations and the necessity of trespassing on private properties. Although this alternative would be impractical to employ, the residents and workers of the City would likely be exposed to fewer adult mosquitoes under this alternative than under the No Action Alternative. However, even with additional larviciding, once mosquito-borne viruses are detected, the public would have greater exposure to infected adult mosquitoes as compared to that expected with the *Mosquito-Borne Disease Control Program.* Therefore, adverse impacts on public health under this alternative could be greater than those expected with the *Mosquito-Borne Disease Control Program.*

Household Prevention Measures

If all New York City residents were required to install window screens, the number of total mosquito bites would be expected to be fewer than under the No Action Alternative. However, this alternative would only lessen potential mosquito bites indoors. Residents would still spend time outdoors during the summer when mosquitoes are at the height of their biting activities.

It would be nearly impossible for the City to force installation of window screens in all New York City (publicly and privately owned) homes and apartments. Legislation would have to be adopted to direct and enforce this alternative. This alternative would also not protect people who were outside against infected adult mosquitoes. Thus, this alternative (as a stand-alone measure) would likely fail to reduce the potential for humans to contract mosquito-borne diseases as effectively as the use of adulticides, and there could be increased public health impacts from this alternative, as compared to the *Mosquito-Borne Disease Control Program.*

Strengthening the Immune System

This alternative would rely upon the average citizen to undertake activities to promote the individual's immune system. Mosquito-borne diseases can still adversely affect people with healthy immune systems. While many people who have died from recent mosquito-borne outbreaks (e.g., West Nile virus) in New York City are the elderly, many people who have been diagnosed as mildly symptomatic and asymptomatic of viruses are in good health, but still can become ill from these pathogens. Even if the entire New York City population tried to cooperate with this endeavor, not all people would be able to improve their immune systems, nor would the educational component be applicable to visitors, who are a significant proportion of the City's overall population during summer months.

The City cannot enforce this alternative on every New York City resident as protection from mosquito-borne diseases. This alternative would require education and cooperation of every New York City resident, and there is no guarantee of effectiveness. It is expected that employing this alternative in lieu of the *Mosquito-Borne Disease Control Program* would create additional risks to public health (especially to segments of the population more sensitive to mosquito-borne pathogens).

Access Approvals

NYCDOH is continuing to pursue approvals for larviciding of areas in Gateway National Park to reduce mosquito generation, and the potential risk to public health from mosquito-borne diseases, but has not been successful to date. NYCDOH would need to obtain approvals to access areas such as Gateway National Park to apply adulticides in the event of a positive case of mosquito-borne disease in proximity to these areas.

Under this alternative, NYCDOH would apply adulticides in Gateway National Park. If such approvals were gained in the future, NYCDOH would work with the National Parks Service to minimize the potential impacts to non-target species from these actions.

PROGRAM ALTERNATIVES

Timing of Application Change

NYCDOH plans to limit the use of adulticides to the period from near sunset through sunrise, because adulticides can break down quickly in the presence of sunlight. Also, the bulk of mosquitoes that are carry of pathogens which threaten public health are more active during nighttime periods than during daytime periods. If NYCDOH should elect to spray in the daylight hours (i.e., daylight hours well before sunset or well after sunrise), it is expected that the adulticide products would be less effective against the target species, and potentially more humans and non-target wildlife would be directly exposed to the adulticides.

NYCDOH will be monitoring the primary mosquito species that are a threat to humans. If at some time in the future NYCDOH plans spraying of adulticides during daylight hours, such actions would be subject to environmental review and assessment pursuant to CEQR and SEQRA.

Elimination of Buffer Zones

Not adhering to buffer zones may have potentially greater impacts on natural resources (i.e., aquatic organisms) than those expected with the limits in the proposed *Mosquito-Borne Disease Control Program.* However, changes in application technology may develop in the future that may increase the percentage of smaller droplet sizes in the distribution of the adulticides, thereby lessening the overall deposition of adulticides when compared to current application methods. Under such conditions, the potential impacts on natural resources without the buffer zones may be equal to or greater than those predicted for the *Mosquito-Borne Disease Control Program* in this EIS. NYCDOH will be monitoring the effectiveness of its future programs, and may at some time in the future decide whether the buffer zones are having a significant effect on the efficacy of the program. If the elimination of the buffer zones are recommended in the future, such actions will be subject to environmental review and assessment pursuant to CEQR and SEQRA.

Use of Additional Carriers

The addition of carriers to ULV applications beyond those required as a minimum by the product label is not expected to result in any increase in efficacy of the adulticide products. “Inert diluents such as water and petroleum-based products do not kill mosquitoes” (Mount *et al.*, 1996). Thermal

fogging uses additional carriers. Thermal fogs result in dense clouds which are helpful to see the drift of the products. Thermal fogging includes the combustion of fuel oil, and is a technology less frequently employed across the country.

The additional carriers would either be water or substances similar to the inerts in the adulticide products. In the case of thermal fogging, it would include the combustion of fuel oil. This alternative would result in increased volume of product per application, but not the amount of active ingredients per acre. Any potential impacts associated with the inert ingredients in the adulticide products under the *Mosquito-Borne Disease Control Program* could be greater under this alternative.

The use of additional carriers in products may result in greater amounts of inert ingredients in the environment. Therefore, this alternative may have potentially greater impacts on public health, natural resources and water supply, as compared to those expected from the voluntary limitations under the proposed *Mosquito-Borne Disease Control Program*. If NYCDOH modifies the *Mosquito-Borne Disease Control Program* at some time in the future to include the use of additives beyond those required as a minimum by the product label, it will be subject to environmental review and assessment pursuant to CEQR and SEQRA.

OPEN MARSH WATER MANAGEMENT (OMWM) ALTERNATIVE

This alternative would have to be examined on a site-by-site basis to ensure that there are no adverse impacts to ecosystems from the changes to tidal flow patterns and wetland vegetation. Permits would be required from NYSDEC and U.S. Army Corps of Engineers (ACOE) to perform such activities.

ACOE proposed that habitat restoration in Bayswater State Park, Dubos Point, and Brant Point would significantly reduce the potential salt marsh mosquito generation in the Jamaica Bay section of Queens by enhancing water circulation and reducing environmental conditions that are conducive to mosquito breeding. Such work will be undertaken by the directive and environmental determinations of ACOE.

In February 2000, the Economic Development Corporation (EDC) proposed mitigation measures on the Flushing Airport project site for wetland losses within the College Point Industrial Park. The mitigation measures are planned to satisfy an Order on Consent under preparation by NYSDEC. The Order on Consent is the first step in seeking NYSDEC approval for the Flushing Airport project. The mitigation plan will go through engineering design, require NYSDEC wetland permit approval, and be subject to the CEQR and SEQRA processes. The mitigation plan includes wetland restoration and enhancement of approximately 32.94 acres on the Flushing Airport property.

These types of source reduction and enhancement measures would reduce potential sites for mosquito breeding. However, these activities would potentially reduce only mosquito larvae populations, and would not have an effect on identified infected adult mosquito populations. Although these measures are being actively being pursued by City, State and Federal agencies, this alternative (as a stand-alone measure) would likely fail to reduce the potential for humans to contract mosquito-borne diseases as effectively as the use of adulticides. Therefore, there could be increased public health impacts from this alternative as compared to the Proposed Action.

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