Commonwealth of Massachusetts
State Reclamation Board

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AND
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Best Management Practice Plan

Topsfield

Draft for FY07 Revised: 1/08 1/09 1/10

Mosquito/Arbovirus Surveillance Summary

Northeast Massachusetts

The 2009 mosquito/arbovirus surveillance program began on May 4th and ended on September 30th. There were two collections per week in trapping stations in each of the thirty-two District cities and towns. Our EEEV-***Culiseta*** surveillance program began on June 16th and also ended on September 30th; ***Culiseta*** is the general name of the principal group of local mosquitoes that transmit Eastern Equine Encephalitis virus (EEEV) to and from local birds. There were two collections per week in nine ***Culiseta*** trapping sites along the border with New Hampshire. With the increase of EEEV-infected mosquitoes collected in August, eleven additional ***Culiseta*** trapping stations were set in communities immediately south of the border towns and in locations deeper in Essex County with recent EEEV histories; these trap stations were also visited twice per week from August 31st until September 30th. When necessary, additional portable mosquito traps were set to increase surveillance of mosquitoes transmitting West Nile Virus (WNV). These traps were set primarily in urban communities with histories of West Nile Virus at times during unusual mosquito population increases and during periods when virus transmissions were suspected to be higher than usual.

All mosquitoes trapped were immediately identified, tallied, and recorded into our database. In 2009, 76,581 mosquitoes were collected from all towns in the District in all three types of surveillance traps. Far more mosquitoes were collected in 2009 as compared to the previous two years with the same numbers of traps and stations. In 2008, 63,833 mosquitoes were collected and 46,575 were collected in 2007.

Specimens from the four key species that can effectively transmit EEEV and WNV were separated, packaged, cataloged, and shipped to the MA Department of Public Health's Arbovirus Surveillance

Lab (DPH/ASL). These specimens (grouped into units called "pools") were tested for presence of these viruses. Specimens were sent on every Thursdays after July 16th, received the following day at the Lab where they were immediately processed and testing commenced. The "virus status" for each pool could be determined as early as the following Monday. We were informed of every positive infected pool the same day the results were obtained, as were the boards of health of communities from where the infected pools were collected. This year in the District, there were fourteen positive EEEV-infected pools from five communities (Amesbury, Merrimac, Haverhill, Methuen, and Hamilton) and only two WNV-infected pools from (Amesbury and North Andover). There were no human cases with either virus but, there were two EEEV-caused animal fatalities: a horse West Peabody and an alpaca in Newbury.

For the first time, the District was charged a fee of $25 for each mosquito pool submitted for virus testing. Due to this, and other restrictions (the numbers of pools that could be sent, the number of mosquito species to be tested) only 567 pools were sent for testing this year, as compared to 773 pools sent last year and 849 in 2007. We do not foresee any changes in fees and restrictions in 2010.

The appearance of EEEV, after two years of no reports in the District, was not totally a surprise, after the unusual weather events that brought on a huge increase in the populations of the principal carrier, ***Culiseta melanura***. What was alarming was the abundance of infected mosquito pools reported over the District's northern border in southeast NH and the trepidation caused wondering whether similar increases will appear on our side of the border. Fortunately, the challenges were met with rapid and targeted responses and regional-wide intervention plans were set and ready for implementation in quick time. For more details on how the reports of EEEV and WNV were addressed, as well as surveillance and response plans (including changes) for 2010, please refer to the District's Vector Management Plan that accompanies this document.

As in 2007 and 2008, there was abundant snowfall throughout the District during the 2008-09 winter. Also, as in the spring of 2008, the anticipated abundance of standing water available for excessive mosquito development and emergence did not materialize this spring. Again, we had a spring drought which was more pronounced than that the previous year, with snowmelt being drawn into the soil and leaving relatively little standing water for mosquito larval development to be completed. In addition, the late spring and early summer was cooler than usual. The result was the reduction in populations of "Spring Brood" mosquitoes, in even fewer numbers than last year! All of the following common "Spring Brood"/floodwater mosquitoes exhibited marked reductions in populations: ***Aëdes vexans***, ***Aë. canadensis***, ***Aë. excrucians***, ***Aë. stimulans***.

After the Spring drought, we have much higher-than-normal rainfall from mid-June through mid-July. The result was a "delayed release" in adult "Spring Brood" mosquitoes (peaking in mid-July rather than in mid-June) and a much greater than normal abundance of these mosquitoes. Furthermore, with several heavy rain events occurring through the end of August, there were several subsequent "heavy" emergences of adult floodwater mosquitoes. These include ***Aëdes cinereus***, ***Aë. canadensis***, and most famously, ***Aë. vexans***.

Although a notorious human biter, ***Aë. vexans*** is not a major player in arbovirus transmission unless it is abundant at the time of high arboviral "presence". This period occurs from late July through August when the greatest proportion of birds is infected with arboviruses. ***Aë. vexans*** not only bites humans, but can bite infected birds and "incubate" the viruses well enough to pass them onto humans at their next feeding. Therefore, when high populations of ***Aë. vexans*** are present, the

probability increases that there will be more infected blood-seeking mosquitoes; thus, the risk to human infection by one of these arbovirus-carrying mosquitoes also increases. This was the scenario that occurred last summer in New Hampshire and indeed, one of the EEEV-infected mosquito pools collected in Merrimac in late August was ***Aë. vexans***.

Although they comprised only a small percentage of all our collected adult mosquitoes, the principal EEEV vector, the Cedar Swamp mosquito (***Cs. melanura***) also increased its population thanks to the abundant seasonal-long rainfall. More of this species was collected in our CO_2-baited traps and especially in our resting boxes. In addition, more trapping sites had collected this species, and these collection of this species continued until the end of the surveillance season. This is the first time in this decade that we've seen such an increase in this species in numbers, locations, and duration. This large increase of ***Cs. melanura*** populations, during the height of maximum EEEV transmission cycle (late July through September), was most likely the cause of the abundant EEEV-mosquito isolations in our District.

Although the abundant rainfall did not influence greatly on the abundance of the "Cattail Swamp/ Salt and Pepper mosquito", ***Coquillettidia perturbans***, the cooler-than-usual spring and early summer retarded the late larval development of this species. The result was an emergence of adults (in July) coinciding with the beginning of the EEEV high-transmission period. ***Cq. perturbans*** can bite infected birds as well as mammals and are considered a most "dangerous" bridge vector. (A "bridge vector" is a mosquito species that can transmit a virus from one type of animal host, namely birds, to another type, like human beings.) And while we did not send adults of this species for arboviral testing unless they were "aged" (due in part to the aforementioned restrictions imposed by DPH/ASL), none of the pools sent were infected with EEEV. Pools of this species from both southeastern NH and southeastern MA were infected with this virus.

Also, in lower populations in 2009 was one of the salt marsh species, ***Aë. sollicitans***. Hydro-geological events affected by drought may have reduced the abundance of early season larvae, and unusually high early season tides may have washed away the bulk of the remainder. However, there were increases in the Brown salt marsh mosquito, ***Aë. cantator*** throughout the season. Salt marsh mosquitoes were kept "under control" by our aerial salt marsh larviciding program releasing the bacteria ***Bacillus thuringiensis israelensis*** to control newly-hatched larvae emerging just after the highest or "Spring tides" each month. However, when heavy rains fell between "Spring tides", the uppermost reaches of the marsh would accumulate and hold water, allowing for hatching and development of ***Aë. cantator***. This species can develop in waters that are mildly brackish thus, with more standing water available, more than usual emergences of this species occurred in August and early September.

If urban container-breeding ***Culex*** mosquitoes are most abundant during droughts, then the converse should be true. And indeed that was the case in 2009. With the overabundance of rain constantly feeding containers and water holes, there was little opportunity for water to go "foul" and become putrid with decaying organic matter until much later in the summer. Thus, with their preferred breeding habitats being relatively scarce, there were fewer of them developing until later in the summer. The result was lower populations of ***Culex pipiens*** and ***Cx. restuans***. In case our surveillance trap locations were not in areas of abundant urban ***Culex*** breeding, temporary gravid traps were placed around urban areas with historically high ***Culex*** populations and after 48 hours of trapping, few of these mosquitoes were collected. Catch basins (a preferred breeding habitat for these species) in the urban areas were also treated with larvicidal agents by early summer. Therefore, the larvicidal agents may have also contributed to the decline of numbers of these two

species in urban communities. Again, you can refer to the 2010 VMP for details on our catch basin larvicidal program and other related urban mosquito control strategies.

Being that these two species are the principal vectors of West Nile Virus in northeast MA, with their populations reduced, so were reports of this species collected with WNV. In 2008, ten pools tested positive for WNV in the District. As discussed earlier, only two isolations of WNV were collected. This marks the lowest number of WNV-mosquito pools recovered in the District since 2003, when only two infected pools were collected that year. Even more remarkable was the mosquito species in both WNV reports was the EEEV vector, ***Cs. melanura*** and not ***Cx. pipiens*** or ***Cx. restuans***! Furthermore, the infected ***Cs. melanura*** were collected in resting boxes (the usual EEEV surveillance trap) and not from any CO_2-baited or gravid traps, the usual traps for collecting WNV-infected mosquitoes.

The early season drought also reduced the abundance of tree-hole breeding species, ***Aë. japonicus*** and ***Aë. triseriatus***. While these species are abundant in forest habitats, they are quite adept in using artificial container into which they can breed. Thus, these species can be common in urban settings, particularly in the vicinity of cemeteries, junk yards, and private properties that are abundant with discarded tires, can, and containers of all sorts. As rainfall increased after mid-July, the populations of these species also increased to higher-than-normal levels. Of interest is the "Japanese Rock pool mosquito", ***Aë. japonicus*** which is a notorious mammalian and human biting mosquito. This species also can function as a "bridge vector" locally transmitting arboviruses and pools of aged females were sent from areas with suspected high levels of EEEV transmission. Fortunately, none were found infected.

Residents should be reminded that our District's mosquito control operations are geared primarily towards "vector management"; i.e., our surveillance and control strategy is designed to identify, monitor, and control vectors of WNV and EEEV. We are not a "nuisance control" or "mosquito eradication" outfit. If annoyed residents live next to huge tracts of freshwater wetlands or forest swamps that are releasing thousands of mosquitoes by the second, there is very little we can do about that!

Topsfield

With the overwhelming dominance of freshwater habitats, one could almost say that Topsfield is really just one giant swamp. And with that giant swamp are giant mosquito concerns with abundant mosquito species and numbers, and more and more of these are having impacts on public health! As populations increased District-wide in 2009, so did mosquito populations in Topsfield, increasing by 75% from 2008 levels, as collected at our historical trapping station (Pleasant Grove cemetery).

And while freshwater habitats are in great abundance throughout Topsfield, we did not record any major increases in most of the freshwater species. Also, it is possible that 2008 was a "low population cycle year" for species often seen in much greater abundance, such as ***Coquillettidia perturbans, Anopheles punctipennis***, ***An. quadrimaculatus***, ***Aë. canadensis***, and ***Culex salinarius***. The only species that showed a dramatic increase in population was the principal floodwater mosquito (also known as the "Re-flood" mosquito) ***Aëdes vexans***. That this species increased its numbers was not a great surprise considering all the rain and the timing of all that rain. ***Aë. vexans*** is one of the group call the "Spring Brood" mosquitoes being that they all emerge at one time, from

May to June. However, ***Aë. vexans*** will usually make additional "appearances" during the season, emerging ten-to-fourteen days after a major rain event, and this was the case in 2009.

Container-breeding ***Aë. japonicus*** and ***Aë. triseriatus*** (in tree-holes, cemetery urns, and discarded tires) were reduced by the spring drought, however, ***Aë. japonicus*** populations increased after the summer rains but never to levels that generated concern.

Also present in Topsfield, although in small numbers, was the "Cedar Swamp mosquito" ***Culiseta melanura***. It's presence is always of concern being that it is the principal vector of EEEV; recall that EEEV was reported in adjacent Hamilton in 2005, 2006, and again in 2009. And while comprising only 6% of this year's total mosquito catch in Topsfield (more than doubled from last year), it caught our attention. A resting box site for EEEV-vector surveillance was set in late August at the Pye Brook Community Park in response to the increase in EEEV-mosquito pools collected in the "Front Line" communities (see 2010 VMP). All specimens of vector species were sent to DPH/ASL for testing and none were reported positive for EEEV. However, from the resting box site set in Hamilton's Chebacco Lake area an EEEV-mosquito pool was collected in mid-September.

As outlined in the 2010 VMP, due to increased presence of EEEV in the District in 2009, we will enhance our surveillance for EEEV vectors in 2010. This includes maintaining our resting box station at Pye Brook, as well as the sites in Boxford and Hamilton throughout the season. If EEEV is found in mosquitoes or if vector populations increase unexpectedly, we will discuss intervention options with the Board of Health and upon their approval, take the necessary actions to protect your residents.

Also decreasing were populations of ***Culex pipiens*** and ***Cx. restuans***. These are the principal WNV vectors in the region. All specimens collected of both species were sent to DPH/ASL and no WNV or EEEV was isolated from these mosquitoes. Since vector populations never reached levels of concern, we attributed our catch basin larviciding operations with assistance in maintaining low vector numbers. With virus transmission kept low, the risk of infection to the residents was kept low as well. It should be noted that while collections of these mosquitoes were low at the trap stations, other areas of the town may have had higher populations since these mosquitoes can easily breed in areas of refuse, especially in abandoned properties.

Focus of Operations

The District's Vector Management Plan VMP will take precedence over all operations prescribed in this BMP. Regional control efforts will focus primarily on adult mosquito surveillance, virus testing and preemptive virus intervention strategies. Specific to Topsfield, are included intensive adult mosquito surveillance, wetland and larval surveillance, larviciding and catch basin applications.

Regional Control Measures

Regional Adult Mosquito Surveillance Program: The importance of surveillance data in reducing the risk of vector borne disease can not be overstated. By focusing on areas of heightened viral activity, preemptive control measures can be timely, efficient and effective. In 2002 we expanded and greatly improved our surveillance program by developing and implemented an automated carbon dioxide (CO_2) surveillance system. This system incorporates a CO_2 modified light trap and

gravid trap into one automated unit. CO_2 traps are used to sample the general adult mosquito population, monitor both short and long term trends, and determine dominant species and population density.

Gravid traps are designed to collect adult female ***Culex*** species the primary vectors of WNV. One of these dual function units is placed in a fixed location in each member municipality for a total of 32 deployed throughout the District. Mosquitoes are collected and identified from each trap twice a week beginning on or about May 1st thorough September 30th and beyond if conditions and circumstance warrant.

The District will operate 136 resting boxes more than doubling the number we deployed in 2009. Resting boxes are designed to collecting blood fed female ***Culiseta melanura*** mosquitoes relevant to EEE transmission. The District began deployment of resting boxes in 2006 in response to the emergence of EEE in the Northeast and they have proven to be a valuable tool in early intervention. Six to eight resting boxes will placed at each fixed location and there will be two fixed locations in communities bordering New Hampshire as well as other communities considered to be at risk. The District will collect and identify samples from each trap twice a week and the specimens will be tested for virus.

In 2008 the District initiated a pilot program of deploying a new type of trap called the "BG Sentinel trap". While these traps have reportedly been effective in attracting ***Aëdes albopictus***, commonly called the Asian Tiger mosquito, our experience with these traps was disappointing. ***Aë. albopictus*** has been rapidly spreading throughout the temperate regions of the U.S., including southeastern Massachusetts and in fact has become the dominate mosquito in New Jersey. ***Aë. albopictus*** is the principal vector of a Chikungunya outbreak in countries along the Indian Ocean Basin and Northern Italy. While the continued deployment of these traps regionally is not practical at this time, it is our intention to develop an early warning surveillance system because of the public health implication posed by ***Aë. albopictus***.

In 2009 we deployed two of these traps in an effort to fine tune these devices to work more efficiently and make comparison with other alternatives we may develop. Again our experience with these traps was disappointing and we have no plans to use these traps in 2010.

In 2010 our efforts to monitor for the potential arrival and distribution of ***Aë. albopictus*** in the District will focus on locating used tire import depots and randomly deploying gravid traps in and around these facilities. Used tires holding water is a common habitat of ***Aë. albopictus*** and the consensus among experts is that tire dumps are likely responsible for the spread of ***Aë. albopictus.***

Virus Testing: Specimens from our trap collections will be sent to The Massachusetts Department of Public Health (DPH) to be tested for the presence of encephalitis viruses.

<u>Control Measures Specific to Topsfield</u>

Surveillance: The Pine Grove Cemetery will serve as the District's fixed location for a CO_2 and gravid trap. Additional traps may be deployed as necessary.

Wetlands Surveillance: Wetlands will be investigated for potential mosquito breeding. A mosquito breeding or larviciding site database will be developed. Sites will be prioritized by mosquito habitat type, vector virus concerns and proximity to human populations.

Ground Larviciding: Larviciding sites will be treated first in those communities prioritized in the District's VMP, otherwise larviciding sites from the District's data base and areas requested by the Board of Health will be checked and treated as necessary, in lieu of catch basin treatments, not to exceed one day per week from April 1st to August 31st and beyond if circumstances warrant and conditions allow.

Catch Basins: Catch basins and storm water structures will be checked and treated as necessary not to exceed one day per week (conditions permitting and in lieu of larviciding) from June 1st to August 31st.

Adulticiding: Selective adulticiding as a vector virus intervention measure only, coordinated through the Board of Health and in accordance with the District's Vector Management Plan.

Barrier Treatment: The District uses a system called Ultra Low Volume (ULV) for ground adulticiding applications. ULV is designed to dispense very small amounts of pesticides over a large area. While this is a cost effective means of reducing mosquito populations on a large scale, it only affects those mosquitoes present at the time of the application and repeated applications are sometimes necessary to sustain the initial reduction in the mosquito population in some areas.

To reduce the need for repeated applications and provide more sustained relief from mosquitoes in high public use areas, the District may provide barrier treatments to public use areas such as schools (applications to schools must be incompliance with MGL ch85), playgrounds, athletic fields, etc., at the request of the Board of Health and school departments.

Ditch Maintenance: In the course of larviciding and catch basin treatments, roadside ditches and culverts will be manually cleared of manageable blockages and debris in order to reduce mosquito breeding habitat and or potential habitat.

Wetlands Management: The Town may petition the District to undertake larger scale ditch maintenance projects, wetlands enhancement, mitigation and restoration projects requiring specialized mechanized equipment. Petitioned sites will be evaluated and a site specific proposal will be written for acceptable projects. Wetlands management projects may be beyond the scope of any municipality's assessment and may require separate and additional appropriation. The District may assist in securing funding for such projects.

Inspectional Services: While the District is authorized under the provisions of Chapter 252: section 4 of the General Laws of the Commonwealth to enter upon lands for the purpose of inspection, it is not a regulatory agency. Nor is it our intention to impose on any resident or business, but rather to be a resource for information and technology to help property owners prevent or abate mosquitoes to the mutual benefit of the property owner and the community. The District will act as a technical advisor as requested by the Board of Health and represent the municipalities public and animal health and human annoyance concerns relative to mosquito breeding, potential breeding and proposed development. The District, at the request of the Board of Health will also review site plans and inspect sites were storm water structures are planned or under construction. Upon inspection of a site the District will make written recommendations, submit these recommendations to the Board of Health and "cc" a copy to the land owner.

Property Inspection: Socioeconomics often plays an important role in mosquito control and associated public health risk. This is evident by a study conducted in 2007 entitled "Delinquent Mortgages, Neglected Swimming Pools, and West Nile Virus, California" which demonstrates a 276% increase in the number of human WNV cases in the summer of 2007 associated with a 300% increase in foreclosures which led to a large number of neglected swimming pools in Bakersfield, Kern County. Last year we received several request from Boards of Health to inspect abandoned properties.

While the District has a long standing policy of property inspections at the request of Boards of health, in the past we have taken a passive approach to property inspection. Given the current economic climate and likelihood of increasing property abandonment and the potential for increased health risk associated with property abandonment the district will take a more aggressive approach to property inspections. In the course of our routine activities in your community we will be on the lookout for such properties and report such properties to Boards of Health. We understand that addressing concerns related to such properties is a matter of time and process. In the Long term we will offer any support that may be appropriated to resolve mosquito problems related to such properties and in the short term with the Boards of Health's support we will implement the necessary control measures to mitigate the immediate mosquito problem associated with such properties.

Research and Development: Investigate new methods, procedures and technologies in mosquito control and wetlands management and evaluate there implications for use in Topsfield.

Education and Outreach: Present education displays and programs on mosquito control and related wetlands management programs at the request of health officials, schools or civic organizations.

FY11 percentage of assessment allocated to specific measures as prescribed by individual municipality's Best Management Practice (BMP) in the Town of Topsfield.

The District has not requested a budget increase since 2004. Over the past two fiscal years the assessments for each municipality has remained the same. Over the past three years the assessment for 17 of our 32 member municipalities has actually gone down. The District's budget for FY 11 will be reduced by $5,029.20 which reflects a mandatory furlough for the Director and Operations Manager.

Assessment: As estimated by the Massachusetts Department of Revenue, Division of Local Services for, in accordance with Chapter 516 of the General Laws of the Commonwealth. The assessment formula is based on a regional concept, which considers square miles and evaluation. The District offers this breakdown as a general guide to how these funds are allocated specific to your community.

FY11 Estimated Assessment for the Town of Topsfield		$ 37,874.00

District Breakdown of Administrative and General Operational Cost

State Reclamation and Mosquito Control Board	1.4%	$ 530.24
Administration and Facilities Cost Share	22.4%	$ 8,483.78
Balance of assessment allocated to Operational Cost	76.2%	$ 28,859.98

District Breakdown in Approximate Percentages
Specific Control Measures as Prescribed by BMP

General Operational Cost Share	25.8%
Regional Adult Mosquito Surveillance Program	9.4%
Regional Vector/Virus Intervention	19.8%
Wetlands Surveillance	0%
Catch Basins/Larviciding/ Manual Ditch Maintenance	40%
Inspectional Services	
Adulticiding	
Research and Development	
Education	5%