

# CMMCP AERIAL MOSQUITO LARVAL CONTROL PROGRAM



## SPRING 2019

**DAVID MULLINS & TIMOTHY D. DESCHAMPS**

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## ABSTRACT

Early season mosquito species spend much of their life cycle in the larval stage when they are concentrated and highly susceptible to control efforts. The larvae are defined within water boundaries and relatively immobile with little ability to disperse. Larviciding is a broad term for killing immature mosquitoes by applying agents called larvicides, while taking advantage of their confinement in their larval habitat. Effective larviciding can reduce the number of adult mosquitoes available to disperse, potentially spread disease, create a nuisance, and lay eggs which leads to more mosquitoes. In 2019, the Central Massachusetts Mosquito Control Project conducted an aerial larvicide under supplemental appropriation in the towns of Billerica, Boxborough, and Chelmsford, using *Bacillus thuringiensis israelensis* (Bti), which resulted in 86.92% reduction in mosquito larvae at monitored areas.

## OBJECTIVE

Some species of mosquitoes lay eggs that stay dormant over winter and begin their development only after they have been cold-conditioned and submerged by water. The melting of snow and spring rains provide the water they need to begin their progression from egg to larvae. The aerial larvicide program aims to reduce the size of the population of mosquitoes by eliminating their ability to develop into flying, mammal-biting adults. *Bacillus thuringiensis israelensis* (Bti) is a naturally occurring bacterium that can effectively kill mosquito larvae present in water. Bti is the primary material used for mosquito control because of its specificity and low toxicity to non-target species. Bti spores that are eaten by mosquito larvae release toxins into the mosquito's gut, causing the larvae to stop eating and die.

*Ochlerotatus abserratus*, *Ochlerotatus canadensis*, and *Ochlerotatus excrucians* are three species of mosquitoes that hatch early in spring and are bothersome to mammals. Additionally, *Oc. canadensis* is known to be a vector for West Nile Virus and Eastern Equine Encephalitis (Andreadis 2005). By reducing their population while they are in the larval form will lead to a reduction in the need for adulticide spraying to combat virus carrying, mammal-biting mosquitoes.

The aerial application of the larvicide *Bacillus thuringiensis israelensis* in the towns of Billerica, Boxborough and Chelmsford was conducted on April 17<sup>th</sup> and 18<sup>th</sup>. The larvicide was applied to wetland areas that amounted to approximately 2,050 acres.

## MATERIALS AND METHODS

CMMCP uses the OMRI organically-certified larvicide AquaBac 200G® (EPA Reg. No. 62637-3). This larvicide contains a non-reproducing bacterium which is applied to areas of standing water which are likely to be larval mosquito habitat. AquaBac 200G® contains the active component *Bacillus thuringiensis israelensis* (Bti). Bti is a naturally occurring bacterium that occurs in soil. It contains spores that produce toxins that specifically target and only affect larvae, the juvenile form of the mosquito. The larvae ingest the toxins and due to the specific pH in the larval gut, the toxins cause the breakdown in the cells of the digestive system. Without the ability to eat, this leads to the mosquito larvae's death. Bti has no toxicity to people, so it can be applied safely to mosquito habitat without a detrimental impact on food crops or water supplies.

(<https://www.epa.gov/mosquitocontrol/bti-mosquito-control>).

The Commonwealth of Massachusetts employs the Generic Environmental Impact Report (GEIR) to determine if the aerial larvicide dispersal was effective. Recoverable Dip Stations (RDS) are established with one RDS set for every 250 acres to be treated. One untreated RDS is set for each town to be used as a control site. Each RDS has ten flagged dip sites. Each of the dip sites are sampled for larvae prior to the treatment. Post-treatment surveys were done to make comparisons. Larval density changes among these observations form the basis for determining the level of

control for the aerial larvicide program. Sampled larvae are always returned to ensure that the treatment and control observations are not artificially impacted. CMMCP personnel identified the areas where the aerial drops would have the greatest impact. In addition, per 333CMR 13.04 (7)(a) a legal notification of the aerial larvicide was placed in The Boston Globe on February 24, 2019, and was posted on the CMMCP website ([https://www.cmmcp.org/sites/cmmcp/files/uploads/2019\\_legal\\_ad.pdf](https://www.cmmcp.org/sites/cmmcp/files/uploads/2019_legal_ad.pdf))

The dates of the aerial treatment were April 17<sup>th</sup> for the member towns of Billerica and Chelmsford, with Warren Farm in Chelmsford, MA. being used as the loading area. Aerial larval treatment of Boxborough took place on April 18<sup>th</sup>. Minute Man Airfield in Stow, MA was used as the landing and reloading area. The dates were chosen to coincide when the larvae are most actively eating and thus make the greatest impact on the population of mosquitoes. It is also done at this time to distribute the Bti to the targets before the canopy of trees has significantly developed.

North Fork Helicopter (Cutchogue, New York) was contracted to apply the larvicide to 850 acres in Boxborough, 600 acres in Billerica and 600 acres in Chelmsford for a total of 2,050 acres. The rate at which the larvicide was applied was five pounds per acre. CMMCP has found the low application rate of AquaBac G® provides proper control in these areas.

Following the application of AquaBac 200G®, the CMMCP crews return to the

flagged sites after 24 and 48 hours. The density of larvae are recorded and compared to the pre-treatment collection numbers and used to determine the effectiveness of the aerial larvicide program. During the post-treatment larvicide surveys, the presence or absence of AquaBac G® is noted by the CMMCP field crews.

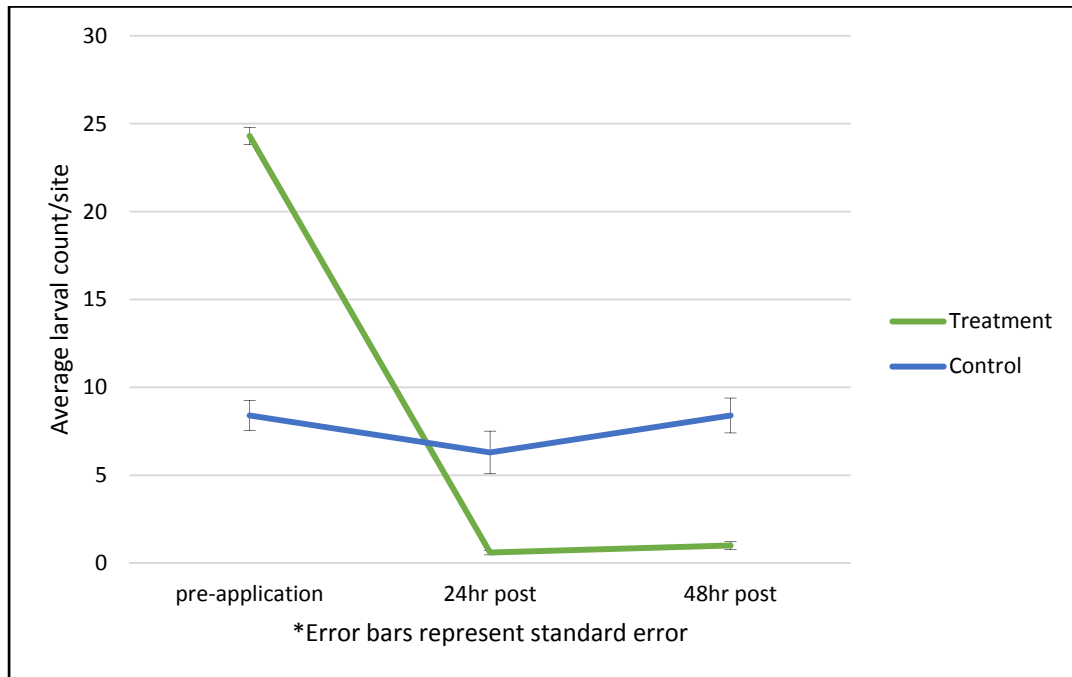
## RESULTS

The average reduction in mosquito larvae amongst the towns of Boxborough, Billerica and Chelmsford following the 2019 spring larvicide application was 86.92%. Individually, the Billerica RDS exhibited an average reduction of 95.79% while an average reduction of 74.18% in Chelmsford and 90.30% in Boxborough. This is in comparison to the untreated (control) in the three communities which saw an increase of 23.36% from the beginning of the program (Table 1; Figures 1-3).

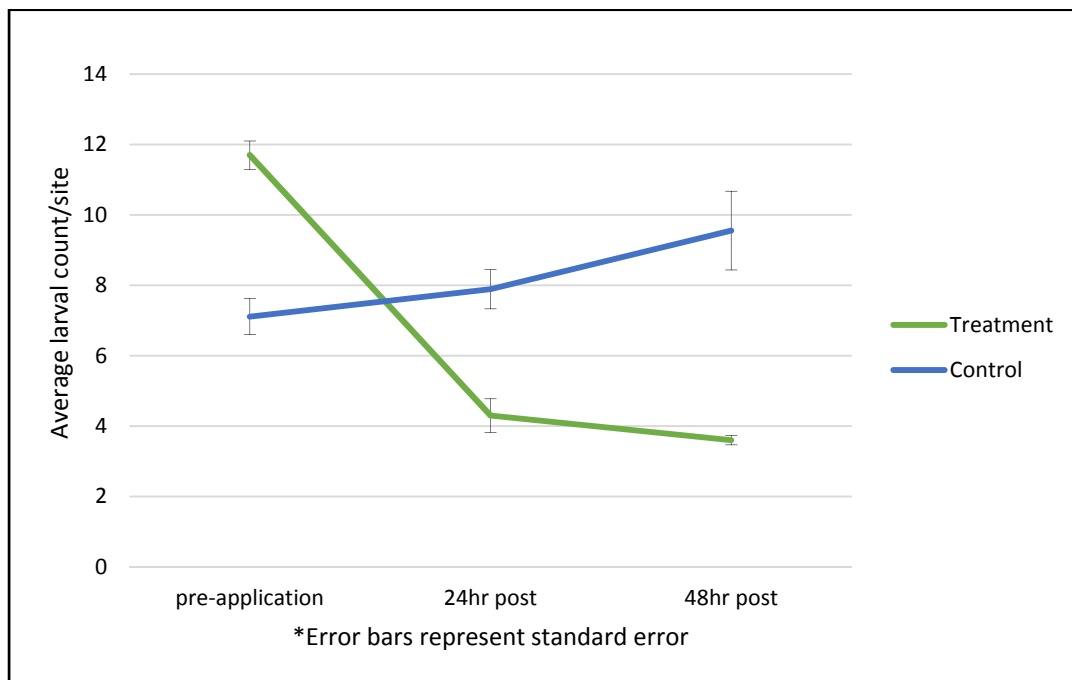
**Table 1: Larval Surveillance of Treatment and Control RDS**

<b>Treatment Sites</b>	<b>Pre-application</b>	<b>Post-application</b>	<b>Observed Change</b>
BIL116	72	4	-94.44%
BIL112	78	3	-96.15%
BIL408	93	3	-96.77%
BOX44	29	2	-93.10%
BOX116	24	3	-87.50%
CHM82	31	5	-83.87%
CHM279	29	1	-96.55%
CHM236	57	33	-42.11%
<b>Overall:</b>	<b>413</b>	<b>54</b>	<b>-86.92%</b>
<b>Control Sites</b>	<b>Pre-application</b>	<b>Post-application</b>	<b>Observed Change</b>
BIL227	84	84	0.00%
ACT41	56	86	53.57%
CHM146	74	94	27.03%
<b>Overall:</b>	<b>214</b>	<b>264</b>	<b>23.36%</b>

**Figure 1: Billerica Treatment RDS Pre and Post Application**

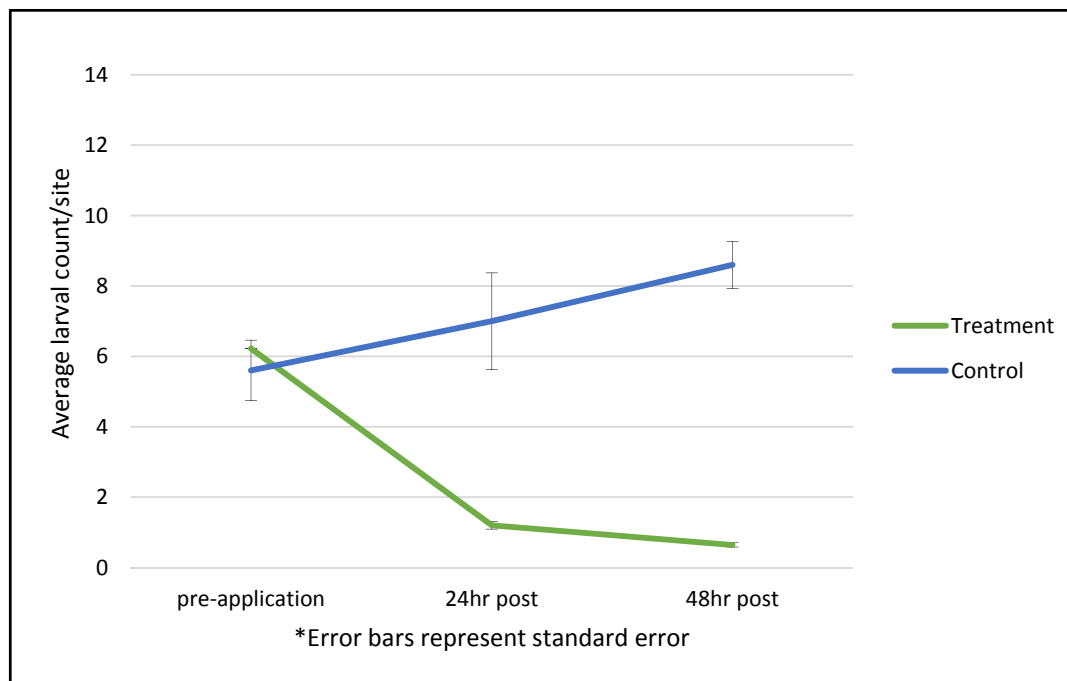


**Figure 2: Chelmsford treatment RDS Pre and Post Application**





**Figure 3: Boxborough Treatment RDS Pre and Post Application**



## DISCUSSION

Control of mosquito larvae is a key component in the decrease of the adult mosquito population. Targeting the developmental stages of the vector by aerial release of AquaBac 200G® allows CMMCP to reach sizeable wetland areas in Boxborough, Billerica and Chelmsford that would otherwise be too large or difficult to treat, and therefore left overwhelmed by mosquitoes. In 2019, the larvicide application took place April 17<sup>th</sup> and 18<sup>th</sup>. Larval surveys conducted prior to the treatment and twice following the treatment showed an overall average reduction of 87.41%. CMMCP considers this treatment a tremendous success. Although we are pleased with the results, one site in Chelmsford had a large number of larvae on the 48 hour recheck. We feel this may have skewed the

statistical outcome of our result. The larvae on that recheck were early stage and could have been a new emergence as a result of rain after the treatment.

With the removal of the early brood *Ochlerotatus excrucians*, *Ochlerotatus abserratus* and *Ochlerotatus canadensis* mosquitoes from the environment, the residents of Billerica, Boxborough and Chelmsford will find less of the bothersome, biting pests. Because of this success the need for adulticide spraying will be reduced early in the season. CMMCP will incorporate this year's experience into future aerial programs. This includes the potential expansion of the program into additional CMMCP member communities.

## ACKNOWLEDGMENTS

The authors would like to acknowledge the participation of Billerica, Boxborough and Chelmsford in this supplemental program; North Fork Helicopters for providing the helicopter service; Warren Farm, Chelmsford and Minute Man Airfield, Stow for providing loading zones; the CMMCP Commission, and the CMMCP staff for larval monitoring, site selection, map development and assisting the helicopter application.

## REFERENCES

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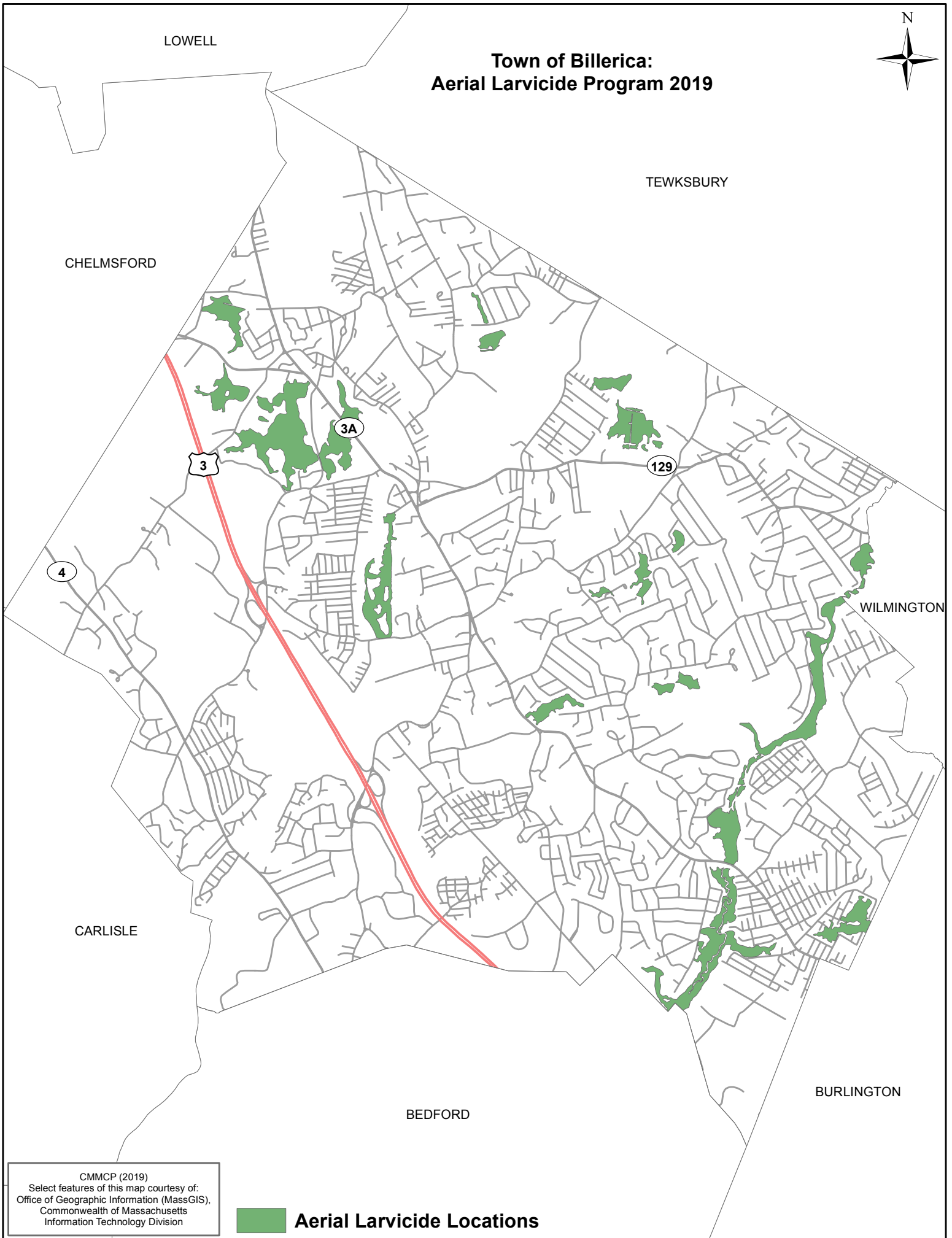
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### **Legal Notice - Aerial Application to Control Mosquito Larvae**

Per 333CMR 13.04(7)(a), the Central Mass. Mosquito Control Project (CMMCP) and North Fork Helicopters will be conducting helicopter applications of the biological larvicide Bti to control mosquito larvae over selected large wetlands in the CMMCP service area. The applications will be conducted during the daylight hours from March 1 to October 31, 2019 as conditions warrant. The trade names of the products to be used are Aquabac 200G (EPA Reg. #62637-3) and/or Vectobac G (EPA Reg. #73049-10). For additional information please contact Tim Deschamps at (508) 393-3055.

**Town of Billerica:  
Aerial Larvicide Program 2019**



CMMCP (2019)  
Select features of this map courtesy of:  
Office of Geographic Information (MassGIS),  
Commonwealth of Massachusetts  
Information Technology Division

 **Aerial Larvicide Locations**



# Town of Boxborough: Aerial Larvicide Program 2019



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CMMCP (2019)  
Select features of this map courtesy of:  
Office of Geographic Information (MassGIS),  
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 **Aerial Larvicide Locations**

