CMMCP AERIAL MOSQUITO LARVAL CONTROL PROGRAM

SPRING 2009

FRANK H. CORNINE III & TIMOTHY D. DESCHAMPS
Central Mass. Mosquito Control Project
111 Otis Street Northborough, MA 01532
(508) 393-3055 • www.cmmcp.org

AERIAL MOSQUITO LARVAL CONTROL PROGRAM – SPRING 2009

FRANK H. CORNINE III & TIMOTHY D. DESCHAMPS
Central Mass. Mosquito Control Project
111 Otis Street Northborough, MA 01532
(508) 393-3055 • www.cmmcp.org

ABSTRACT

CMMCP conducted an aerial application of *Bacillus thuringiensis israelensis (Bti)* for selected wetlands that are either too large or inaccessible to treat by ground larviciding in the towns of Chelmsford, Billerica and Boxborough. This is similar to the program that has operated in these towns over the past few years. There was a 95.58% overall reduction found in the emergence of spring mosquito species observed through pre- and post application larval monitoring at these treated areas.

INTRODUCTION

The primary objective for the CMMCP aerial mosquito larval control program is to reduce the emergence of several key mosquito species; two univoltine species *Ochlerotatus abserratus* and *Ochlerotatus excrucians*, and an early brood of *Ochlerotatus canadensis*, a multivoltine species. The first two species tend to hatch early and in overwhelming numbers, and contribute to the vast number of service request (spray) calls received from late May through the month of June. *Oc. canadensis* usually emerges slightly later than those two species and will continue to feed and lay multiple clutches of eggs into the summer. *Oc. canadensis* is also a competent vector of both Eastern Equine Encephalitis, and West Nile Virus, and will feed on mammals including humans and horses (Andreadis 2005).

Snowmelt greatly contributes to the habitat of these species along with early spring rain events. These factors result in elevated levels of standing water. Day length, water temperature and other factors cause the overwintered eggs of these species to begin hatching into larvae. These snowmelt pools are the target for this program. Larval control is generally the most successful form of mosquito control next to source reduction, since the mosquito larvae are contained in their aquatic environment and the product used is very species-specific. This is a significant component of our Integrated Pest Management (IPM) program.

MATERIALS AND METHODS

The larvicide product used for the aerial application was VectoBac G® (EPA Reg. No. 73049-10), which is a granular product containing the soil bacteria *Bacillus thuringiensis israelensis (Bti).* This non-reproducing bacterium creates toxins in the digestive system of the mosquito larvae, and is very specific to mosquito larvae (Extension Toxicology Network 1996). The VectoBac G® was applied at a rate of 5lbs/acre, within the suggested label range of 2.5-10lbs/acre (VectoBac G label). This product is classified as a "biopesticide" and is the same one used in our ground larval control program for over 20 years. North Fork Helicopters (Cutchogue, New York) was contracted for the application, and they are familiar with the CMMCP program having worked past applications with us.

Site selection for the application was based on wetlands over 5 acres in size that are categorized as either wooded swamp, deciduous, conifer & mixed; shallow marsh; and shrub swamp. These wetland types have shown to be a preferred larval habitat during pre-larval surveillance and according to historical records at our office. All potential mosquito habitat under 5 acres in size were to be examined if possible, and treated accordingly using the ground larval control program.

The timeframe for the aerial larvicide application is relatively fluid because it is predicated on the current developmental stage of the targeted mosquito species and local weather conditions. Second and third larval instars are the preferred target life stage because of their mobility and potential to freely acquire the *Bacillus thuringiensis israelensis* toxins. First instar larvae are not usually well dispersed yet, and fourth instar larvae require additional Bti in the habitat to achieve adequate control due to their size and proximity to pupation. In the past these factors for the application have been most advantageous during the third week of April, which occurred again in 2009.

The aerial larvicide application was conducted over the course of three days; April 22nd for the towns of Chelmsford and Billerica, and April 23rd and 24th for the town of Boxborough. Originally scheduled to be completed on April 23rd, a portion of the Boxborough application had to be suspended until the following day due to high winds interfering with the rotary aircraft. The application for Chelmsford and Billerica was staged at the landing zone used in previous years (Warren Farm) while the application for Boxborough was carried out at the Stow Airport facility. Approximately 713 acres were treated in Chelmsford, 557 acres in Billerica, and approximately 928 acres for Boxborough. CMMCP staff performed all pre- and post monitoring, transported the VectoBac G® product to each of the landing zones, and loaded the helicopter for each application.

Legal notifications were placed in the Boston Globe in the February 26, 2009 edition, and were done in accordance with 333CMR 13.04 (7). (See Appendix A for the complete regulation and Appendix B for a copy of the legal notice tear sheet). This information was also available on the CMMCP website.

Following the recommendations in the 1998 Generic Environmental Impact Report (SRMCB website, http://www.mass.gov/agr/ mosquito/), recoverable dip stations (RDS) were established so that larval surveillance could be conducted at the same sites pre- and post application. Per the GEIR, for every 250 acres treated there is to be one RDS, as well as one control RDS per town (which is not to be treated with *Bti*). These RDS allow larval mortality to be observed in those sites treated as well as comparing that with the untreated control findings.

Each dip station, whether it is control or treatment, contains 10 individual dip sites, each flagged and numbered. The number of mosquito larvae at each of these sites is recorded as well as their developmental stage (instar). Every time larvae are sampled they are put back in the water so the sampling will not impact the post-application data. However, a larval sample from the

general area is collected for later species identification to help determine what species are present.

RESULTS

Billerica, Boxborough and Chelmsford each achieved excellent control from the application. The three RDS at the Billerica treatment sites showed a 99.28% reduction from pre-application levels, with moribund larvae observed along with *Bti* product throughout. The treatment sites in Boxborough showed a 95.93% reduction from pre-application levels, with moribund larvae seen in the area as well. *Bti* was present at three of the RDS, while only noted to be in the general vicinity of the other. This was similar to Chelmsford; two sites had *Bti* throughout, while one of the sites only had *Bti* in the area. These three Chelmsford sites displayed a reduction of 91.55%. For the aerial larvicide application program overall, there was a 95.58% reduction in mosquito larvae from the pre-application levels. The Billerica, Boxborough, and Chelmsford control sites had observed decreases of 8.33%, 31.25% and 22.81% respectively, with an overall change of -23.26% (Table 1; Figures 1-4).

Table 1: Larval Surveillance of Treatment and Control RDS

Treatment Sites	Pre-application	Post-application	Observed Change
BIL108	38	0	-100.00%
BIL112	62	0	-100.00%
BIL409	39	1	-97.44%
BOX127	56	0	-100.00%
BOX128	20	2	-90.00%
BOX92	59	5	-91.53%
BOX8	37	0	-100.00%
CHM81	41	0	-100.00%
CHM37	39	12	-69.23%
CHM236	62	0	-100.00%
Overall:	453	20	**-95.58%**

Control Sites	Pre-application	Post-application	Observed Change
BIL341	24	22	-8.33%
ACT37	48	33	-31.25%
CHM146	57	44	-22.81%
Overall:	129	99	**-23.26%**

Figure 1: Billerica Treatment RDS Results Pre- and Post application

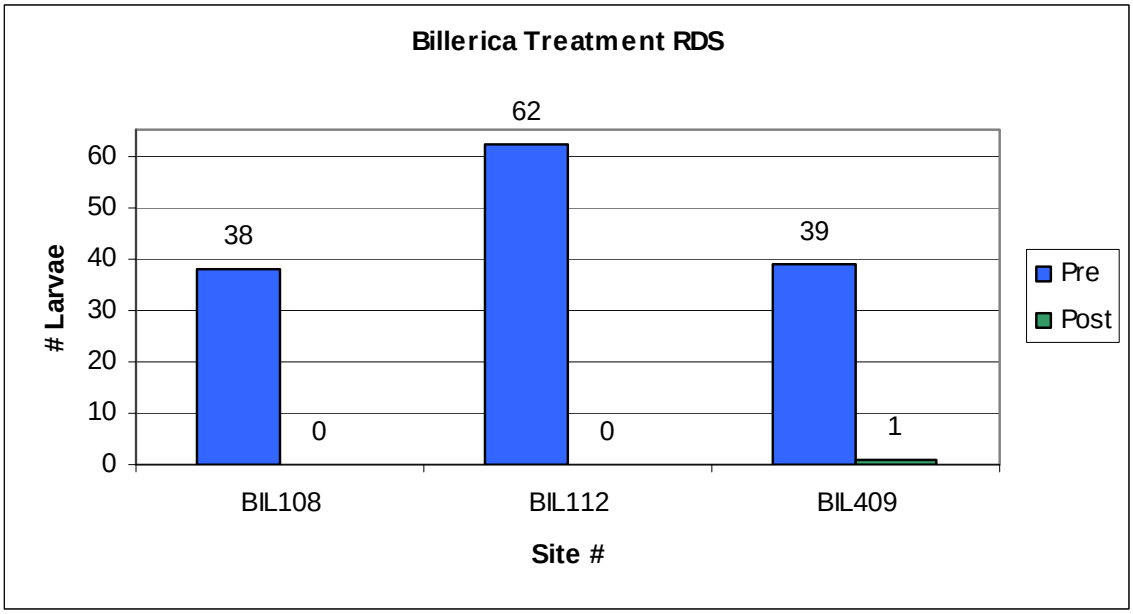


Figure 2: Boxborough Treatment RDS Results Pre- and Post application

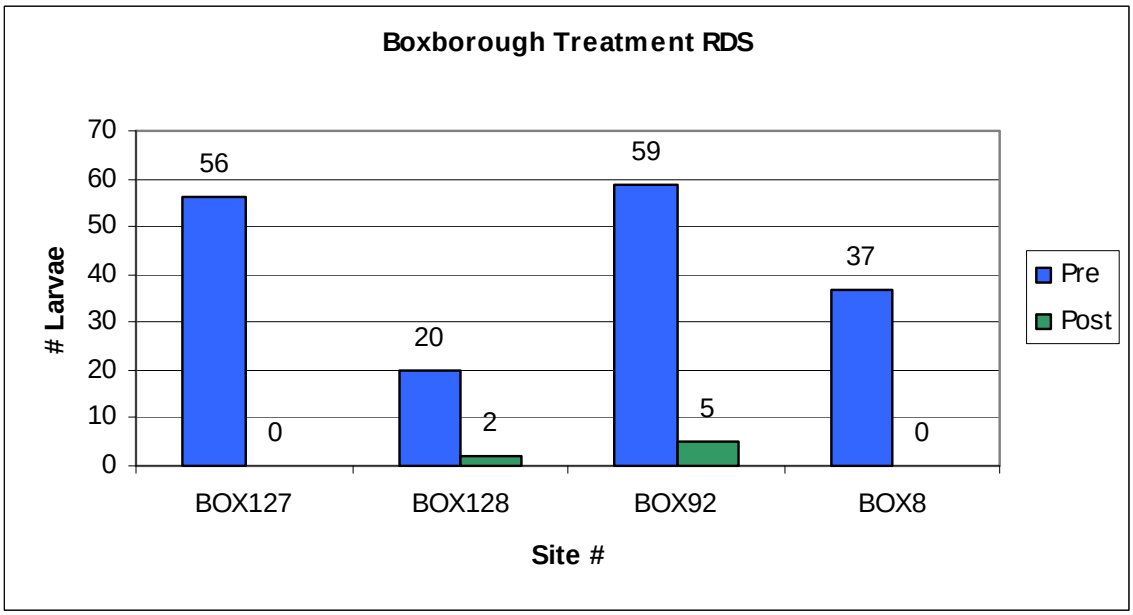


Figure 3: Chelmsford Treatment RDS Results Pre- and Post application

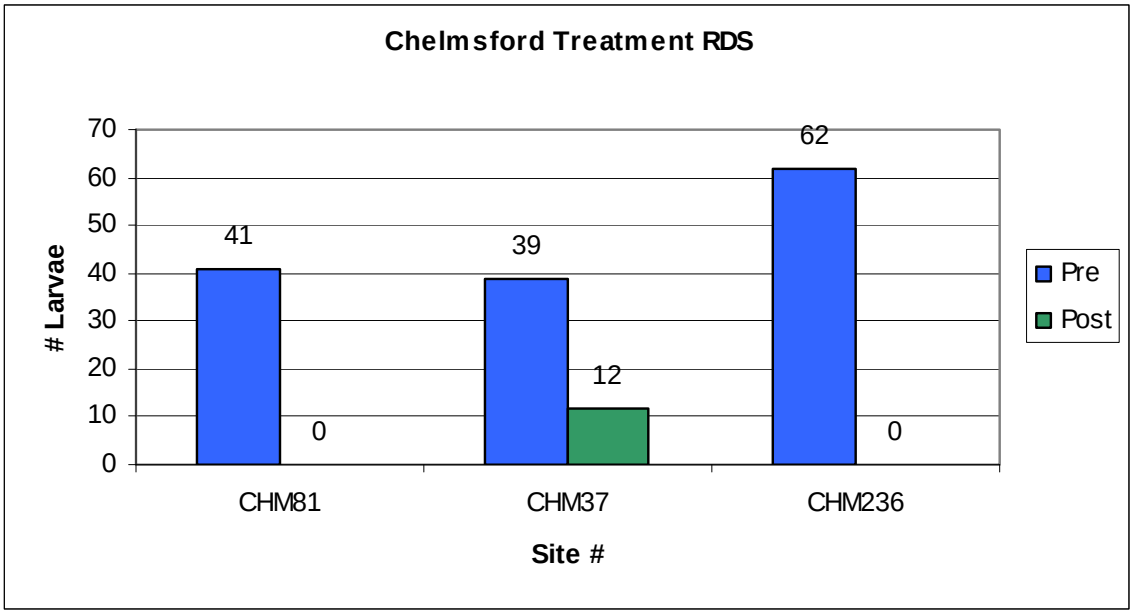
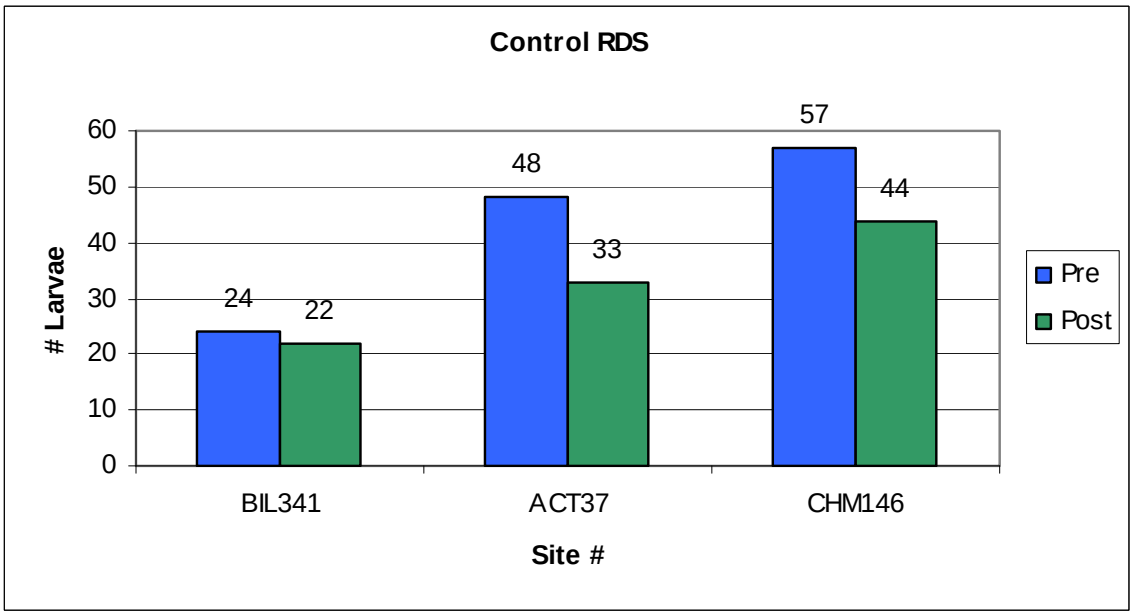


Figure 4: Control RDS Results Pre- and Post application



DISCUSSION

With a 95.58% overall reduction in mosquito larvae, this application was a success. Several rain events totaling 1.48 inches (CMMCP Weather Station: Northborough, MA) between pre- and post dips visibly diluted the control sites dip stations, which could have contributed to the decrease in larvae observed per dip. A reduction due in part to a hatch is less likely as surveillance was still indicating middle to late (3rd & 4th) instar larvae in most areas. Other factors such as data collections techniques, weather and natural

larval mortality may also explain this decline. Consideration will be made next year to move the control sites to more stable wetlands, where rain events may not impact them as drastically.

The treatment dip stations showed better coverage than in previous years. CMMCP was able to better coordinate the locations of the RDS with helicopter navigation data of the previous application in 2008. More of the dip stations showed a positive presence of *Bti* than in the past. CMMCP will plan to continue assessing the navigation data when preparing the RDS sites.

Larvae collected prior to the application were reared to fourth instar or adult life stage if possible, and were positively identified as *Oc. abserratus*. Both *Oc. excrucians* and *Oc. canadensis* were also observed in larvae collections but as early instar larvae; this classification is not as reliable as data obtained from fourth instar larvae but we are confident in this identification.

The success achieved through the aerial mosquito larval control program reduces service calls and the need for area adulticiding early in the season for the targeted mosquito species. With the future addition of neighboring towns to this program, the region could see an even greater reduction in these species and the need for adulticiding.

ACKNOWLEDGEMENTS

The authors would like to thank the towns of Billerica, Boxborough, and Chelmsford, and the respective Boards of Health; North Fork Helicopters for conducting the application; Frank Warren and Don McPherson for allowing us to stage and fly the aircraft from their properties; Clarke Mosquito Control Products for supplying the VectoBac G®; the CMMCP Commission, and especially the CMMCP field staff for larval monitoring, site selection, map development and assisting with the loading of the helicopter.

REFERENCES

Andreadis TG, Thomas MC, Shepard JJ. 2005. Identification guide to the mosquitoes of Connecticut. Bulletin of The Connecticut Agricultural Experiment Station 966:1–173.

Central Massachusetts Mosquito Control Project. 2009. *Bti (Bacillus thuringiensis israelensis)* [Internet]. Northborough, MA: Central Mass. Mosquito Control Project [accessed April 27, 2009]. Available from: http://www.cmmcp.org/bti.htm.

Extension Toxicology Network. 1996. *Bacillus thuringiensis* [Internet]. Extoxnet [accessed April 27, 2009]. Available from: http://extoxnet.orst.edu/pips/bacillus.htm

United States Environmental Protection Agency. 1998. *Bacillus thuringiensis subspecies israelensis strain EG2215 (006476) Fact Sheet* [Internet]. Washington, D.C.: United States Environmental Protection Agency [accessed April 27, 2009]. Available from: http://www.epa.gov/pesticides/biopesticides/ingredients/factsheets/factsheet_006476.htm

APPENDIX A

(7) Exemptions for Aerial Application of Mosquito Larvicides. Mosquito larvicide applications made by mosquito control programs approved by the State Reclamation and Mosquito Control Board are exempt from 333 CMR 13.04(4) and 333 CMR 13.04(6) if all of the following conditions have been met:

(a) Notice of the proposed application has been published in a newspaper of general circulation in the affected municipality between February 1st and March 1st of the year the application is intended to be made. The notice shall include the following information:

1. Purpose of control program;
2. Method of application;
3. Area of application if known;
4. Name and EPA Registration Number of the pesticide product to be applied; and
5. Phone number of a contact person from whom additional information can be obtained.

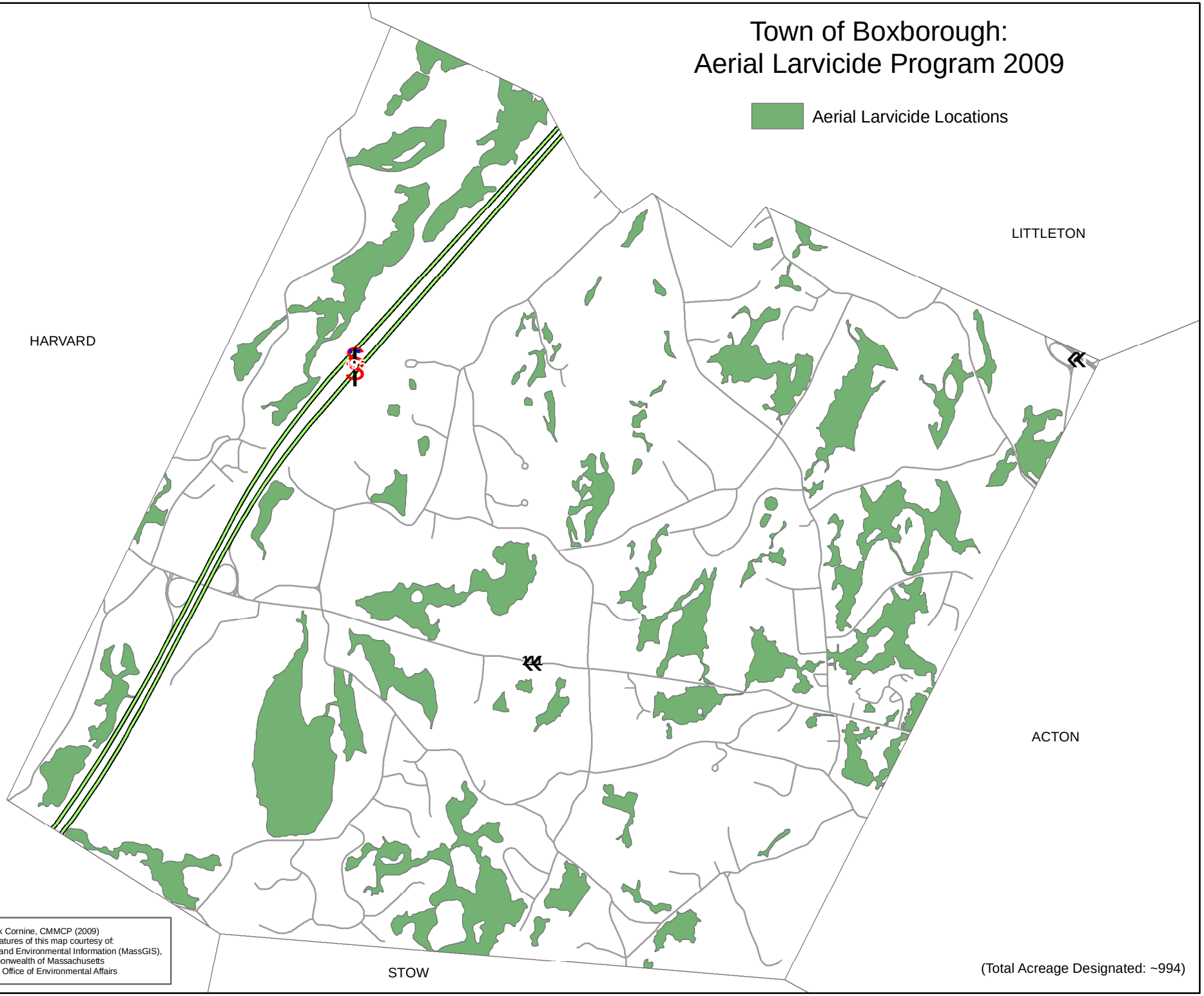
Within seven calendar days of publication, a copy of the notice shall be provided to the Department and the Board of Health in the municipality where the application is to be made.

(b) Notice of the proposed application has been provided to the Department and the Board of Health in the municipality where the application is to be made prior to the application. The notice shall include the following information:

1. Purpose of control program;
2. Method of application;
3. Area of application;
4. Date and time of application;
5. Name and EPA Registration Number of the pesticide product to be applied; and
6. Name of the applicator and phone number of a contact person from whom additional information can be obtained.

The full text of these regulations can be found at this link: http://www.mass.gov/agr/legal/regs/pesticides_regulations_list.htm

Town of Boxborough:
Aerial Larvicide Program 2009



Town of Billerica:
Aerial Larvicide Program 2009

Ü

Aerial Larvicide Locations

LOWELL

TEWKSBURY

CHELMSFORD

WILMINGTON

CARLISLE

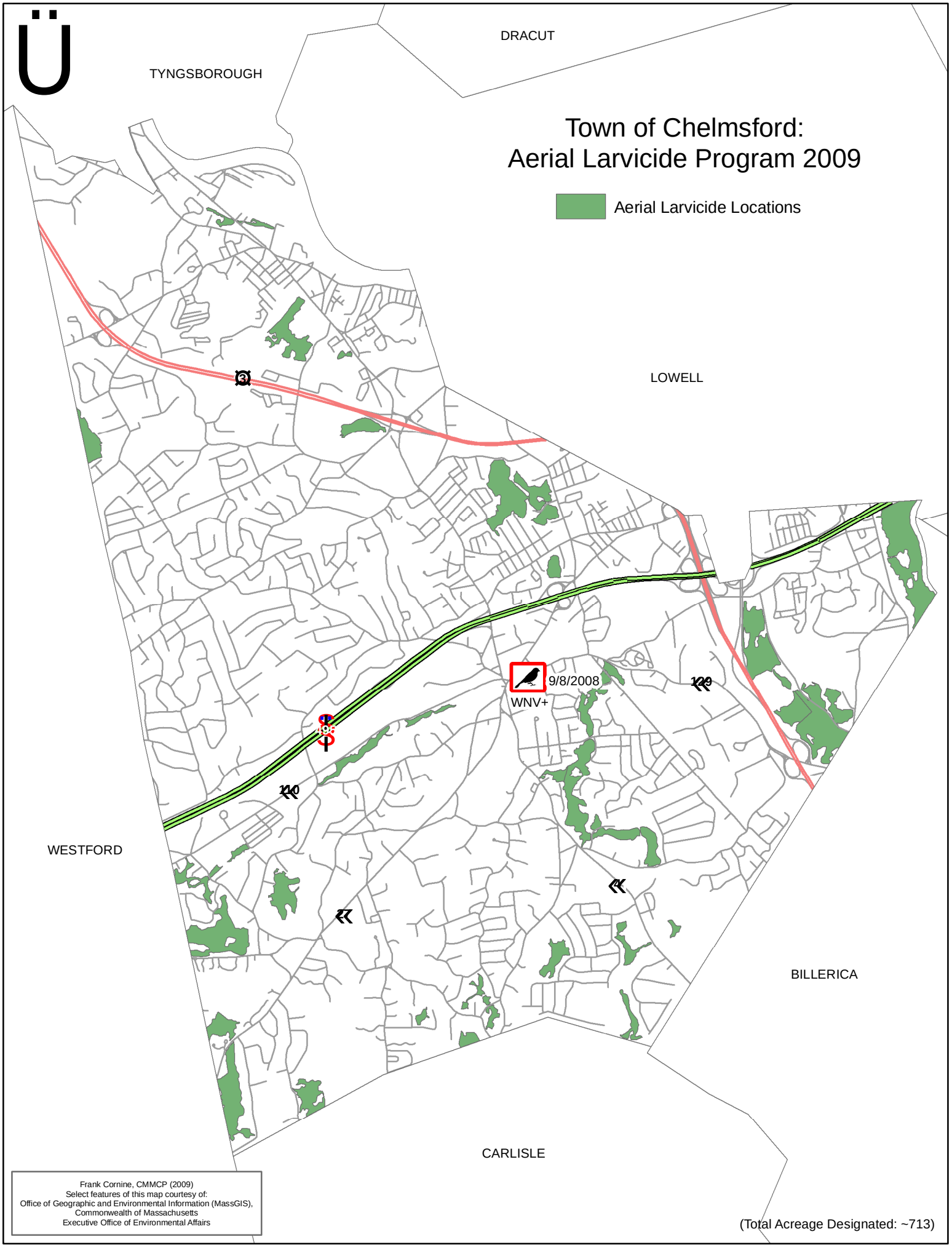
BURLINGTON

BEDFORD

8/14/2008
WNV+

Frank Cornine, CMMCP (2009)
Select features of this map courtesy of:
Office of Geographic and Environmental Information (MassGIS),
Commonwealth of Massachusetts
Executive Office of Environmental Affairs

(Total Acreage Designated: ~557)


DRACUT
TYNGSBOROUGH
Town of Chelmsford:
Aerial Larvicide Program 2009
Aerial Larvicide Locations
LOWELL
9/8/2008
WNV+
WESTFORD
BILLERICA
CARLISLE
Frank Cornine, CMMCP (2009)
Select features of this map courtesy of:
Office of Geographic and Environmental Information (MassGIS),
Commonwealth of Massachusetts
Executive Office of Environmental Affairs
(Total Acreage Designated: ~713)