CMMCP AERIAL MOSQUITO LARVAL CONTROL PROGRAM

SPRING 2012

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ABSTRACT

Following ground surveillance in the spring of 2012, the Central Mass. Mosquito Control Project conducted a May aerial application of *Bacillus thuringiensis israelensis* in the towns of Billerica, Boxborough, and Chelmsford for selected wetlands. These areas were selected in part because they cannot be treated through standard ground larviciding. In conducting pre- and post application larval surveillance, a 94.0% overall reduction was found in the emergence of spring mosquito species at treated monitoring sites.

OBJECTIVE

In a typical New England spring, snow melt causes the dormant eggs of several mosquito species hatch into larvae and develop in the pools formed. In the central Massachusetts region, two spring univoltine mosquito species, *Ochlerotatus abserratus* and *Ochlerotatus excrucians*, have one only population emergence a year. Another potential spring species found in this temporary habitat is *Ochlerotatus canadensis*. There is some evidence that this particular species may be multivoltine, and have more than one population emergence per year. *Oc. canadensis* has also been observed carrying West Nile virus and Eastern Equine Encephalitis, as well as other diseases (Andreadis 2005). Together, *Oc. abserratus*, *Oc. excrucians* and *Oc. canadensis* can be considered the primary pestiferous group upon emergence to both humans and other mammals during the spring season. The main goal of the 2012 spring aerial larvicide was to reduce the number of these mosquito species while they are still in their aquatic larval stage, therefore reducing the number of host-seeking adults that otherwise would negatively impact residents and livestock in the surrounding areas. In the case of *Oc. canadensis* this would also include the potential transmission of West Nile virus and Eastern Equine Encephalitis.

METHODS AND MATERIALS

The commercial product used in this aerial larvicide is VectoBac G® (EPA Reg. No. 73049-10), with an active component of *Bacillus thuringiensis israelensis* (Bti). VectoBac G® is the same product that CMMCP uses in its ground larvicide program (CMMCP 2009). This granular "biopesticide" contains a non-reproducing soil bacterium (Bti). This bacterium operates by generating toxins that are specific to the mosquito larvae, and when ingested by the larvae reduce the likelihood of pupation and later emergence as an adult (Extension Toxicology Network 1996). This formulation of Bti tends to be most effective when used prior to the mosquito larvae reaching the 4th instar stage. It is at this point that they begin to slow their feeding and begin metamorphosis to the pupa stage. As in previous CMMCP spring aerial applications, an application rate of

5lbs/acre was applied by the helicopter. The recommended application rates for VectoBac G® are 2.5-10lbs/acre (VectoBac G® label). North Fork Helicopters (Cutchogue, New York) was again contracted to perform the aerial application.

Similar to previous seasons, treatment areas for the program were selected through larval surveillance, treatment history, past mosquito-borne disease activity, and town priorities. Selected wetland bodies tended to be over 5 acres and through the use of GIS, were categorized as wooded swamp, deciduous, conifer and mixed, shallow marsh, and shrub swamp, (MassGIS 2007). Any mosquito breeding habitat below the 5 acres threshold was to be inspected and/or treated during the CMMCP ground larvicide program.

Bti is more effective if applied while the mosquito larvae are in the younger, more susceptible instars, and the application should be performed prior to larvae being in the 4th instar. This is due in part to mosquito larvae being less likely to ingest a sufficient amount of the product to cease their development as they approach the pupa stage. Furthermore, mosquitoes in the pupa stage do not feed and therefore cannot be controlled by Bti. Because larval stage plays such a crucial role in the effectiveness of this larvicide, the influence by weather can be significant. The winter leading up to this application was warmer than normal, with little snowpack formed. This was followed by little substantial rain in the weeks leading up to our expected application dates (3rd week in April). According to the US Drought Monitor website http://droughtmonitor.unl.edu, conditions in Massachusetts ranged from D1, moderate to D2, severe (see map on page 8). Meteorologists reported up to a 8 inch deficit from average rainfall in the region[1]. But after receiving over 2 inches of rain during Epi week 17 (Apr. 22-28), larval surveillance showed that the applications were necessary. We expected the target areas to change due to the continuing low water levels, and alternate sites were selected if ground surveillance showed a targeted site to have no larvae or were dry. Under our new NPDES permit, we are required to note any adverse effects from any pesticide applications in and around wetlands. During our post spray dipping, no adverse effects were noted.

The Boxborough portion of the aerial application was conducted on May 2nd using Minute Man Airfield, Stow as a loading/landing zone. The following day Billerica and Chelmsford were treated using Warren Farm, Chelmsford as a loading/landing zone. The designated treatment amounts for the aerial larvicide this year were 600, 900, and 544 acres for Billerica, Boxborough, and Chelmsford respectively. In accordance with 333CMR 13.04 (7) (Appendix A), CMMCP placed legal notifications in local newsprint prior to the aerial larvicide. This notification was printed February 15th, 2012 in the Boston Globe, and additionally was also posted on the CMMCP website (/www.cmmcp.org/aerialprogram.htm).

The Generic Environmental Impact Report (GEIR) outlines the protocol for this application as well as other aerial larvicide programs in Massachusetts. It includes efficacy monitoring through the creation of recoverable dip stations (RDS) (Massachusetts Department of

[1] Wicked Local online, May 8, 2012: http://www.wickedlocal.comwareham/topstories/x1310203898/Drought-conditions-still-exist-in-Massachusetts-despite-recent-rain#axzz1wHg1ovJX

Agricultural Resources 2011). Each town receives one treatment RDS for every 250 acres included in the application, as well as one untreated control RDS for comparison. This procedure allows for the levels of larvae in treatment sites to be compared to the levels in an untreated control site. These locations help gauge the level of success for the application. At each RDS, ten larval surveillance positions are marked and monitored both before and after the application. Prior to the application each position is flagged and numbered so that they can be rechecked following the application. The number and instars of larvae observed at each position is recorded and following the application the presence or absence of Bti product and observed larvae health is also noted. Larvae that are sampled before the application are placed back in place so that the treatment results are not impacted by the monitoring. However, larvae samples are collected from the surrounding areas to help observe what mosquito species are present and controlled during the aerial larvicide program.

RESULTS

The results from the treatment RDS indicate that for Billerica, Boxborough, and Chelmsford, the 2012 spring aerial larvicide had an overall observed larval reduction of 94.0% from pre-application levels. Following the application, the Billerica treatment RDS exhibited a 96.57% decrease, the Boxborough treatment RDS a 90.70% decrease, and the Chelmsford treatment RDS showed an 81.10% decrease. For the untreated (control) RDS, there was a decrease of 4.57%, but when these results were combined with an additional site in Boxborough that was not treated, the observed change dropped to a decrease of only 0.97% (Table 1; Figures 1-4).

Table 1: Larval Surveillance of Treatment and Control RDS

Treatment Sites	Pre-application	Post-application	Observed Change
BIL116	82	1	-98.78%
BIL112	66	0	-100.00%
BIL408	65	3	-95.38%
BOX77	26	0	-100.00%
BOX92	25	0	-100.00%
BOX7	27	0	-100.00%
CHM81	32	0	-100.00%
CHM279	24	1	-95.83%
CHM236	53	19	-64.15%
Overall:	400	24	**-94.00%**
Control Sites	**Pre-application**	**Post-application**	**Observed Change**
BIL227	79	35	-55.70%
BOX104	32	38	18.75%
ACT37	32	58	81.25%
CHM146	64	74	15.63%
Overall:	207	205	**-0.97%**

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

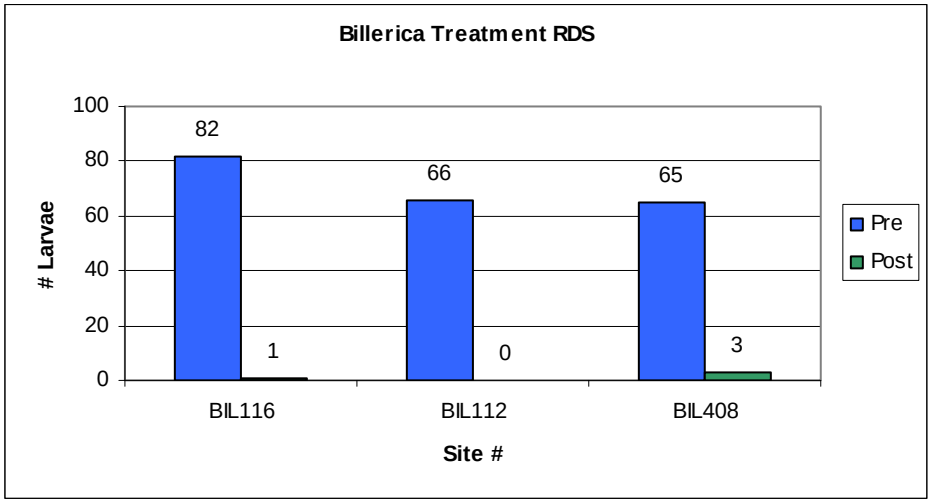


Figure 2: Boxborough Treatment RDS Results Pre- and Post Application

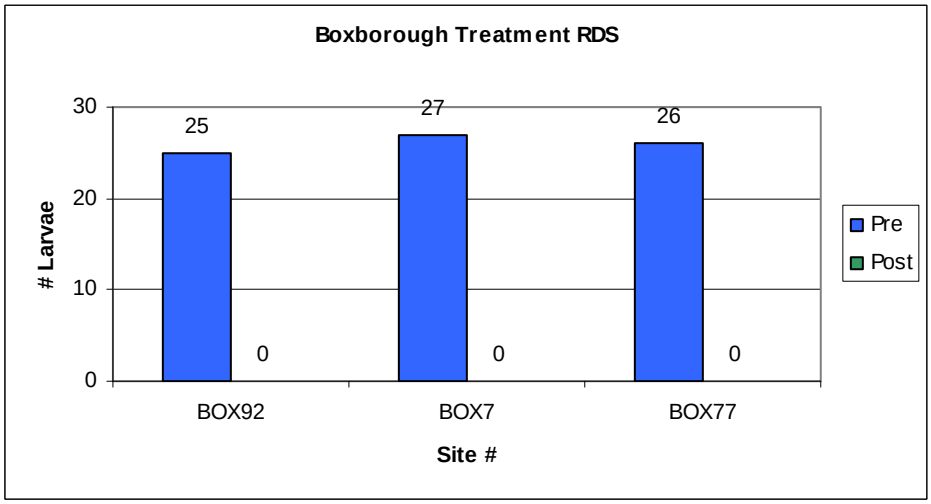


Figure 3: Chelmsford Treatment RDS Results Pre- and Post Application

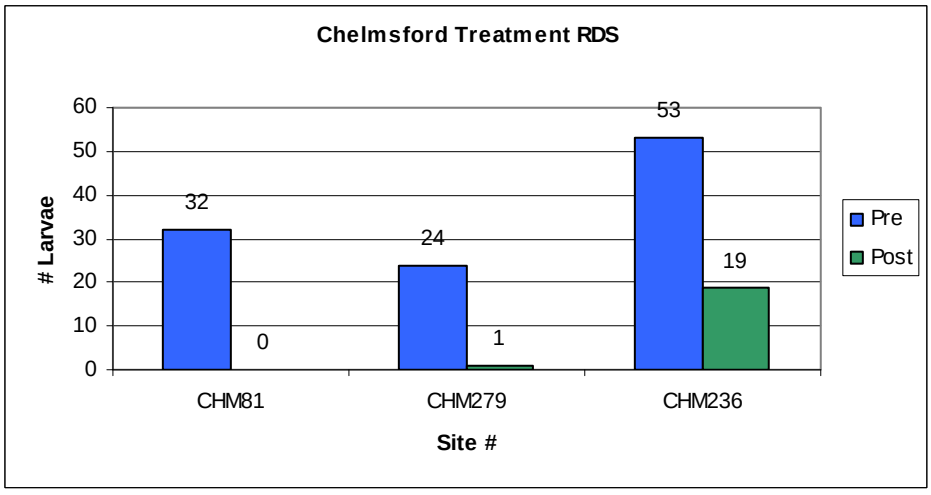
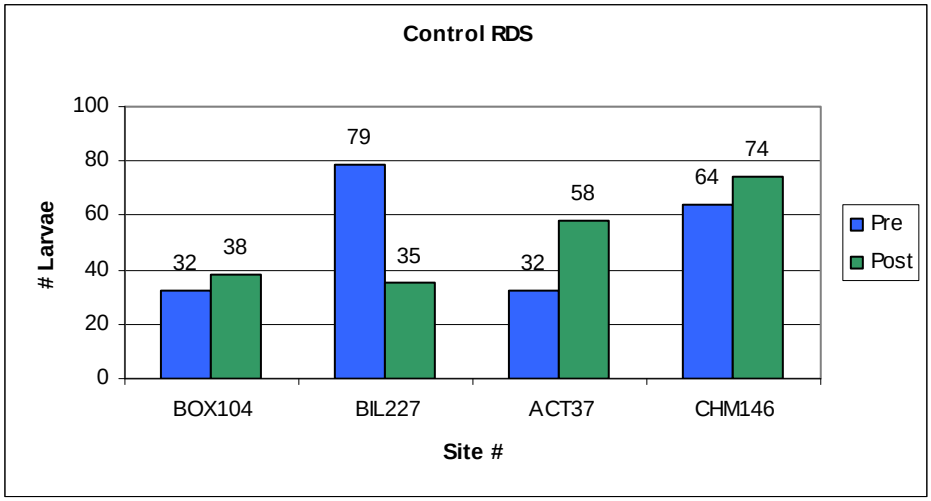


Figure 4: Control RDS Results Pre- and Post Application



DISCUSSION

With approximately 94.0% overall control, the 2012 CMMCP spring aerial larvicide was considered very effective. The conditions leading up to this application were drastically different from previous years, which impacted the program in several ways. Along with a warm winter and little snowpack leading into spring, the absence of significant rains in the weeks prior to the traditional mid-April aerial application caused the region to be under drought-like conditions. This left the status of the 2012 spring aerial in serious doubt as the temporary pools formed by melting snow typical to this time of year were virtually absent. Eventually there was enough rain to fill these pools, leading dormant mosquito eggs to hatch into larvae and begin development. Once there were widespread observations of larvae in the field, it was decided that the program would move forward, albeit much later than usual. Whereas this program is typically conducted in the third week of April, it was held in the first week of May in 2012.

Of the 10 treatment RDS, the application provided ample coverage at 9, with one of the Boxborough RDS not having Bti readily present following the application. However, it was noted that there was Bti product at other areas of that particular target. On occasion an RDS will not be treated directly at the surveillance points, but control may still be considered achieved as the majority of the site had ample coverage with Bti product. The timing of the application was ideal for control in that the observed larval stages were generally either 1st or 2nd instars. Historically *Oc. canadensis* begins initial development slightly later than both *Oc. abserratus* and *Oc. excrucians*, but the early instars of sample larvae proved difficult for proper identification. Subsequent field observations tend to favor the presence of *Oc. canadensis*. The observed reduction in mosquito larvae from this aerial larvicide should lower the degree of adulticide interventions required to assist local residents. There remains potential for this program to expand in the future, with neighboring towns joining Billerica, Boxborough, and Chelmsford. This would also help lessen the need for later adulticide

events in the spring and summer. All components of this program will be further reviewed to increase the efficacy of future applications.

ACKNOWLEDGEMENTS

The authors would like to thank the towns of Billerica, Boxborough, and Chelmsford for participating in this program; North Fork Helicopters for conducting the aerial application; Clarke Mosquito Control Products for supplying the Vectobac G®; Minute Man Airfield, Stow and Warren Farm, Chelmsford for the use of loading zones; the CMMCP Commission, and the CMMCP field staff for larval monitoring, larval identification, site selection, map development and assisting with the helicopter application.

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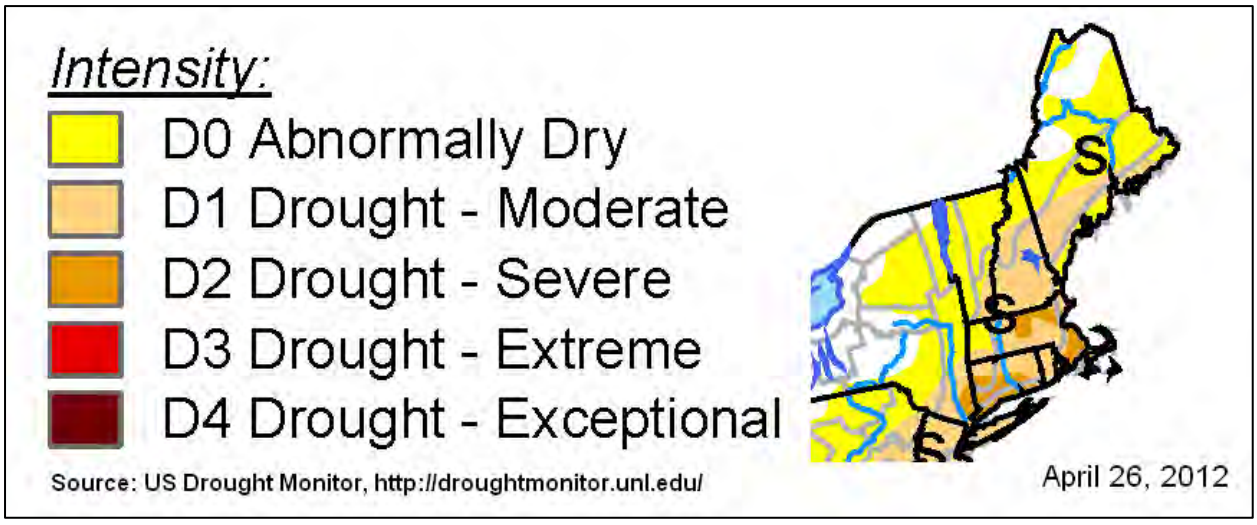
Excerpted from Wicked Local Wareham, May 8, 2012:

<u>Drought conditions still exist across Massachusetts despite recent beneficial rain.</u>

Current, year-to-date rainfall deficits are 4 to 8 inches across the state, said Raymond J. Raposa, executive director of the New England Water Works Association, the region's largest not-for-profit organization of water works professionals.

Recent periods of heavy rain eradicated much of the precipitation deficit for April. But deficits for January, February, and March, caused by precipitation that averaged about 50 percent below normal throughout Massachusetts, still exist.

Read more:
http://www.wickedlocal.com/wareham/topstories/x1310203898/Drought-conditions-still-exist-in-Massachusetts-despite-recent-rain#ixzz1wHhcFi4U



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Below is your advertisement from THE BOSTON GLOBE, beginning 2/15/2012 and ending 2/15/2012, appearing 1 time(s) in Classification, LEGAL.

Legal Notice - Aerial Application to Control Mosquito Larvae

Per 333CMR 13.04(7), Central Mass. Mosquito Control and North Fork Helicopters will be conducting helicopter applications of the biological larvicide Bti to control mosquito larvae over selected large wetlands in the towns of Boxborough, Billerica and Chelmsford. The applications will be conducted during the daylight hours from March 15 to October 31, 2012 as conditions warrant. The trade name of the product to be used is Vectobac G (EPA Reg. #73049-10). For additional information please contact Tim Deschamps at (508) 393-3055.

Thank you!
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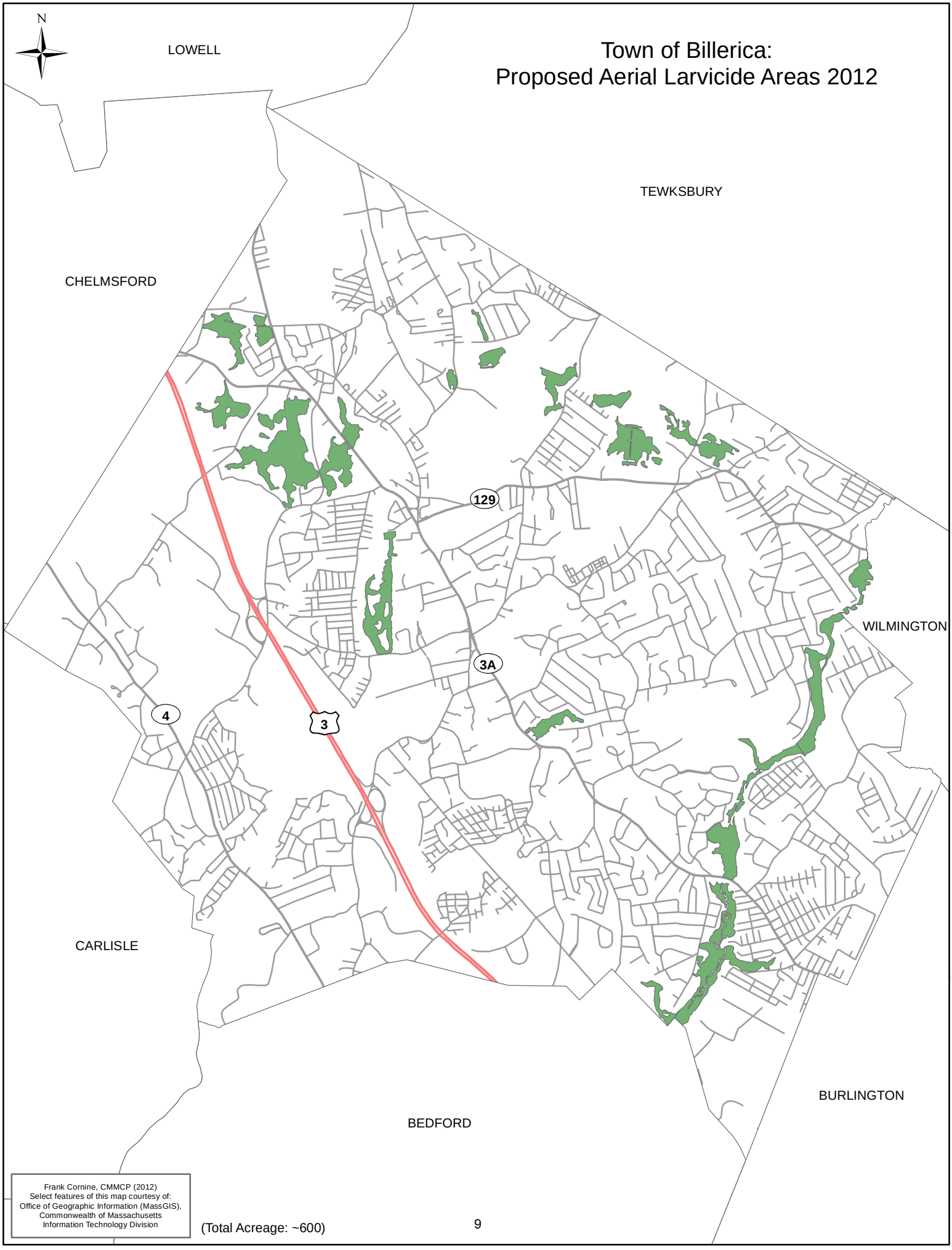
N
LOWELL
Town of Billerica:
Proposed Aerial Larvicide Areas 2012
TEWKSBURY
CHELMSFORD
129
WILMINGTON
3A
4
3
CARLISLE
BURLINGTON
BEDFORD
Frank Cornine, CMMCP (2012)
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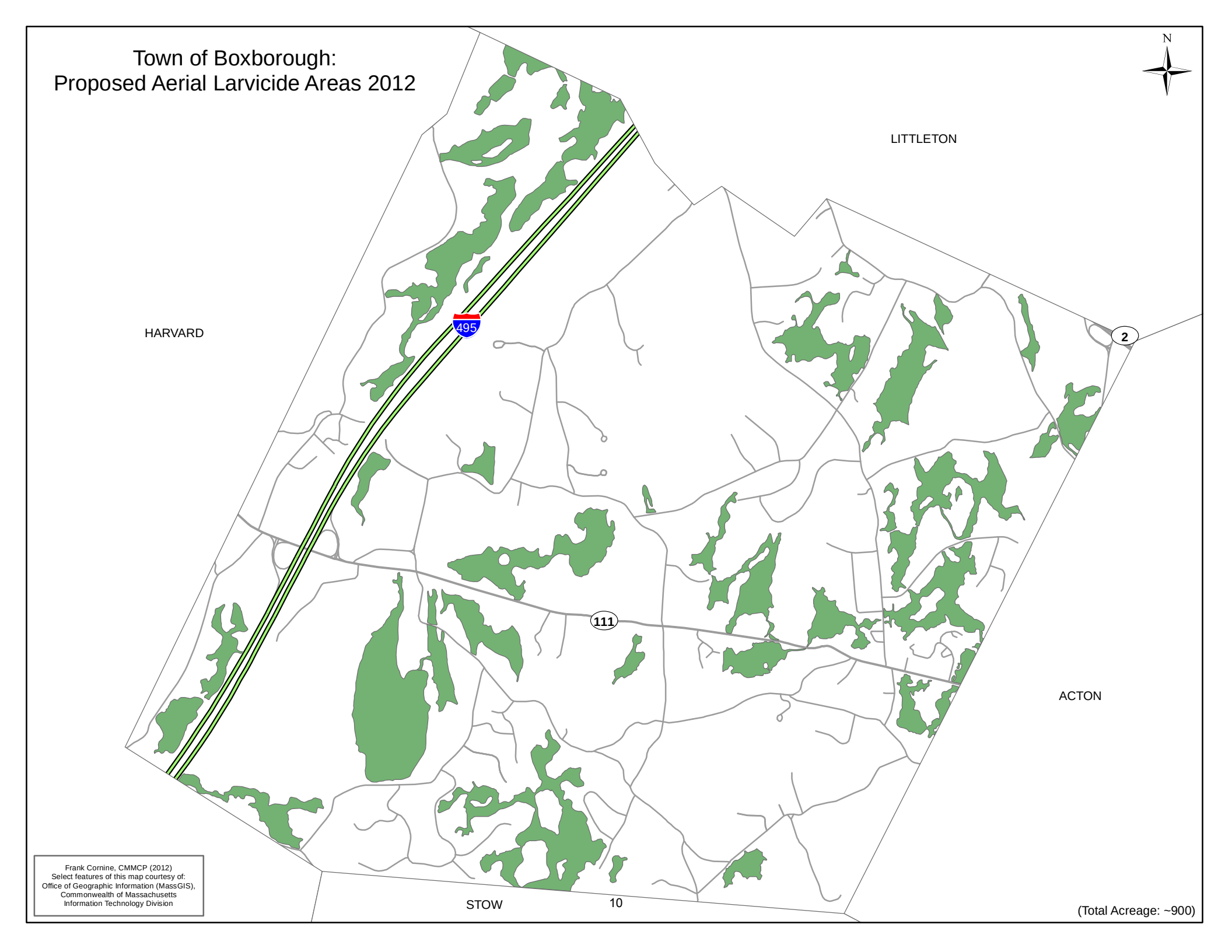
Town of Boxborough:
Proposed Aerial Larvicide Areas 2012



Frank Cornine, CMMCP (2012)
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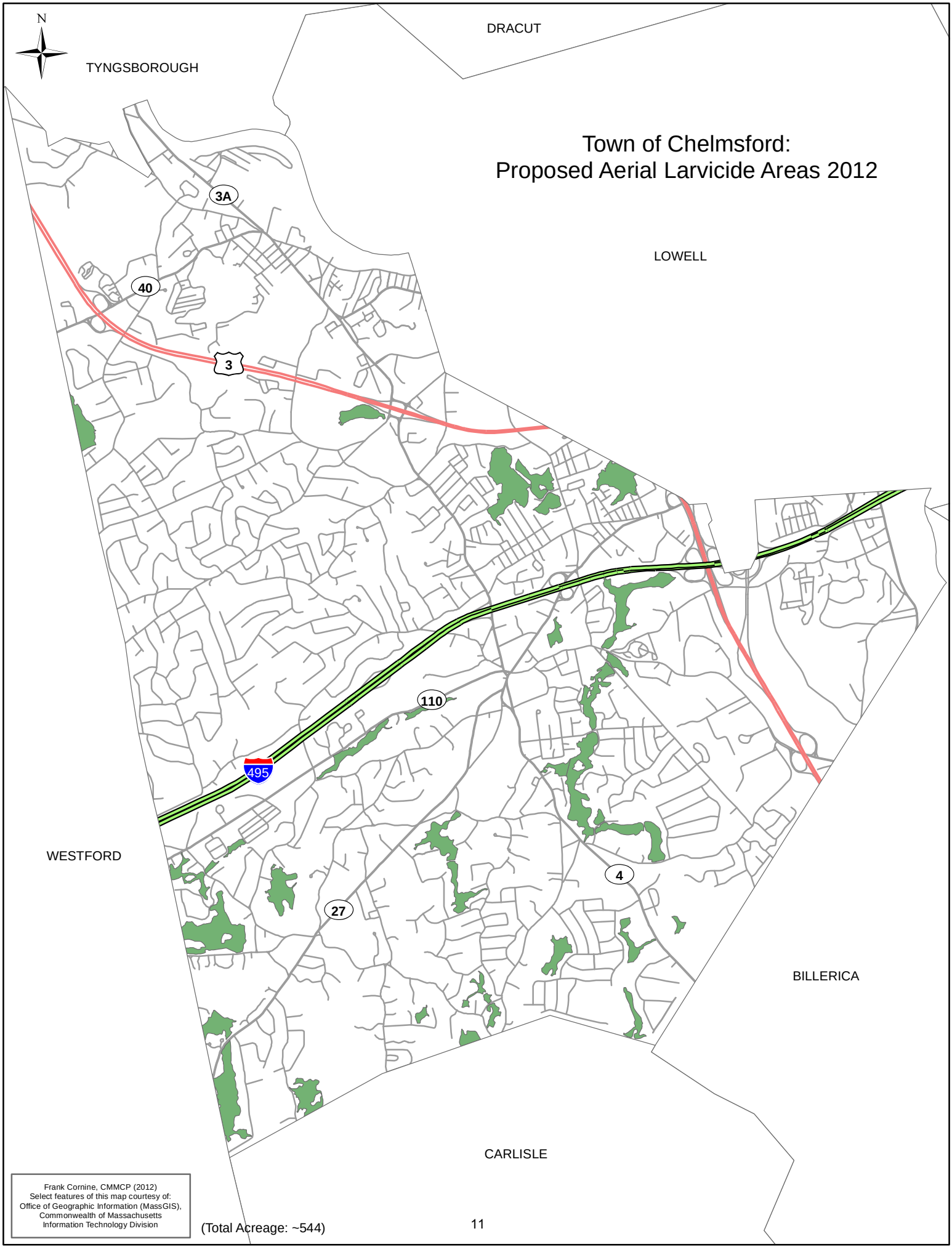
N
DRACUT
TYNGSBOROUGH
Town of Chelmsford:
Proposed Aerial Larvicide Areas 2012
LOWELL
3A
40
3
110
495
WESTFORD
4
27
BILLERICA
CARLISLE
Frank Cornine, CMMCP (2012)
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