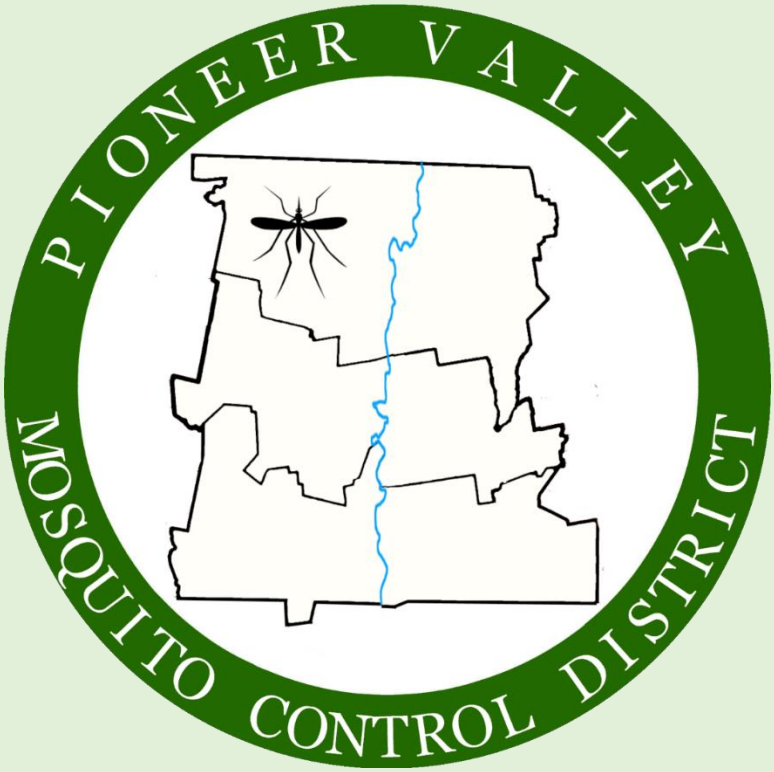

2025 Annual Report

MEMBER COMMUNITIES

AMHERST
BERNARDSTON
BUCKLAND
CHICOPEE
DEERFIELD
EAST LONGMEADOW
ERVING
GILL
GRANBY
GREENFIELD
HADLEY
HEATH
HOLYOKE
LEYDEN
NORTHAMPTON
NORTHFIELD
MONTAGUE
PALMER
ROWE
SHELBURNE
SHUTESBURY
SOUTH HADLEY
SOUTHAMPTON
SUNDERLAND
WEST SPRINGFIELD

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Introduction

Established pursuant to M.G.L. c. 252 in 2017, the Pioneer Valley Mosquito Control District (PVMCD) provides mosquito control services to its member municipalities in Franklin, Hampshire, and Hampden counties. The District is governed by a Board of Commissioners appointed by the State Reclamation and Mosquito Control Board.

This annual report summarizes arbovirus surveillance and mitigation activities conducted by the Pioneer Valley Mosquito Control District (PVMCD) during the 2025 mosquito season. These efforts are focused on monitoring mosquito populations, identifying vector species, and detecting mosquito-borne viruses of public health concern, including West Nile virus (WNV) and Eastern equine encephalitis (EEE). A total of 53 WNV-positive mosquito pools were detected within the District during the 2025 season, reflecting a substantial increase in virus activity within the region compared to previous years.

PVMCD's surveillance program includes routine mosquito collection and targeted testing of species known to be involved in WNV and EEE transmission. This systematic approach allows for early identification of virus activity and helps guide operational decisions throughout the season.

Mitigation efforts expanded in 2025, with pilot larval control services extended to two additional member communities, bringing the total number of communities receiving mitigation services to seven. Mitigation efforts focused on habitats of vector species in areas where WNV activity was detected, with the goal of reducing mosquito populations and limiting the risk of disease transmission.

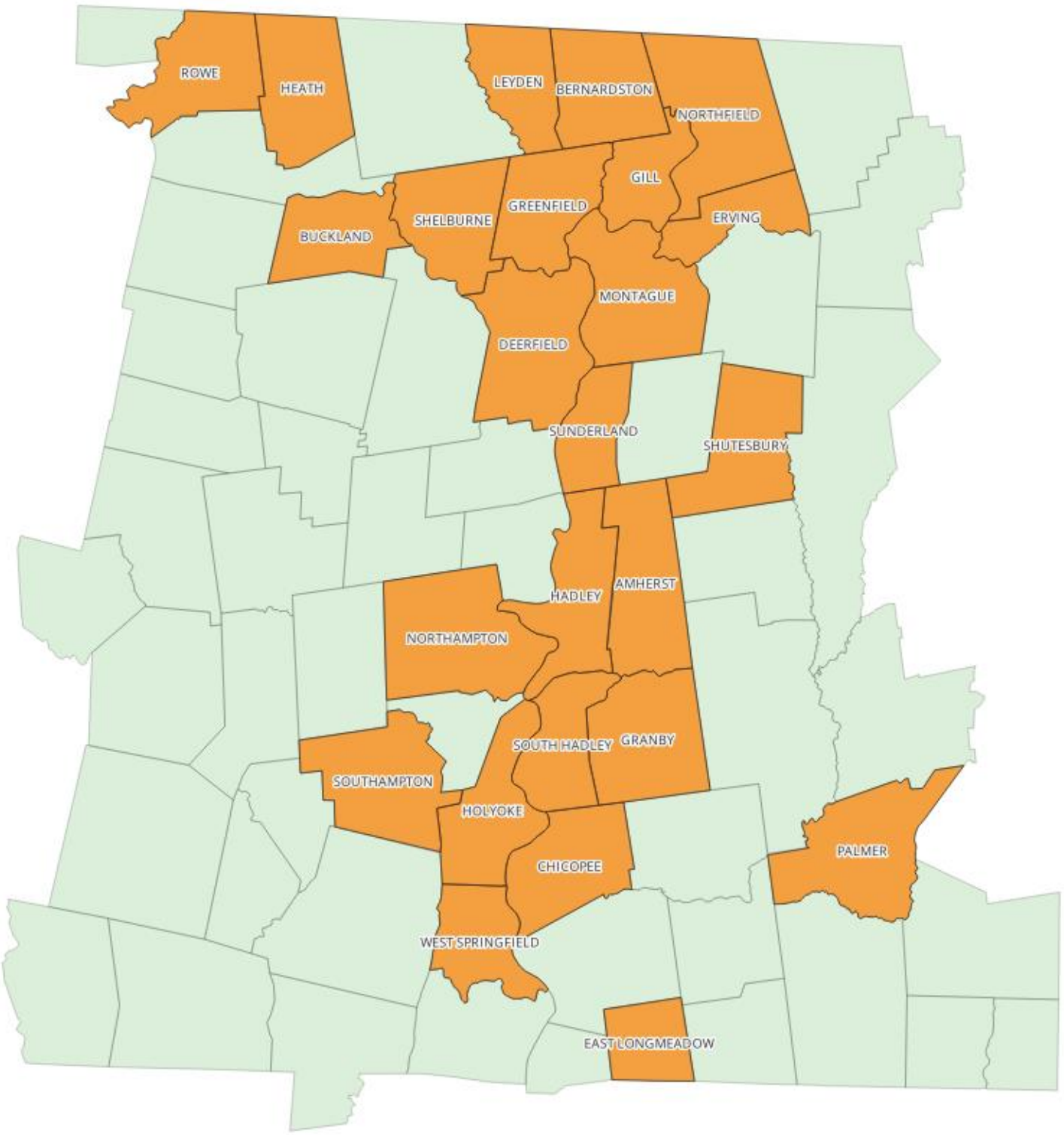
In addition to routine surveillance and mitigation activities, PVMCD continued collaboration with the University of Massachusetts Laboratory of Medical Zoology (LMZ) for arbovirus testing, including Jamestown Canyon virus (JCV). Surveillance efforts also documented notable numbers of Cx. *erraticus*, a species more commonly associated with warmer climates. Cx. *erraticus* is a potential vector of EEE and may eventually contribute to the EEE transmission cycle in Massachusetts if it's able to become established. Genetic testing of Cx. *erraticus* is being conducted at the UMass LMZ to determine whether any mutations of significance are present.

Our Mission

The Pioneer Valley Mosquito Control District (PVMCD) is dedicated to safeguarding the health of its member communities in Franklin, Hampden, and Hampshire Counties by addressing the public health risks associated with mosquito-borne diseases. Our primary objective is to meticulously monitor and effectively mitigate the transmission of these diseases through the implementation of a robust Integrated Mosquito Management (IMM) program. This program is designed to encompass a wide range of environmentally conscious and scientifically proven mitigation strategies, aiming to prevent the need for extensive wide-area adulticide applications.

The IMM program employs techniques for mosquito control grounded in a comprehensive understanding of mosquito biology, the life cycle of mosquitoes, and disease dynamics. When implemented correctly, these scientifically proven strategies not only reduce mosquito populations but also pose no danger to the public and have minimal to no environmental impact.

Figure 1: PVMCD Service Area and Current Member Communities



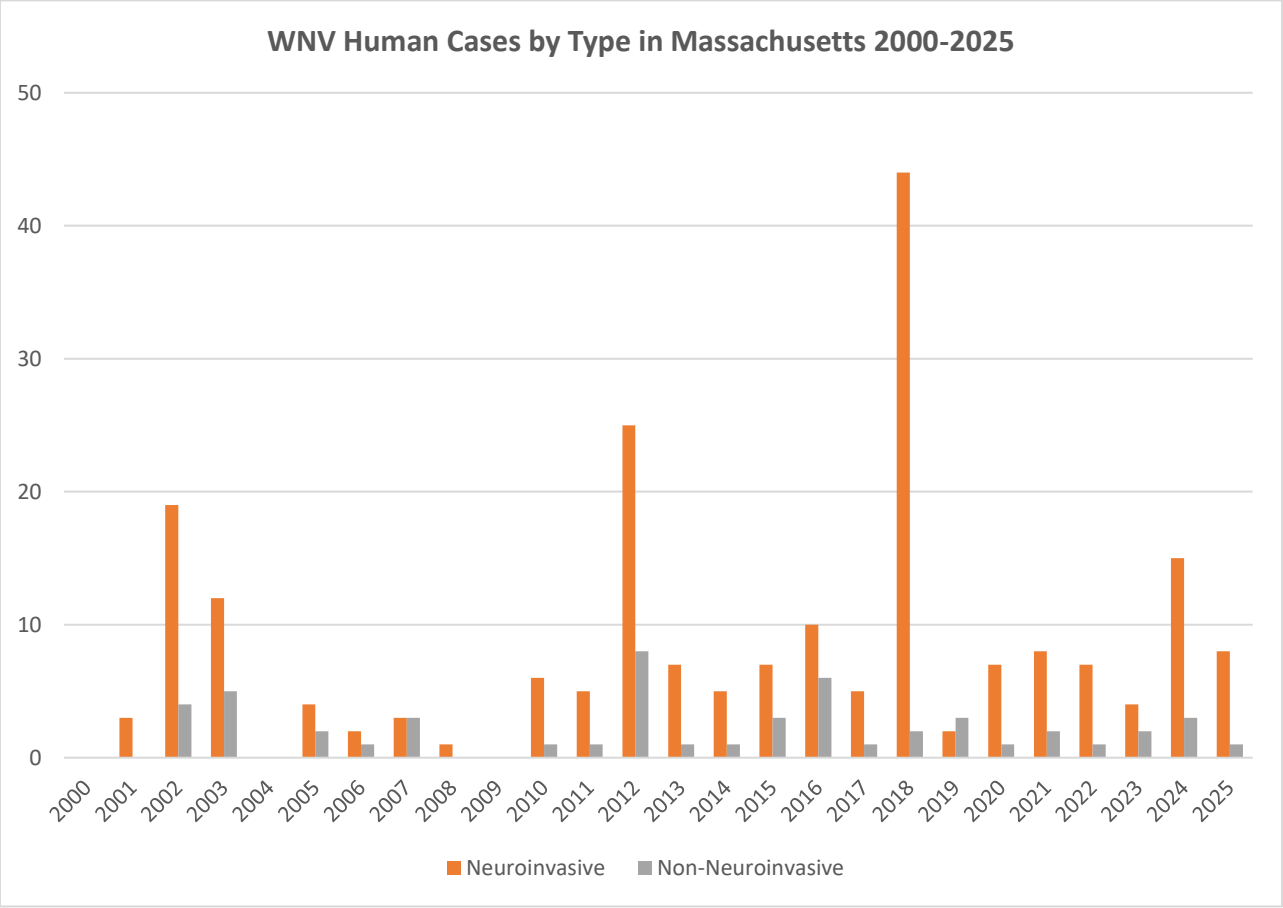
Mosquito-Borne Diseases Impacting the Commonwealth

West Nile virus is a flavivirus belonging to the Japanese encephalitis virus group and was originally discovered in the West Nile District of Uganda in 1937. The virus was not detected in the United States until the summer of 1999 in New York City. Since then, WNV has significantly expanded its reach across North America.

WNV was first confirmed in Massachusetts in 2000 and has since become endemic, with human cases occurring regularly throughout the Commonwealth. As of December 2025, there have been a total of 268 reported human cases in Massachusetts. This spread underscores the importance of ongoing surveillance and public health efforts to reduce the risk of transmission.

Severe illness is very rare, and roughly 80% of people infected with the virus do not develop any symptoms. People over the age of 50 are considered at higher risk of developing more severe symptoms of neuroinvasive disease, which include stiff neck, muscle tremors, seizures, changes in vision, and weakness or paralysis. Less severe symptoms of febrile illness include headache, fever, muscle aches, joint pain, fatigue, and rash. The onset of symptoms typically occurs within 2 to 14 days of being bitten by an infected mosquito.

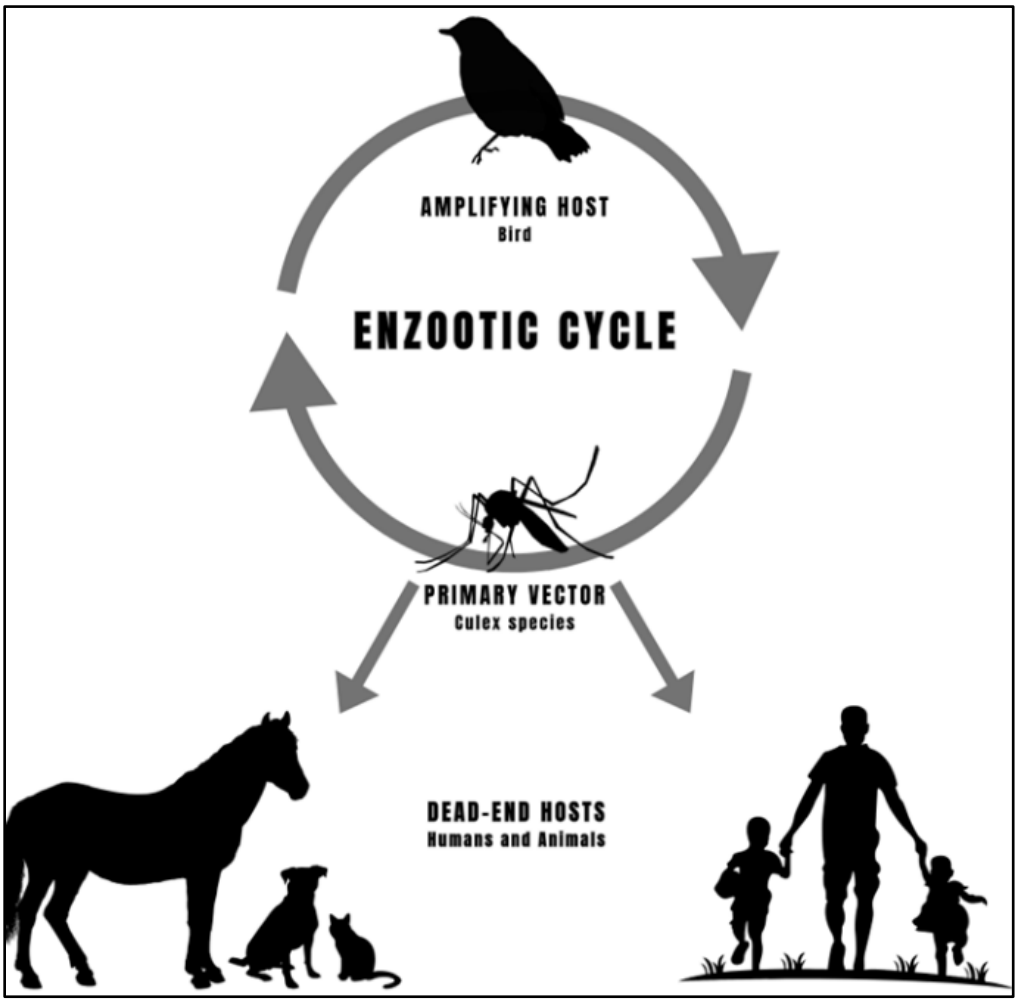
Figure 2: Historical WNV Human Case Data



The WNV transmission cycle involves several key players: mosquitoes, birds, and mammals, including humans. The cycle begins when mosquitoes, particularly Culex species, feed on infected birds. Birds are the primary reservoirs and amplifying hosts of the virus, and some infected birds can develop high levels of virus in their bloodstream. After feeding on an infected bird, the virus replicates within the mosquito and eventually reaches the salivary glands.

When an infected mosquito bites another bird or a mammal, such as a human or horse, it transmits the virus through its saliva. Humans and horses are considered dead end hosts because they do not develop high enough levels of the virus in their bloodstream to infect mosquitoes and therefore do not contribute to ongoing transmission. In rare cases, WNV can also be transmitted through blood transfusions, organ transplants, laboratory exposure, and from mother to baby during pregnancy, delivery, or breastfeeding.

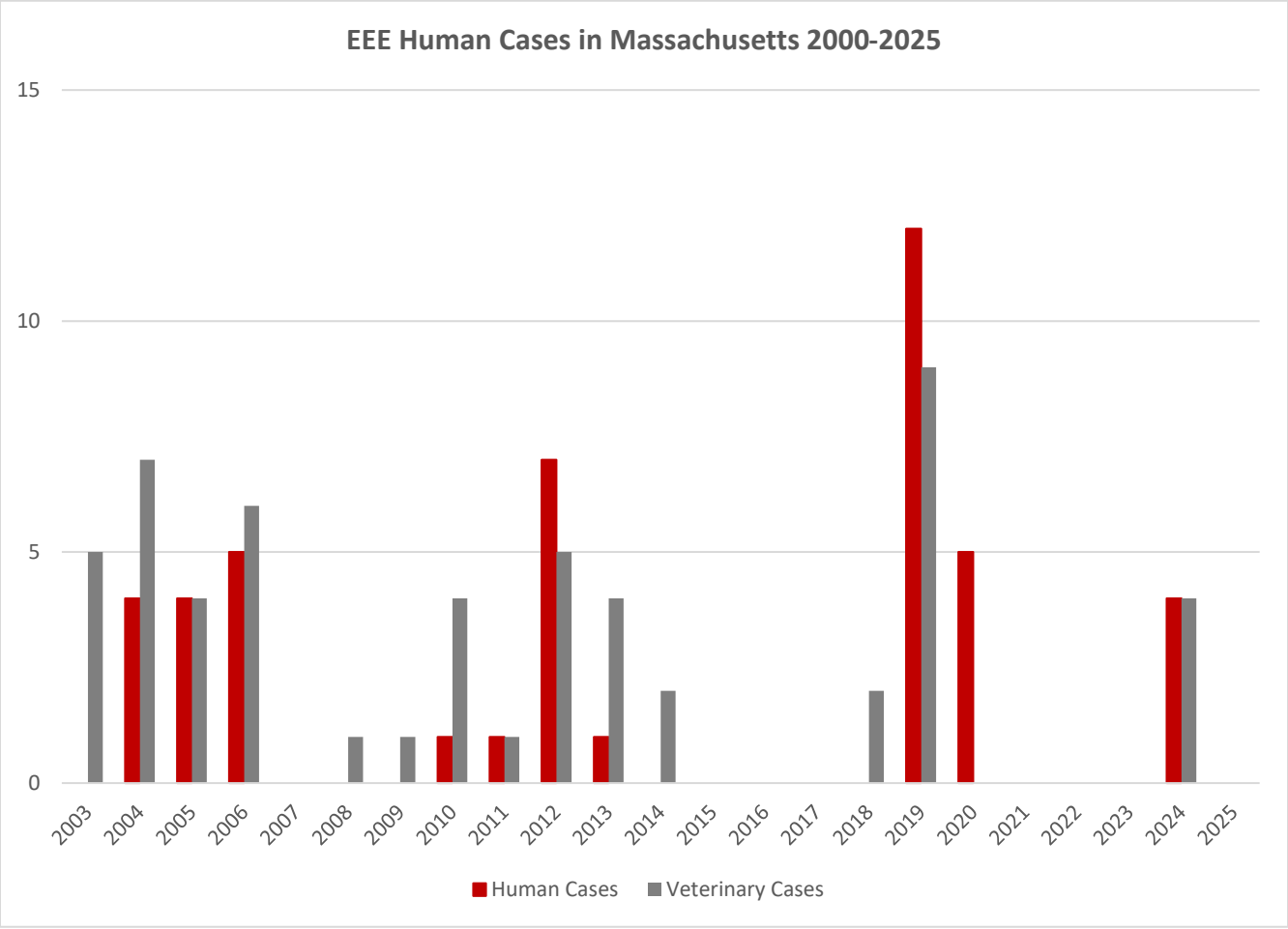
Figure 3: WNV transmission cycle graphic. The enzootic cycle occurs between birds (amplifying hosts) and mosquitoes. Zoonotic spillover occurs when an infected mosquito transmits the virus to humans.



Eastern Equine Encephalitis is a severe mosquito-borne alphavirus that was first detected in humans during the historic 1938 outbreak in Massachusetts. Instances of EEE transmission to humans and horses occur periodically in North America, where the virus is considered endemic. Since its first detection in Massachusetts in 1938, there have been 119 documented human cases of the disease. Historically, EEE has been more prevalent in Bristol, Plymouth, and Norfolk Counties. However, in recent years, EEE has also had a significant impact on additional communities in Central and Western Massachusetts.

Transmission of EEE to humans is very rare; however, the disease can be severe. Among cases involving neuroinvasive disease, approximately 30% result in death, and many survivors experience long-term neurologic impairments. Children and older adults are at higher risk of severe outcomes. The onset of symptoms typically occurs within 4 to 10 days of infection. Symptoms of neuroinvasive disease may include fever, headache, seizures, changes in behavior, vomiting, and coma. Individuals who recover from neuroinvasive disease often experience long-term cognitive impairments that may require lifelong medical support. Febrile illness is a less severe form of the disease and typically includes fever, muscle and joint pain, and chills, similar to influenza. Recovery from febrile illness generally occurs within 1 to 2 weeks of symptom onset.

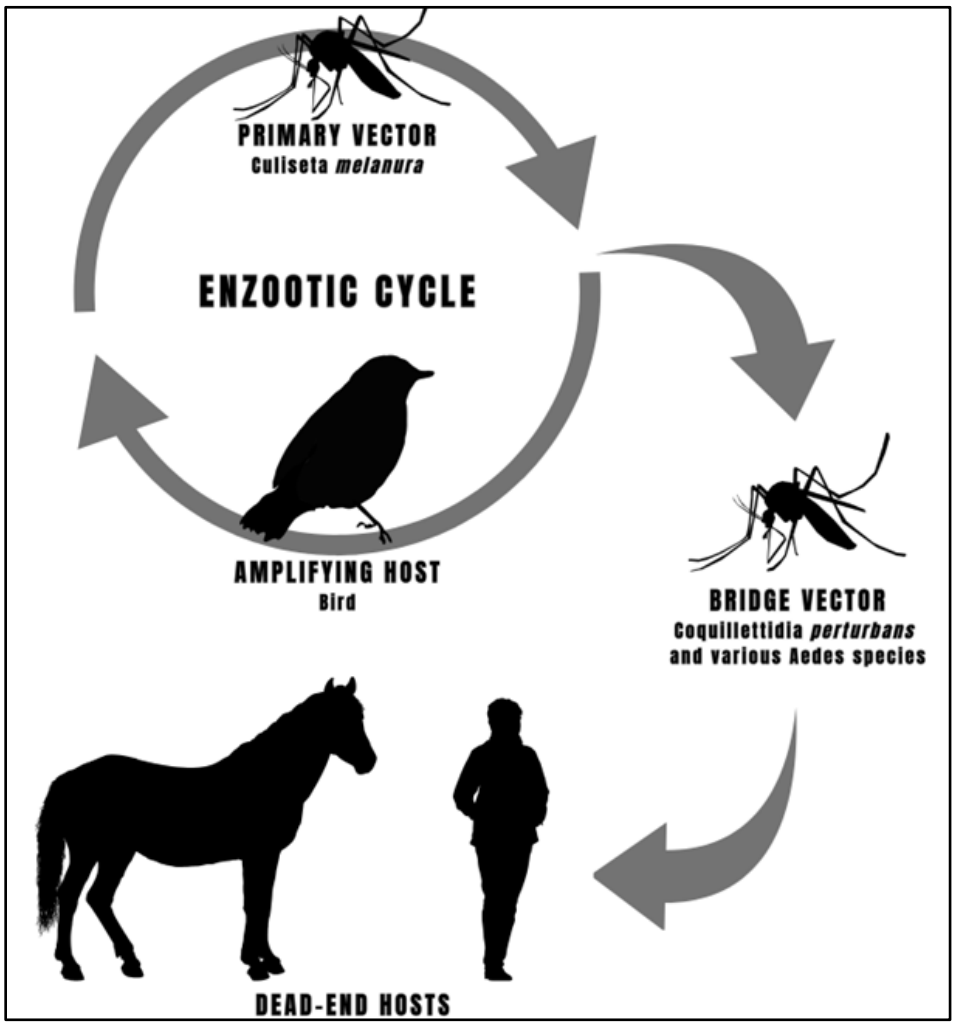
Figure 4: Historical EEE Human and Veterinary Case Data



The EEE transmission cycle involves mosquitoes, birds, and mammals, including humans and horses. The cycle begins when Culiseta *melanura*, a mosquito species associated with freshwater hardwood swamps, feeds on infected birds. Birds serve as the primary reservoirs and amplification hosts of the virus, developing viremia sufficient to infect mosquitoes. After feeding on an infected bird, the virus replicates within the mosquito, which can then transmit the virus to other birds, continuing the cycle.

Other mosquito species, including Aedes, Coquillettidia, and Culex, can serve as bridge vectors. These mosquitoes feed on both birds and mammals, allowing the virus to spill over from the enzootic bird mosquito cycle to humans and horses. Like WNV, humans and horses are considered dead-end hosts because they do not develop high enough levels of the virus in their bloodstream to infect other mosquitoes and therefore do not contribute to onward transmission.

Figure 5: EEE transmission cycle graphic. Like WNV, the enzootic cycle occurs between birds (amplifying hosts) and mosquitoes.

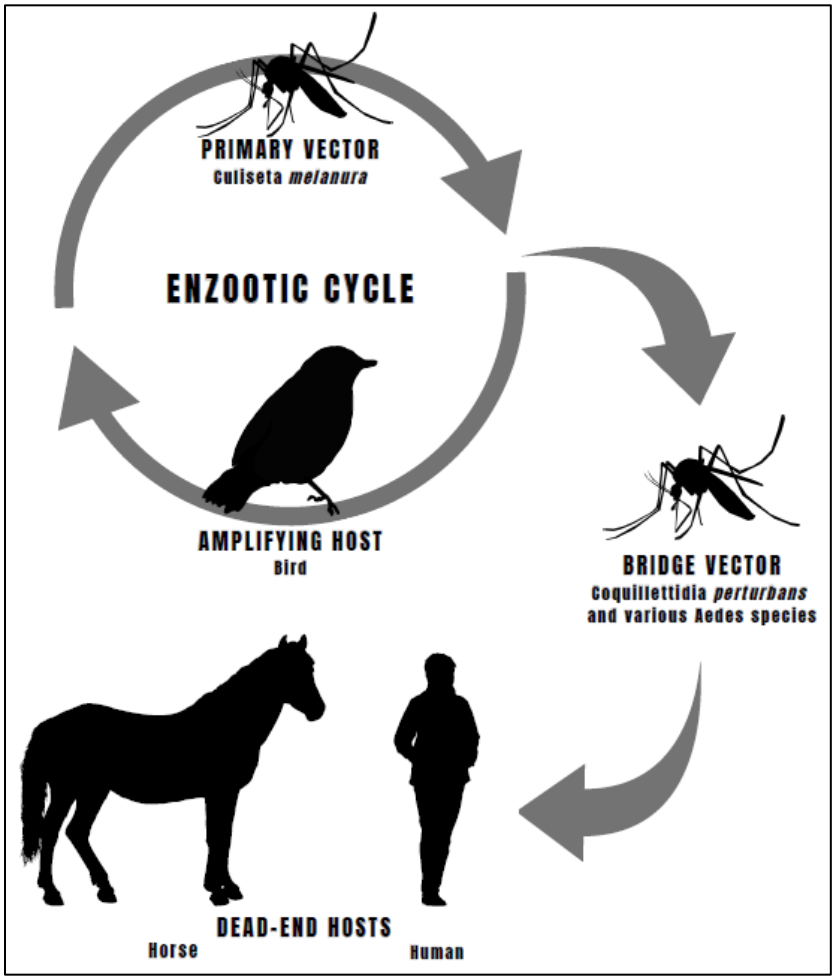


Jamestown Canyon virus (JCV) was first identified in 1961 from mosquitoes collected in Jamestown Canyon, Colorado. JCV is a California serogroup virus in the genus Orthobunyavirus (family Peribunyaviridae) and is closely related to La Crosse virus. Since its discovery, JCV has been detected in multiple mosquito species across the United States and Canada and is an emerging public health concern because it can cause neuroinvasive disease, such as meningitis or encephalitis; severe outcomes and death are rare.

In 2025, according to CDC ArboNET, a total of 21 human cases of JCV were reported in the United States. Of these, 14 cases were classified as neuroinvasive and 7 as non-neuroinvasive. At the regional level, Massachusetts reported zero human cases, while New Hampshire, Vermont, and Maine each reported one confirmed case.

The JCV transmission cycle involves mosquitoes and wildlife hosts, typically deer. Mosquitoes become infected when they feed on infected deer or other ungulates. After feeding on an infected host, the virus replicates within the mosquito. When an infected mosquito subsequently feeds on another host, such as a human or another deer, the virus is transmitted through the mosquito's saliva. Humans are considered dead-end hosts because they do not develop sufficient levels of viremia to infect mosquitoes and therefore do not contribute to further transmission.

Figure 6: The JCV transmission cycle graphic.

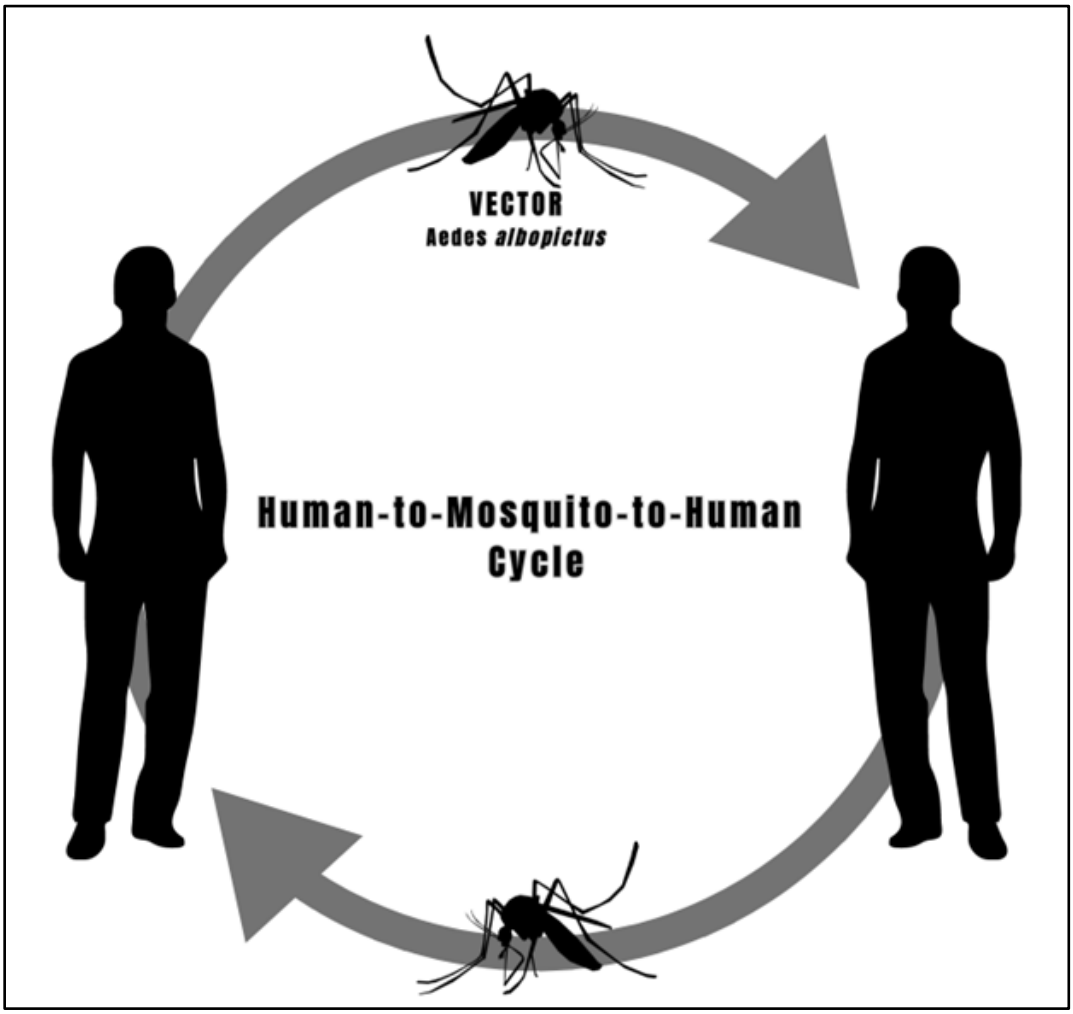


Dengue fever is not endemic to Massachusetts; however, local transmission is possible through a human-to-mosquito-to-human cycle in areas where competent Aedes *albopictus* mosquitoes are established. Although Aedes *albopictus* is a competent dengue vector, Aedes *aegypti,* a mosquito that is not present in MA*,* is generally considered the primary and most efficient vector associated with sustained dengue outbreaks, and the likelihood of local dengue transmission in Massachusetts remains very low.

Dengue transmission occurs most commonly in tropical and subtropical regions, including the Caribbean, Central and South America, Southeast Asia, and the Pacific Islands. Travel to these regions increases the likelihood of imported cases. In the continental United States, most reported dengue cases are travel-associated, although limited local transmission has been documented in a small number of states.

In 2025, dengue cases reported in New England and nearby northeastern states were travel-associated, including Massachusetts (23), Rhode Island, Connecticut (10), New York, New Hampshire (3), Vermont, and Maine (2).

Figure 7: Dengue fever transmission cycle graphic.



Primary Vector Species in Massachusetts

Culiseta *melanura* feed almost exclusively on avian hosts and play a central role in the enzootic amplification of eastern equine encephalitis (EEE) virus within bird populations. This species is considered the primary enzootic vector of EEE in freshwater hardwood swamp habitats. Blood meal studies conducted in the northeastern United States indicate that Cs. *melanura* feed predominantly on passerine birds, including species such as the American robin, which serve as important amplification hosts for the virus.

Cs. *melanura* typically produce two generations per year in Massachusetts, with development and seasonal activity strongly influenced by temperature and the length of the growing season. Warmer conditions can accelerate larval development and extend adult activity later into the season. Larvae overwinter in subterranean structures known as crypts, which are commonly found in red maple and Atlantic white cedar swamps. Adult mosquito activity declines sharply following the first hard frost, effectively ending seasonal transmission.

Culex *pipiens* plays a significant role in the transmission cycle of West Nile virus (WNV) by amplifying the virus within wild bird populations. This species feeds primarily on birds but will also feed on mammals, allowing it to function as both an amplification and potential bridge vector. Cx. *pipiens* produces multiple generations throughout the warm season, and extended periods of warm weather can contribute to increased mosquito abundance and prolonged virus transmission. As temperatures decline, adult females seek sheltered overwintering sites, often within man-made structures. Larval habitats commonly include stagnant water sources such as catch basins, discarded tires, neglected swimming pools, and other artificial containers.

Figure 8: Cs. *melanura* adult female

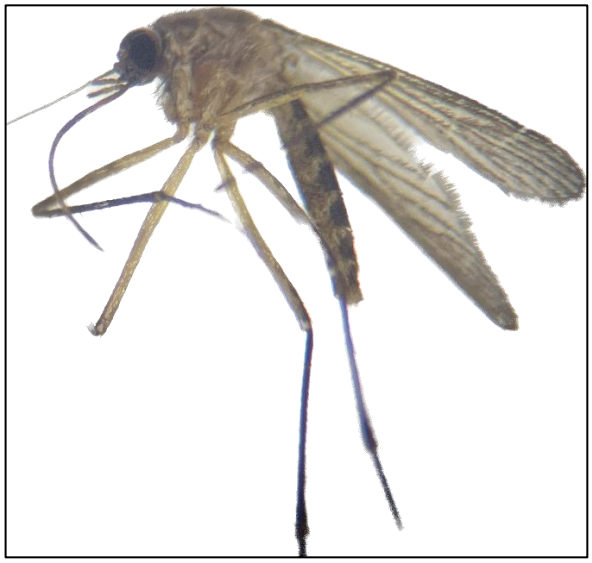


Figure 9: Cx. *pipiens* adult female

Additional mosquito species play a role as bridge vectors in virus transmission cycles, including Coquillettidia *perturbans*, Aedes *vexans*, Culex *salinarius*, and Ochlerotatus *canadensis*. Please refer to the Targeted Mosquito Species in Table 1 for more information on medical importance, habitat, and phenology.

Table 1: Targeted Vector Species

Species Name	Description	Habitat	Months Active
Aedes *albopictus*	An invasive species that is an aggressive and relentless day biter. Ae. *albopictus* prefer to feed on humans and can transmit chikungunya, dengue, and Zika.	Discarded tires and other containers.	June-October Peak: July
Aedes *vexans*	An aggressive biter that falls within the "flood water" species. Ae. *vexans* is a bridge vector for EEE and will feed on both birds and mammals.	Temporary freshwater pools such as flood meadows, retention ponds, and vernal pools.	May-October Peak: Varies and is dependent on precipitation.
Culiseta *melanura*	Cs. *melanura* mosquitoes are a primary vector for EEE. Cs. *melanura* feed mainly on avian species and are responsible for amplifying the virus to the point that it spills over into bridge vectors.	Tree root cavities or "crypts" covered by peat moss in red maple and cedar swamps.	May-December Peak: July-August and mid-September
Culex *pipiens* and *restuans*	These two mosquito species are abundant in Massachusetts and can amplify WNV in bird populations and infect humans. While *Cx. pipiens* are more strongly implicated in WNV transmission, both *Cx. pipiens* and *Cx. restuans* are grouped together because morphological features between the two species are difficult to distinguish using standard identification methods in adult females.	Artificial containers such as "green" swimming pools, catch basins, discarded tires, buckets, etc.	May-October Peak: July-August
Coquillettidia *perturbans*	Cq. *perturbans* is one of the most abundant mosquitoes in Massachusetts and is considered a competent bridge vector for EEE. Cq. *perturbans* will feed on both birds (reservoir for EEE) and mammals.	Permanent bodies of water with emergent vegetation such as cattails.	May-September Peak: July
Ochlerotatus *canadensis*	Oc. *canadensis* is a bridge vector that can transmit EEE to humans.	Woodland/vernal pools.	May-October Peak: June
Ochlerotatus *japonicus*	An invasive species that is a potential bridge vector for WNV and EEE.	Discarded tires and other containers	May-October Peak:
Culex *salinarius*	*Cx. salinarius* are considered bridge vectors for both EEE and WNV, readily feeding on mammals.	Brackish and freshwater swamps.	May-November Peak: August
Other species	There are many other species that PVMCD staff will submit to the Arbovirus Surveillance Laboratory at DPH for testing. These species are considered potential vectors in transmitting arboviruses.		

Arbovirus Surveillance Overview

To develop baseline surveillance data and identify areas of elevated mosquito activity, the District has utilized a relatively large number of trap sites across member communities. While the total number of trap sites was modestly reduced from 212 in 2024 to 167 in 2025, this change reflects an incremental shift toward establishing consistent, long-term surveillance locations rather than a substantial reduction in coverage.

The identification of established trap sites does not occur over the course of a single season and varies by community, as local habitat conditions, access, and surveillance results differ from town to town. The use of consistent, long-term trap sites is considered best practice in mosquito surveillance, as it supports reliable year-to-year comparisons and improves interpretation of trends in mosquito abundance, species composition, and virus activity. The District's long-term goal is to maintain a set of established trap sites in each community to support meaningful comparisons and coverage over time.

Figure 10: PVMCD 2025 trap sites

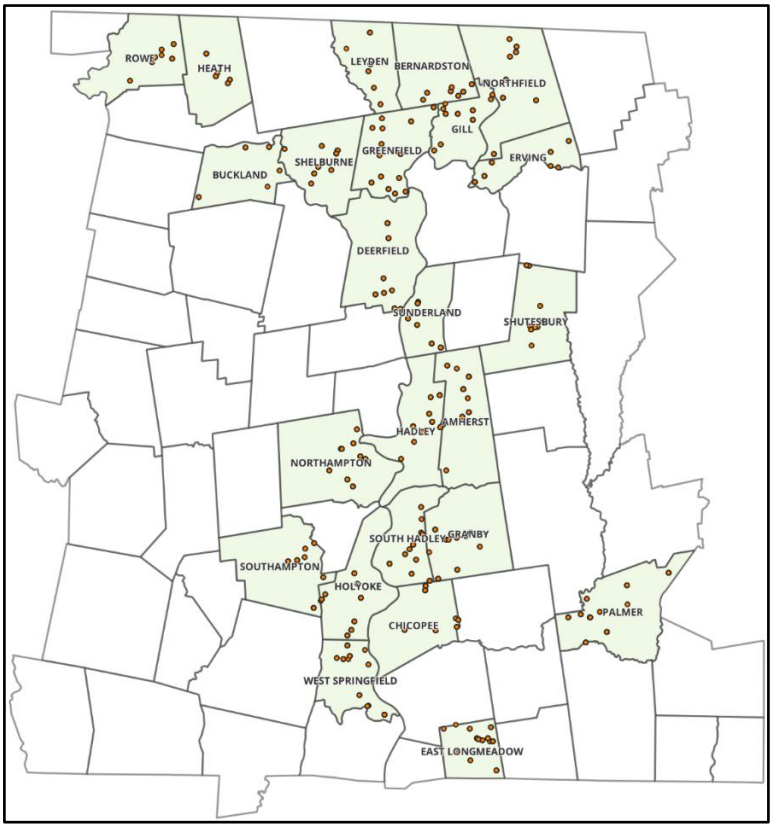


Figure 11: Most common surveillance traps used.

CDC Trap: Baited with carbon dioxide (CO_2), CDC traps attract a wide range of mammal-biting mosquitoes by mimicking host respiration.

Gravid Trap: Baited with hay-infused water, gravid traps attract *Culex pipiens* seeking egg-laying sites and are used to target species associated with WNV transmission.

2025 Surveillance Effort and Results

A total of 710 traps were strategically deployed across 167 trap sites within PVMCD member communities to capture and test targeted vector mosquito species for Eastern Equine Encephalitis and West Nile virus.

Altogether, there were 53 WNV-positive isolations detected in Pioneer Valley, 5 of which were from Culex species. The most abundant vector species were Cx. *pipiens*, accounting for 43% of all mosquitoes collected. Cx*. pipiens* are container-breeding mosquitoes and are considered the primary vector for WNV, feeding primarily on birds.

We did not collect many bridge vector species or see much spillover this year, which is likely due to the lack of significant rainfall during the fall of 2024 and this past summer. Cq. *perturbans*, a bridge vector for WNV and EEE, require a permanent source of water and will overwinter in the larval phase. Weather conditions likely negatively impacted Cq. *perturbans* densities in our area, as evidenced by their low numbers, which were down 76% from the previous year.

Table 2: Mosquito surveillance data by county 2020-2025. Although established in 2017, it should be noted that surveillance did not begin until 2020.

Franklin

Year	Mosquito Pools Tested	WNV Positive Pools	EEE Positive Pools	Total Mosquitoes Collected	Most Abundant Species (Total)
2020	94	0	0	3220	Cq. perturbans (1579)
2021	113	0	0	2245	Oc. canadensis (1042)
2022	98	0	0	2097	Cq. perturbans (1272)
2023	338	1	0	6551	Cx. pipiens/restuans (1987)
2024	238	0	0	9537	Cq. perturbans (5838)
2025	291	16	0	8885	Cx. pipiens/restuans (3713)

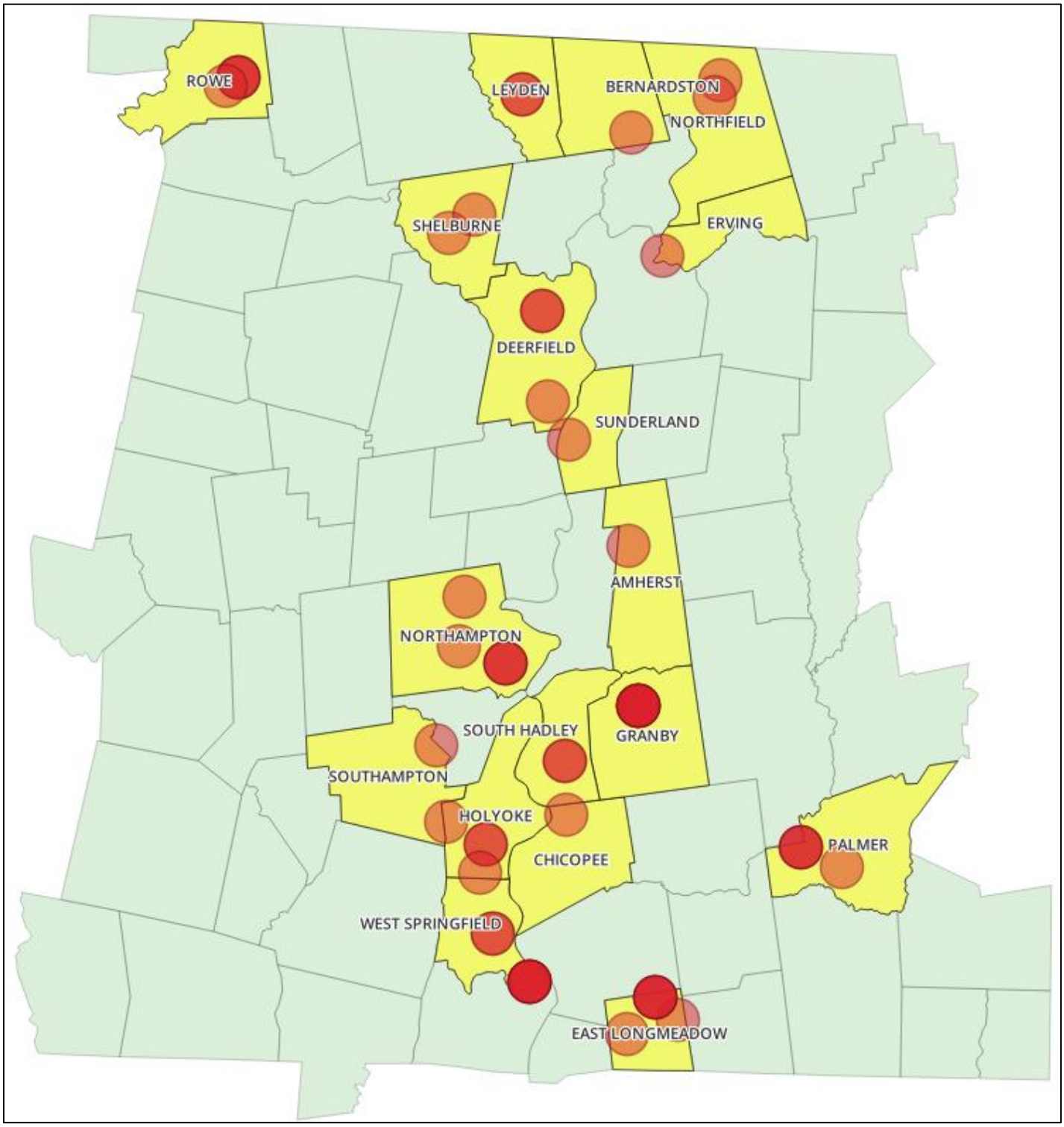
Hampden

Year	Mosquito Pools Tested	WNV Positive Pools	EEE Positive Pools	Total Mosquitoes Collected	Most Abundant Species (Total)
2020	137	1	0	4247	Cq. perturbans (1686)
2021	126	2	0	2593	Cq. perturbans (1067)
2022	76	0	0	1854	Cq. perturbans (1060)
2023	192	7	1	4399	Cx. pipiens/restuans (1818)
2024	191	3	0	10736	Cq. perturbans (6584)
2025	202	22	0	8351	Cx. pipiens/restuans (3513)

Hampshire

Year	Mosquito Pools Tested	WNV Positive Pools	EEE Positive Pools	Total Mosquitoes Collected	Most Abundant Species (Total)
2020	97	0	0	3115	Cq. perturbans (1752)
2021	130	2	0	3196	Cq. perturbans (1797)
2022	77	0	0	2356	Cq. perturbans (2244)
2023	222	8	0	5423	Cq. perturbans (2058)
2024	188	0	0	10148	Cq. perturbans (6524)
2025	208	15	0	7390	Cx. pipiens/restuans (3470)

Figure 12: WNV-Positive Pool General Locations



Individual Member Community Surveillance Data

Member communities received surveillance services across the 16-week testing period, with the exception of holidays. Every pool submitted consisted of 5-50 mosquitoes and were tested for both WNV and EEE. Please see table 3 below for specific member community surveillance data.

Table 3: Arbovirus surveillance data by town.

Municipality	Pools	WNV Pools	EEE Pools	Total Mosquitoes Collected	Most Prevalent Species of Medical Importance (Total)
Amherst	41	1	0	1009	Culex pipiens/restuans (449)
Bernardston	19	1	0	677	Culex pipiens/restuans (276)
Buckland	18	0	0	381	Culex pipiens/restuans (169)
Chicopee	55	1	0	1636	Culex pipiens/restuans (445)
Deerfield	34	3	0	889	Culex pipiens/restuans (505)
East Longmeadow	29	6	0	997	Culex pipiens/restuans (829)
Erving	29	1	0	566	Culex pipiens/restuans (198)
Gill	21	0	0	819	Coquillettidia perturbans (250)
Granby	48	6	0	2128	Culex pipiens/restuans (975)
Greenfield	23	0	0	512	Culex pipiens/restuans (206)
Hadley	35	0	0	947	Culex pipiens/restuans (450)
Heath	8	0	0	487	Coquillettidia perturbans (384)
Holyoke	38	4	0	991	Culex pipiens/restuans (428)
Leyden	18	2	0	411	Culex pipiens/restuans (272)
Northampton	30	5	0	1770	Coquillettidia perturbans (723)
Northfield	19	2	0	672	Culex pipiens/restuans (180)
Palmer	39	4	0	1300	Culex pipiens/restuans (871)
Rowe	33	4	0	1372	Culex pipiens/restuans (1025)
Shelburne	28	2	0	920	Coquillettidia perturbans (397)
Shutesbury	16	0	0	605	Culex pipiens/restuans (220)
South Hadley	29	2	0	912	Culex pipiens/restuans (578)
Southampton	25	1	0	624	Culex pipiens/restuans (296)
Sunderland	25	1	0	574	Culex pipiens/restuans (270)
West Springfield	41	7	0	3427	Culex erraticus (1500)

Human Cases across the Commonwealth

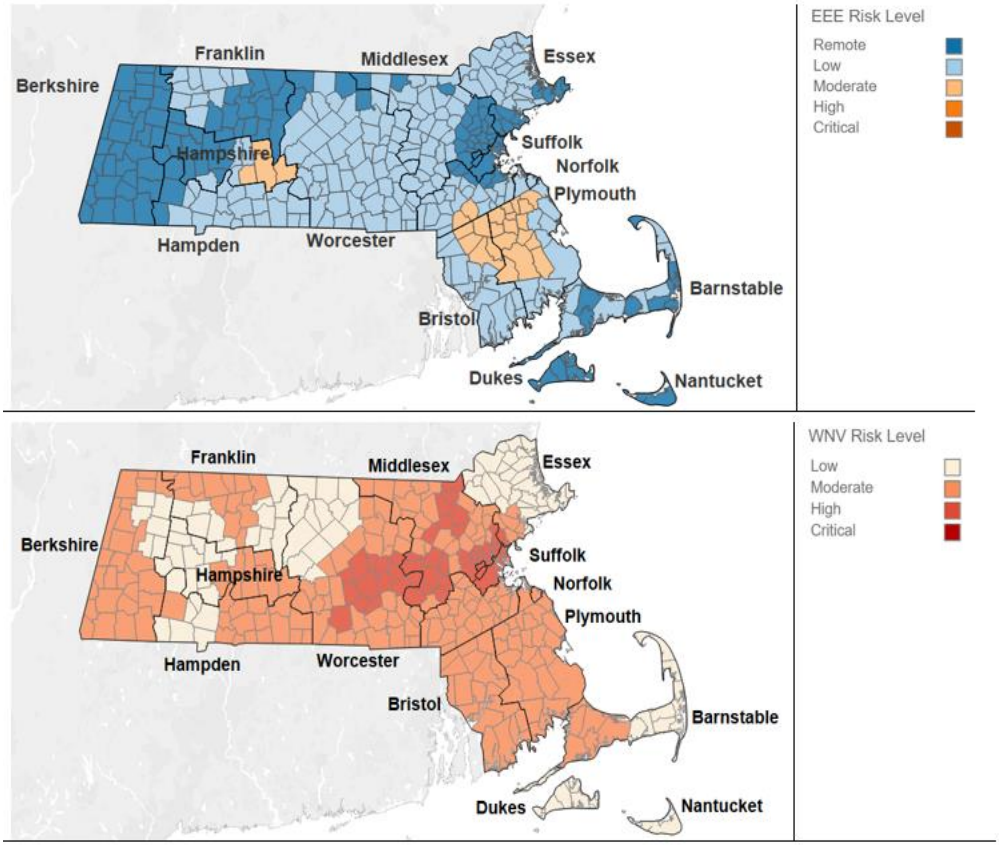
The most recent season saw a total of 9 confirmed human cases of WNV and one veterinary case (see Table 4). In addition, 451 WNV-positive mosquito pools were detected. For EEE, 23 positive mosquito pools were identified, and no human or veterinary cases were reported. Please refer to Table 6 for additional details regarding human cases.

Table 4: WNV human cases across the Commonwealth in 2025.

Onset Date	County of Exposure	Age	Gender	Clinical Presentation
August 11, 2025	Hampden	40-49	Male	Meningitis
August 15, 2025	Middlesex	70-79	Female	Encephalitis
August 21, 2025	Worcester	60-69	Male	Fever
August 22, 2025	Essex	60-69	Female	Meningoencephalitis
August 22, 2025	Middlesex	80-89	Male	Meningoencephalitis
August 30, 2025	Worcester	60-69	Male	Meningoencephalitis
September 9, 2025	Middlesex	60-69	Female	Meningitis
September 10, 2025	Suffolk	50-59	Male	Meningitis
October 1, 2025	Middlesex	50-59	Male	Other Neuroinvasive

WNV transmission was primarily concentrated in Middlesex County (4), followed by Worcester (2), Essex, Hampden, and Suffolk (all 1 case each). All areas impacted by positive mosquito pools and human cases can be viewed in the October arbovirus risk maps provided by the MA Department of Public Health.

Figures 9 and 10: October (peak) risk maps for EEE and WNV from MA Dept. of Public Health.



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Weather Impacts

Weather conditions during the 2025 season likely influenced mosquito abundance and species composition. Weekly precipitation totals were generally low and inconsistent throughout much of the peak mosquito season, with several weeks receiving little to no rainfall. This pattern likely reduced the extent and persistence of flooded, vegetated habitats that support many bridge vector species.

In contrast, temperature conditions during the peak season were consistently favorable for *Culex pipiens*. Average weekly maximum temperatures frequently reached the mid-80s to upper-80s °F, with minimum temperatures remaining relatively warm during mid-summer. These conditions likely supported rapid development and multiple generations of Cx. *pipiens*, a species well adapted to artificial, stagnant water sources such as catch basins that are less dependent on precipitation.

Table 5: Weather data taken during EPI weeks 23-40.

Station	Name	EPI Week	PRCP Total (in.)	TMAX AVG (°F)	TMIN AVG (°F)
USC00190120	AMHERST, MA US	**23**	**1.53**	**77.43**	**51.14**
USC00190120	AMHERST, MA US	**24**	**0.69**	**74.5**	**56**
USC00190120	AMHERST, MA US	**25**	**0.55**	**74.8**	**58.5**
USC00190120	AMHERST, MA US	**26**	**0.35**	**87.9**	**66**
USC00190120	AMHERST, MA US	**27**	**0.16**	**84.1**	**59.5**
USC00190120	AMHERST, MA US	**28**	**0.54**	**87.6**	**66.1**
USC00190120	AMHERST, MA US	**29**	**1.75**	**86.1**	**66.4**
USC00190120	AMHERST, MA US	**30**	**0.76**	**83.7**	**58.5**
USC00190120	AMHERST, MA US	**31**	**1.94**	**84.1**	**61.9**
USC00190120	AMHERST, MA US	**32**	**0**	**82.4**	**54.9**
USC00190120	AMHERST, MA US	**33**	**0.01**	**89**	**61.1**
USC00190120	AMHERST, MA US	**34**	**1.25**	**78.3**	**53.1**
USC00190120	AMHERST, MA US	**35**	**0.08**	**77.57**	**49**
USC00190120	AMHERST, MA US	**36**	**0.33**	**78.57**	**50.29**
USC00190120	AMHERST, MA US	**37**	**0.76**	**75.43**	**47.43**
USC00190120	AMHERST, MA US	**38**	**0**	**78.86**	**49.86**
USC00190120	AMHERST, MA US	**39**	**0.46**	**73.67**	**48**
USC00190120	AMHERST, MA US	**40**	**0**	**74.17**	**44**

Larval Mitigation Summary

2025 marked the second year for our larval mitigation program. As part of a preventative strategy and in response to WNV-positive pools, PVMCD staff treated 4,871 catch basins/storm drains targeting Cx. *pipiens* across Amherst, Chicopee, East Longmeadow, Northampton, Palmer, South Hadley, and West Springfield. Approximately 18.8 acres of wetland habitat were treated, targeting the following vector species capable of transmitting EEE and/or WNV: Ae. *vexans,* Cx. *salinarius*, and Oc. *canadensis*. Targeted wetland treatments occurred in the following member communities: Chicopee, East Longmeadow, Deerfield, and Northampton.

All wetlands and ditches were inspected before and after treatments to monitor larval mortality and any non-target impacts. To minimize indirect trophic effects, areas where predatory species such as dragonfly larvae were found did not receive treatment. Only areas with either an absence of predatory species or low biodiversity and a high abundance of mosquito larvae were treated.

The two products used during the 2025 season were FourStar CRG granules, which were applied to wetlands and tire habitats, and FourStar 45 and 90 day briquets, which were used to treat catch basins and other container habitats. Both products contain *Bacillus thuringiensis* subspecies *israelensis* (Bti), a naturally occurring soil bacterium that is considered safe for humans, pets, and wildlife when used as directed. The first application of 90 day briquets typically occurs in late April or early May, followed by a second application of 45 day briquets in August.

Bti targets mosquito larvae during their actively feeding larval stages. Once ingested, Bti toxins are activated in the alkaline gut environment of larval mosquitoes, where they damage the gut lining and cause larval mortality prior to pupation. Due to this highly specific mode of action, Bti primarily affects mosquito larvae, as well as a limited number of other Dipteran larvae such as black flies and non-biting midges. As noted above, potential indirect trophic effects are considered with each application of Bti to minimize unintended ecological impacts.

Table 6: Catch Basin/Storm Drain Treatment Applications

Town	Product	Amount
Amherst	FourStar 45 and 90 day briquets	630
Chicopee	FourStar 45 and 90 day briquets	268
East Longmeadow	FourStar 45 and 90 day briquets	1,214
Northampton	FourStar 45 and 90 day briquets	1,730
Palmer	FourStar 45 day briquets	54
South Hadley	FourStar 45 and 90 day briquets	747
West Springfield	FourStar 45 day briquets	228

Table 7: Wetland Treatment Applications

Town	Product	Amount (LBS)	Area (Acres)
Chicopee	FourStar Bti CRG	1.88	0.25
Deerfield	FourStar Bti CRG	56.2	7.5
East Longmeadow	FourStar Bti CRG	15.2	2.03
Northampton	FourStar Bti CRG	97.5	9.05

Public Health in Action: Coordinated Response

When a mosquito sample tests positive for an arbovirus, the work does not end with the result. The District contacts the community's Public Health Director, Local Board of Health, and other municipal partners to provide support, identify likely sources, and decide what action makes sense in each case. The cases below show how early communication and shared decision making between towns, the District, and public health partners lead to quicker, more effective responses. We appreciate the municipal officials and staff who helped turn information into action this past season, often on short notice.

Case 1: Finding an unexpected breeding source in a rural area

West Nile virus positive Culex *pipiens* were detected in a rural section of the District. Because Culex *pipiens* is most often associated with artificial containers around homes (old tires, buckets, neglected pools) and high organic habitats (catch basins, septic systems, water treatment structures), staff began by looking for those common sources.

During the initial field investigation, none of those typical habitats were found within a quarter mile of the mosquito trap location.

Because Culex *pipiens* can also develop in natural environments rich in organic material, such as isolated pockets of water near beaver dams, the District worked with the Parks and Recreation Department to broaden the search. Parks and Recreation provided GIS data identifying beaver dam locations in the area, allowing District staff to target specific sites efficiently. After surveying multiple dam systems, staff identified one area with active breeding. Larval samples were collected and later confirmed in the lab to include Culex *pipiens*.

This response did two things at once. It identified a subtle breeding source that would have been easy to miss, and it showed how quick coordination between departments can strengthen a town's ability to respond early, before mosquito activity and associated risk increase.

Case 2: Reducing exposure through quick, practical changes

During routine field work, the District's seasonal entomologist noted an outdoor senior yoga class taking place near the trap location. Once West Nile virus positive mosquitoes were confirmed from that site, the entomologist promptly notified the Director, given that the group represented a higher risk population.

The Director notified the Town's Board of Health, and the class was moved indoors for the remainder of the season. It was a simple adjustment, but it reduced unnecessary exposure while allowing the program to continue.

Case 3: Coordinating access to address a high density breeding site

West Nile virus positive Culex *pipiens* mosquitoes were collected in large numbers from a trap site in a District member community, with counts in the hundreds. The Public Health Director was notified immediately, and District staff conducted a field investigation to identify potential sources of breeding.

Within a quarter mile of the trap location, staff checked nearby catch basins (one of which was completely dry) and conducted visual inspections of accessible residential yards for common container habitats such as neglected pools, buckets, and tires. A nearby water treatment facility was also considered a likely potential source early, but access was needed for sampling.

Once the water treatment facility was identified as a likely source, the Public Health Director quickly worked with Town officials and facility staff to coordinate access for District personnel.

Although the facility had been flushing the area weekly, warm summer nights and timing gaps likely allowed mosquitoes to complete development and emerge between maintenance cycles. Once the specific breeding location was confirmed, facility staff were able to adjust their maintenance schedule to disrupt mosquito development more effectively.

Response Approach

Once a positive result is received, the District promptly contacts Public Health Directors, Local Boards of Health, and other municipal partners to discuss next steps. Depending on the situation, that can mean a targeted field investigation, an operational adjustment by a town department, a program change to reduce exposure, or a combination of approaches. The goal is consistent: early communication, shared decision making, and coordinated action to limit risk.

This past season marked a milestone for the District, as it was the first year full mosquito borne disease response activities were carried out, including investigating potential habitat and treating catch basins around West Nile virus positive sites. We are grateful to the municipal officials and staff who helped make these investigations possible and who acted quickly to help implement practical solutions.

2025 Community Outreach and Engagement

Throughout the 2025 season, the District supported communities not only through surveillance and response, but also through education, presentations, and collaboration with municipal and public health partners. The activities below summarize key outreach and engagement efforts completed this year.

- **New England Center of Excellence in Vector Borne Diseases (NEWVEC) Summer Academy for STEM Students across Massachusetts**
  - **Volunteered as an instructor:** Delivered two sessions on the ecology and biology of mosquitoes in the region.

- **Cooperative Public Health Service February meeting**
  - **Presented:** The District's history, current operations, membership, and funding structure

- **Massachusetts Beekeepers Association Spring 2025 newsletter**
  - **Authored:** A feature article summarizing mosquito borne disease risk in Massachusetts and describing the District's surveillance program and targeted larval control approach using Bti, with an emphasis on minimizing impacts to pollinators and protected species.

- **Town of Shutesbury and Valley Health Regional Collaborative listening session**
  - **Presented:** Behind the Buzz: How Mosquitoes Live, Breed, and Spread Diseases.

- **Deerfield Flood Resiliency Workshop for property owners and residents**
  - **Presented:** Supporting Healthy Wetlands and Promoting Dragonfly Habitat.

- **Meetings and follow up coordination with multiple Local Boards of Health and town officials**
  - Provided support and coordinated appropriate responses following West Nile virus positive mosquito detections, including coordination with Town Administrators in communities without a Board of Health or Public Health Agent.

- **UMass and NEWVEC Work in Progress series**
  - **Presented:** Community of Practice for Mosquito Control in Massachusetts.

Looking ahead to spring 2026, the District plans to expand outreach and presentations, including programs for schools and senior centers. Member communities interested in hosting a presentation are encouraged to contact the District to discuss scheduling and local needs.

FAQ	Answer
What is a primary vector?	A primary vector is a species of mosquito that plays a significant role in the virus cycle.
What is a bridge vector?	Once EEE and/or WNV are amplified enough in the bird population, spill over into other mosquito species will occur. Species that are competent vectors and feed on both birds and humans will create a "bridge" for virus transmission to occur.
How long do mosquitoes live?	Lifespan varies from a few weeks to several months depending on species, environmental conditions, and resource availability. Additionally, some species can lay multiple batches of eggs while others will lay a single batch and die shortly after.
What is an instar phase?	Mosquito larvae go through 4 instar phases where they molt. The 4th instar phase is when larvae stop eating and molt into pupae. It is important to understand these phases when applying larvicide products that have one mode of action via ingestion.
How long does it take mosquitoes to develop?	This period of development will vary in the spring depending on environmental conditions. In the summer, however, it typically takes a week for mosquitoes to develop from egg to adult.
What are mosquito pools?	A pool consists of 5-50 mosquitoes placed into a PCR tube for arbovirus testing.
What is a Gravid trap?	A gravid trap is one of the two main traps used by PVMCD. The trap primarily targets "gravid" Culex mosquitoes (WNV vector) seeking out suitable habitat to lay their eggs. Culex species look for bacteria rich (foul smelling and stagnant) water to lay their eggs. The Gravid trap essentially replicates an artificial container habitat.
What is a CDC trap?	A CDC trap is the second main trap used by the PVMCD. It is used to target mosquitoes that feed on mammals and are capable of transmitting EEEV or WNV to humans. The CDC trap utilizes CO2, which mimics the breath of a potential blood meal.
Why are there pools submitted from one trap but not the other?	Not every trap yields enough targeted vector species to submit for testing. Factors influencing this are weather, habitat, and equipment failures.
What is a "trap failure" (TF)?	Sometimes faulty parts or wear from regular use result in trap failures. Trap failures are inevitable but do not occur that often.
What does "no collection recorded" (NCR) mean?	A "no collection recorded" or "NCR" means no mosquitoes were collected from a trap deployed in the field. This will occur throughout the season but tends to be more frequent during the earlier and later parts of the season.
Does PVMCD offer control services?	PVMCD implemented a pilot larval mitigation program in 2024 at a practical level of capacity. Control services consisted of targeting vector species habitat via larvicide granule formulations primarily in the spring to mitigate arbovirus.
What is Bti?	Bti stands for *Bacillus thuringiensis israelensis* and is naturally occurring soil bacterium that is used to control larval mosquito populations. Bti is safe for humans, animals, and the environment when used as directed. It is effective in reducing mosquito larvae that are feeding during the first 4 instar phases. The timing of application is imperative to Bti's effectiveness in controlling mosquito populations.

FOURSTAR®

Bti CRG

Specimen Label

Multi-Brood Controlled Release Granule

ACTIVE INGREDIENTS:

Bacillus thuringiensis subspecies ***israelensis*** Strain BMP 144 solids, spores and insecticidal toxins*	10%
OTHER INGREDIENTS:	90%
TOTAL:	100%

* Equivalent to 700 International Toxic Units (ITU/mg).

Note: The percent active ingredient does not indicate product performance, and potency measurements are not federally standardized.

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS – CAUTION:

Causes moderate eye irritation. Harmful if absorbed through skin. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

Mixers / loaders and applicators not in enclosed cabs or aircraft must wear gloves and a dust / mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.

FIRST AID	
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth if possible. • Call a poison control center or doctor for treatment advice.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, and then continue rinsing eyes. • Call poison control center or doctor for treatment advice.
If on skin	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call poison control center or doctor for treatment advice.
HOT LINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-248-7763 for emergency medical treatment information.	

ENVIRONMENTAL HAZARDS:

Do not contaminate water when disposing of equipment washwaters or rinsate. Do not apply to treated, finished drinking water reservoirs or drinking water receptacles when the water is intended for human consumption.

DIRECTIONS FOR USE

It is a violation of Federal law to apply this product in a manner inconsistent with its labeling.

APPLICATION DIRECTIONS

FourStar® Bti CRG is a highly selective multi-brood microbial insecticide granule effective against mosquito larvae in a variety of aquatic habitats for up to 40 days or more. **FourStar® Bti CRG** releases effective levels of ***Bacillus thuringiensis*** subspecies ***israelensis*** to the water surface and throughout the water column over time.

FourStar® Bti CRG can be applied prior to flooding (i.e. "pre-hatch") to known breeding sites that flood intermittently. In such areas, one application of **FourStar® Bti CRG** prevents adult mosquito emergence for up to four subsequent floodings. The actual length of control depends on the duration and frequency of flooding events. Alternate wetting and drying will not reduce granule effectiveness.

Apply uniformly according to rates listed below by conventional aerial or ground equipment as needed to maintain mosquito control. Reapply after 40 days under typical environmental conditions. More frequent applications may be made if monitoring indicates that larval populations have reestablished or weather conditions have rendered initial treatments ineffective.

APPLICATION SITES

Apply **FourStar® Bti CRG** pre-hatch or post-hatch as directed above to temporary and permanent water sites, which support mosquito larval development. **FourStar® Bti CRG** can be applied to areas that contain aquatic life, fish and plants as well as areas in contact with humans, animals, horses, livestock, pets, birds or wildlife.

Examples of application sites include: tidal water, salt marshes, mangroves, estuaries, freshwater marshes, cattail marshes, woodland pools and meadows, grassy swales, floodplains, flood water, standing water, roadside ditches, canals, woodland pools, catch basins, storm drains, storm water collection areas, retention and detention impoundments, lakes and ponds, abandoned swimming pools, water holding receptacles, and other natural and man-made sites where mosquitoes may develop.

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather related factors determine the potential spray drift. The applicator and treatment coordinator are responsible for considering all these factors when making decisions.

FOURSTAR®

Bti CRG

APPLICATION RATES

To control mosquito larvae, apply 7.5 to 10 lbs of **FourStar® Bti CRG** per acre. Use 10 to 20 lbs of **FourStar® Bti CRG** per acre where late instar larvae predominate, larval populations are high, water is heavily polluted and/or algae are abundant, or under conditions where local experience indicates the need for higher rates to achieve extended control.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Pesticide Storage: Store in a cool, dry place.

Pesticide Disposal: To avoid wastes, use all material in this container by application according to label directions. If wastes cannot be avoided, offer remaining product to a waste disposal facility or pesticide disposal program (often such programs are run by state or local governments or by industry).

Container Handling: Nonrefillable container. Do not reuse or refill this container. Completely empty bag into application equipment by shaking and tapping sides and bottom to loosen clinging particles. Then offer for recycling if available, or dispose of empty bag in a sanitary landfill or by incineration. Do not burn unless allowed by state and local ordinances.

NOTICE TO USER

To the extent consistent with applicable law, seller makes no warranty express or implied, of merchantability, fitness or otherwise concerning the use of this product other than as indicated on the label. To the extent consistent with applicable law, user assumes all risks of use, storage or handling not in strict accordance with label instructions.

Net Contents: 35 lbs (15.86 kg)

Lot No.: _____

Manufactured for: FourStar Microbial Products LLC | 1501 E Woodfield Road, 200W, Schaumburg, IL 60173 | ©2013-2016 Fourstar
EPA Reg. No. 85685-4 | EPA Est. No. 2724-TX-1 | FourStar and the FourStar design are trademarks of B2E Microbials LLC

DUAL ACTION

VEC 16-013

Safety Data Sheet

FOURSTAR®

Briquets

Specimen Label

Sustained Release 90 Day Microbial Briquets

ACTIVE INGREDIENTS:

*_Bacillus sphaericus_ 2362, Serotype H5a5b, Strain AML614 ..... fermentation solids, spores and insecticidal toxins	6.00%
**_Bacillus thuringiensis_ subspecies _israelensis_ Strain BMP 144 ..... fermentation solids, spores and insecticidal toxins	1.00%
OTHER INGREDIENTS:	93.00%
TOTAL:	100.00%

* Equivalent to *60 Bs ITU/mg and **70 ITU/mg respectively. The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS – CAUTION:

Harmful if inhaled. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Avoid breathing dust. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

ENVIRONMENTAL HAZARDS:

Do not apply to treated, finished drinking water reservoirs or drinking water receptacles when the water is intended for human consumption.

FIRST AID	
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth to mouth if possible. • Call poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call poison control center or doctor for treatment advice.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, and then continue rinsing eyes. • Call poison control center or doctor for treatment advice.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-248-7763 for emergency medical treatment information.	

DIRECTIONS FOR USE

It is a violation of Federal law to apply this product in a manner inconsistent with its labeling.

APPLICATION DIRECTIONS

FourStar® Briquets are a highly selective microbial insecticide effective against mosquitoes in a variety of habitats for up to 90 days or more. **FourStar® Briquets** release effective levels of ***Bacillus sphaericus*** and ***Bacillus thuringiensis*** subspecies ***israelensis*** to the water surface over time as the briquet dissolves.

APPLICATION SITES

FourStar® Briquets can be applied to areas that contain aquatic life, fish and plants, as well as areas used by or in contact with humans, animals, horses, livestock, pets, birds or wildlife. Examples of application sites include, but are not limited to: storm drains, catch basins, underground drainage systems, storm water retention areas, retention ponds, abandoned swimming pools, ornamental fountains and ponds, fish ponds, water gardens, animal drinking troughs, standing water, water holding receptacles, man-made and natural sites where mosquitoes may develop.

APPLICATION RATES

For control of mosquito larvae, place one (1) briquet in sites up to 100 square feet of surface area. For large sites, apply 1 additional briquet for each additional 100 square feet of water surface, regardless of water depth. When mosquito populations are high, water is heavily polluted, and/or algae are abundant, double the above application rate.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Pesticide Storage: Store in a cool, dry place.

Pesticide Disposal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Nonrefillable container. Do not reuse or refill empty carton or packaging material. Offer for recycling if available or crush and discard carton in a sanitary landfill or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

NOTICE TO USER

Seller makes no warranty express or implied, of merchantability, fitness or otherwise concerning the use of this product other than as indicated on the label. User assumes all risks of use, storage or handling not in strict accordance with label instructions.

Always read the label before using this product. For product information, call 1-800-248-7763 or visit our web site: **www.fourstarmicrobials.com**

DUAL ACTION

Manufactured for: B2E Microbials LLC
DBA FourStar Microbials LLC
1501 East Woodfield Road, #200W
Schaumburg, Illinois, 60173 U.S.A.

EPA Reg. No. 83362-3 | EPA Est. No. 86884-OR-1

VEC 13-009

[Safety Data Sheet]

FOURSTAR®

Briquets

Specimen Label

Sustained Release 45 Day Microbial Briquets

ACTIVE INGREDIENTS:

**Bacillus sphaericus* 2362, Serotype H5a5b, strain AML614	6%
***Bacillus thuringiensis* subspecies *israelensis*, strain BMP 144	1%
fermentation solids, spores and insecticidal toxins	
OTHER INGREDIENTS:	93%
TOTAL:	100%

* Equivalent to *60 Bs ITU/mg and **70 ITU/mg respectively. The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS – CAUTION:

Harmful if inhaled. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Avoid breathing dust. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

ENVIRONMENTAL HAZARDS:

Do not apply to treated, finished drinking water reservoirs or drinking water receptacles when the water is intended for human consumption.

FIRST AID	
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth to mouth if possible. • Call poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call poison control center or doctor for treatment advice.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, and then continue rinsing eyes. • Call poison control center or doctor for treatment advice.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-248-7763 for emergency medical treatment information.	

DIRECTIONS FOR USE

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APPLICATION DIRECTIONS

FourStar® Briquets are a highly selective microbial insecticide effective against mosquitoes in a variety of habitats for up to 45 days or more. FourStar® Briquets release effective levels of *Bacillus sphaericus* and *Bacillus thuringiensis* subspecies *israelensis* to the water surface over time as the briquet dissolves.

APPLICATION SITES

FourStar® Briquets can be applied to areas that contain aquatic life, fish and plants, as well as areas used by or in contact with humans, animals, horses, livestock, pets, birds or wildlife. Examples of application sites include, but are not limited to: storm drains, catch basins, underground drainage systems, storm water retention areas, retention ponds, abandoned swimming pools, ornamental fountains and ponds, fish ponds, water gardens, animal drinking troughs, standing water, water holding receptacles, man-made and natural sites where mosquitoes may develop.

APPLICATION RATES

For control of mosquito larvae, place one (1) briquet in sites up to 100 square feet of surface area. For large sites, apply 1 additional briquet for each additional 100 square feet of water surface, regardless of water depth. When mosquito populations are high, water is heavily polluted, and/or algae are abundant, double the above application rate.

STORAGE AND DISPOSAL

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Pesticide Disposal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Nonrefillable container. Do not reuse or refill empty carton or packaging material. Offer for recycling if available or crush and discard carton in a sanitary landfill or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

NOTICE TO USER

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Always read the label before using this product. For product information, call 1-800-248-7763 or visit our web site: www.centralmosquitocontrol.com

DUAL ACTION

Manufactured for: B2E Microbials LLC
DBA FourStar Microbials LLC
1501 East Woodfield Road, #200W
Schaumburg, Illinois, 60173

EPA Reg. No. 83362-3 | EPA Est. No. 2724-TX-1

VEC 26-005

[Safety Data Sheet]