

CLARK COUNTY
MOSQUITO CONTROL DISTRICT

ANNUAL WORK PLAN 2017-2018

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Executive Summary

The purpose of the 2017-2018 Bi-annual Work Plan (AWP*) is to describe the Clark County Mosquito Control District's (CCMCD) routine strategy for nuisance mosquito* abatement, and to propose a strategy for addressing the threat of West Nile Virus (WNV), Zika, and other mosquito borne diseases. The AWP, once adopted, will provide relevant information and guidance for CCMCD staff, the CCMCD Board of Trustees, Clark County Public Health, and community stakeholders.

CCMCD utilizes Integrated Pest Management* (IPM) to formulate abatement strategies and respond appropriately to mosquito borne disease threats. IPM is an effective, integrated strategy endorsed by the Department of Ecology and the Centers for Disease Control (CDC) that emphasizes using multiple methods to achieve long-term control of mosquito populations before they become adults and are able to spread disease. Prevention is achieved through public education, surveillance, monitoring of treatment threshold* levels, and control activities that use the least toxic and most environmentally friendly methods available.

The development of the 2017-2018 work plan is based on the following principles:

- The CCMCD was originally formed in 1982 to mitigate the presence of nuisance mosquitoes as directed by the Revised Code of Washington 17.28.
- In 1999, WNV emerged as an infectious and deadly mosquito borne disease that continues as a threat to public health. WNV is carried to humans as part of a larger cycle of infection that primarily involves birds and mosquitoes.
- WNV was first discovered in Washington State in 2002 and has been present every year since.
- Effective WNV prevention and control methods decrease the potential of transmission of the disease to humans and animals by infected mosquitoes. Prevention is best accomplished by engaging the public into taking actions that reduce mosquito breeding habitat and to protect themselves from exposures.
- Prevention and control methods for WNV must be effective as well as environmentally and economically sustainable over a long period of time.
- Reducing the risk of WNV involves balancing the benefits of these control methods with the possible negative consequences on humans and the environment.
- In 2016 Zika virus emerged as a dangerous infectious disease in the United States. Because Zika is in its infancy stage in the US, much of the current information about the disease, including responses to controlling the mosquitos responsible for spreading the disease (*Aedes aegypti* and *Aedes albopictus*), is being updated frequently.
- *Ae. aegypti* and *Ae. albopictus* are the two species of mosquitos that have currently been identified as vectors for Zika and they are not currently found in Clark County, Washington State, or the immediate region.
- Enhanced surveillance is important to help the district identify these mosquitos when they arrive.
- The CDC has developed recommended responses for Mosquito Control District's response to Zika.

- This plan includes a Zika risk based response plan. This plan follows the CDC’s recommendations for Zika vector control.

2. Background and Introduction

The Board of Trustees is responsible for program oversight; establishes policy; prepares, approves and reviews the budget; and approves expenditures. The ten-member Board is composed of three members appointed by County Counselors for the county at large, and one member appointed by and representing each of the cities and towns of Vancouver, Camas, Washougal, Ridgefield, La Center, Battle Ground and Yacolt.

Clark County Mosquito Control District contracts with Clark County Public Health to provide the following staffing services at the request of the District:

- a) Process accounts payable.
- b) Provide Board support: publish notices for Board meetings; take minutes at quarterly meetings, prepare annual report.
- c) Assist in budget preparation with Board and Office of Assessor.
- d) Keep insurance policy current and maintain back up documentation of equipment, assets, and staff.
- e) Assign staff to remove service requests from the mosquito service request line message box and track data as needed.
- f) Designate Public Health staff to serve two-year term as non-voting liaison to ensure ongoing communication and coordination between County and District.
- g) Host District web page and mosquito service request line using public health infrastructure.
- h) Provide financial services as needed.

West Nile virus was first detected in the United States in New York City in 1999. This virus, a mosquito transmitted disease, had never before been detected in the Western Hemisphere. Since 1999, WNV has rapidly spread throughout the continental United States. 2009 was Washington’s peak year for WNV. In 2009, Washington experienced 38 human cases, 73 horses, 22 birds, and 364 mosquito pools testing positive for virus. More recently, Washington experienced 22 human cases in 2015.

This AWP describes CCMCD’s current approach to mosquito prevention and control, and provides a West Nile Virus risk-based response plan should the disease become widespread in Clark County.

Zika virus has recently emerged as a significant threat in the United States, especially in the southern states. The species of mosquitos known to be Zika vectors are not found in the state or region but vigilant surveillance will help the district identify vectors if they arrive.

This plan has been adjusted to include information regarding a Zika risk based response plan. This plan will follow the CDC’s recommendations for Zika vector control.

It is expected through continual community involvement, changing circumstances in mosquito populations and mosquito borne diseases that the AWP can be adapted to respond to those changes.

3. Current Program Overview and WNV Recommendations

3-1. Staffing and Training Requirements

The CCMCD has sufficient funding and staffing capacity to meet the routine, seasonal demands of mosquito control in Clark County. All staff work under the supervision of a state licensed pesticide applicator, and are also offered the necessary training to meet state certification requirements. Staff members attend local, regional and national mosquito association conferences to learn new technological advances. Specialized training in mosquito identification and surveillance, equipment maintenance and use, and other training is provided as needs are identified.

Recommendation: *Develop interagency mutual aid agreements (inter-local agreements) that provide direction and allow assistance from or with other Mosquito Districts (e.g. Multnomah County) to help with staffing and equipment needs in the event of a disease outbreak. Mutual aid assistance could include supplying equipment or personnel for needed surveillance, inspection, treatment or public outreach.*

3-2. Equipment and Supply Requirements

CCMCD has equipment to apply both larvacides and adulticides.

Recommendation: *When WNV is detected in Clark County, additional control products should be purchased as needed. If additional vehicles, equipment or services (such as extensive aerial spraying) are needed beyond what is budgeted for this year, consideration should be given to contracting out for additional services. CCMCD maintains an Emergency Aerial Contract to provide aerial spraying for adult mosquitos in the event of a WNV outbreak.*

3-3. Community Outreach/Public Education

Primarily through staff presentations and one-to-one consults, it is standard practice for CCMCD to provide community education to homeowners and others about nuisance mosquito prevention and control measures. Clark County Public Health (CCPH) provides outreach and education on the health threat of WNV, placing educational materials on the Clark County website. CCPH also provides media outreach through its Public Information Officer.

Recommendation: *Clark County Public Health should give high priority to establishing a communication plan for public education regarding West Nile and Zika Virus in Clark County before the crises arrives. It should emphasize the importance of the public taking steps toward personal protection and reducing the possibility of infection by eliminating conditions (such as stagnant water) that encourage mosquito breeding.*

3-4. Surveillance

CCMCD utilizes a number of surveillance methods: Crews go out in the field sampling standing water for mosquito larva and investigate service requests from the public in response to nuisance mosquitoes or standing water concerns. Lab Technicians trap and identify the populations and specific species of adult mosquitoes. They also test adult mosquito samples for WNV using the RAMP test in the district lab and maintain collection data on mosquitoes and mosquito-borne diseases. CCMCD routinely communicates with other regional mosquito districts, sharing information about mosquito populations and species as an important part of surveillance. CCMCD reports all trapping data including RAMP test results to the Zoonotic Disease Program, Environmental Public Health Sciences, and Washington State Department of Health.

CCMCD recognizes that diligence is required to identify when new, non-native mosquito species are introduced into our community. This is especially true when the species is recognized as being a threat to public health. At the request of the Washington State Department of Health, the district has begun surveillance efforts to identify adult mosquitos known as Zika virus vectors, *Ae. aegypti* and *Ae. albopictus*, by using CDC recommended BG Sentinel II traps in the Port of Vancouver. The district has also identified used tire stores in the county as potential host breeding sites and will be trapping those sites as well.

It is recognized that one of the preferred methods for monitoring or predicting mosquito borne disease outbreaks is to detect cases in people. All mosquito borne diseases are nationally notifiable conditions. Health Care Providers are required to report confirmed or suspected cases to local or state health departments. In Clark County, the Clark County Health Department notifies CCMCD of any of these reportable diseases in the county.

Recommendation: *CCMCD should continue routine prevention and control measures as well as adult and immature mosquito* surveillance and testing for WNV. CCMCD should send any positive WNV samples to Oregon State University for WNV confirmation. As part of enhanced Zika surveillance, CCMCD should routinely trap for adult *Ae. aegypti* and *Ae. albopictus* using CDC recognized BG Sentinel II mosquito traps in or near the Port of Vancouver and any and all used tire stores in the county. These areas have been identified as possible routes of entry for these invasive *Aedes* mosquitos. In order to improve surveillance and workflow documentation, data collection and reporting, and analysis of surveillance results, CCMCD should implement a Geographic Information System (GIS) Map based surveillance and reporting system.*

3-5. Nuisance Mosquito Control

CCMCD inspects new areas reported by the public. Catch basins, retention ponds, and flood water areas that are known breeding sites for surveillance are monitored for control purposes. If required the least toxic approach such as biorational insecticides will be used.

4. West Nile Virus Response Plan

When WNV is detected in the county, priority will be given to area disease prevention rather than nuisance mosquito abatement at individual residences. This plan provides risk-based guidelines for the abatement of disease-carrying mosquitoes. Additionally, the plan provides all stakeholders with educational information about WNV and about the methods and materials to be used to reduce the potential for transmission of the disease in humans and domestic animals.

No changes to this plan will be made without approval of the CCMCD Board of Trustees. When the use of insecticides is required, all application methods and materials used will be in compliance with federal, state and local regulations.

4-1. Public Education /Community Outreach

The most effective way for the public to prevent WNV exposure involves self-protection (taking measures to avoid being bitten, e.g., using DEET and other proven insect repellants, protective clothing, staying inside at dawn/dusk etc.). The public can also take actions such as eliminating potential mosquito breeding areas (i.e. emptying gutters or containers in the yard that accumulate water). CCPH coordinates dissemination of information about WNV to the public and media. Both CCMCD and CCPH coordinate closely with local and state officials.

4-2. Surveillance

4-2.1. Immature Mosquito Surveillance

Immature mosquito surveillance can provide early warning to forecast the size of future adult mosquito populations and provide estimates of control effectiveness. The data collected from immature (breeding)*sites must be carefully recorded and maintained. The sites that are found positive for *Culex pipiens* and *Culex tarsalis* (the species considered most likely to transmit WNV to humans in Washington) will be mapped by Global Positioning System (GPS). When sufficient data is obtained, the information will be utilized in the control process. Control measures as given in Risk Levels 2-4 will be implemented at these sites.

4-2.2. Adult Mosquito Surveillance

Adult mosquito density is a key factor contributing to the risk of WNV. Monitoring adult mosquito populations provides essential information on population size, infectivity rate and effectiveness of larval and adult control efforts.

Two methods are used by CCMCD to sample adult mosquito populations. One is the EVS trap* to collect *Cx. tarsalis* and *Cx pipiens*, the other a gravid trap* to collect *Cx. pipiens*. CCMCD has predetermined locations for placement of these traps, mapped using GPS. The EVS trap will be used in urban and rural areas; the gravid trap, primarily in urban areas. Over time, this trapping regime will provide valuable information that may allow prediction of high-risk areas for WNV transmission to humans.

The mosquitoes collected in these traps will be returned to the CCMCD laboratory for identification and WNV testing using a RAMP test. A WNV positive sample with a RAMP result of 100-299.9 will be sent to Oregon State University for confirmation using a polymerase chain reaction (PCR) test. A WNV positive sample with a RAMP result ≥ 300 is considered positive and the results will be immediately communicated to CCPH and the CCMCD Board. All trapping data and test results are reported to the Zoonotic Disease Program/Environmental Public Health/Washington State Department of Health (DOH). Results from these tests will be a key factor in determining the areas requiring adult control measures.

4-2.3. Dead Bird Surveillance

The Online Dead Bird Reporting System for West Nile Virus (WNV) surveillance has been discontinued. Research has shown that testing local mosquito populations is the best way to detect the presence of WNV. The Clark County Mosquito Control District will continue to actively monitor and test local mosquito populations.

4-2.4. Human Surveillance for WNV

Clark County Public Health has primary responsibility for WNV surveillance. Human WNV is reportable first to CCPH. The Washington State Department of Health (DOH) works closely with CCPH and maintains all information regarding human infections of WNV in Washington State. It is expected that CCPH will immediately notify CCMCD of any locally acquired human WNV in the county. This information will be used to direct enhanced surveillance and control measures in the area identified as potential for WNV. Contact information can be found in *Appendix 2*.

4-2.5. Domestic Animal Surveillance for WNV

Domestic animals, particularly equines, can be seriously affected by WNV. The Washington Department of Agriculture* (WDA) provides surveillance and laboratory detection of WNV in animals. Contact information is given in *Appendix 2*.

4-2.6. Washington State Department of Health WNV surveillance.

The Zoonotic Disease Program (ZDP) at the Washington State Department of Health, collects all WNV surveillance and test results throughout the state involving mosquitoes, birds, equines, and humans. The ZDP reports these results weekly to all county health departments and mosquito control districts in the state.

4-3. Control Activities

The CCMCD Response Guidelines use five risk levels to provide a phased response based on surveillance results. The levels (1-5) represent increasing risk of human health impacts from WNV in the County. Each level builds on the activities of the previous levels and includes specific response actions, emphasizing public education and control methods to reduce the spread of WNV.

Larviciding will be limited to those areas where the mosquito species are potential carriers of WNV. These sites will not be treated if adequate predator populations are present. The use of larvicides* and adulticides* will be limited to the conditions set in Risk Levels 2 through 4. CCMCD will consider the environmental impact of larvicides and adulticides when purchasing products.

When ecologically sensitive areas* are involved, such as the Ridgefield Wildlife Refuge, this process will be carried out cooperatively between CCMCD and the agency responsible for stewardship of the area of concern.

4-3.1. Larvae/Pupae Control

This control program will reduce development of larvae* and pupae* by habitat management and the selective use of larvicides. CCMCD will consider the toxicity and environmental impact when selecting pesticides and will make efforts to choose the least toxic and environmentally friendly pesticide that meets treatment requirements. The materials to be used are given in *Appendix 3* along with pertinent information on the use of each product. Additionally, CCMCD will collaborate with local, state, federal, and private agencies to identify water sources that create mosquito breeding problems and reasonable efforts will be made to reduce mosquito development in these zones.

4-3.2. Adult Mosquito Control

When adulticiding is required, the least toxic products possible will be applied using truck-mounted or hand held Ultra Low Volume (ULV)* sprayers. If a major outbreak of WNV should occur in Clark County, consideration would be given to aerial application by order of Clark County Public Health's Health Officer. This application would be done by a qualified contractor using EPA* and state approved insecticides. Additionally, ground or aerial application for adult mosquitoes will require the recommendation of the CCMCD Operations Manager, authorized by the Board of Trustees.

If the application of adulticides becomes necessary, CCPH will coordinate an intensive public outreach using various media outlets. Advanced public notification of at least 24 hours, but recommended 72 hours will be given prior to application. This outreach will include details and hazards about the pesticides being used along with the dates, times, and locations of the applications. The County Health Officer, CCMCD Board, and the Operations Manager will approve the information being disseminated.

5. Risk Level Descriptions

5-0. West Nile Virus Risk Level 0

Status1

- No nuisance mosquitoes present.
- Environmental conditions not conducive to mosquito development.

Action

- Monitor environmental conditions to include: rainfall, temperature, humidity and snowmelt.
- Routine administrative and maintenance activities.
- Update Annual Plans.
- Attend training classes and mosquito control association meetings as appropriate.
- Consolidation and interpretation of previous year's data for Annual Reports.
- Map standardized locations for all mosquito control activities, to include: surveillance and control measures.
- Coordinate with Public Works and other public agencies in Clark County responsible for surface water management to identify catch basins, retention/detention systems and other water holding areas.
- Identify locations to place adult mosquito traps.
- Develop pesticide needs and gather price quotes from qualified distributors of pesticide products to be used by CCMCD in 2017-2018.
- Update the equipment list and identify vehicles and equipment needing replaced or purchased.
- Prepare and implement contracts and collect price quotes from private companies for the lease or purchase of vehicles and equipment to be used for mosquito control.
- Identify and map new mosquito breeding sites such as storm water facilities and wetlands that are not currently in the CCMCD database.

Status 2: Nuisance Mosquitoes Present

- Environmental conditions conducive to mosquito development.

Action

- CCMCD staff responds to requests for service. Explanation of service and requirements of property owners are provided by CCMCD staff.
- Types of service provided to property owners related to nuisance mosquito prevention and control include: public education (both printed and verbal), inspection of property for surveillance or control purposes.
- CCMCD works to eliminate mosquitoes through mechanical modification of problem areas. This includes making recommendations to local, state and federal agencies and property owners of Clark County to eliminate or alter practices involving vegetation, water and animal management that create or maintain mosquito breeding habitat.
- CCMCD staff applies larvicides, to reduce mosquito populations, to areas identified through surveillance. Criteria for control are given below.

Control Criteria

Criteria 1

One mosquito larva and no pupae per dip. Count based on the average from 10 dips. Mosquitoes identified and data recorded. Recommended treatment—No insecticide application at this time. Monitor site monthly for any mosquito population changes.

Criteria 2

One or more larvae or pupae present. Count based on the average from 10 dips. Mosquitoes identified and data recorded. Recommended treatment—larvicide with state and federal approved materials. Site monitored weekly until it meets Criteria 1 or produces negative collections.

Summary WNV Risk Level 0

The actions taken in Risk Level 0 include routine nuisance mosquito monitoring, seasonal mosquito control activities, and public education efforts. Given the presence of WNV in Washington State over the past several years, services to property owners for nuisance mosquitoes will be less of a priority than WNV surveillance and control.

5-1. West Nile Virus Risk Level 1

Status

- No WNV activity in State, Clark County or bordering counties.
- Environmental conditions not conducive to support WNV activity.

Actions

- Identify and recruit stakeholder individuals and groups for volunteer activities during WNV season. Consider using CCPH to assist with identifying these persons or groups.
- Identify individuals, groups or locations such as nursing homes, hospitals, medical facilities and schools, that can be considered higher risk for WNV and prioritize these locations for treatment when necessary.
- Prepare specifications for a contingency aerial contract for controlling adult mosquitoes in response to a WNV emergency situation.
- Continue actions detailed in Risk Level 0.

Summary WNV Risk Level 1

The actions taken in Risk Level 1 include basic monitoring, seasonal mosquito control activities, and public education efforts that realistically describe WNV risks, transmission, and prevention strategies. As historical data is collected these actions will evolve and provide CCMCD information critical to the maintenance and improvement of the program.

5-2. West Nile Virus Risk Level 2

Status

- No WNV activity detected in Clark County.
- WNV detected mosquitos in Washington or Oregon
- Environmental conditions suitable for mosquito development.

Actions

Public Information and Agency Coordination

- Coordinate through CCPH to provide media general information on WNV; follow media's response to public.
- Coordinate source reduction activities, such as container removal and site modification with public agencies and stakeholders.

Surveillance and Control

- Maintain close coordination with county and state health officials responsible for WNV monitoring of human infections. Notify these agencies when immature mosquito activity is found. Provide these agencies with locations, species (*Cx. pipiens* and/or *Cx. tarsalis*) and numbers of the immature mosquitoes.
- Initiate trapping of adult mosquitoes. These traps will be set throughout the county to monitor WNV activity in mosquito populations and identify the presence of invasive *Ae. aegypti* and *Ae. albopictus* mosquitoes. The number of traps and locations will be adjusted throughout the season to provide maximum coverage for detection of WNV and invasive Aedes species.
- Identify and map mosquito-breeding sites not presently in CCMCD's database.
- Implement immature mosquito control measures. Criteria for control are given below.

Control Criteria

Criteria 1

One mosquito larva and no pupae per dip. Count based on the average from 10 dips. Mosquitoes identified and data recorded. Recommended treatment—No insecticide application at this time. Monitor site at least monthly for any mosquito population changes.

Criteria 2

Two or more larvae or pupae present. Count based on the average from 10 dips. Mosquitoes identified and data recorded. Recommended treatment—larvicide with state and federal approved materials. Site monitored weekly until it meets Criteria 1 or produces negative collections.

Summary Risk Level 2

At this level, the prevention and control activities from Level 1 continue and public education is heightened. The action taken in WNV Risk Level 2 is directed at the surveillance and control of immature mosquitoes (larval/pupal stages). The purpose of these actions is to reduce mosquito populations, particularly *Cx. pipiens* and *Cx. tarsalis* to a level where adult mosquito populations are reduced to a level that greatly diminishes the transmission of WNV to wild birds.

Information on larvicides to be used by CCMCD is given in *Appendix 3*. All pesticides used meet EPA and state approval.

5-3. West Nile Virus Risk Level 3

Status

- Environmental conditions ideal for mosquito development.
- West Nile virus detected in *Cx. pipiens*, *Cx. tarsalis* mosquitos in Clark County.
- No human or equine cases diagnosed.

Actions

Public Information and Agency Coordination

- Coordinate with Clark County Public Health regarding: increasing public information through community outreach and media releases, including general locations of WNV positive mosquito samples.
- Initiate daily contact with local and state officials regarding potential human or equine cases.
- If the emergency application of adulticides by aircraft becomes necessary, CCPH will coordinate an intensive public outreach using various media outlets. Advanced public notification of at least 24 hours, preferably 72 hours, will be given prior to application. This outreach will include details and hazards about the pesticides being used along with the dates, times, and locations of the applications. Information will also focus on instructions as to how the public can reduce mosquito breeding habitats by removing any standing water on their property and how they can protect themselves from mosquito bites. The County Health Officer, CCMCD Board, and the Operations Manager will approve the information being disseminated. This information will also be posted on the Clark County Public Health website.

Surveillance and Control

- Increase immature mosquito surveillance in locations where WNV has been detected. Monitor these sites two times per week and adjacent zones once a week.
- Treat larva/pupa sites using the same criteria as given in **Risk Level 2**.
- Initiate ground adult control measures (adulticides) in locations identified as having adult populations of a WNV carrying mosquito.
- Increase adult mosquito trapping in locations where WNV has been detected. Monitor these sites two times per week and adjacent areas once a week to test for WNV as well as to confirm effectiveness of control measures if adulticiding is taking place.
- Initiate activation of mutual aid (inter-local) agreements for assistance with surveillance and control.

Control Criteria

- Immature Mosquito Control—Use same criteria as in Risk Level 2.
- Adult Mosquito Control—WNV detected in one mosquito sample in one location. No adult mosquito control initiated.
- Multiple positive samples from any surveillance method detected in one location. Adulticides applied using ground ULV application in that zone using EPA and state approved materials. Adulticides applied to positive and adjacent areas.
- Multiple positive samples detected in two or more locations and adjacent areas. Adulticides applied to positive and adjacent locales.

Summary Risk Level 3

The action taken in **Risk Level 3** is done to reduce the potential for increased WNV activity in adult mosquito populations, thereby, reducing the threat to humans and domestic animals. No treatment for adult mosquitoes will be done without the recommendation of Clark County Public Health's Health Officer and approval of the CCMCD Board of Trustees or executive committee (President, Vice-President and Secretary/Treasurer) and communication with appropriate local and state officials.

Information on adulticides and larvicides to be used by CCMCD is given in *Appendix 3*. All insecticides used meet state and EPA approval.

5-4. West Nile Virus Risk Level 4

Status

- Environmental conditions ideal for mosquito development.
- West Nile virus detected in *Cx. pipiens*, *Cx. tarsalis* or other mosquito species in multiple areas in the county.
- One or more equine cases.
- One or more human cases diagnosed in one or more locations in Clark County.

Actions

Public Information and Agency Coordination

- Daily information exchanged between CCMCD and CCPH on status of WNV outbreak.
- Consideration of the following actions in collaboration with local and state health officials: recommend the restriction/cancellation of outdoor evening activities and closing of recreational areas.
- Local and state health officials will provide direct notification to health care facilities, nursing homes and other with high risk locations.
- Continue Public Information and Agency Coordination detailed in **Risk Level 3**.

Surveillance and Control

- Immature mosquito surveillance activities the same as **Risk Level 2**.
- Increase ground adult mosquito control operations using the criteria given below.
- Consider the use of aerial application for the control of adult mosquitoes in high risk areas using the criteria given below.
- Initiate activation of mutual aid/ inter-local agreements as needed for assistance with surveillance and control.

Control Criteria

- Immature Mosquito Control—Use same criteria as in **Risk Level 2**.

- Two or more positive mosquito samples in one location or in multiple locations with two or more positive mosquito samples or one human case. Increase ground adult control to include all areas meeting these criteria.
- Three or more human cases diagnosed in adjacent locations or 10 or more human cases countywide. Initiate aerial adult mosquito control in areas determined to be highest risk of more human cases.

Summary Risk Level 4

The action taken in **Risk Level 4** will be based on a severe outbreak of WNV. All decisions made at this level must be approved by the Board of Trustees and by state and local health officials, including Clark County Public Health's Health Officer.

Information on adulticides and larvicides to be used by CCMCD is given in *Appendix 3*. All insecticides used meet state and EPA approval.

6. Summary of Zika Virus and Response plan for Clark County

The information in this summary has been summarized and copied directly from the CDC document, *Surveillance and Control of Ae. aegypti and Ae. albopictus in the United State*. Use this link (<http://www.cdc.gov/chikungunya/pdfs/surveillance-and-control-of-aedes-aegypti-and-aedes-albopictus-us.pdf>) or visit the CDC website (www.cdc.gov) to view the document in its entirety. The CDC developed this document to assist and guide state and local public health officials and vector control specialists with the Zika virus vector mosquitoes, *Ae. aegypti* and *Ae. albopictus*.

It is noted that with Zika a new and evolving threat in the United States, much of the information about the virus, the mosquitoes that can transmit Zika, and best practices for surveillance and control, are evolving and changing. It is CCMCD's intention to follow the CDC's information and recommendations and will adjust surveillance protocols and this work plan accordingly.

6-1. Overview

Zika virus (ZIKV) is an arbovirus that has existed in other parts of the world since the 1950s. From that time it had been known to occur within a narrow equatorial belt from Africa to Asia. From 2007 to 2016, the virus spread eastward, across the Pacific Ocean to the Americas, leading to a 2015–16 ZIKV epidemic. In 2015, ZIKV outbreaks had, for the first time, been reported in the Western Hemisphere, with local transmission occurring in Central and South America, the Caribbean, and Mexico. In 2016, local transmission of Zika virus was first reported in the United States. ZIKV transmission has increased throughout the region, which has increased the incidence of infection in returning travelers and has contributed to local transmission in the US. Local outbreaks have occurred in the southeast part of the US and will continue to occur as the result of virus importation by infected travelers combined with the existence and abundance of the principal know vectors, *Ae. aegypti* and *Ae. albopictus*. Any viremic travelers visiting or returning to parts of the United States with established populations of *Ae. aegypti* or *Ae. albopictus* mosquitoes could initiate local virus transmission.

Ae. aegypti most likely originated in Africa and *Ae. albopictus* originated in Asia. Both mosquitoes have been transported globally throughout the tropical, subtropical, and parts of the temperate world, through global trade and shipping activities.

Neither of these mosquitoes is currently found in our region, with the closest known location in the San Francisco Bay area for the *Ae. albopictus*. Much of the CDC's prevention and control recommendations are intended for regions where these mosquitoes currently exist. CCMCD recognizes these activities in the anticipation that these mosquitoes could one day exist in Clark County. Therefore, CCMCD's current actions will focus on increased surveillance. This will include;

- Enhanced adult trapping using the CDC's recommended trap, the BG Sentinel II
- Trapping the areas that have been identified as probable routes of entry for *Ae. aegypti* and *Ae. albopictus*. The areas currently identified for this increased focus are the Port of Vancouver and used tire stores in the county.
- Enhanced larva collection and identification in these identified areas.
- Educating businesses that store tires outdoors of the importance of habitat source reduction.

6-2. Prevention and Control

The following prevention and control actions would be implemented in the event that CCMCD determines, through surveillance, that ZIKV vector mosquitoes are identified in Clark County.

Mosquito surveillance is a key component of any local integrated vector management program. The goal of mosquito-based surveillance is to quantify human risk by determining local vector presence and abundance. The principal functions of ZIKV mosquito-based surveillance programs are to:

- Determine presence or absence of *Ae. aegypti* and *Ae. albopictus* in a geographic area.
- Identify what types of containers are producing the most mosquitoes for targeting vector control efforts.
- Develop detailed maps to track larval sites if *Ae. aegypti* or *Ae. albopictus* are detected in an area.
- Collect mosquito population data and identify geographic areas of high abundance (high-risk).
- Monitor the effectiveness of vector control efforts.
- Collect data on mosquito infection rates during outbreaks to:
 - Identify primary/secondary mosquito vectors
 - Establish thresholds at which humans get infected

Whereas mosquito-based surveillance is the preferred method for monitoring or predicting West Nile virus outbreaks, it is not the preferred method for monitoring or predicting ZIKV outbreaks. For ZIKV, it is more efficient to detect cases in people. As an arboviral disease, Zika is a nationally notifiable condition. Healthcare providers are required to report any confirmed or suspected cases to local and state health authorities. Clark County Public Health currently has a process in place to communicate this information to CCMCD. CCMCD regularly receives Health Updates, Health Advisories, and Health Alerts from Clark County Public Health.

6-3. Vector Surveillance and Control Recommendations

6-3.1 Before Mosquito Season

- Conduct public mosquito education campaigns focusing on reducing or eliminating larval habitats for the *Ae. aegypti* and *Ae. albopictus* vectors.
- Conduct surveys to determine abundance, distribution, and type of containers.
- Initiate a community wide source reduction campaign.
- Cover, dump, modify, or treat large water-holding containers with long-lasting larvicide.
- Reduce adult mosquito resting sites by keeping vegetation trimmed and tall grass cut.

- Develop mosquito education materials about *Ae. aegypti* and *Ae. albopictus* and personal protection measures. (Note that both the CDC and the American Mosquito Control Association have developed some educational materials available for the District and Health Department to use.)

6-3.2 Beginning of mosquito season

- Continue public education campaigns focusing on reducing or eliminating larval habitats for *Ae. aegypti* and *Ae. albopictus* vectors.
- Continue to distribute mosquito education materials about *Ae. aegypti* and *Ae. albopictus* and personal protection measures.
- Initiate *Ae. aegypti* and *Ae. albopictus* community-wide surveys to:
 - Determine presence or absence
 - Estimate relative abundance
 - Determine distribution
 - Develop detailed vector distribution maps
 - Evaluate the efficacy of source reduction and larvicide treatment.
- Continue/maintain community source reduction efforts
- Initiate adult sampling to identify or confirm areas of high adult mosquito abundance.
- Initiate preventive adult control to reduce adult populations targeting areas of high mosquito abundance.
- Concentrate control efforts around places with high mosquito density.

6-3.3 Single or several suspected/confirmed imported/locally acquired cases

- Begin public mosquito containment education campaigns aimed at preventing or minimizing contact between vectors and suspected or confirmed human cases, especially during the first week of illness when an infected person is viremic and can infect mosquitoes, thereby possibly triggering or contributing to a local outbreak.
 - Educate the public to continually dispose of water holding containers to eliminate larval habitats. Or, if funding allows, host a community volunteer/waste disposal program to help facilitate removal of larval habitats.
 - Treat with long-lasting larvicide any water-holding containers that cannot be dumped, covered, discarded or otherwise modified.
 - Eliminate larval habitats within 100-200 yards/meters around a case's home.
- Initiate community source reduction, adult mosquito, and case containment initiatives to minimize the spread of infected mosquitoes.
- Educate the public about reported cases of disease and urge them to use:
 - Insect repellents
 - Window and door screens to prevent mosquitoes from entering the house
 - Air conditioning

6-3.4 Adult mosquito control

- Treat the outdoors within 100–200 yards/meters around a case's home with adulticide.
- Provide outdoor residual and spatial insecticide treatments; repeat as necessary to reduce vector abundance.
- Initiate/maintain adult sampling to estimate adult mosquito abundance and evaluate effectiveness of insecticide treatments.

6-3.5 Outbreak; clusters of suspected or confirmed cases

- Divide the outbreak area into operational management areas where control measures can be effectively applied within a few days; repeat as needed to reduce mosquito density.

- Conduct door-to-door inspections and mosquito control in an area-wide fashion (reach >90% coverage of the control area within a week).
- Identify and treat, modify, or remove mosquito-producing containers.
- Organize area/community clean-up campaigns targeting disposable containers (source reduction), including large junk objects that accumulate water (broken washing machines, refrigerators, toilets) in buildings, public areas, etc.
- Combine outdoor spatial and residual spraying with source reduction and larviciding (including residual spraying of container surfaces and adjacent mosquito resting areas). Don't forget to treat storm drains, roof gutters, and other often overlooked cryptic water sources.

6-4. Specimen Collection and Types of Traps

6-4.1 Ovitrap

Ovitrap are small container traps that are designed to attract gravid female mosquitoes. Ovitrap take advantage of the fact that gravid *Ae. aegypti* and *Ae. albopictus* females lay their eggs in artificial containers.

Since Ovitrap compete with naturally occurring larval habitats, interpreting data may require caution. Also, some degree of training in microscopy may be needed for accurate egg counting especially when there is debris on the oviposition surfaces. Lastly, the collected eggs need to be hatched and reared out in the laboratory and the larvae or adults identified to species, which requires trained personnel.

6-4.2 Adult Mosquito Trapping

Ae. aegypti and *Ae. albopictus* are not efficiently captured by the most commonly used mosquito traps, such as the CDC miniature light trap, CDC gravid trap, or the New Jersey light trap. Currently the most commonly used adult traps for *Ae. aegypti* and *Ae. albopictus* are BG Sentinel Traps, and a variety of gravid traps such the CDC-Autocidal Gravid Ovitrap (CDC-AGO) (Mackay et al. 2013, Barrera et al. 2014a, b).

The BG Sentinel Trap: The BG Sentinel Traps use a combination of attractive visual and olfactory cues. BG-Sentinel traps are more effective in capturing *Ae. aegypti* than CDC backpack aspirators, and also collect adult females in all physiological states (Maciel-de-Freitas et al. 2006, Williams et al. 2006, Ball and Ritchie 2010). These traps are also effective for collecting *Ae. albopictus* (Meeraus et al. 2008, Bhalala and Arias 2009, Farajollahi et al. 2009, Obenauer et al. 2010). The efficiency of BG traps can be increased by baiting them with lures (e.g., CO₂, BG-Lure®).

6-5. Handling of Field-Collected Adult Mosquitoes

Because virologic surveillance relies on identifying ZIKV in the collected mosquitoes through detection of viral proteins, viral RNA, or live virus, efforts should be made to handle and process the specimens in a way that minimizes exposure to conditions (e.g., heat, successive freeze-thaw cycles) that would degrade the virus.

- Optimally, a cold chain should be maintained from the time mosquitoes are removed from the traps to the time they are delivered to the processing laboratory, and through any short-term storage and processing.

- Transport mosquitoes from the field in a cooler either with cold packs or on dry ice. Sort and identify the mosquitoes to species on a chill-table or tray of ice if available.
- If arbovirus screening is not done immediately after mosquito identification and pooling, the pooled samples should be stored frozen, for as short as period as possible.

Mosquitoes are generally tested in pools no greater than 50 and only female mosquitoes are tested in routine arbovirus surveillance programs. Arboviruses can be detected in mosquito pools by using PCR assays

6-6. Vector Control

6-6.1 Control of immature stages

An important step in *Ae. aegypti* and *Ae. albopictus* control operations is identifying the types and abundance of containers producing mosquitoes and their productivity. Different containers require specific control measures that depend on the nature of the container and how it is used. There are five general types of containers producing *Ae. aegypti* and *Ae. albopictus*:

- Phytotelmata (treeholes, leaf axils, etc.)
- Non-essential or disposable containers (food and drink containers, tires, broken appliances)
- Useful containers (water-storage vessels, potted plants and trivets, animal drinking pans, paint trays, toys, pails, septic tanks)
- Cavities in structures (fence poles, bricks, uneven floors and roofs, roof gutters, air-conditioner trays)
- Outdoor underground structures (storms drains, water meters, public wells, septic tanks)

6-6.2 Commonly used control methods

Environmental sanitation: This is the permanent elimination of containers producing *Ae. aegypti* and *Ae. albopictus* such as establishing reliable supplies of piped water, municipal refuse recycling programs (glass, metal, and plastic), used-tire recycling operations, replacing septic tanks with sewerage, etc.

Larvicides: This is the use of chemicals or biological agents to kill or prevent development of mosquito immature stages. There are a number of agents that can be used to control mosquito production in containers:

- Chemical larvicides
- Biological larvicides: These include products containing *Bacillus thuringiensis* var. *israelensis* (B.t.i.), spinosad, and Insect Growth Regulators (IGR's) such as juvenile hormone analogs (methoprene, pyriproxyfen) and chitin synthesis inhibitors (Diflubenzuron, Novaluron). Biological larvicides have little or no impact on non-target organisms and do not accumulate in the environment.
- Monomolecular films and oils. These products spread on the water surface forming a thin film that causes suffocation of immature mosquitoes by preventing gas exchange.

Evaluation of the effectiveness of pre-adult mosquito control may be accomplished by comparing the presence/absence and abundance of immature stages in treated containers before and after treatment or by comparing treated and untreated areas (Chadee 2009).

6-6.3 Control of adult mosquitoes

Chemical control:

- Chemical control of adult mosquitoes includes space spraying, residual spraying, barrier spraying, and using attractive toxic baits.
- Barrier spraying of residual insecticides on external walls of houses and vegetation has been effectively used to reduce exposure to exophilic mosquito species (Anderson et al. 1991, Perich et al. 1993, Cilek 2008), including *Ae. albopictus* (Trout et al., 2007).
- Residual insecticides are used on surfaces that adult mosquitoes frequently visit and land on, such as walls and ceilings, discarded containers, vegetation, curtains, covers for water-storage vessels, lethal ovitrap oviposition strips, etc. There is evidence that indoor residual spraying (IRS) is particularly effective for controlling *Ae. aegypti* (Chadee 1990, Vazquezp-Prokopec et al. 2010) primarily due to its indoor resting behavior. However, there are concerns about continuous insecticide exposure for the residents. In the continental United States, many houses are air conditioned or have screening preventing *Ae. aegypti* from establishing itself indoors. In such structures, the need for indoor residual spraying is not necessary.
- Space spraying of insecticides is carried out by handheld, backpack, truck- or air craft mounted equipment.

Using insecticides to control mosquitoes should always include insecticide resistance monitoring and management. Insecticide resistance, which is an inheritable trait, usually leads to significant reduction in the susceptibility of insect populations which renders insecticide treatments ineffective.

Physical control (non-insecticidal and insecticidal mosquito traps): Gravid female mosquitoes can be lured to traps baited with an oviposition medium and captured or treated with pesticide while attempting to lay eggs.

6-7. Personal Protection

Repellents: CDC recommends the use of products containing active ingredients which have been registered by the U.S. Environmental Protection Agency (EPA) for use as repellents applied to skin and clothing. EPA registration of repellent active ingredients indicates the materials have been reviewed and approved for efficacy and human safety when applied according to the instructions on the label. For more details, see the Mosquito Bite Prevention fact sheet (http://www.cdc.gov/chikungunya/pdfs/fs_mosquito_bite_prevention_us.pdf).

See the CDC document *Surveillance and Control of Ae. aegypti and Ae. albopictus in the United States* for the complete document and references used in its' creation.

6-8. Recommendations

In 2016, in recognition of the need for enhanced surveillance, the CCMCD Board directed the Operations Manager to purchase five BG Sentinel Traps to begin adult trapping as part of the surveillance plan to identify invasive *Ae. aegypti* and *Ae. albopictus* mosquitoes in Clark County. The same winter, the Washington State Department of Health, Zoonotic Disease Control Program, contacted CCMCD and asked if the district could begin adult trapping for these mosquitoes at the Port of Vancouver in the 2016 season. During discussion, it was identified that used tire stores were another possible source for invasive Aedes mosquitoes to enter the county. Both the Port and four different used tire stores were trapping sites in 2016 with zero *Ae. aegypti* or *Ae. albopictus* identified.

Recommendation: *It is recommended that CCMCD continue to trap these areas with the BG Sentinel Trap and work to identify other potential locations where these mosquitoes could be introduced to the county.*

CCMCD recognizes the importance of identifying and documenting the species of mosquitoes found in the county. Identifying immature and adult mosquitoes requires special training and equipment. Accurate identification is necessary to ensure that invasive species are identified when they are introduced to the County. Early identification of the ZIKV vectors enables the District to take action to control the mosquitoes before they are established in the county.

Recommendation: *It is recommended that CCMCD identify and purchase a modern stereo microscope with digital capability and a large viewing monitor. This will improve the Lab Technician's ability to identify species of both larva and adults. The monitor would reduce fatigue from looking into microscope eyepieces for hours a day. The digital capability would allow the Lab Technician to share images with the state entomologist or other districts, to ensure proper identification of species new to the area.*

CCMCD recognizes that identifying immature and adult mosquitoes requires special training. Historically, CCMCD has provided this training in house. The enhanced surveillance required to identify invasive Aedes mosquitoes when they are introduced, has caused the Washington State Zoonotic Disease Program to recognize the need to provide mosquito species identification training to mosquito districts in the state. CCMCD supports all training that would enhance a district employees ability to do their job.

Recommendation: *Research and locate classes or training for mosquito species identification and send the District Lab Technician to the class.*

The CDC and the mosquito control industry recognize that Gravid and Oviposition Traps can be a valuable tool as part of a Surveillance Program.

Recommendation: *Research and identify options for gravid and oviposition traps for district purchase and use. Identify the potential increase in labor hours that would be required to enhance trapping by adding these traps and whether the Lab Technician could implement this enhancement or whether another Lab Technician would be required.*

In the winter of 2015, CCMCD identified the need for a modern reporting/documentation program with GIS based mapping capabilities. The new system would increase accuracy and improve the districts tracking and mapping of all surveillance and treatment activities. This includes; service requests, larva surveillance, manmade and natural breeding habitats, adult trapping locations, and pesticide application and use. The new system would include tablets with GIS capability for field use. The CCMCD Board authorized the purchase of this reporting system.

Recommendation: *Identify and purchase a new reporting and documentation system with GIS capability and all supporting hardware. Implement this new system and train District staff in its' use.*

7. Glossary/Acronyms

Adulticide	Insecticides used to kill adult mosquitoes. All must be approved by EPA and state.
AWP	Annual Work Plan
BG Sentinal II Trap	Adult mosquito trap identified by the CDC as the recognized

trap for trapping *Ae. aegypti* and *Ae. albopictus* mosquitos.

Biorational Insecticide	Biorational pesticides are considered the safest to humans and the environment. They are derived from a variety of biological sources, including bacteria, viruses, fungi and protozoa. They also include chemical analogues of naturally occurring biological chemicals such as pheromones and insect growth regulators (IGRs). These analogues are considered third-generation pesticides that are more environmentally sound and closely resemble or are identical to chemicals produced by insects and plants. Biorational products are quite different from conventional, broad-spectrum pesticides in that they are typically target-specific and have little to no acute impact on most non-target organisms.
Breeding Habitat	An aquatic habitat where immature mosquitoes hatch and develop into adults.
CCPH	Clark County Public Health
CCMCD	Clark County Mosquito Control District
DOE	Department of Ecology
DOH	Washington State Department of Health
EPA	Environmental Protection Agency
Equine	Horse/Donkey/Ass/Mule
Ecologically Sensitive Areas	Areas that are maintained or preserved primarily for their habitat value, or that have local ecosystems that are particularly sensitive to disruption.
EVS Trap	Encephalitis viral surveillance trap
GIS	Geographical Information System
GPS	Global Positioning System
CoCo Bear Surfactant	A surface film product that prevents air intake by the larva, used as a last resort due to the broad spectrum of organisms that can be affected. Coco Bear is used where control efforts have begun too late to for immature mosquito control.
Gravid Trap	A mosquito trap designed to attract and catch pregnant female mosquitoes.
Immature Mosquitoes	The larval and pupal forms of mosquitoes. All are found in

aquatic habitats.

Integrated Pest Management	The best management practices used by mosquito control agencies that include: surveillance, public education, source reduction, and the use of insecticides in the most environmentally friendly ways possible.
Larvae	The aquatic, immature stage of a mosquito that undergoes four molts then changes into the pupal stage.
Larvicides	Natural and synthetic insecticides that are used with the intent of killing immature mosquitoes during the phases of their life when they live in water.
Mosquito	A dipterous, two-winged, family of insects in which the females have sophisticated mouthparts for sucking blood from a variety of animals. Often this trait will lead to the transfer of parasites from one host to another.
Nuisance Mosquitoes	Mosquitoes that bite but are not identified as vectors in the transmission of disease to humans. It is recognized that bites from Nuisance Mosquitos can cause a myriad of other public health threats or risks and medical complications such as various allergic reactions, skin irritations, and secondary infections among others. Excessive numbers of mosquito bites also impact quality of live, and the ability to use and enjoy property, parks and the outdoors.
Polymerase Chain Reaction (PCR) test	Test used to detect WNV in mosquitoes, dead birds or humans.
Pupae	The aquatic, immature form of a mosquito prior to emerging as an adult.
RAMP	Rapid Analyte Measurement Platform. Test used to detect WNV in mosquitoes and dead birds.
Treatment Threshold Levels	Levels of immature or adult mosquitoes that are used as guidelines for control activities: <ul style="list-style-type: none">▪ Larval – 1 larva per standard dip (random 400 mL dip in body of water)▪ Adult –more than 100 adult mosquitoes collected in an EVS (encephalitis viral surveillance), New Jersey Light trap in 8 hours.
ULV	Ultra Low Volume. The term used to describe insecticide spray units that break up spray particles into micron size units, typically 15-25 microns. Insecticide labels state micron size allowable for that particular material.

WNV West Nile Virus

ZIKV Zika Virus

Appendix 2

Key Agencies

This list provides only the key agencies with WNV responsibilities in Clark County and Washington. Most have websites can provide further information regarding these and other organizations involved with WNV.

- Clark County Mosquito Control District, John Jacobson, Operations Manager (360) 574-7906
- Clark County Public Health, Dr. Alan Melnick (360) 397-8412
- Washington State Department of Health, 1-866-78VIRUS
- <http://www.doh.wa.gov/DataandStatisticalReports/DiseasesandChronicConditions/WestNileVirus>
- U.S. Department of Agriculture (360) 753-9430
- Washington Department of Fish and Wildlife (360) 902-2936

Appendix 3

Larvicides

Products

These insecticides are applied directly to the water or to habitats that routinely flood by vector control staff by using vehicle mounted applicators, backpack sprayers, or hand-held squirt bottles. The larvicides given below will be used by CCMCD. Complete product information, including details for use, labels and material safety data sheets is available at the listed websites and/or e-mail addresses.

- Altosid (methoprene) www.altosid.com
- *Bti* (*Bacillus thuringiensis var. israelinsis*) www.clarke.com
- *Bs* (*Bacillus sphaerius*) www.clarke.com
- Natular www.clarke.com
- Coco Bear www.myadapco.com

Rationale

CCMCD primarily uses larval sampling results to select the appropriate pesticide before application.

- Biorationals are not effective on late 4th instars and pupae, thus are not used as a control product in areas where those life stages are present. Instead, CCMCD will use alternate products such as oils and films (e.g. Coco Bear*) on sites with those specific life stages present.

Application

There are two basic techniques used for applying larvicides.

- Ground-based application. Larvicides are applied to bodies of water by CCMCD staff by using vehicle mounted applicators, backpack sprayers, or hand-held squirt bottles.
- Aerial application. Granular larvicides (e.g., BTi on corn-cob granules) are broadcasted on bodies of water from a helicopter. Aerial application has the benefits of being able to efficiently treat large areas or areas that are not accessible by CCMCD staff.

Adulticides

Products

These insecticides are applied into the air to kill flying, adult mosquitoes. Two classes of insecticides may be used by CCMCD as adulticides, pyrethroids and natural pyrethrins.

Pyrethroids: sumithrin and prallethrin (Duet).

Complete product information including detail for use, labels and material safety data sheets are available at the websites listed below.

- Duet www.clarkemosquito.com

Rationale

In the event of a Health Emergency due to the detection of WNV in a vector population in Clark County and specific criteria as described above being met, CCMCD would initiate a local adulticide program. CCMCD would apply pesticides at appropriate times of the day when adult mosquitoes are most active with ULV output to minimize the quantity of active ingredient applied. CCMCD may use barrier sprays in areas with elevated public exposure. A synthetic pyrethroid, applied to residential property, agricultural areas, green spaces etc., would be used by CCMCD in a ground application ULV form.

Application

There are two basic techniques used for applying adulticides:

- Barrier application: Adulticides are sprayed onto vegetation or other surfaces to leave a residual adulticide intended to kill mosquitoes that land on that surface. Barrier application is typically done with backpack sprayers that produce large droplets that immediately fall out of the air onto the intended surface. Barrier type adulticides can kill “non-target” insects.
- ULV (Ultra Low Volume) application: Adulticides are sprayed into the air with the intent of killing mosquitoes that are flying or resting in the sprayed area. ULV application is typically done with truck-mounted sprayers, but can be done with aircraft. ULV produces very small droplets that hang in the air for a few hours. ULV application is done during atmospheric conditions that promote slow drift of the adulticide for a distance of a few hundred feet from the path (or point) of application. By definition, ULV uses that smallest possible amount of adulticide that will kill adult mosquitoes. ULV applied adulticides can also kill “non-target” insects.