County of San Diego
Mosquito-Borne Pathogen Strategic Response Plan

Department of Environmental Health and Quality

Public Health Services

2026

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Leadership Review & Approval

This *Mosquito-borne Pathogen Strategic Response Plan* was developed in concurrence with Public Health Services and approved by the Director of Environmental Health and Quality and the Public Health Officer.

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Purpose

The County of San Diego *Mosquito-borne Pathogen Strategic Response Plan* provides the basis for implementing an integrated, risk-based response to limit the risk of disease from endemic mosquito-borne pathogens, such as West Nile, St. Louis, and Western equine encephalitis viruses, as well as transmission of non-endemic pathogens, such as dengue, chikungunya, Zika, malaria, and others.

Introduction

The County of San Diego Vector Control Program (VCP) is responsible for mosquito and vector-borne disease surveillance and control services in all 18 incorporated cities and the unincorporated area of San Diego County. The VCP has been reducing and controlling mosquitoes and other vectors and protecting the county against vector-borne diseases for over 40 years. To accomplish this, it uses a strategy called integrated vector management (IVM). This approach uses a balanced and "lightest touch" combination of methods to reduce the risk of vector-borne diseases while minimizing effects on the environment. It involves:

- **Public Education** - Empowering the public with the knowledge of how to protect themselves from vectors.
- **Surveillance and Monitoring** - Monitoring vector populations throughout the county to find potential problem areas.
- **Disease Diagnostics** - Detecting vector-borne pathogens using a state-of-the-art lab to protect public health.
- **Source Reduction** - Reducing vectors by removing or reducing their breeding sources.
- **Source Treatment** - Reducing vectors using a "lightest touch" approach. This includes biological and chemical control methods.

As part of this strategy, the VCP also responds to reports of unmaintained "green" swimming pools and other potential sources of mosquito breeding and provides educational mosquito and rat inspections by request. A service charge and benefit assessment are used to fund the program and are approved annually by the County Board of Supervisors. *Culex tarsalis* and *Culex quinquefasciatus* are mosquitoes endemic in the county that are most active during dusk and dawn (crepuscular) and lay eggs in as little as 1/4"' of organically charged stagnant water. They lay eggs both above and below ground. Unmaintained swimming pools and retained water in stormwater drainage infrastructure can be sources of abundant breeding of *Cx. quinquefasciatus* and larger water bodies like rivers and lagoons support *Cx. tarsalis* breeding. These species are primary vectors of West Nile, St. Louis encephalitis, and Western equine encephalitis viruses.

Culex Mosquitoes and Related Infections

West Nile virus (WNV) was first detected in the United States in 1999 in New York when it caused an outbreak of encephalitis in people (Nash et al., 2001) and significant mortality in birds (Kilpatrick et at., 2007). Circulating primarily in passerine birds and transmitted by mosquitoes, it rapidly spread westward and reached San Diego County in 2003. Although 80% of people infected with WNV do not become ill, 20% of infections result in clinical signs including fever,

headache, joint pain, vomiting, diarrhea, or rash. Less than 1% of infected people develop a severe illness that causes permanent brain damage or death. From 2003 to July 2025, 8,255 symptomatic and 860 asymptomatic human cases of WNV have been reported in CA with 407 deaths. There is no vaccine or specific treatment for people infected with WNV.

WNV is maintained in wild bird populations, especially passerine birds such as sparrows and finches, through a wild bird-mosquito-bird infection cycle (Figure 1). It has been found in more than 110 bird species, with corvids, like crows and jays, and raptors, being highly susceptible and frequently dying from infection. Monitoring dead corvids and raptors for WNV is a sensitive indicator of WNV activity and often precedes detection of WNV in mosquitoes and people. Infection can occur in other species as well, such as people and horses. Although very effective horse vaccines have reduced the incidence of WNV-induced disease in horse populations, no human vaccine exists. St. Louis encephalitis virus (SLEV) and western equine encephalitis virus (WEEV) are also maintained in bird-mosquito infection cycles but do not cause bird mortality. They are largely monitored by detection in mosquito pools.

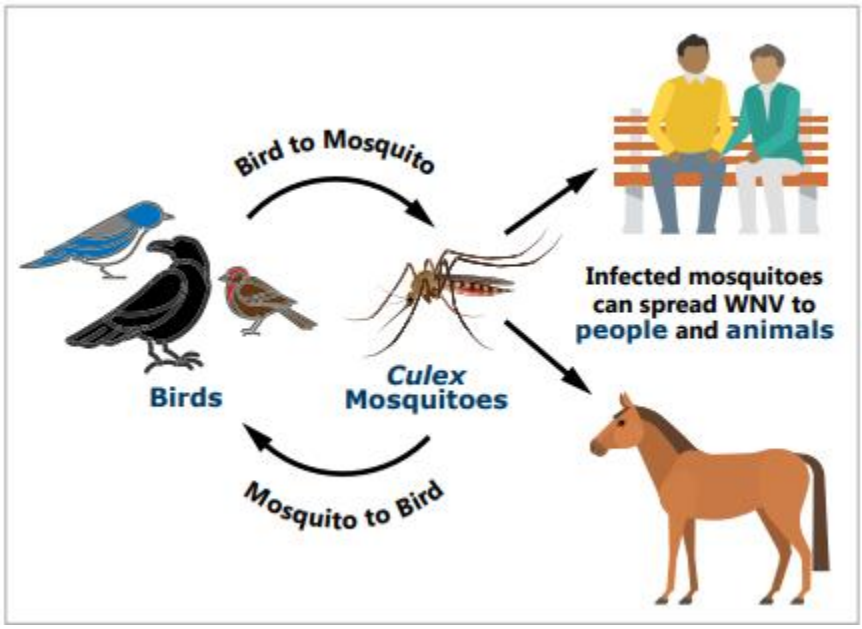

Figure 1. WNV transmission cycle (CDPH).

SLEV was first recognized in California in 1937 and caused sporadic cases until 2003. Fewer than 10 cases of SLEV in people were reported per year in California from 1990-2021. It was not detected from 2003-2014, but after it reemerged in California in 2015, human cases were reported from 2016-2023. In 2024, 34 mosquito pools tested positive for SLEV in California, but no human cases were reported. WEEV can cause infections in people and horses. Fortunately, the last case reported in the U.S. was 1999 (CDC) and it has not been detected in California mosquitoes since 2008 (Reisen and Wheeler, 2016). However, monitoring for its reemergence is important as it is considered endemic in California. Since WNV is by far the most common of these viruses, this SRP focuses on response to WNV but applies to the other viruses as well if they are detected.

Invasive *Aedes* Mosquitoes and Related Infections

In 2014 and 2015, two non-native invasive mosquitoes, *Aedes aegypti* and *Ae. albopictus*, respectively, were detected in San Diego and a third invasive *Aedes* species, *Ae. notoscriptus*, was found in 2018. It is not known how *Ae. aegypti, Ae. albopictus,* and *Ae. notoscriptus* entered California; however, *Ae. aegypti* found in Los Angeles and San Diego counties are genetically similar to populations found in Arizona, New Mexico, and Mexico (Pless et al., 2016). In contrast, *Ae. aegypti* in northern California match populations found in Texas (Gloria-Soria et al., 2014). Furthermore, *Ae. albopictus* in Los Angeles County match the genetic profile of a previous introduction in Los Angeles in 2001 that arose from lucky bamboo shipments originating from China; thus, it is presumed that the introduced population was not eradicated and remained undetected until 2011 (Zhong et al., 2013). The biology of invasive *Aedes* mosquitoes and some of the diseases they vector differ from *Culex* mosquitoes that commonly transmit WNV. Invasive *Aedes* species prefer to feed on people, breed in small stagnant water sources often found in and around homes and aggressively bite during the day (diurnal). *Aedes aegypti* and *Ae. albopictus* can transmit non-endemic viruses such as dengue, chikungunya, yellow fever, and Zika viruses (referred to as *Aedes*-transmitted diseases or ATD), and their eggs can survive without water for greater than one year (Faull and Williams, 2015). Although *Ae. notoscriptus* can transmit Ross River and Barmah Forest viruses in Australia, its ability to transmit dengue, chikungunya, Zika, West Nile, and yellow fever viruses is thought to be limited (Metzger et al., 2022). Furthermore, *Ae. aegypti* and *Ae. albopictus* have been found infected with WNV, however, because they prefer human hosts over bird hosts, the latter being reservoirs of WNV, they are not considered to be primary vectors of WNV. Due to the limited vector potential of *Ae. notoscriptus*, it is not considered further in this strategic response plan and the term invasive *Aedes* pertains to *Ae. aegypti* and *Ae. albopictus*.

Aedes aegypti and/or *Ae. albopictus* have become established in many counties in California However, *Ae. albopictus* has not been detected in San Diego County since 2020. There is no simple solution to eradicating invasive *Aedes* or preventing all ATDs. Fortunately, the VCP has successfully employed IVM strategies for many decades to control mosquitoes and these IVM strategies can be applied to invasive *Aedes* as well.

Anopheles hermsi Mosquitoes and Malaria

There are approximately 430 species of *Anopheles* mosquitoes globally of which only 30-40 can vector or transmit human malaria (Malaria.com). *Anopheles hermsi* is a highly competent vector of malaria exceeding that of the infamous *An. gambiae* found in Africa (Vaughan et al., 1994). *An. hermsi* is the primary malaria vector in San Diego County based on abundance, distribution, and competency across all anopheline species historically detected in San Diego County (Porter and Collins 1990, Vaughan et al., 1994, and VCP unpublished data). *An. hermsi* larvae are typically found in riparian areas in clear, sunlit water, often with matts of algae, however they can be found in shaded areas as well (Carpenter and LaCasse, 1955). Although malaria parasites (*Plasmodium* spp.) were historically present in California they are no longer endemic in San Diego County. The most likely scenario Malaria transmission could occur in San Diego County would be from an infected individual who recently acquired malaria while traveling in another country, returns to San Diego County with an active infection (parasitemic), who is then bitten by

an *An. hermsi* mosquito which then bites an uninfected individual about 10-20 days later (temperature dependent) after the mosquito develops a disseminated infection.

The species of *Plasmodium* can play a role in the treatment and response as there are variances in when and how long a person can be infective as well as how successful anti-malarial medications are at eradicating the parasite. In addition, some people who may have been infected months or years earlier with certain malaria species (*P. ovulae* or *P. vivax*) may develop a recrudescence at a later date in life and can develop a parasitemia which can then infect *Anopheles* mosquitoes. In contrast to regions where malaria is endemic and sustained transmission results in partial immunity in older children and adults (e.g. parts of Africa), populations in San Diego County are mostly naïve and severe disease could be expected in locally transmitted cases. The most recent outbreaks of locally transmitted malaria in San Diego County occurred from 1986-1990 with at least 66 people being infected (Ginsberg 1991, Hunt 1990, Maldonado 1990). Thirty people were infected in 1988, which was the largest outbreak of malaria in the U.S. since 1952. However, the CDC states that the current risk of becoming infected with malaria while in the U.S. is very low. *An. hermsi* populations are generally low but fluctuate depending on season and weather. The routine IVM methods used to control WNV vector mosquitoes work against *An. hermsi* mosquitoes and are used to keep these populations in check.

This *Mosquito-borne Pathogen Strategic Response Plan* was created to mitigate these arbo-pathogen effects on people and to protect public health. It is based on published research, state, federal, international guidelines, VCP experience, and is updated as new information becomes available.

WNV Integrated Vector Management Strategy

Goals

The VCP's goals are to mitigate the impacts of WNV to the health, well-being, and economy of San Diego County by: 1) limiting vector mosquito numbers in critical areas; 2) educating residents about how to prevent mosquitoes from breeding at their homes and to protect themselves from mosquito bites; and 3) mobilizing residents to report mosquito breeding sites and sentinel dead bird species to the VCP. These goals are met using an integrated vector management strategy (IVM) approach to limit mosquito numbers and protect public health and the environment from WNV.

Surveillance and Monitoring

Goal**:** *To monitor levels of vector mosquito populations and virus activity in San Diego County to mitigate the spread of WNV.*

Birds
Dead corvid and raptor birds are often one of the earliest indicators of WNV activity and precede human WNV cases. Consequently, the VCP operates a year-round program for collecting and testing dead corvids and raptors for WNV. The public is encouraged to report these species of

dead birds to the VCP. Birds meeting testing criteria are collected from throughout the county 7 days a week, tested at the Vector Disease and Diagnostic Laboratory (VDDL) for the presence of WNV, SLEV, and WEEV, and are used by the VCP to help direct surveillance, control, and outreach efforts.

Mosquitoes
The VCP monitors approximately 1,600 mosquito-breeding locations throughout the county. Monitoring involves visual observation, trapping adult mosquitoes, and/or larval collection from water sources. In addition, the VCP investigates reports and complaints of mosquito activity from the public. An increase in mosquito abundance and the presence of specific species that can transmit WNV inform control and outreach efforts. In addition, mosquitoes are tested by the VDDL for WNV, SLEV, and WEEV. If mosquitoes test positive for one of these viruses or a human or equine case is reported, additional traps are set to determine the level of risk to public health. In addition, mosquito populations are periodically monitored for susceptibility to pesticides so that optimal mosquito control products can be used.

Horses
Local equine WNV cases are reported to the VCP or to the California Department of Food and Agriculture, which in turn reports the cases to the VCP. Since horses are stabled and their travel histories can be determined, the location of their exposure to mosquitoes can be pinpointed. The VCP uses this information to find additional sources of mosquitoes that can transmit WNV, assess the risk to public health, and direct control efforts to reduce these risks (Appendix A).

Humans
In accordance with Title 17 of the California Code of Regulations (Section 2500 and 2505), healthcare providers, diagnostic laboratories, blood and tissue banks are required to report suspected or confirmed cases of human WNV infection (i.e., any positive laboratory finding of WNV) within one (1) working day of identification to the local public health department, which is the Public Health Services (PHS) department, in the County of San Diego Health and Human Services Agency (HHSA). Suspect human WNV cases (i.e., presumptive WNV IgM antibody positive, nucleic acid-amplification test (NAAT) reactive, or healthcare provider-diagnosed) are interviewed, if possible, by PHS Epidemiology staff using a standardized risk history questionnaire. The questionnaire documents illness onset, signs and symptoms, travel history, mosquito exposure, or potential non-mosquito routes of transmission, such as blood transfusion or organ transplantation. Symptomatic cases that meet the national surveillance case definition for acute WNV infection, as well as asymptomatic WNV-positive blood donors are reported to the California Department of Public Health (CDPH) and the Centers for Disease Control and Prevention (CDC). In addition, the VCP is notified and staff members investigate the property and neighborhood of locally acquired WNV-positive cases that are reported within 30 days of local mosquito exposure unless conditions warrant more prolonged monitoring (such as prevailing response levels 2 or 3 in the county). The investigation includes efforts to trap and test mosquitoes and to identify, eliminate, or treat mosquito breeding sites. Human case counts can be found on the CDPH WNV website. If applicable, a news article is published, and specific health alert notices are sent to at-risk areas to inform/alert the public to prevent mosquito breeding on their properties and to protect themselves from mosquito bites.

Disease Diagnostics

Goal: *To rapidly detect WNV in surveillance specimens and to confirm human cases.*

Mosquitoes and Birds
The VDDL tests field-caught mosquitoes and dead birds for WNV, SLEV, and WEEV. It uses highly sensitive and accurate advanced molecular tests, such as *real-time* reverse transcriptase Polymerase Chain Reaction (RT-PCR) and genetic sequencing, to detect these viruses and performs an annual proficiency examination administered by the UC Davis DART laboratory. Timely test results enable VCP surveillance, control, and outreach groups to rapidly respond and reduce the spread of WNV. Additionally, new emerging diseases are analyzed by the VDDL to better prepare and protect the public.

Humans
Identification of WNV cases is important to assess the burden of human illness and to target mosquito control and public education activities to reduce exposure risk. During the WNV season, testing is recommended for individuals with aseptic meningitis, encephalitis, acute flaccid paralysis, atypical Guillain-Barré Syndrome, transverse myelitis, and febrile illness lasting 7 days. Residual serum specimens (if available) from suspect WNV cases are requested from non-public health diagnostic laboratories for submittal through the San Diego County Public Health Laboratory (SDCPHL) or directly to the California Department of Public Health Viral and Rickettsial Disease Laboratory (CDPH VRDL) for confirmatory testing. If cerebrospinal fluid (CSF), whole blood, and/or urine are also available, they can be submitted as well, but ideally paired with a serum sample.

WNV testing capacities available through CDPH VRDL include the following:
- IgM and IgG enzyme immunoassay (EIA) testing;
- IgM and IgG immunofluorescent assay (IFA) testing;
- Plaque Reduction Neutralization Test (PRNT) which is a virus-specific neutralizing antibody test for distinguishing between arthropod flaviviruses;
- Reverse Transcriptase – Polymerase Chain Reaction (RT-PCR).

Source Reduction and Treatment

Goal: *To decrease the risk of WNV transmission by reducing mosquito populations.*

IVM practices include reducing and eliminating mosquito breeding sources, reducing larvae through biological and chemical means, and reducing adult mosquitoes through chemical applications, when necessary. Specific actions include:

- Responding to resident service requests to find, eliminate, and/or treat mosquito breeding sources and provide education about how to prevent mosquito breeding on their properties;
- Using aerial images to find unmaintained swimming pools, ponds, and other sources that could be breeding mosquitoes;

- Using mosquitofish to consume larvae where appropriate;
- Applying highly specific larvicidal bacteria or mosquito growth regulators or films to water to kill mosquito larvae and/or prevent adult mosquito emergence;
- Using helicopters to apply larvicide to waterways that are inaccessible or inefficiently treated from land;
- Applying insecticides that kill adult mosquitoes when necessary; and
- Ordering abatement of mosquito breeding sources.

Public Education

Goal: *To educate the public about how to prevent mosquito breeding on their properties, how to prevent mosquito bites, and how to report mosquito breeding sites and dead birds to the VCP.*

The VCP Outreach team coordinates communications with the HHS communications team and sends notification letters to residents within a 1/4-mile radius of where WNV-positive mosquitoes, horses, or human infections are detected. Year round, it educates residents how to protect against mosquito bites, prevent mosquito breeding on their properties, and report dead birds and locations of breeding mosquitoes. Outreach staff members give presentations and attend events to educate the public about WNV and mosquitoes. The website www.SDFightTheBite.com is kept current with the latest county WNV information and can be translated into over 100 languages using an embedded Google Translate widget. In addition, the team creates and distributes educational brochures and public service information campaigns that utilize combinations of TV, radio, outdoor displays, mobile devices, social media, and internet distribution platforms. Brochures and media campaign content are translated into County of San Diego threshold languages. Outreach also works with city and County storm water management programs to distribute information on how to prevent rain barrels from breeding mosquitoes. Education about how to prevent mosquito breeding in home water sources (unmaintained pools, overwatered plants/saucers, landscape drains, and gutters) is distributed widely to the public and to groups such as realtors, tire dealers, nurseries, cemeteries, apartment associations, schools, health groups, and other organizations. Information is available in multiple languages, upon request.

WNV Risk Analysis and Response

Response to WNV is based on a risk-based continuum of three graduated levels in response to increasing risks of WNV (CDPH, 2026 California Mosquito-borne Virus Surveillance & Response Plan). VCP Ecologists evaluate the WNV risk level to protect public health by considering many variables such as the vector index[2], environmental conditions, population

[2] The Vector Index (VI) incorporates virus infection rates for each species of female vector mosquito and their corresponding abundance. Summing the VI for the key vector species incorporates the contribution of more than one species and recognizes the fact that WNV transmission may involve one or more primary vectors and/or one or more accessory or bridge vectors in an area. In this analysis, it is multiplied by 1000 to align with calculation via the minimum infection rate (MIR) or the maximum likelihood estimate MLE (see below).

density, pesticide resistance, disease detections, GIS maps, operational factors, and VectorSurv/CalSurv risk assessment tools operated by the UC Davis Arbovirus Research and Teaching laboratory (DART) (VectorSurv Maps; https://gateway.calsurv.org/, Table 1). They then propose the appropriate response to executive management which may be further modified by other considerations such as the time-of-year and enterprise-level considerations. For example, a high calculated risk level at the end of the mosquito season may warrant a more tempered response due to declining transmission risk as temperatures and photoperiod decrease. Conversely, a low calculated risk level at the beginning of the season could warrant a more aggressive response if conditions are forecast to elevate mosquito levels and risk to public health.

Table 1. WNV response levels.

Level	Description	Example Conditions
1	Endemic conditions with low risk to human health (normal season)	• Cool to moderate average seasonal temperatures (< 65°F) • *Culex* mosquito abundance near or below five-year average (key indicator = adults of vector species) • No virus infection detected in mosquitoes • No infected WNV-positive dead birds • No locally acquired human or horse cases
2	Above average circulation of WNV with medium risk to human health	• Average temperature 66–79°F • Adult *Culex* mosquito abundance greater than 5-year average (150% to 300% above normal) • One or more virus infections detected in *Culex* mosquitoes (MIR < 5 per 1,000 tested) • One to five infected WNV-positive dead birds in specific region • One locally acquired human case

Minimum Infection Rate (MIR) is: $\frac{\text{\# of WNV positive mosquito pools X 1,000}}{\text{Total \# of mosquitoes collected}}$

The Vector Index (VI) is: Abundance X Infection Rate

Therefore, the VI is: $\frac{\text{Average mosquitoes caught per trap night X \# WNV-positive mosq pools X 1000}}{\text{Total \# mosquitoes caught}}$

It can also be calculated from the minimum infection rate (MIR) as: $\sum_{i=\text{species}} N_i P_i$

N= Average vector species mosquitoes/trap night
P= MIR or MLE (number of infected mosquitoes per 1,000 tested)
a. MIR = number of infected batches/total mosquitoes x 1000; (50 female mosquitoes/pool)
MLE is more accurate than MIR at high infection prevalence and incorporates variably sized mosquito pools. The Excel plugin to calculate MLE can be found at: http://www.cdc.gov/westnile/resourcepages/mosqsurvsoft.html.

		• WNV detected in rural area
3	Conditions highly conducive to spread of WNV with high potential risk to human health	• Average temperature above > 79°F • Adult vector population extremely high (> 300% above normal) • Virus infections detected in multiple pools of *Cx. tarsalis* or *Cx. quinquefasciatus* mosquitoes (MIR > 5 per 1,000 tested) • More than five infected WNV-positive dead birds and multiple reports of dead birds in specific region • More than one locally acquired human case in specific region WNV detection in urban or suburban areas

If a mosquito pool, horse, or person tests positive for WNV, residents within a ¼ mile radius are notified, the localized risk to public health is assessed, and a comprehensive response that involves additional surveillance trapping for infected mosquitoes, source control (breeding source reduction, larvicides), outreach, and adulticides, if necessary, is used (Figure 2).

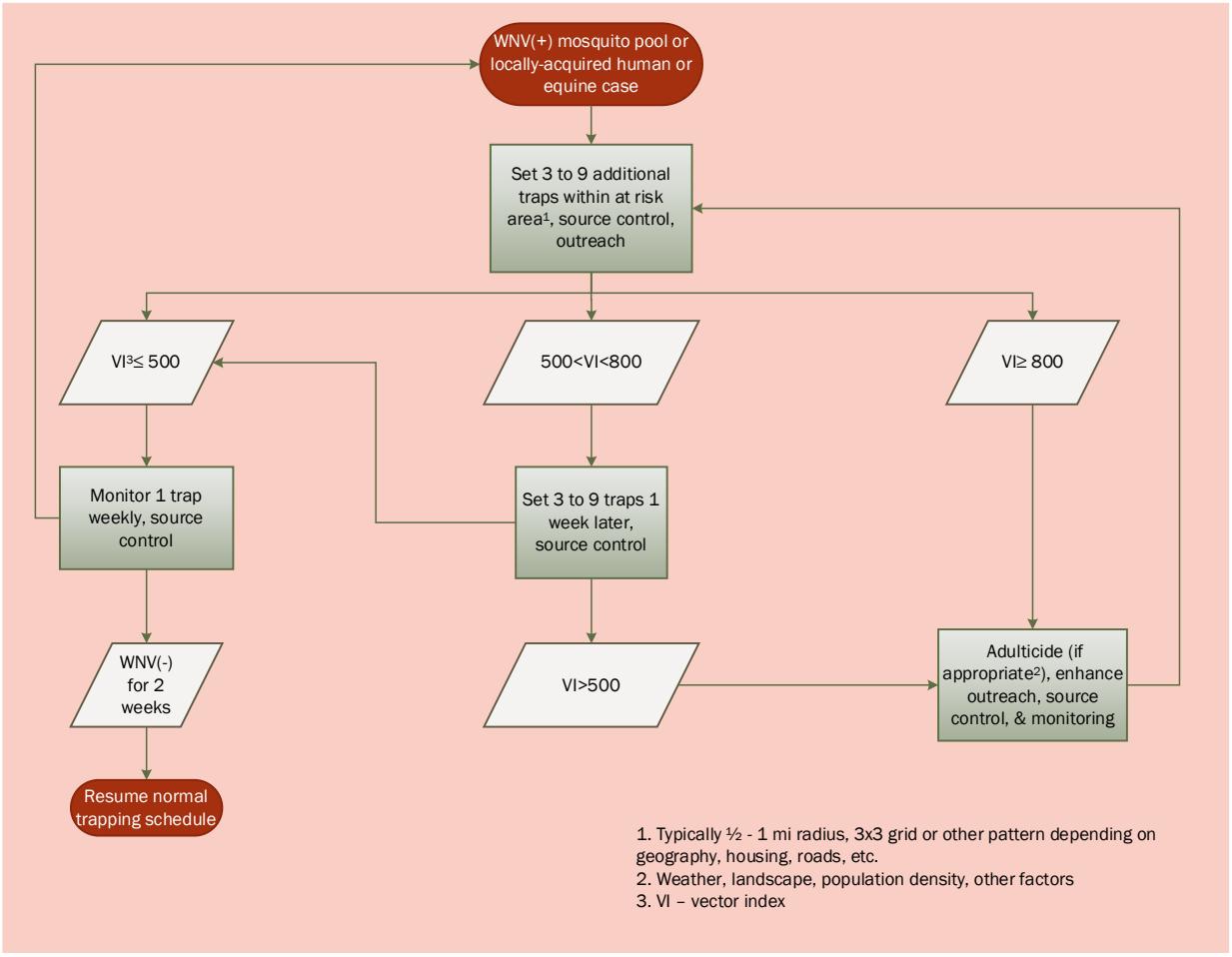

Figure 2. WNV response decision algorithm.

Invasive *Aedes* Integrated Vector Management Strategy

The IVM Strategy for invasive *Aedes* is structured as a phased, risk-based continuum that is based on parameters described in the Zika Centers for Disease Control and Prevention (CDC) Interim Response Plan (May 2017) and the California Department of Public Health's Guidance for Surveillance of and Response to Invasive *Aedes* Mosquitoes and Dengue, Chikungunya and Zika in California (March 2025). Because invasive *Aedes* breed in small, cryptic locations, many of which cannot be found, reached, or treated by the VCP, eradication of invasive *Aedes* mosquitoes from San Diego County is unlikely. However, reduction of invasive *Aedes* breeding in urban and man-made water sources and reduction of risk of disease transmission are possible with the participation of county residents through elimination or treatment of invasive *Aedes* breeding sources from properties.

Goals

The VCP goals are to mitigate the impacts of invasive *Aedes* to the health, well-being, and economy of the County by: 1) limiting invasive *Aedes* numbers, 2) educating residents about how to prevent invasive *Aedes* from breeding at their homes, 3) reducing risk of disease transmission by invasive *Aedes*, and 4) preventing sustained transmission of diseases by invasive *Aedes* mosquitoes. These goals are met using an IVM approach to limit mosquito numbers and protect public health.

Surveillance and Monitoring

Goal: *To monitor the levels and distribution of Aedes and Aedes-transmitted diseases ATDs in San Diego County and to ascertain their genetic predisposition and/or susceptibility to insecticides.*

Mosquitos
Vector Control staff routinely set mosquito traps (e.g. Biogents sentinel mosquito trap, Encephalitis virus surveillance mosquito trap+lure, etc.) to monitor invasive *Aedes* activity. During disease investigations, technicians set traps near suspected and confirmed ATD cases to evaluate the presence and abundance of invasive *Aedes* mosquitoes.

Humans
In accordance with Title 17 of the California Code of Regulations (Section 2500 and 2505), healthcare providers, diagnostic laboratories, blood and tissue banks are required to report suspected or confirmed cases of certain human infection (e.g., any positive laboratory finding of dengue virus) within one (1) working day of identification to the local public health department, which is the PHS department, in the County of San Diego HHSA. Suspect human dengue cases (i.e., presumptive IgM antibody positive, NS1 antigen positive, nucleic acid-amplification test (NAAT) reactive, or healthcare provider-diagnosed) are interviewed, if possible, byPHS Epidemiology staff using a standardized risk history questionnaire reported to the California Department of Public Health (CDPH) and the Centers for Disease Control and Prevention. The

questionnaire documents illness onset, signs and symptoms, travel history, mosquito exposure, or potential non-mosquito routes of transmission, such as blood transfusion or organ transplantation. Symptomatic cases that meet the national surveillance case definition for acute dengue infection, as well as asymptomatic dengue-positive blood donors are investigated. VCP is immediately notified and staff members investigate the property and neighborhood of locally acquired dengue-positive cases that are reported within 30 days of local mosquito exposure unless conditions warrant more prolonged monitoring (such as prevailing response levels 2 or 3 in the county). The investigation will include efforts to trap and test mosquitoes and to identify, eliminate, or treat mosquito breeding sites. After determination by PHS of whether the infection(s) was acquired within or outside of the county (locally and non-locally acquired, respectively), if applicable, a news article is published, and specific health alert notices are sent to at-risk areas to inform/alert everyone to prevent mosquito breeding and to protect themselves from mosquito bites.

Disease Diagnostics

Goal: *To rapidly detect dengue, chikungunya, Zika and other viruses in invasive Aedes mosquitoes so that the VCP can rapidly respond to elevated health risks.*

Mosquitos
The VDDL tests invasive *Aedes* via real-time reverse transcriptase-polymerase chain reaction (RT-PCR) for ATDs. *Aedes* collected from the vicinity of a viremic case are tested for the same virus that the case is infected with. Due to the rarity of these viruses, RNA from positive samples will be sent to the UC Davis Arbovirus Research and Training laboratory for confirmation. In addition, periodically, *Aedes* are tested for genetic predisposition and/or susceptibility to insecticides used by the VCP so that appropriate chemical control methods can be used, if needed.

Humans
Identification of cases of mosquito-borne viral infections carried by invasive *Aedes* is important to assess the burden of human illness and to target mosquito control and public education activities to reduce exposure risk. Testing is recommended for symptomatic individuals returning from endemic regions. (Dengue and Zika Virus Diagnostic Testing for Patients with a Clinically Compatible Illness and Risk for Infection with Both Viruses | MMWR (cdc.gov))

Arboviral testing capacities available through CDPH VRDL include the following:
- IgM and IgG enzyme immunoassay (EIA) testing;
- IgM and IgG immunofluorescent assay (IFA) testing;
- Plaque Reduction Neutralization Test (PRNT), which is a virus-specific neutralizing antibody test for distinguishing between arthropod flaviviruses; and
- Reverse Transcriptase – Polymerase Chain Reaction (RT-PCR).

Source Control

Goal: *To find and eliminate Aedes breeding sources, to decrease the number of immature and adult Aedes, and to prevent local mosquito transmission of ATDs.*

Vector Control Technicians respond to complaints of daytime or indoor biting by mosquitoes by assessing properties for breeding locations, eliminating small stagnant water sources, applying larvicide to breeding locations that cannot be eliminated; and, in cases of an elevated health risk, using adulticidal pesticides to kill adult mosquitoes.

Public Education

Goal: *To educate the public about invasive Aedes mosquitoes and the diseases they can transmit, how to prevent their breeding, and how to protect oneself from mosquito bites.*

The Outreach team maintains the website SDFightTheBite.com and produces social media postings with information on invasive *Aedes*, how to prevent them from breeding at home, how to prevent mosquito bites, and current VCP operations to prevent ATD transmission. The website can be automatically translated into over 100 languages using an embedded Google Translate widget. The team also develops brochures, gives presentations, teaches students, and conducts media campaigns to educate residents about *Aedes* and how to prevent them from breeding at homes. Brochures, presentations, and media campaigns are translated into County of San Diego threshold languages. Up-to-date informational web pages and info helps inform residents within areas that are scheduled to be treated to control adult mosquitoes. A phone line to answer questions regarding mosquito control operations, (858) 694-2888. Outreach Team coordinates public communications with the HHS communications team.

Aedes Transmitted Disease Risk Analysis and Response

The VCP follows best management practices and uses the least invasive control measures appropriate for a given ATD risk. The continuum of phased response to invasive *Aedes* mosquitoes and ATDs progresses from baseline endemic mosquito conditions without virus present, to travel-associated cases of ATDs, locally acquired ATDs or ATDs detected in mosquitoes, and continuing transmission of ATDs (Table 2).

Table 2. Response to Aedes-transmitted diseases.

PHASE	*CATEGORY*	*RESPONSE*
1	*Aedes* present, endemic conditions with low risk to human health	Conduct routine mosquito and virus surveillance, source reduction, larval control, public education and awareness messaging. Evaluate pesticide resistance.
2	Travel-associated ATD case (probable or confirmed) reported viremic while in San Diego County	Assess risk of disease transmission, such as investigating case residence and sites of possible mosquito exposure. Take appropriate actions to prevent spread that could include focused education and personal protection outreach, source control, and application of adulticides[2].

3	Local transmission of ATD (probable or confirmed); ATD detected in mosquito	Investigate ATD case's residence and sites of possible mosquito exposure for presence of invasive *Aedes* mosquitoes. If ATD was acquired in home with little risk to surrounding community, overall risk may be low or medium. If community acquisition determined, risk level is "high."
4	Sustained local transmission (such as, but not limited to, 3 or more cases of *Aedes*-transmitted diseases with onsets ≥2 weeks apart but <45 days apart within 1 mile diameter area; or ATD detected ≥3 times in mosquitoes tested from the same area and timespan as delimited above, or genetic data indicating same viral strain in 3 or more cases.	Risk level is high. Notify residents in active transmission and cautionary zones, (as set by PHS) and implement area-wide application of larvicides and/or adulticides (truck or aerial), as needed. Request mutual aid (including from CDC), if needed.

According to the overall transmission risk, the following response actions are taken (Table 3).

Table 3. Invasive Aedes transmitted disease intervention matrix.

Risk Level	Response
Low	Outreach, source control
Medium	Outreach & source control at case and adjoining neighbor properties, rapid application residual insecticide at case property (conditions permitting)
High	Outreach, source control, rapid application residual insecticide at case property, wide area ULV adulticide treatment and wide area larviciding (conditions permitting)

Rapid application of residual insecticide refers to the application of a residual adulticide product on the case property as soon as possible after determination of *Aedes* presence. If permission is not granted, the property will be treated after an inspection and treatment warrant is obtained (single or multiple property warrant).

Follow up

In low-risk cases, additional mosquito trapping will typically be conducted during the peak invasive *Aedes* mosquito season July – November unless additional information suggests it is no longer needed. This could include inclement weather towards the end of the peak season or lack of invasive *Aedes* collected during the first trapping week in an area where *Ae. aegypti* has not been found. If the risk level remains low, then no further follow up is required. In medium risk cases that require treatment, follow-up trapping and mosquito testing will be performed 1 week following treatment for 2 consecutive weeks. In high-risk cases, follow up trapping and mosquito testing will be performed every week for 4 consecutive weeks. If any mosquito pool tests positive for an ATD or local transmission is identified in another case, then Phase 3 or 4 guidance is followed, as appropriate.

The time when the public's health may be at risk is dependent on the duration of viremia in people and the lifespan of infected mosquitoes following the extrinsic incubation period. Exact extrinsic incubation periods vary depending on the infecting virus (Table 4).

Table 4. Viremic and extrinsic incubation periods of Aedes-transmitted diseases (ATDs).

VIRUS	VIREMIA	EXTRINSIC INCUBATION PERIOD (MOSQUITO)
ZIKA	2 days prior to 10 days after symptom onset	10 days (Boorman, 1956)[7]
CHIKUNGUNYA	2 days prior to 10 days after symptom onset	2 days (Dubrulle, 2009)[8]
DENGUE	2 days prior to 10 days after symptom onset	7 days (Chan, 2012, Waggoner, 2016)[9]

Integrated Vector Management Strategy for Anopheline Vectors of Human Malaria

Goals

The VCP goals are to mitigate the impacts of human malaria vectors (e.g. *Anopheles hermsi)* -to the health, well-being, and economy of the County by: 1) reducing their abundance; 2) educating residents about how to protect themselves from mosquito bites, and 3) preventing local mosquito transmission of malaria and preventing malaria from establishing in the County of San Diego. These goals are met using an IVM approach to limit mosquito numbers and protect public health.

Surveillance and Monitoring

Goal: *To monitor the levels and distribution of Anopheline malaria vectors in San Diego County.*

Mosquitoes
The VCP surveillance group routinely sets encephalitis virus surveillance (EVS) mosquito traps to monitor various areas of the County for *Anopheles* activity.

During investigations of probable and confirmed malaria cases reported to the VCP by PHS, *Anopheles* levels are assessed from traps at known *Anopheles* breeding areas near the case residence historically and during the parasitemic period. If historical and/or recent high levels are found, a VCT will inspect the neighborhood around the case's residence and set additional traps to ascertain the *Anopheles* level at the case's location.

Humans
In accordance with Title 17 of the California Code of Regulations (Section 2500 and 2505), healthcare providers, diagnostic laboratories, blood and tissue banks are required to report suspected or confirmed cases of certain human infection (e.g., any positive laboratory finding of malaria) within one (1) working day of identification to the local public health department, which is the PHS department, in the County of San Diego HHSA, suspect or confirmed human malaria cases (i.e. detection of Plasmodium species by rapid diagnostic antigen testing without confirmation by microscopy or nucleic acid testing in any person (symptomatic or asymptomatic), detection and specific identification of malaria parasite species by microscopy on blood films in a laboratory with appropriate expertise in any person (symptomatic or asymptomatic), detection of *Plasmodium* species by nucleic acid test in any person (symptomatic or asymptomatic), or detection of unspeciated malaria parasite by microscopy on blood films in a laboratory with appropriate expertise in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country.) PHS Epidemiology staff use a standardized risk history questionnaire. The questionnaire documents illness onset, signs and symptoms, travel history, mosquito exposure, or potential non-mosquito routes of transmission, such as blood transfusion or organ transplantation. Symptomatic cases that meet the national surveillance case definition for malaria infection, as well as asymptomatic malaria-positive blood donors are reported to the California Department of Public Health (CDPH) and the Centers for Disease Control and Prevention (CDC). In addition, the VCP is immediately notified, and staff members investigate the property and neighborhood of locally acquired malaria-positive cases that are reported within 30 days of local mosquito exposure unless conditions warrant more prolonged monitoring (such as prevailing response levels 2 or 3 in the county). The investigation will include efforts to ascertain mosquito levels and to identify, eliminate, or treat mosquito breeding sites. If applicable, a news article is published, and specific health alert notices are sent to at-risk areas to inform/alert everyone to prevent mosquito breeding and to protect themselves from mosquito bites.

Disease Diagnostics

Goal: *To rapidly detect malaria so that the VCP can rapidly respond to elevated health risks.*

Mosquitoes
The VDDL tests *An. hermsi* found in proximity to a case of malaria for *Plasmodium* parasites via qPCR. Positive detections may be sent to the CDC for confirmatory testing.

Humans
Identification of malaria-infections is important to assess the burden of human illness and to target mosquito control and public education activities to reduce exposure risk. Testing is recommended for any febrile person who has traveled to an area with malaria in the weeks to months preceding symptom onset (CDC - Malaria - Diagnosis & Treatment (United States) - Treatment (U.S.) - Guidelines for Clinicians). Malaria testing capacities available through San Diego Public Health Laboratory include microscopic evaluation of blood for malaria parasites.

Goal: *To find and eliminate or treat Anopheles breeding sources, to decrease the number of immature and adult Anopheles, and to prevent local transmission of malaria.*

Vector Control Technicians respond to complaints of biting by mosquitoes by assessing properties and natural waterways for *Anopheles* breeding locations, applying larvicide to breeding locations that cannot be eliminated; and, in cases of an elevated health risk, using adulticidal pesticides to lower transmission risk, if necessary.

Public Education

Goal: *To educate the public about how to protect against mosquito bites.*

The Outreach team develops brochures, gives presentations, conducts media campaigns, and maintains the SDFightTheBite.com to educate the public about mosquitoes and how to protect from getting bitten by them. The website can be translated into over 100 languages using an embedded Google Translate widget and brochures, presentations, and media campaigns are translated into County of San Diego threshold languages when feasible. The team also helps to inform residents within areas that are scheduled to be treated to control mosquitoes using formats that can include informational door hangers and sandwich boards, informational web pages and social media, and staffing a phone line to answer questions regarding mosquito control operations: (858) 694-2888.

Malaria Risk Analysis and Response

People can become infected while traveling to parts of the world where malaria is circulating. Transmission occurs when *Anopheles* ingest blood from an individual that has malarial parasites (*Plasmodium* spp.) in their blood and then spreads the *Plasmodium* to other people via bite. It takes from 1 to over 3 weeks before an infected mosquito can transmit malaria to someone else. The VCP malaria response incorporates guidance from the WHO Guidelines for Malaria Vector Control and CDC Operational Guidance for Investigating Locally Acquired Mosquito-Transmitted Malaria, United States, 2026 and is comprised of graduated actions to the detection of *Anopheles*, imported cases of malaria, locally acquired malaria, and continuing transmission of malaria (Table 5).

Table 5. Phase, category, and response to malaria.

PHASE	*CATEGORY*	*RESPONSE*
1	*Anopheles* present, endemic conditions with low risk to human health	Conduct routine mosquito surveillance, source reduction, larval control, public education and awareness messaging. May evaluate mosquitoes for pesticide resistance.

2	Travel-associated malaria case reported parasitemic while in San Diego County and with opportunity to have been bitten by *Anopheles* mosquitoes.	Assess *Anopheles* levels from traps at known breeding areas and near the vicinity of the case residence during the past 3 years. If *Anopheles* are present in sufficient quantities to pose a transmission risk (usually >5), then investigate and set traps at malaria case's residence and sites of possible exposure. According to trap results, assess risk and initial response (Table 6).
3	Local transmission of malaria (probable or confirmed)	Same as phase 2 plus: perform public education to prevent bites and seek medical care if needed, enhance source control, and evaluate feasibility of adulticiding to reduce infected adult mosquitoes. Notify County Health Department and California Department of Public Health and confirm findings, if necessary. Develop coordinated media release.
4	Sustained local transmission occurring (such as, but not limited to, 3 or more cases of malaria with onsets ≥2 weeks apart but <45 days apart within 1 mile diameter area; or malaria detected ≥3 times in mosquitoes tested from the same area and timespan as delimited above)	Same as Phase 3 plus, notify residents in active transmission and cautionary zones, (as set by PHS) and implement application of larvicides and adulticides (truck or aerial), as needed. Notify County Health Department and California Department of Public Health and confirm findings, if necessary. Develop coordinated media release. Request mutual aid (including CDC), if needed.

When PHS reports a probable or confirmed malaria case to the VCP that was parasitemic while in the county, VCP Ecologists evaluates the risk of malaria transmission, including whether they could have been fed upon by female *An. hermsi* mosquitoes. *Anopheles* abundance levels are assessed from traps at or near known *Anopheles* breeding areas close to the case residence. If elevated *Anopheles* counts are found, a VCT will inspect the neighborhood around the case's residence and VCT set at least two mosquito traps as close to the patient's residence as possible and checks breeding sources within ¼-½ mile of the residence, identifies larvae in field and lab, and treats breeding sites appropriately. Known breeding sites within ½ mile of the residence are prioritized for reinspection for mosquito breeding and treatment. Ecologists ascertain the transmission risk level and propose a response to executive management (Table 6).

Table 6. Malaria response matrix.

Risk Level	Response
Low	Outreach and regular mosquito site inspections and abatement
Medium	Outreach, mosquito site inspections, and abatement of known and potential *Anopheles* breeding sites with two-week follow-up at case property (conditions permitting).

High	Outreach, mosquito site inspections and abatement at known and potential *Anopheles* sites with one-week follow-up, ULV and residual adulticide application of areas surrounding *Anopheles* breeding source and/or case residence, if warranted (conditions permitting).

Interventions may include source control, education/outreach, and applications of ultra-low volume (ULV) and/or residual adulticides by backpack, truck, drone, helicopter, or fixed wing aircraft. Wide area larviciding (WALS) may also be used to suppress mosquito populations for longer durations.

Application of a residual adulticide product on the case property or breeding location as soon as possible after determination of *Anopheles hermsi* presence may be performed. If permission to treat is not granted, the property will be treated after an inspection and treatment warrant is obtained (single or multiple property warrant). Because the origin of the *Anopheles* may not be at the case residence, both the source of the *Anopheles* as well as the area around the case residence may need to be treated; the former to reduce overall *Anopheles* numbers, the latter to kill any *Anopheles* infected with *Plasmodium* from the case(s).

After assessing local conditions and factors, these responses will typically be applied to an area up to 1 mile radius from the breeding source and/or case. Females vector *Anopheles* mosquitoes are active primarily at and shortly after dusk; therefore, adulticide control measures will likely be employed between dusk and dawn.

The VCP will perform a risk assessment, including additional mosquito trapping and testing, 1 week after an intervention in medium and high-risk level situations and will continue until risk level decreases to LOW. If local transmission occurred, enhanced vector control operations will continue for at least six weeks after diagnosis or treatment of the most recent malaria case.

Public Communication

Communication and transparency of operations are of paramount importance to prevent the spread of mosquito-borne pathogens (MBPs). The County employs a wide spectrum of media and staff to inform affected residents about County operations to control the spread of these diseases. In the event of MBP detections that necessitate aerosol adulticide or Wide Area Larvicide treatments, the County may communicate using any of the following methods:

- Staffed phone line (858) 694-2888 to answer questions during regular business hours and additional days and hours, if needed
- Informational signs posted in neighborhoods where ULV treatment will occur at least 24 hrs. prior to treatment.
- Communications with other governmental and non-governmental agencies where operations will occur including city governments, USPS, schools, daycare centers, and healthcare facilities. The VCP will work with these entities, as well as homeowners, to resolve potential problems or concerns.
- Informational news releases on the County News Center: http://www.countynewscenter.com/, the California Health Action Network for San Diego County: CAHAN San Diego

(sandiegocounty.gov), and Health Professionals Telebriefings: Resources For Health Professionals (sandiegocounty.gov)

- Situation updates and information on the VCP website www.SDFightTheBite.com
- Maps and descriptions of areas that will be treated, and
- Insecticide information-Safety Data Sheets, FAQs, product labels
- Posts on social media platforms such as Facebook, X, and Nextdoor
- Informational door hangers and free inspections of all residences that will be treated at least 48 hours prior to treatment, may be used. Follow up door hangers after treatment may be used to confirm that treatment occurred. These are made available in multiple languages, especially those used in the affected communities.

Conclusion

The VCP strives to safeguard the public's health from mosquito-borne pathogens while minimizing harmful effects to the environment by using an integrated vector management, data-driven approach to controlling the spread of diseases. Public communication, education, and transparency are cornerstones of the strategy to protect against mosquito-borne pathogens. As new information develops, this *Mosquito-borne Pathogen Strategic Response Plan* will be updated to reflect new technologies and best practices. The latest information on VCP operations can be found at www.SDFightTheBite.com.

Appendix A. Mosquito Control

Immature Mosquitoes

Eliminating immature mosquitoes reduces the number of biting adult females capable of transmitting disease-causing pathogens, causing discomfort, and ultimately producing another generation of mosquitoes. Immature mosquito control has three key components: 1) breeding source reduction/environmental management; 2) biological control; and 3) larvicides/pupacides.

1. Breeding source reduction/environmental management involves eliminating stagnant water in and around homes, storm drains, flood control channels, and underground utility vaults so that mosquitoes cannot breed. Breeding sources can be anything that collects ¼ inch or more of standing water for 1 week including common household items like pots, saucers, vases, pet bowls, unused tires, tire swings, buckets, rain barrels, wheelbarrows, bird baths, non-circulating fountains, toys, garbage cans, hollow uncapped fence posts, landscape drains, clogged rain gutters, and many others. Dumping out, tipping over, covering, screening and/or cleaning up these water collection sources weekly are effective and inexpensive ways to prevent mosquitoes from breeding in them. Environmental management includes steps to prevent water accumulation such as proper storm water management and controlling irrigation to avoid overwatering of the landscape, and vegetation management to reduce emergent vegetation that provides habitat and refuge for mosquito larvae.

2. Biological control entails the use of natural predators, parasites, or pathogens to reduce immature mosquito numbers. The western mosquitofish, *Gambusia affinis*, is the most widely used biological control agent in California. This fish can be placed in standing water sources that cannot be drained and do not connect to waters of the U.S., such as fountains, ponds, and unused pools. The County provides these fish free of charge to residents to prevent mosquito breeding on their property.

3. Mosquito larvicides are products that selectively kill mosquito larvae but are nontoxic to terrestrial insects, fish, mammals, birds, people, or the environment (Attachment C, 5 1). They are applied to sites where mosquito larvae are found or expected to occur, such as tidal marshes. The VCP only uses EPA-registered larvicides. There are several larvicides that are highly specific and thus have minimal impact on non-target organisms. These include microbial control agents, such as *Bacillus thuringiensis israelensis* (Bti) and *Lysinibacillus* (*Bacillus) sphaericus* (Bs), as well as natural insecticides like spinosad that is derived from a microbial fermentation process. Ninety-four to ninety-eight percent of the larvicides that the VCP uses (by weight) are organic registered or have organically viable active ingredients. Other larvicides include insect growth egulators and surface films.

4. Insect growth regulators, such as methoprene, prevent immature mosquitoes from developing into adults and are sometimes used in shallow, standing water sources like shallow ponds and areas subject to periodic flooding. Surface films prevent larvae and pupae from breathing at the surface of the water. They are very effective but may suffocate other surface or breathing aquatic insects; therefore, they are used judiciously and only on small pockets of calm

water. Because larvicides prevent mosquito larvae from becoming adult mosquitoes, their effects at reducing the adult mosquito population are most noticeable several days to weeks after they are applied. During the mosquito-breeding season, aerial applications of larvicide are conducted to mosquito-breeding sites throughout San Diego County that are inaccessible or inefficiently treated by other means. These applications are performed by a contracted helicopter service. Treatments are conducted approximately every three to four weeks from April through October. Application equipment is calibrated by the contractor to assure the delivery of the correct amount of larvicide consistent with label amounts. Aerial application locations and application dates can be found at www.SDFightTheBite.com.

Adult Mosquitoes

When adult mosquito populations must be rapidly suppressed to reduce a condition that may cause an elevated risk to human health, insecticides that kill adult mosquitoes may be used.

Insecticides that kill adult mosquitoes are called "adulticides" and, by nature, are less specific than larvicide products; therefore, whenever possible, they are applied in a restricted manner (limited time and space) to maximize the impact on mosquitoes and minimize the effect on other insects. They are applied as regular or ultralow volume sprays (ULV) that are delivered via ground-based spray equipment (hand-held, backpack, watercraft, or truck mounted spray equipment) or by aircraft. The ULV sprays create microscopic, aerosolized droplets that kill mosquitoes that fly into them. Other adulticide sprays can be applied directly to resting sites to create a barrier so that when mosquitoes land on these areas they absorb the adulticide and are killed. Adulticide products include pyrethrins, which are derived from the chrysanthemum flower, pyrethroids, which are synthetic versions of pyrethrins, organophosphates as well as other products (Attachment C, Table 2).

Additional chemicals that act as synergists with the pyrethrins and permethrins may also be used and have the effect of *lowering* the amount of insecticide needed while *increasing* the efficacy of the treatment. The VCP contracts with a certified pesticide applicator to provide aerial applications of mosquito adulticides for mosquito control, if needed. A link to FAQs regarding adulticides can be found at www.SDFightTheBite.com.

All insecticide applications are performed in accordance with EPA-label instructions in conformance with all environmental and pesticide use laws and regulations and are regulated by the County of San Diego's Department of Agriculture, Weights and Measures - Pesticide Regulation Program.

Public Health & Emergency Declarations

Conditions that rise to a level 3 for WNV or 4 for ATDs and malaria may warrant declaration of a public health crisis, local health emergency (H&S Code S101080), or general local emergency (Gov. Code S8630) to raise awareness (public health crisis) and bring legal and operational resources to protect public health (emergencies) (Association of State and Territorial Public Health Officers). Declaration of a public health crisis is made by a government official and

although has no legal definition or statutory powers it is used to raise awareness of a public health threat that affects many people, threatens health over the long-term, and requires adoption of large-scale solutions. In contrast, a local health emergency is declared by the County Public Health Officer when an imminent and proximate threat of the introduction of infectious disease presents a risk to the public's health. Mutual and state aid (H&S Code § 101085(b)(1)), H&S Code § 101085(b)(2)), respectively), are available during local health emergencies and reimbursement by the State of local costs may be approved by the Governor (H&S § 101085(b)(3)). If a local health emergency persists, it must be renewed every 30 days. A declaration of a general local emergency is made by the County Administrative Officer under conditions of disaster or of extreme peril to the safety of persons and property within the county. Mutual and state aid are available (Gov. Code S8631, 8632, respectively) and County costs may be reimbursable by the State if approved by the Governor (S8633). Extension of a general local emergency must be made after 60 days if the emergency persists. These declarations can be viewed as a spectrum of increasing risk and measures to protect public health. Any declaration will be made in consultation with the Director of the Department of Environmental Health and Quality, the Public Health Officer and as needed the Chief Administrative Officer and must be ratified by the County Board of Supervisors.

Appendix B. Legal Authority for Mosquito Control

The legal authority for the Vector Control Program within the Community Health Division of the Department of Environmental Health and Quality is derived from statutes and regulations in the California Government Code, California Health and Safety Code, California Civil Code,

California Penal Code, San Diego County Code of Regulatory County Ordinances, and the California Environmental Quality Act.

The legal authority of a vector control agency such as routine surveillance, control, and access issues do not require obtaining a permit from regulatory agencies (e.g., California Department of Fish and Wildlife). Under the requirements of the State Porter-Cologne Act and the Federal Clean Water Act, the State Water Resources Control Board is delegated authority for protection of surface and groundwater.
The Vector Control Program is subject to: State Water Quality Order No. 2016-0039-DWQ, General Permit No. 990004; Statewide National Pollutant Discharge Elimination System Permit for Biological and Residual Pesticide Discharges to Waters of the United States from Vector Control Applications. (County of San Diego Vector Control Program enrollee number: 937AP00009).

Statutory Exemptions
Actions in response to an imminent threat to public health, as determined by the County Health Officer (delegated to the Director of Environmental Health and Quality), are exempt from CEQA and other regulatory permits under the Public Resources Code 21080(b)(4). Vector control programs that have entered into a cooperative agreement with the California Department of Public Health (as San Diego County has) and that meet certain requirements are also exempt from certain pesticide-related requirements when applying approved pesticides for vector control purposes. Exemptions include employee certification requirements (but substitute training is required) and certain notification and permitting requirements (however, this plan retains equivalent notification protocols).

- Education Code § 17613;
- Food and Agriculture Code § 11408(e);
- Health and Safety Code §25174.7(a)(3);
- California Code of Regulations, Title 3, sections 6400(c)(2), 6400(e), 6620, 6651, and 6760.

California Government Code

- Title 3, Division 2 – Officers, Part 2, Board of Supervisors; and Chapter 8 Health and Safety, Article 3 Miscellaneous

California Health and Safety Code

- Division 3 – Pest Abatement, Chapter 2, Section 1800;
- Division 3 – Pest Abatement, Chapter 5 Mosquito Abatement Districts, Article 1 General Provisions, Section 2200;
- Division 3 Pest Abatement, Chapter 5 Mosquito Abatement District, Article 4 District Powers;

- Division 13 Housing, Part 1.5 Section 17920.3 Substandard Building Conditions

California Civil Code
- Sections 3479 and 3480

California Penal Code
- Sections 372 and 373 (a)

San Diego County Code of Regulatory County Ordinances
- Title 6 Health and Sanitation Division 4 Disease Control, Chapter 1 General Provisions Nuisances, Sections 64.101-64.106; and
- Division 4 Disease Control, Chapter 2 Mosquitoes and Flies Sections 64.201 *et seq*. Division 4 Disease Control, Chapter 3 Sections 64.301*et seq.*
- Municipal Codes for all 18 incorporated cities within San Diego County (e.g., City of San Diego Municipal Code)

California Environmental Quality Act
- Public Resources Code sections 21000-21004;
- California State CEQA Guidelines, California Administrative Code (Guidelines), sections 15002, 15086, and 15087

Appendix C. Larvicide and Adulticide Products Used by the VCP

Type	Active Ingredient/Product Name	Use/ Action
Larvicide	*Bacillus thuringiensis* subsp. *israelensis* (Bti) Trade names: Vectobac®, Teknar®, Fourstar®	Use: approved for most permanent and temporary bodies of water. Limitations: only work on actively feeding stages. Does not persist well in the water column.
Larvicide	Spinosad (spinosyn A and D compounds derived from a fermentation process by certain microbes) Trade name: Natular®	Use: approved for most water bodies. Good penetration into vegetated areas. Works predominantly on feeding stages. Limitations: limited contact activity unless the extended release form used.
Larvicide	*Lysinibacillus* (*Bacillus) sphaericus* (Bs) Trade name: Vectolex®	Use: approved for most permanent and temporary bodies of water. Limitations: only works on feeding stages. Does not work well on all species. May persist and have residual activity in some sites.
Larvicide	*Bs* and *Bti* combined. Trade name: Vectomax®	Use: approved for most permanent and temporary bodies of water. Limitations: only works on feeding stages. May persist and have residual activity in some sites.
Larvicide	*Bti* and methoprene combined. Trade name: VectoPrime®	Use: approved for most permanent and temporary bodies of water. Effective against all larval instars. Can be used in pre-flood environments and best against single brood.
Larvicide	Methoprene Trade names: Metalarv S-PT, Altosid®	Use: approved for most permanent and temporary bodies of water. Limitations: works best on older instars. Some populations of mosquitoes may show some resistance.
Larvicide	Larvicide oils Trade names: Golden Bear Oil (GB-1111), BVA Chrysalin	Use: ditches, dairy lagoons, floodwater. Effective against all immature stages, including pupae. Limitations: consult the California Department of Fish and Wildlife for local restrictions.
Adulticide	Pyrethrins (pesticides containing natural pyrethrins) Trade names: Pyrenone®, Pyrocide®	Use: wetlands, floodwater, residential areas, some crops. Limitations: do not apply to drinking water, milking areas; may be toxic to bees, fish, and some wildlife. Some formulations with synergists have greater limitations.

Adulticide	Pyrethroids - synthetic pyrethrin products containing resmethrin, sumithrin, prallethrin, lambda-cyhalothrin, deltamethrin, or permethrin Trade names: Scourge, AquaDUET®, Demand® CS, DeltaGard®, AquaReslin®, Suspend SC®	Use: all non-crop areas including wetlands and floodwater. Limitations: may be toxic to bees, fish, and some wildlife; avoid treating food crops, drinking water or milk production.

Appendix D. Glossary

AEDES	*Aedes aegypti, Aedes albopictus, Aedes notoscriptus, invasive Aedes mosquitoes*
ATD	*Aedes-transmitted disease*
BS	*Lysinibacillus (Bacillus) sphaericus*
BTI	*Bacillus thuringiensis* subsp. *israelensis*
CCR	California Code of Regulations
CDC	Centers for Disease Control and Prevention
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CHD	Community Health Division
CMR	Confidential Morbidity Report
DART	UC Davis Arbovirus Research and Training laboratory
DEHQ	Department of Environmental Health and Quality
EIA	Enzyme-linked immunoassay
EPA	Environmental Protection Agency
FAQ	Frequently Asked Questions
HHSA	Health and Human Services Agency
IFA	Indirect fluorescent antibody
IPM	Integrated Pest Management
MIR	Minimum infection rate
MLE	Maximum likelihood estimate
NPDES	National Pollutant Discharge Elimination System
PHL	Public Health Laboratory
PHO	Public Health Officer
PHS	Public Health Services
PRNT	Plaque reduction neutralization test
RT-PCR	Reverse transcription polymerase chain reaction
SDCCAO	San Diego County Code of Administrative Ordinances
SLEV	Saint Louis Encephalitis virus
SWRCB	State Water Resources Control Board
ULV	Ultralow volume insecticide spray or mist
VCT	Vector Control Technician
VCP	Vector Control Program
VDDL	Vector Disease and Diagnostic Laboratory
VRDL	Viral and Rickettsial Disease Laboratory
WALS	Wide Area Larviciding
WEEV	Western Equine Encephalitis virus
WNCH	West Nile virus case history
WNV	West Nile virus

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