# 2017 ANNUAL REPORT

CONTRA COSTA
MOSQUITO
&VECTOR
CONTROL
DISTRICT

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# *Principles*

## Vision

Healthy people who can live, work, and play in a healthy environment

## Mission

To protect and promote public health and welfare through integrated vector management services and programs utilizing best management practices and least toxic components by:

### Community Value

Providing essential services to prevent, detect, and suppress public health pests, and to reduce the risk of vector-borne disease transmission to the people who live, work or play within the county

### Service Area

Serving all of Contra Costa County

### Public Confidence

Delivering accessible, accountable, efficient, transparent and cost-effective services

### Public Relations

Working closely with all constituents, private and public, to ensure prompt delivery of accurate information, to raise public awareness, and to develop relationships that promote healthy living

### Environmental Commitment

Meeting or exceeding federal, state, and local environmental standards, practicing responsible environmental stewardship, enhancing value of wetlands, and considering relevant environmental factors as an integral component of mosquito and vector control

### Research

Investigating environmental concerns and developing and/or testing new materials, methods and technologies to ensure quality control oversight on all services and programs, while anticipating resurgent and/or newly introduced vectors or vector-borne diseases

### Interagency Relations

Integrating and communicating District programs and services with other public agencies to ensure cooperative, cohesive, and innovative program delivery

# 1927-2017 90 Years of Service


## History

As early as 1772, hordes of mosquitoes welcomed the first Europeans as they explored the San Francisco Bay Area. According to the explorers' travel log, they saw few signs of indigenous people in the area. It would soon become clear the Native Americans avoided the mosquito infested area.

More than 100 years later, thousands of men were dying of an unknown illness while working on the construction of the Panama Canal. In 1897, British officer Ronald Ross discovered mosquitoes transmit malaria parasites and in 1900, Dr. Walter Reed and his associates confirmed Carlos Finlay's hypothesis of mosquitoes as the vector (carrier) of yellow fever. These discoveries were important to the workers of the Panama Canal, as well as Californians who had contracted malaria. Scientific research proved mosquitoes are not only a nuisance, they can also carry the causative agents of diseases.

In California, mosquito abatement activities in the early 1900s focused on controlling the mosquito that carries malaria parasites and reducing the numbers of nuisance salt marsh mosquitoes. Before 1915, mosquito control in the state was financed by subscription and donation. In 1915, the State Legislature passed a bill that was signed by the governor to provide for the formation, organization, and financing of mosquito abatement districts. Noble Stover, manager for both Marin County Mosquito Abatement District and Three Cities Mosquito Abatement District in San Mateo County coauthored the Act.

Quite often, schools in Contra Costa County had to be closed, waterfront industry was periodically shut down, and recreational areas were abandoned, all due to salt marsh mosquitoes. Periodically, citizens of Pittsburg lined the street curbs with smudge pots (pots that release smoke) in an attempt to drive the mosquitoes away. Realtors found it difficult to attract home buyers into mosquito-infested neighborhoods. As a result of the mosquito activity, Contra Costa County citizens, together with several waterfront industries, formed a committee in 1926 to address the need for mosquito control.

In 1926, Stover directed the first operations of Contra Costa Mosquito Abatement District (CCMAD #1), concurrently with his duties in Marin and San Mateo Counties. The District's main purpose was to control marsh mosquitoes in north central Contra County. CCMAD #1 was formed and work began on

April 15, 1927. The District, with two employees, began various engineering projects near the cities of Martinez, Concord, and Pittsburg. Much of the work was contracted out to dredging and construction companies. The District contracted with Delta Dredging Company to excavate ditches at the cost of $5 per hour. The District supplemented the program by spraying standing water with light oil, such as stove or diesel oil to kill the mosquito larvae. They also stocked various sources with mosquitofish.

Stover was a pioneer in drainage and engineering methods, which were his primary approaches to controlling salt marsh mosquitoes. Many of those early projects still exist and are functional now more than 90 years later. Stover served as manager/engineer for CCMAD #1 until his death on September 17, 1935. Ernest Campbell, who had worked for the District since its inception, was appointed manager/engineer by the Board of Trustees.

In the summer of 1930 there was an outbreak of a horse plague in the San Joaquin Valley that resulted in the death of 3,000 horses. In 1933, it became known that mosquitoes could transmit what is now called Western equine encephalomyelitis (WEE). In 1938, a human case of WEE infection was confirmed. Human cases of another virus, St. Louis encephalitis (SLE), were isolated in California in 1938 as well. Before the early 1940s, people thought that it was only *Aedes* mosquitoes that transmitted disease. In 1941, *Culex tarsalis* mosquitoes were found to transmit the encephalitis virus.

Until 1941, the District's jurisdiction only covered the waterfront and marsh areas from Martinez to Antioch. On November 25, 1941, the communities of Saranap, Danville, and the City of Walnut Creek petitioned the CCMAD #1 Board of Trustees, requesting annexation into the District. Annexation took place on December 19, 1941. In November 1943, CCMAD #1 annexed the area comprising the Lafayette and Orinda School Districts upon their request. Oak Grove School District was annexed in July 1946 upon their request. In the midst of these events, and while serving as manager/engineer for CCMAD, Ernest Campbell, helped found and manage Northern San Joaquin Mosquito Abatement District.

*Mosquito Spraying in Contra Costa County. Date unknown.*

At this time, other portions of Contra Costa County were also in need of mosquito control, which led to the formation of CCMAD #2, CCMAD #3, and Antioch-Live Oak MAD. Under Ernest Campbell's leadership and the Board of Trustees, CCMAD #1 merged with Antioch-Live Oak MAD, CCMAD #2, and CCMAD #3 in December of 1952. As of January 1953, CCMAD #1 provided mosquito control for the communities of Orinda and Port Costa in the west to the Antioch-Live Oak school District in the east, an area of 509 square miles.

Mosquito control was established in the eastern portion of Contra Costa County by the formation of the Diablo Valley Mosquito Abatement District (DVMAD) in 1952. The Diablo District was 136 square miles in size and encompassed the communities of Oakley, Brentwood and Byron. The Diablo District's headquarters was located in the community of Brentwood. The primary purpose of creating DVMAD was for the control of pasture and irrigation mosquitoes. Diablo Valley MAD came into existence in time for the largest human outbreaks of WEE the state had been known to experience. In 1952, there were 375 human cases of WEE and 45 human cases of SLE in California. There were eight reported human cases of WEE in Contra Costa County that same year.

In the 1940s and 1950s, with the introduction of broad spectrum chemicals such as DDT the District changed to other strategies to control mosquitoes in the county. A "flit gun" was used to create a pesticide fog to kill adult mosquitoes. Jeeps were used to gain access to hard-to-reach areas and aircraft were used to spray large areas that were producing mosquitoes. The District hired its first entomologist, James Mallars, in 1952 and soon expanded its focus from mosquito control of the marshes to include treatment of creeks as well. In 1956, the District treated 1,080 miles of creeks at a cost of approximately $5.10 per mile. By the late 1950s, the District began to see mosquitoes develop resistance to DDT.

From 1945 to 1957, CCMAD #1 retained a commercial telephone answering service, utilized part-time secretarial service, owned limited yard facilities for automotive and other equipment, and raised mosquitofish on Berrellessa Street in Martinez. In 1955, the District purchased approximately one acre of land on Concord Avenue in Concord and embarked on building its new headquarters, which opened in January 1957. Prior to that time, the District office was located in various managers' homes from 1927 until 1957. The Board of Trustees held their board meetings at one of the local oil refineries until the completion of the new headquarters.

*A mosquito and vector control technician monitors mosquitofish. Date unknown.*

Contra Costa County in the 1950s was primarily a rural county with commercial rabbitries, poultry ranches, stables, cattle ranches, and orchards. In April of 1955, CCMAD #1 expanded its program to include fly control. This was the first time CCMAD #1 officially sought to control a disease vector other than mosquitoes. On occasion, the District would also remove or destroy bee hives.

In 1959, the employees joined the County Employees Association. From that date to the present, the District's field employees have been represented by Associations or Public Employee Unions.

In the 1960s, in response to DDT resistant mosquitoes, CCMAD #1 switched to organophosphate pesticides as the primary method for control of mosquitoes. By the 1970s, mosquitoes were beginning to show resistance to these pesticides as well.

Contra Costa County had its most recent reported human cases of SLE in 1967 and WEE in 1968. The District continued an active source reduction program into the 1970s. In 1970, the District started treating non-structural yellowjacket nests located underground.

Ernest Campbell retired in March of 1966. In July of 1966, John Brawley became the new manager. Under John Brawley's tenure the District annexed the Western portion of the county in June of 1969. Before June 1969, West County, which included the City of Richmond and the communities of El Cerrito, Kensington, San Pablo, El Sobrante, Pinole, Hercules, and Crockett, had no organized mosquito control. In the 1930s, however, some ditching was conducted in the Richmond marshes under the supervision of Harold Gray, the manager of Alameda Mosquito Abatement District. John Brawley retired in September 1976.

Brawley's replacement was Brad Anderson who became manager in November of 1976. During Anderson's tenure, California passed Proposition 13, which reduced residential, business and farming property taxes and resulted in reduced funding for mosquito abatement districts throughout the state. CCMAD #1 lost 50 percent of its revenue. In response, the District's Board of Trustees laid off 13 of the 21 full-time employees in November of 1978. Brad Anderson chose to resign so that his position and the entomologist's position could be combined. Charles Beesley, Ph.D., who was already employed by CCMAD #1 as the entomologist, became the new manager. The Board of Trustees chose to cease fly control and only continue mosquito and yellowjacket control. The District's source reduction program also ended at this time and equipment was sold to keep the District afloat. After Proposition 13, there were only four of 14 field personnel retained.

## Timeline

Early in the century, Northern California suffered through epidemics of encephalitis and malaria, diseases transmitted by mosquitoes. At times, parts of Contra Costa County were considered uninhabitable, with waterfront areas and schools shut down during peak mosquito seasons.

1926 - mosquito control committee formed by Contra Costa County citizens and several waterfront industries

March 31, 1927- Contra Costa Mosquito Abatement District (CCMAD) began operations in Martinez

1950s - CCMAD began using mosquitofish as biological control of mosquitoes

January 15, 1957 - CCMAD relocated to Concord

July 1, 1970 - CCMAD annexed to West County

1970 - CCMAD began treating ground-nesting yellowjacket nests

July 1, 1986 - CCMAD consolidated with east county to become countywide

1986 - CCMAD expanded services by conducting field surveys and testing ticks for Lyme disease

1993 - the District added the rodent control and rabies risk reduction programs previously operated by the county Environmental Health Department. Name changed to Contra Costa Mosquito & Vector Control District

1997 - the District began the Africanized Honey Bee ("killer bee") response program

2004 - West Nile virus detected for the first time in dead birds in Contra Costa County

2005 - First West Nile virus human case in Contra Costa County

2006 - Two residents die from West Nile virus in Contra Costa County

Today, the District services 736 square miles in Contra Costa County.

*In 1986,* CCMAD #1 and DVMAD merged to create one countywide agency, Contra Costa Mosquito Abatement District (CCMAD). In 1988, CCMAD purchased land on Mason Circle in Concord and built a new facility that included a greenhouse for mosquitofish rearing. The District began modernizing its equipment with the purchase of new vehicles, modern spray equipment, and eight-wheel all-terrain vehicles. The work that took 16 field employees before Proposition 13 (including DVMAD) was now being done by nine. The District expanded services by conducting field surveys and testing the *Ixodes pacificus* tick for the Lyme disease spirochete. Research projects on wetlands were also initiated to determine ways to eliminate mosquito production and enhance wildlife habitat in the county.

In 1993, Contra Costa County transferred its rat and rabies risk reduction programs to CCMAD. Along with the programs, three employees and equipment were transferred to CCMAD from the county. Subsequently, the District changed its name to Contra Costa Mosquito & Vector Control District (District). In 1993, the District's mosquito arbovirus surveillance program detected WEE in sentinel chickens and in mosquitoes collected in Contra Costa County. No human cases were reported. Surveillance and control of *Culex tarsalis* mosquitoes once again became the District's primary focus. In the spring of 1994, the District purchased a custom built landing craft from a boat builder in Seattle, Washington. The landing craft could transport all-terrain vehicles, which allowed for regular inspection and treatment of islands in the Sacramento and San Joaquin Rivers.

In 1993 and 1994, the state of California took 40 percent of the District's property tax revenues to be used to balance the state budget. District leadership and the Board of Trustees made sure the District was financially prepared for this event and enacted a county parcel fee to replace the local property tax revenues that the state had taken.

The District was able to continue tick surveillance and Lyme testing while the mosquito control program relied more on "biorational" methods (biopesticides and mosquitofish) that have minimal environmental impact. The District was viewed as a leader regarding wetland restoration, protection of endangered species and the environment. In 1996, the District received an Environmental Achievement Award in marsh management. Due to changing legislation (Proposition 218), the District anticipated the loss of its parcel fee that originated in 1993 and established a benefit assessment fee to ensure sufficient operating funds in 1996 and beyond.

In 1999, West Nile virus (WNV) was first detected on the East Coast of the United States. The District began preparing for its eventual migration into California.

In 2001, after 27 years of distinguished service, General Manager Charles Beesley, Ph.D., retired. The building at 155 Mason Circle in Concord was dedicated in his honor. Assistant Manager Craig Downs was promoted to general manager. Downs began his career at the District as a vector control technician in 1981, advanced to biologist, superintendent, and assistant manager prior to his appointment to general manager.

By 2003, WNV reached California. The District detected WNV in Contra Costa County for the first time in 2004 in dead birds submitted for testing. The first human cases appeared in 2005. The virus was also detected that year for the first time in mosquitoes. To date, every year since 2005, WNV has been detected in the county with several human cases. In 2006, two people died from the virus.

In 2017, Craig Downs retired after 36 years with the District and Paula Macedo, DVM, Ph.D., became the District's general manager. Prior to the District, Macedo was the laboratory director of the Sacramento -Yolo Mosquito & Vector Control District. She is a Doctor of Veterinary Medicine and holds a Ph.D. in entomology from the University of Nebraska.

Today, District employees continue to serve and protect the public by monitoring and controlling vectors of disease in Contra Costa County. For 90 years, the District has remained steadfast in protecting public health from vector-borne diseases.

*Vector Control Inspector Chris Doll conducts surveillance in a marsh.*

# Contra Costa Mosquito & Vector Control District

155 Mason Circle
Concord, CA 94520
925-685-9301
www.ContraCostaMosquito.com

# Personnel

## Administration

General Manager: Paula Macedo, DVM., Ph.D.

Assistant Manager: Ray Waletzko

Accounting & Benefits Specialist: Tina Cox

Administrative Secretary: Natalie Jones

## Laboratory

Scientific Program Manager: Steve Schutz, Ph.D.

Vector Ecologist II: Eric Ghilarducci

Vector Ecologist: Damien Clauson

Biologist/Fish Program: Chris Miller

## Public Affairs

Public Affairs Manager: Deborah Bass

Community Affairs Representatives:
Andrew Pierce
Nola Woods

## Shop & Facility Maintenance

Mechanic II: Tom Fishe

## Information Technology

IT Systems Administrator: Wayne Shieh

## Operations

### Mosquito Control Operations
Program Supervisor: Sheila Currier

*Inspectors*:
Lawrence Brown
Josefa Cabada
Felipe Carrillo
Jeremy Tamargo
David Wexler
Brandon French

### Mosquito Control Operations
Program Supervisor: Greg Howard

*Inspectors*:
Reed Black
Tim Mann
Patrick Vicencio
Christopher Doll

*Technicians*:
Shaun Redman
Miaja McCauley

### Vertebrate Vector Control Operations
Program Supervisor: Jonathan Rehana

*Inspectors*:
Joe Cleope
Jason Descans
Steve Fisher
Dave Obrochta
Danielle Wisniewski

Vector Control Planner: Jeremy Shannon

# Independent Special District Classification

The Contra Costa Mosquito & Vector Control District is classified as an independent special district and is *not* part of Contra Costa County's governmental system. Contra Costa County encompasses the District's physical jurisdiction for mosquito and vector control. Special districts are:

- Formed by local residents to provide local services
- Sanctioned by the State of California Government Codes
- Often the most economical means of providing public service
- Independent agencies governed by a board of trustees
- Operated as non-profit organizations
- Responsible directly to the people
- Accountable - Accessible - Efficient

# Board of Trustees

**Standing Left to Right:** Randall Diamond, Danville; Robert Lucacher, Moraga; James Murray, Walnut Creek; Daniel Pellegrini, Martinez; Peter Pay, San Ramon; Richard Ainsley, Ph.D., Pittsburg; Jim Fizsimmons, Lafayette; Richard Means, Pleasant Hill; and Michael Krieg, Oakley

**Kneeling/Seated:** Chris Cowen, Contra Costa County; H. Richard Mank, Secretary, El Cerrito; Perry Carlston, Concord; Diane Wolcott, Orinda; Peggie Howell, President, Clayton; Sohelia Bana, Ph.D., Richmond; and Darryl Young, Contra Costa County

*Not pictured: Warren Clayton, Vice President, Pinole; James Pinckney, Contra Costa County; Lola Odunlami, Antioch*


Ray Waletzko, Assistant Manager; Paula Macedo, DVM, Ph.D., General Manager; Sheila Currier, Program Supervisor; Natalie Jones, Administrative Assistant; Jeremy Shannon, Vector Control Planner; Andrew Pierce, Community Affairs Representative; Nola Woods, Community Affairs Representative; Deborah Bass, Public Affairs Manager; Wayne Shieh, IT Systems Administrator; Damien Clauson, Vector Ecologist; Tina Cox, Accounting/ Benefits Specialist; and Steve Schutz, Ph.D., Scientific Program Manager

*Not pictured: Eric Ghilarducci, Vector Ecologist II; Chris Miller, Biologist; Jonathan Rehana, Program Supervisor; and Greg Howard, Program Supervisor*


Patrick Vicencio, VCI; Shaun Redman, VCT; Christopher Doll, VCI; Tom Fishe, Mechanic II; Steve Fisher, VCI; Lawrence Brown, VCI; David Wexler, VCI; Miaja McCauley, VCT; Joe Cleope, VCI; Josefa Cabada, VCI; Danielle Wisniewski, VCI; Felipe Carrillo, VCI; Reed Black, VCI; Brandon French, VCI; and Tim Mann, VCI

*Not Pictured: Jason Descans, VCI; Jeremy Tamargo, VCI; and Dave Obrochta, VCI*

## Service Area

The District's service area encompasses Contra Costa County, California, and the islands pertaining to the Military Ocean Terminal Concord that are in Solano County. In addition, the District can take action in bordering areas of Solano County, Sacramento County, San Joaquin County, or Alameda County if needed to provide control of mosquitoes or other vectors for residents of Contra Costa County [California Health & Safety Code Section 2270]. Areas covered by the program include:

1. The incorporated cities of Antioch, Brentwood, Clayton, Concord, Danville, El Cerrito, Hercules, Lafayette, Martinez, Moraga, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, and Walnut Creek

2. The unincorporated areas of Contra Costa County

3. Those portions of the Concord Naval Weapons Stations that lie outside Contra Costa County (Roe, Ryer and Seal Islands and three small unnamed islands)

4. Other bordering areas in Solano, Sacramento, San Joaquin, or Alameda Counties

### Surrounding Land Uses

The service area, which is essentially within the borders of Contra Costa County, has a diverse set of land uses and environmental settings. The District divides the service area into four regions, corresponding roughly to the pattern of vector production found in each. East County is generally hot and dry, with land use dominated by agriculture and residential communities. North County includes the coastal marshlands, the established port and industrial cities from Martinez to Antioch. West County, like the north, includes coastal areas, older cities, and parklands, but is generally cooler and wetter. South Central Contra Costa, on the other hand, is generally warm and dry, with land use dominated by moderate to low-density housing mixed with open space, including some grazing areas, woodlands, and intermittent creeks.

Mosquito production is associated with standing water of all types and sizes. This includes marshes, ponds, creeks, seasonal wetlands, wastewater ponds, storm-water detention basins, irrigated pastures, duck clubs, etc., as well as individual homes and commercial buildings. Other vectors, especially rats, inhabit an even wider range of natural settings, as well as virtually all types of structures. Because of the diversity of mosquito and other vector habitats, almost all land use categories in the District's service area may be affected by the District's efforts.

### Other Public Agencies Providing Oversight

The District's integrated vector management program as a whole, including the certification and continuing education of state-certified personnel, is reviewed, approved, and renewed annually by the California Department of Public Health through a formal cooperative agreement.

For work on state lands and riparian zones, wetlands or other sensitive habitats, the District coordinates and reviews activities with the California Department of Fish and Wildlife and the California State Lands Commission as Trustee Agencies.

To ensure full compliance with CEQA (California Environmental Quality Act), the District's Board of Trustees completed a full Programmatic Environmental Impact Report in January 2016.

For chemical control activities, the District reports to and is reviewed, at least annually, by the Contra Costa County Agricultural Commissioner.

The District also reports pesticide applications to 'Waters of the U.S.' annually to the State Water Resources Control Board, as required under the District's NPDES (National Pollutant Discharge Elimination System) permit.

# Programs & Services

The District exists to reduce the risk of vector-borne disease or discomfort to the residents of Contra Costa County. The California Health and Safety Code defines a vector as "any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal".

Most vectors are extremely mobile and can cause the greatest hazard or discomfort away from their breeding site. Each potential vector has a unique life cycle and occupies a specific habitat.

**Most District programs and services are funded by tax dollars and are therefore provided at no additional charge.**

The District undertakes activities through its integrated vector management program to control the following vectors of disease and/or discomfort:

## Mosquitoes

Contra Costa County is home to 23 different species of mosquitoes that inhabit diverse ecological regions that create a range of mosquito sources. The District regularly surveys more than 10,000 acres of marshland along the waterfront, acres of irrigated farmland in the eastern portion of the county, and numerous ponds, creeks and residential sources countywide.

Mosquitoes can transmit the pathogens that cause a variety of diseases including West Nile virus (WNV). Certain species of mosquitoes found in Contra Costa County can transmit malaria, WNV, SLE, WEE, and potentially other encephalitis viruses. Another species of mosquitoes is also capable of transmitting dog heartworm.

In addition to the ability to transmit disease, mosquitoes can cause human discomfort when the female mosquito bites to obtain blood. Physical reactions range from irritation in the area of the bite to severe allergic reactions or secondary infections resulting from scratching the irritated area. Additionally, an abundance of mosquitoes can cause economic losses, and loss of use or enjoyment of recreational, agricultural or industrial areas.

Upon request for service, District employees inspect residential and commercial properties for mosquito problems and provide recommendations for controlling mosquito populations. District technicians and inspectors are certified through the Vector Control Certification Program of the California Department of Public Health. When a homeowner provides a mosquito sample, which consists of a dead mosquito saved in a clear plastic bag or taped onto a piece of paper, the District employee can identify the mosquito species, and possible breeding locations.

## Rats & Mice

Two introduced species of rats—the Norway rat and the roof rat—and the house mouse are present in Contra Costa County and are subjects of District action. In addition to being unsanitary, rats and mice can transmit a variety of organisms that can infect humans.

Rats are hosts to the worm that causes trichinosis in humans. Humans may become infected when they eat poorly cooked meat from a pig that has eaten an infected rat. Rat and mouse urine may contain the bacteria that cause leptospirosis, and their feces may contain Salmonella bacteria. Bubonic plague and murine typhus may be transmitted by infected rat fleas. Rat bites may cause bacterial rat-bite fever or infection. Gnawing by rats and mice causes damage to woodwork and electrical wiring, resulting in damaged circuits and potential fires. Additionally, an abundance of rats and mice can cause economic losses, loss of use of public recreational areas and loss of the enjoyment of property.

Homeowners, business owners or any group in Contra Costa County can request a site visit to assist them with rat and mouse issues. District services include rat and mouse identification and advice for prevention and control. District employees do not bait nor set traps, but provide valuable, detailed information, guidance and recommendations. They may also issue a formal, detailed report, upon request.

## Skunks

One of the primary reservoirs and vectors of rabies in California is skunks. Because of extensive residential development near natural areas and their ability to live in close proximity to people, skunks pose a potential health risk.

In an effort to reduce risk of rabies transmission by reducing potential contact/conflicts between humans and skunks, the District works with homeowners to discourage skunks from visiting their property. District employees survey properties, provide guidance and recommendations and may warrant live catch skunk traps if a skunk has created a den and is actively living on private property. Typically, an active skunk den may be found under a deck, shed, house or wood pile.

## Yellowjackets

Yellowjackets are beneficial insects that eat garden pests and complete incidental pollination of crops through daily foraging; however, ground-nesting yellowjackets can bite, have a painful sting, can fly moderate distances, and are found throughout Contra Costa County. A single nest can lead to loss of use of public recreational areas, and loss of the enjoyment of property. More significantly, yellowjacket stings can result in anaphylactic shock and rapid death for the approximately 0.5 percent of the public with severe allergies.

The District provides extermination of ground-nesting yellowjackets only. Ground-nesting yellowjackets typically build nests in areas such as abandoned rodent burrows, the hollow areas near the root systems of shrubs, under railroad ties or under wood piles. Residents must locate and mark the nest before contacting the District for service. This can be achieved by pointing a garden tool, or identifying the site with a marker (small sign, tool, garden glove, etc.). The District also asks residents to provide a simple map of the location to assist the District employee with properly locating the nest. The District does not provide a service for other species of yellowjackets, nor those that make their nest on or in structures.

## Ticks

There are four common species of human-biting ticks in Contra Costa County. Of these four, only the Western black-legged tick (*Ixodes pacificus*) is known to transmit Lyme disease in California.

The District provides tick identification services to the public and medical personnel. People who are concerned about possible Lyme disease infections should contact their physician. Information on Lyme disease testing of ticks may be found by visiting Lyme disease Q & A**.** Several commercial laboratories will test ticks for Lyme disease for a fee. Visit Tick Testing Labs for more information.

## Public Information & Education

The Public Affairs Department employees work closely with residents and the media to inform and educate about important health topics. Staff members provide general and tailored presentations to various groups of 12 or more adults or school children. Public Affairs personnel also write articles, create videos, participate in social media interaction, and provide information at events, workshops, and community discussions.

## Africanized Honey Bees

Africanized honey bees (AHBs) were first detected in California on October 24, 1994 and were detected and successfully intercepted in Contra Costa County (Crockett) in 1997 and 2008.

AHBs are not known to transmit disease and are no more venomous than European honey bees (EHBs); however, AHBs respond to threats more rapidly than EHBs and will defend their hive with greater numbers of bees which could result in an increased number of stings to an individual. Although people have died as a result of 100 - 300 stings, it is estimated that the average lethal dose of venom for an adult human is 1,100 bee stings.

Average reaction to a bee or wasp sting includes redness, itching, swelling, and pain at the site of the sting. Some individuals are allergic to all bee and wasp stings. Allergic reactions may include swelling of an entire extremity, abdominal cramps, vomiting, diarrhea, upper respiratory distress, and constriction of the throat and chest. Bee stings, like yellowjacket stings, can result in anaphylactic shock and death within 15 to 30 minutes for the approximately 0.5 percent of the public with severe allergies.

District services for bees are very limited. The District does not respond to bee stinging incidents. District employees treat bee swarms or hives that are a threat to people in public areas such as a school or shopping center. The District does not treat bee hives that are in or on a structure or on private property. The District does not determine if bees are Africanized or European.

## Other Animals of Importance

Although certain animal and insect species such as bats, ground squirrels, fleas, and opossums are not regularly controlled by the District, these animals play important roles in the transmission of rabies, plague, murine typhus, Hantavirus, or Lyme disease and may be surveyed for diseases. The District may provide education and consulting services to the public about disease risk associated with these vectors and appropriate measures to protect human health.

In extreme cases where the transmission of disease is likely, as with the other District integrated vector management activities, control efforts may be employed. Control of these animals is done in consultation with the California Department of Public Health, Contra Costa County Department of Health Services, Contra Costa County Animal Control Department, Contra Costa County Agricultural Commissioner's Office and other state and local agencies.

# Integrated Vector Management

Mosquito and vector control is based on scientifically planned management tactics and control strategies that reduce the abundance of target pests in a timely manner. Integrated vector management (IVM) is a comprehensive program that incorporates several coordinated activities:

- **Vector Surveillance —** Investigating vector populations, vector habitats, disease pathogens, and public distress including trapping and laboratory analysis of vectors to evaluate populations and disease threats, direct visual inspection of known or suspected vector habitats, the use of all-terrain vehicles, maintenance of paths, and public surveys
- **Physical Control** — Managing vector habitat, especially through vegetation management, water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities
- **Public Education —** Encouraging and assisting reduction or prevention of vector habitats on private and public property through shared information
- **Biological Control** — Rearing, stocking, and providing to the public the "mosquitofish" *Gambusia affinis;* and possibly using other predators or pathogens of vectors
- **Chemical Control —** Applying bacterial products and non-persistent selective insecticides to reduce populations of larval or adult mosquitoes and other invertebrate threats to public health, and rodenticides to control rats and other rodent threats to public health
- **Trapping**—Trapping and euthanizing skunks that pose a threat to public health and welfare

The IVM program of the Contra Costa Mosquito & Vector Control District is an ongoing program of surveillance and control of mosquitoes and other vectors of human disease and discomfort. The following information details the District's IVM program activities:

## VECTOR SURVEILLANCE

The District's responsibility to protect public health and welfare involves monitoring the abundance of vectors, vector habitat, vector-borne pathogens, and interactions between vectors and people over time and space. Collectively, these monitoring activities are termed vector surveillance.

Vector surveillance provides the District with valuable information on what vector species are present or likely to occur, when they occur, where they occur, how many there are, and if they are carrying disease or otherwise affecting humans. Vector surveillance is critical to an IVM program because the information it provides is evaluated against treatment criteria to decide when and where to institute vector control measures. Equally important is the use of vector surveillance in evaluating the efficacy, cost effectiveness, and environmental impacts of specific vector control actions.

The District routinely uses a variety of tools and methods to conduct vector surveillance including specialized traps to collect adult mosquitoes, regular field investigation of known vector sources, flocks of sentinel chickens to detect arboviruses, public service requests for vertebrate pests, adult mosquitoes, and other insect pests; and low ground pressure all-terrain vehicles to access these potential vector sites.

The District's vector and disease surveillance activities are conducted in compliance with accepted federal and state guidelines. These guidelines recognize that local conditions vary, and are thus flexible in the selection of specific application methods.

## PHYSICAL CONTROL (HABITAT MODIFICATION)

Physical changes to the land can reduce mosquito production directly by improving water circulation or drainage. Mosquito production can also be reduced indirectly by improving habitat values for predators of larval mosquitoes, including fish and many invertebrates, or by otherwise reducing a site's habitat value for mosquito larvae.

The District achieves physical control through dredging, installation of culverts, alternative engineering works, or the use of herbicides. The use of herbicides can improve access to standing water for inspections and treatment. Herbicides are applied in strict conformance with label requirements.

The District advises property owners on physical control methods and encourages them to complete habitat modification in accordance with all appropriate environmental regulations (wetland fill and dredge permits, endangered species review, water quality review, etc.), and in a manner that generally maintains or improves habitat values for desirable species.

## BIOLOGICAL CONTROL

Mosquitofish (*Gambusia affinis*) are used throughout the world for effective mosquito control. The District uses mosquitofish in some types of mosquito larval habitat to provide biological control of mosquitoes through direct predation of larvae. They are capable of eating large numbers of mosquito larvae daily.

Fish stocking conducted by District personnel complies with strict guidelines designed to ensure that no significant impacts can occur to native species. The District also provides mosquitofish from the District's office to county residents for use in private ponds, horse troughs, non-maintained swimming pools and spas, rain barrels, and other water features. As mosquitofish are not native

to California, District staff are conducting research on several native fish species as alternative biological control agents.

## CHEMICAL CONTROL

### MOSQUITO LARVICIDES

District staff applies public health pesticides to the site in strict accordance with each pesticide label instructions. Depending on time of year, water temperature, organic content, mosquito species present, larval density, proximity to human settlements, presence of predators, and other factors, pesticide applications may be repeated at any site at recurrence intervals ranging from weekly to annually.

The District uses several natural bacterial products for control of larval mosquitoes. These include *Bacillus thuringiensis israelensis* (*Bti*), a bacterium that is ingested by larval mosquitoes and disrupts their gut lining, leading to death before pupation. *Bti* is applied by the District as a liquid or bonded to inert substrate (sand, corn cob granules) to assist penetration through vegetation. Persistence is low in the environment and efficacy depends on careful timing of application relative to the larval growth stage. Therefore, use of *Bti* requires frequent inspections of larval sources during periods of larval production, and may require frequent applications of material. Application can be by hand, All-terrain vehicle (ATV), helicopter, or airplane.

*Bacillus sphaericus* (*Bs*) is similar to *Bti*, but has the additional capability of natural re-cycling, providing a longer duration of control. *Bti* and *Bs* have very low toxicity to non-target organisms. Spinosad is a bacterial fermentation product which acts on the nervous system of mosquito larvae and is available in several liquid and solid formulations.

Chemical larvicides routinely used by the District include Methoprene, larvicidal oils, and monumolecular films. Methoprene, is a synthetic insect hormone designed to disrupt the transformation of a larval mosquito into an adult. It is applied either in response to observed high populations of mosquito larvae at a site, or as a sustained-release product that can persist for up to about four months. Application can be by hand, ATV, helicopter, or airplane. While highly effective against mosquitoes, it has very low toxicity to non-target organisms.

Larvicidal oil is a petroleum distillate (mineral oil) with low toxicity to plants and fast environmental breakdown that forms a thin film on water and kills larvae through suffocation and/or direct toxicity. It is typically applied by hand, ATV, or truck. Unlike most other larvicides, this material is also effective against mosquito pupae. Monomolecular (one molecule thick) surface film larvicides, comprised of ethoxylated alcohol, work by disrupting the surface tension of water, preventing mosquito larvae and pupae from being able to remain at the surface to breathe air. Sustained winds tend to disrupt the film, so this material is most useful in enclosed areas like swimming pools and other artificial containers.

### MOSQUITO ADULTICIDES

In addition to chemical control of mosquito larvae, the District also makes aerosol ultra low volume applications of pesticides for control of adult mosquitoes if specific criteria are met, including species composition, population density (as measured by landing count or other quantitative method), proximity to human populations, and/or human disease risk. As with larvicides, adulticides are applied in strict conformance with label requirements. Adulticides currently used by the District include natural Pyrethrins (derived from chrysanthemum flowers) and the synthetic pyrethroid Etofenprox. Pyrethrin products also contain the synergist Piperonyl butoxide (PBO) which improves their effectiveness against adult mosquitoes while reducing the amount of active ingredient needed and the potential for development of resistance. Both materials are applied as ultra-low-volume (ULV) spray by truck or potentially by aircraft. In addition to having low toxicity to humans, these materials are applied in very small amounts (approximately 1 oz. to 2 oz. of active ingredient per acre) and are non-persistent (break down rapidly in sunlight). Applications are generally conducted at night or before dawn, when the target mosquitoes are most active, but exposure of bees and other nontarget organisms would be minimized.

Naled is an organophosphate material which the District may use for direct control of adult mosquitoes. Naled can be used in the event that mosquito populations in our area develop significant resistance to other adulticides.

### OTHER INSECTICIDES

In addition to direct chemical control of mosquito populations, District employees also apply insecticides to control bees and ground-nesting yellowjackets that pose an imminent threat to humans or pets. This activity is triggered by a public request for assistance, rather than in response to direct population monitoring. The District does not control any bees or yellowjackets that are on or inside a structure. If a District technician elects to treat stinging insects, he or she will apply an insecticide directly to the insect or insect nest in accordance with District policies and pesticide label to avoid any drift and harm to other organisms.

Pesticides that contain the active ingredient potassium salts of fatty acids (insecticidal soaps), are used to control feral bees. Potassium salts of fatty acids are extremely low in toxicity. District workers use an insecticidal dust containing pyrethrins, PBO and silica against ground-nesting yellowjackets. The potential environmental impact of this material is very small because the active ingredients include Pyrethrins, and PBO

(discussed above), and the mode of application — deep into underground nest — further limits the potential for environmental exposure.

### RODENTICIDES

The District uses the rodenticides (rodent poisons) bromadiolone, diphacinone and cholecalciferol. Most of the material is used in sewer systems, or is deployed in locked, tamper-resistant bait stations along creeks and in other natural habitats with no potential for direct human or pet exposure. Used bait is disposed of in accordance with the labels.

## OTHER VERTEBRATE VECTOR MANAGEMENT

In addition to the use of rodenticides for the control of rats and potentially other rodents of public health significance, the District also traps and humanely euthanizes skunks that have established dens on residential or commercial properties. Property owners are educated by District employees on how to limit contact with skunks. Skunks can be a reservoir of rabies.

The District has approximately 175 live traps which can be distributed to residents and local business owners in the service area. Prior to delivering a trap, a District employee will conduct an inspection of the property to determine what existing conditions might be attracting skunks and provide recommendations for habitat modification. In spite of these efforts, if the problem persists and a skunk is actively living on the property, the District may provide a trap. Members of the public with District traps on their properties are instructed to check the trap daily and to call the District promptly if an animal is captured. If a skunk is trapped, it is humanely euthanized with carbon dioxide gas and transported to the District for storage before being transported to a landfill. Animals other than skunks that are caught in the traps are promptly released on site; however, our trap design makes capture of other animals unlikely. Public requests for routine assistance with trapping or removal of other vertebrate animals such as raccoons or opossums are referred to Contra Costa County Animal Control or to local private pest control companies.

Under some circumstances, the District might trap rodents of public health significance, or, in an emergency, other vertebrate vectors for disease surveillance and control.

## PUBLIC INFORMATION & EDUCATION

The District's outreach program educates and informs the public about mosquitoes and other vectors along with their associated diseases. Emphasis is placed on prevention methods and reducing the risk of illness. The District utilizes the news media, various advertising outlets and the District's website. Staff provides presentations to a combination of private groups and community organizations. Additionally, staff disseminates health messages through newsletters, videos, social media, events, health fairs, city and county partnerships.

# Mosquito & Vector Surveillance

The District's Entomology Laboratory collects and analyzes the following types of information to help guide and plan effective and environmentally sound control of vectors and vector-borne diseases in Contra Costa County:

- Mosquito population surveillance
- Encephalitis virus surveillance
- Surveillance for other vector-borne diseases
- Assistance to local and State public health agencies with vector-borne disease case investigations
- Identification of ticks and other biting arthropods
- Quality control for pesticide applications
- Research and special projects

## Mosquito Population Surveillance

Mosquito surveillance is a key component of the District's integrated vector management (IVM) program. Twenty-three different species of mosquitoes are found in Contra Costa County, and each one is different in terms of its habitat, biting habits, ability to transmit disease, flight range and appropriate control methods. The District's surveillance program monitors larval and adult mosquito populations countywide to track changes over time and identify potential risk areas for nuisance or disease issues. This information is used by the District's Operations employees to plan and carry out efficient, effective and environmentally sound mosquito control strategies.

### Larval Mosquito Surveillance

District personnel collect samples of mosquito larvae in the field daily and return them to our Laboratory for counting and identification. Treatment decisions can then be made, based on species and density information in addition to other factors like habitat type, proximity to populated areas, and presence or absence of natural predators. The data are stored in a database which enables us to make comparisons with historical averages and to map larval populations by species. In 2017, our laboratory staff counted and identified 33,986 mosquito larvae and pupae.

### Adult Mosquito Surveillance

The District utilizes two types of traps to monitor adult mosquito populations throughout the District's service area—New Jersey light traps and Carbon dioxide ($CO_2$) traps—at representative locations throughout the county.

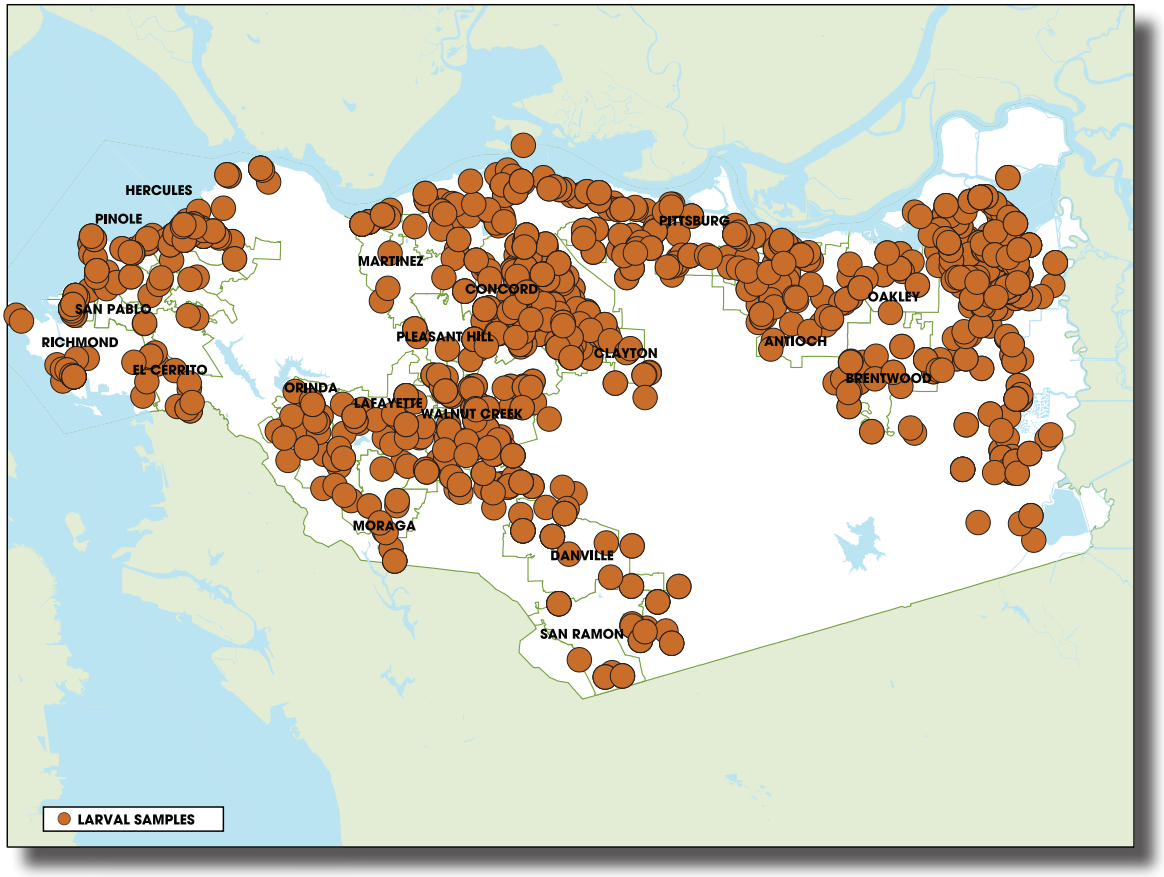
**LARVAL SAMPLES BY SPECIES**

| SPECIES | COUNT |
|---|---|
| *Culiseta incidens* | 10,337 |
| *Culex tarsalis* | 9,917 |
| *Culex pipiens* | 6,919 |
| *Culiseta inornata* | 1,015 |
| *Aedes washinoi* | 758 |
| *Aedes dorsalis* | 597 |
| *Culex stigmatosoma* | 566 |
| *Aedes melanimon* | 538 |
| *Aedes nigromaculis* | 516 |
| *Aedes squamiger* | 493 |
| *Aedes sierrensis* | 171 |
| *Culiseta particeps* | 48 |
| *Culex erythrothorax* | 44 |
| *Aedes vexans* | 32 |
| *Culex apicalis* | 26 |
| *Anopheles punctipennis* | 25 |
| *Anopheles franciscanus* | 21 |
| *Anopheles occidentalis* | 2 |
| Pupae* | 1,961 |
| **TOTAL** | **33,986** |

*pupae not identified to species

*Mosquito larvae identified in 2017 by species*

*Mosquitoes collected in traps are counted and identified to species in the laboratory.*




*Locations of mosquito larval samples collected by the District in 2017*

New Jersey light traps use light from a 5-watt fluorescent bulb to attract night-flying mosquito species. The traps have light sensors which automatically turn them on at dusk and off at dawn and are operated year-round at 23 locations, some of which have been in use for 20 years or more. District employees pick up samples once a week and return them to the District laboratory for counting and species identification. Each week, current trap counts are compared with historical averages for different regions of the county to identify population trends that might require additional scrutiny.

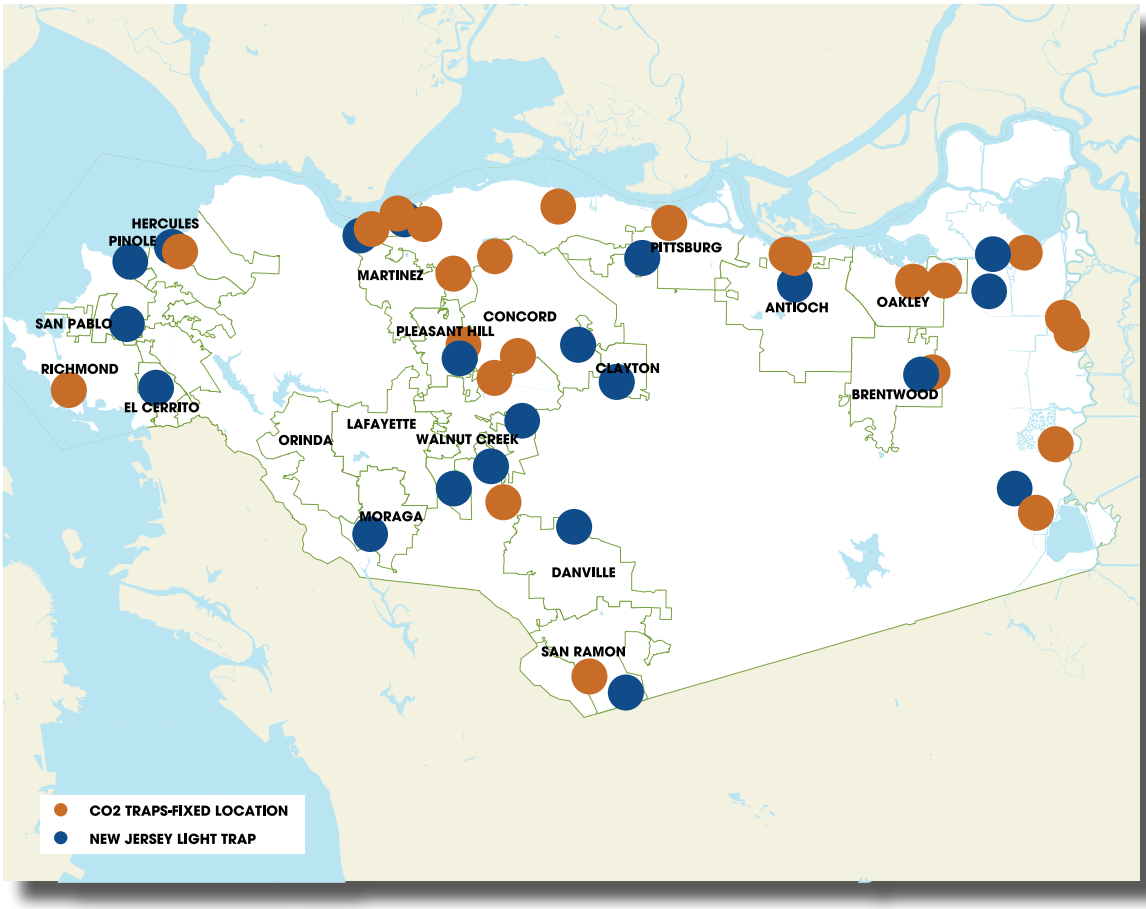
$CO_2$ traps are portable, battery powered, and use dry ice to produce carbon dioxide, which is a powerful attractant for mosquitoes, as well as a small LED light. Traps are set overnight once per week at 24 'fixed' locations throughout the county and as many as 10-20 variable locations that are chosen based on other surveillance information (dead bird reports, mosquito complaints, field observations by District personnel, etc.). In addition to collecting both day and night-flying mosquitoes, these traps also allow us to return the mosquitoes to the District lab while still alive so they can also be tested for WNV and other viruses. Counts can also be compared with regional averages to track population changes and target control activities.

A $CO_2$ trap hangs ready to trap adult mosquitoes. Dry ice produces carbon dioxide, which simulates the breath of a person or animal and attracts adult mosquitoes.

## Adult Mosquito Abundance Trends

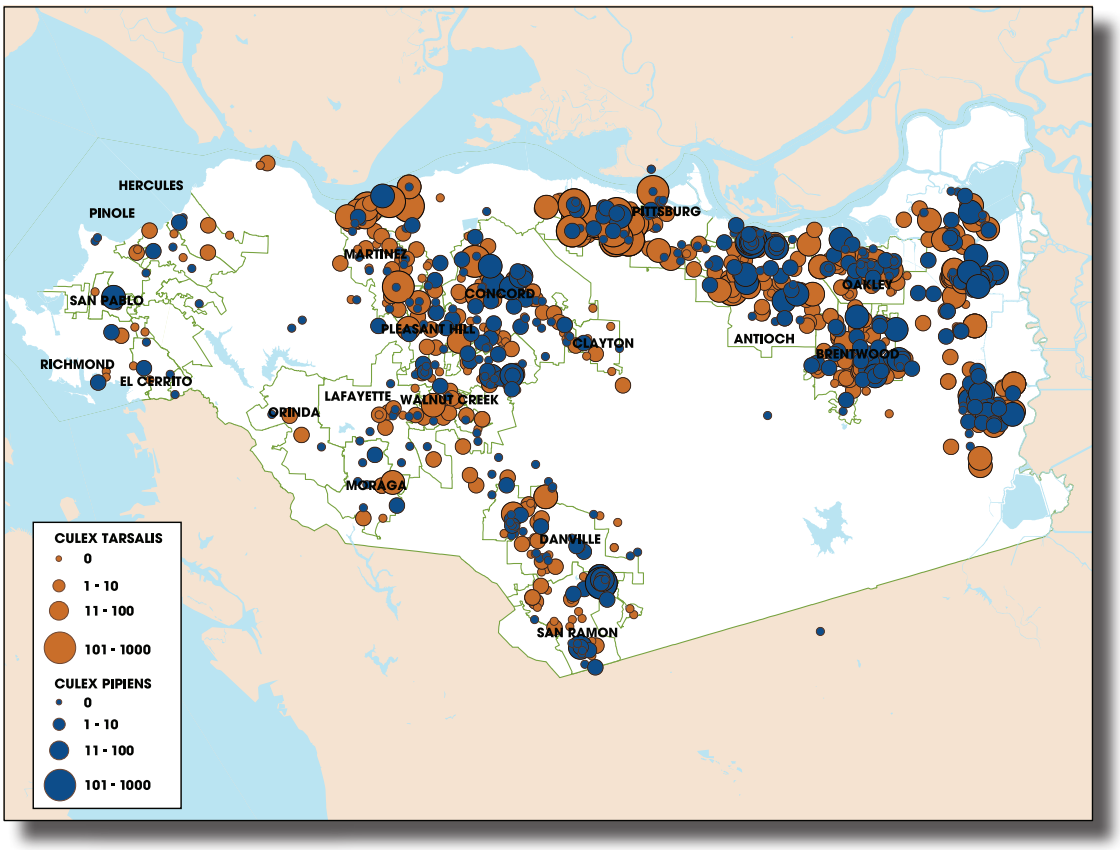
Although the District is able to monitor abundance of most of the mosquito species present in Contra Costa County, two species—the Western Encephalitis Mosquito, *Culex tarsalis,* and the Northern house Mosquito, *Culex pipiens*—are considered the most significant since they are the primary vectors of WNV and other encephalitis viruses such as SLE. Both species are widespread and abundant throughout the county. *Culex tarsalis* prefers clear water, and used to be more common in rural agricultural areas; however, in recent years it has become the most abundant species in abandoned or unmaintained swimming pools in residential neighborhoods. This mosquito may fly five miles or more from its larval habitat and so a single 'bad' pool can affect a large area. *Culex pipiens* prefers water containing a large percentage of organic material and is most common in sewer plants, dairy farm ponds and underground storm drains. This mosquito usually does not travel more than a few blocks from its larval 'source', but may be extremely widespread in residential neighborhoods during the summer due to overwatering of lawns and other urban water runoff that keeps the storm drains constantly wet.

*Adult mosquitoes trapped in the field are examined under a microscope in the District's laboratory.*




*FIXED ADULT MOSQUITO TRAP LOCATIONS IN 2017*

*Both carbon dioxide, which simulates the breath of a person or animal, and light attract mosquitoes to the trap. Mosquitoes are then counted and identified to species to determine the risk of disease or nuisance to people. This graphic shows the locations of the District's $CO_2$ traps and New Jersey light traps in 2017.*




*RANDOM ADULT MOSQUITO TRAP LOCATIONS IN 2017*

*Random traps set throughout Contra Costa County capture mosquitoes for surveillance and control applications. Culex tarsalis and Culex pipiens are primary vectors of West Nile virus and other diseases.*

*In this figure, the size of the circles illustrate how many mosquitoes were collected.*

California's drought abated in 2017, with rainfall well above average and summer peak temperatures a little above average. Countywide populations of *Culex tarsalis* and *Culex pipiens* fluctuated, but were above the five-year average for much of the season. Most of that average is based on drought conditions, and the county's mosquito populations were still well below long-term averages. High *Culex tarsalis* counts and the presence of West Nile virus prompted several adult mosquito control operations in the affected areas.

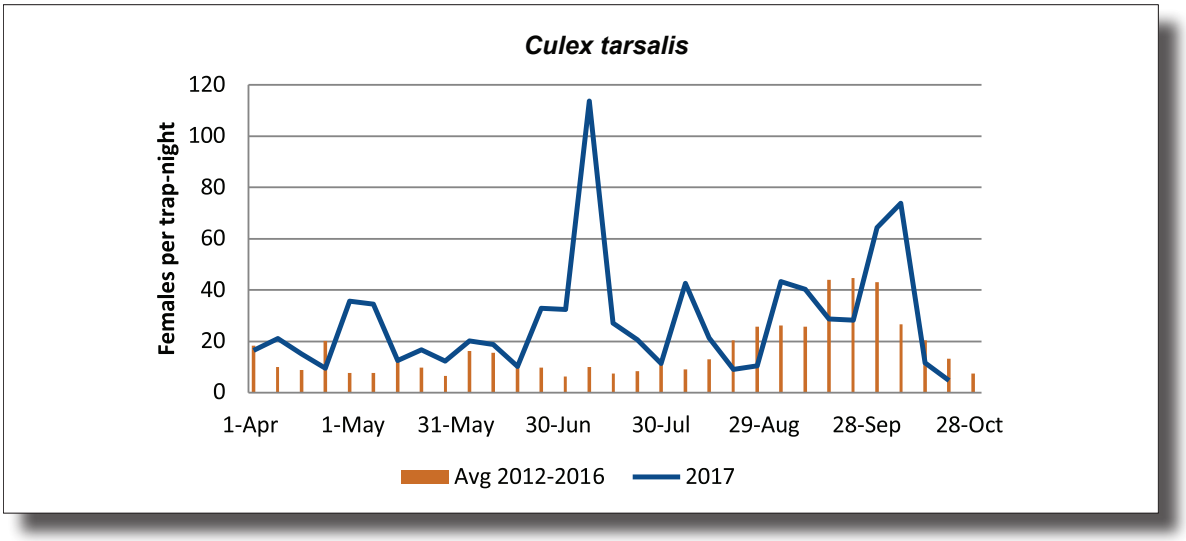
A total of more than 37,000 adult mosquitoes were collected and identified in our random and fixed-location traps in 2017.

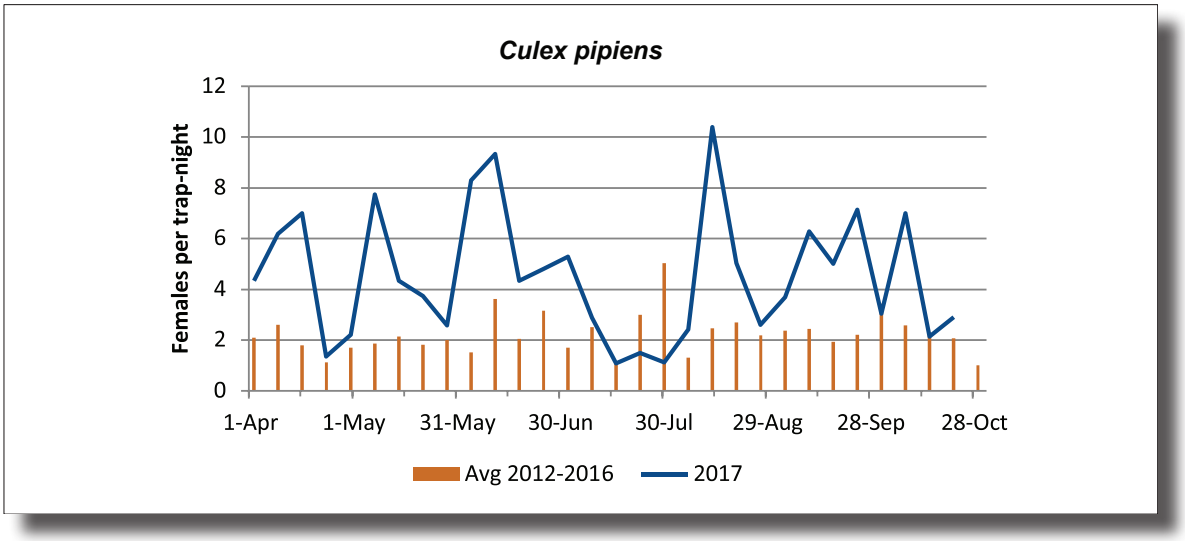
**ADULT SAMPLES BY SPECIES**

| SPECIES | COUNT |
|---|---|
| *Cx tarsalis* | 24,839 |
| *Cx pipiens* | 5,514 |
| *Ae melanimon* | 1,818 |
| *Cs inornata* | 1,388 |
| *Cx erythrothorax* | 1,008 |
| *Ae dorsalis* | 706 |
| *Cs incidens* | 578 |
| *Ae washinoi* | 547 |
| *Ae vexans* | 411 |
| *Ae squamiger* | 374 |
| *Ae sierrensis* | 186 |
| *Cs particeps* | 123 |
| *An franciscanus* | 84 |
| *Ae nigromaculis* | 29 |
| *An freeborni* | 10 |
| *An occidentalis* | 9 |
| *An punctipennis* | 7 |
| *Cx stigmatosoma* | 1 |
| **TOTAL** | **37,632** |

*Adult mosquitoes identified in 2017 by species*

# Abundance of Vector Mosquito Species in Contra Costa County in 2017

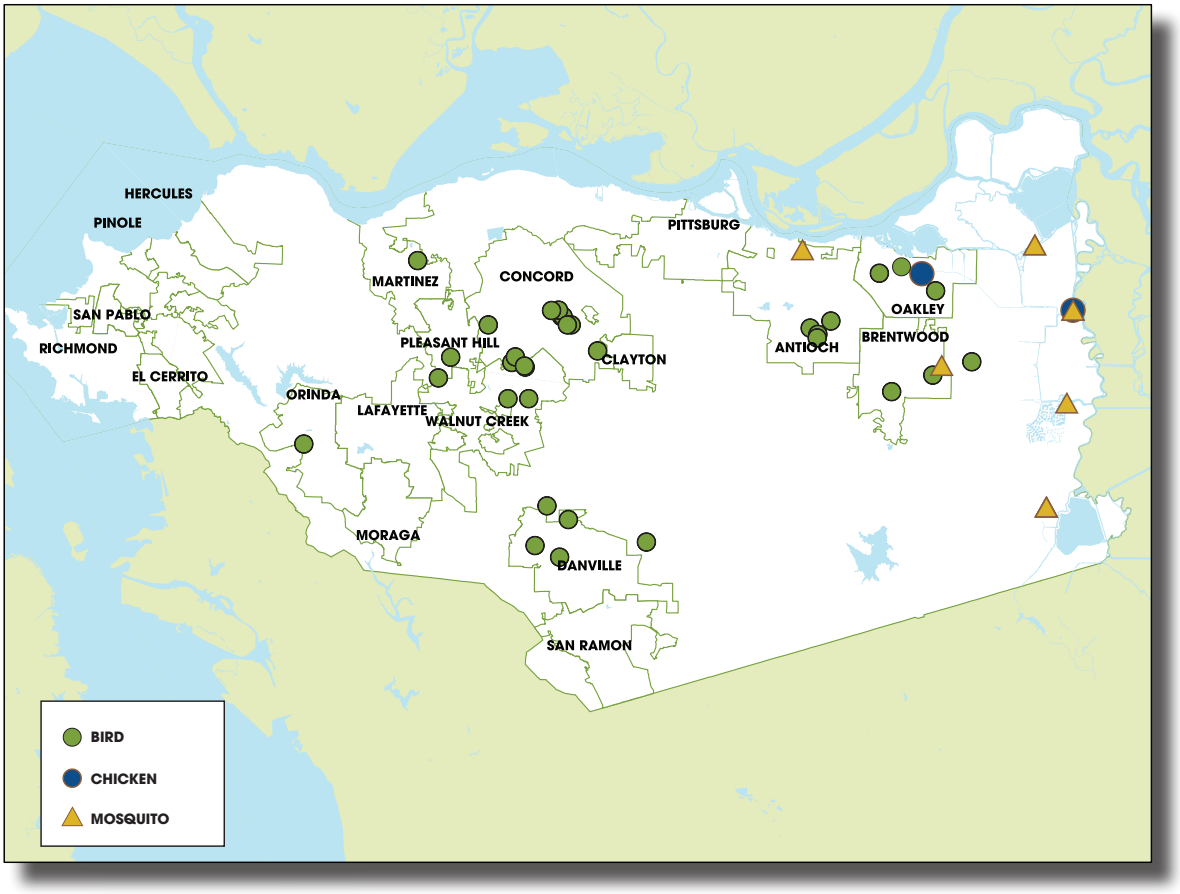


# Mosquito-Borne Disease Surveillance

The District's Laboratory staff conducts a comprehensive surveillance program for diseases transmitted by mosquitoes, includingWNV, WEE and SLE as part of California's statewide surveillance effort. The District also collaborates with the California Department of Public Health, the University of California and other state and federal agencies on studies intended to detect or predict new mosquito-borne diseases which might be introduced to our area in the future. WNV, a virus native to Africa which first appeared in the US in 1999, has been the most prominent mosquito-borne virus here in California since its arrival in 2004, with more than 6,000 reported cases and 248 deaths (the actual number of cases is probably much higher since only patients with the most severe form of the illness tend to be tested and diagnosed). Serious outbreaks of WEE and SLE occurred in California as recently as the 1950s and 1960s. Four human cases of SLE were reported in California in 2017, one each in Butte, Kern, Stanislaus and Ventura Counties. CCMVCD last detected WEE activity in 1997, when two chickens at the District's flock in the Martinez waterfront area tested positive for antibodies. Occasional travel-related human cases of Zika, dengue and chikungunya viruses have been reported in Contra Costa County, but so far the District has not found evidence of local transmission of these diseases or of the mosquito species known to be capable of transmitting them.

The Bay Area also had a history of severe malaria outbreaks in the early part of the 20th century. Pioneering mosquito control efforts by Stanley Freeborn and others led to the eradication of malaria in California. However, international travel still occasionally brings people infected with malaria to our area, and *Anopheles* mosquitoes capable of transmitting the disease still occur here. The District works with the Contra Costa Department of Public Health to investigate and treat (if necessary) *Anopheles* mosquito breeding sites in the vicinity of reported human cases in order to prevent local disease transmission.




*Positive West Nile Virus Activity in Contra Costa County in 2017*

## Mosquito Samples

Between 30 and 50 dry ice-baited mosquito traps are set every week, some at fixed locations and others at variable or 'random' locations, based on dead bird reports, mosquito complaints, or other indicators of possible virus or nuisance risk. Mosquitoes from these traps are tested for mosquito-borne viruses in batches, or 'pools' of between 10 and 50 individuals of a particular species. Samples are sent to the University of California Davis Arborvirus Research and Training where they are tested for WNV, WEE, and SLE. Results of this testing enable us to determine areas of the County at risk for disease transmission and target our control resources efficiently.

In 2017, 550 samples comprising 16,546 mosquitoes were tested; 9 samples were positive for WNV (6 *Culex tarsalis*, 3 *Culex pipiens*). All but one of these samples came from the eastern Contra Costa County cities of Antioch, Brentwood, Oakley, Knightsen, Discovery Bay and Byron; one came from the Martinez waterfront. Adult mosquito control operations were conducted at the Martinez waterfront, Brentwood, Antioch, Discovery Bay, Oakley, Bethel Island and Point Pinole, to reduce the risk of West Nile virus cases and alleviate severe nuisance (biting) issues.

*District Vector Ecologist Eric Ghilarducci prepares a trap to capture adult mosquitoes. The trap uses dry ice as bait to trap the mosquitoes, simulating the breath of a person or animal.*

## 2006 – 2017 SUMMARY OF ENCEPHALITIS VIRUS SURVEILLANCE

| | | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mosquito Samples | Samples Tested | 523 | 721 | 729 | 814 | 536 | 484 | 468 | 454 | 652 | 622 | 495 | 550 |
| | Total No. Mosquitoes | 24,358 | 28,290 | 23,502 | 27,436 | 16,820 | 14,321 | 11,571 | 12,730 | 17,999 | 21,533 | 15,612 | 16,546 |
| | West Nile Virus Positive | 20 | 28 | 31 | 17 | 4 | 7 | 19 | 13 | 25 | 8 | 11 | 6 |
| Chickens | Blood Samples Tested | 904 | 669 | 851 | 717 | 773 | 600 | 590 | 631 | 598 | 609 | 571 | 624 |
| | Total No. Chickens | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| | Seropositive | 24 | 5 | 15 | 13 | 4 | 0 | 7 | 8^ | 15 | 18 | 5 | 7 |
| Dead Birds | Total Reported | 3,472 | 2,042 | 2,227 | 1,221 | 923 | 1,057 | 1,816 | 1,377 | 1,355 | 912 | 861 | 692 |
| | Total Tested | 388 | 158 | 115 | 80 | 32* | 74* | 106* | 123* | 115* | 49* | 76 | 58 |
| | West Nile Virus Positive | 92 | 29 | 88 | 45 | 8 | 43+ | 66 | 68 | 44 | 11 | 33 | 19 |
| Dead Squirrels | Total Tested | 41 | 29 | 39 | 19 | 0** | 0** | 0** | 1 | 0** | 0** | 0** | 0** |
| | West Nile Virus Positive | 19 | 5 | 9 | 2 | -- | -- | -- | 1 | -- | -- | -- | -- |

*testing restricted to crows/jays only **squirrels not tested + includes five 'chronic positive' birds ^Includes 1 RAMP positive

## Dead Birds

The dead bird surveillance program represents a very successful collaboration between the California Department of Public Health, the District and the residents of Contra Costa County. Members of the public report dead birds to the statewide WNV Hotline (1-877-WNV-BIRD) or online at http://westnile.ca.gov. Hotline operators screen the calls to determine whether the birds are suitable candidates for testing; if so, they are referred to the District to be collected. Although not all birds are candidates for testing, all reports are important since they are mapped and used to identify potential risk areas and to target additional surveillance (mosquito trapping and larval source inspections, for example).

Testing in 2017 was restricted to corvid (crow family) birds only (crows, ravens, jays, magpies). Although the District has occasionally found WNV positive birds of other species, corvids are the most highly susceptible and therefore represent the most sensitive indicators. Also, corvids tend to develop higher virus levels in their bodies than other birds, which means that preliminary detection of the virus can be done in the District's own laboratory the same day the bird was collected, using a rapid screening test. During 2017, the WNV Hotline received 692 dead bird reports from Contra Costa County residents, which was lower than previous years. Of those, 58 birds were collected for testing and 19 (33%) tested positive. Positive birds were scattered throughout Central County with a few in East County.

*Paper strips with blood samples from chickens' combs are marked and saved for testing. Chickens do not get sick from West Nile virus, but they develop antibodies to the virus. If antibodies are detected, then it's evidence of West Nile virus transmission in the area.*

## Sentinel Chickens

Chickens are naturally resistant to mosquito-borne viruses and do not become ill, nor can they pass the virus back to mosquitoes, but they do develop antibodies that can be detected in lab tests. This makes them ideal 'sentinels' for detection of virus transmission. The District maintains a total of 50 chickens (ten at each of five flock sites) within Contra Costa County. The District obtains new young chickens from a commercial chicken farm each spring to ensure that they have not been previously infected. Blood samples are collected twice a month from April through October and submitted to the California Department of Public Health's Viral and Rickettsial Disease Laboratory in Richmond to be tested for antibodies towards WNV, WEE and SLE viruses.

In 2017, seven of the District's chickens (five in Holland Tract, two in Martinez) tested positive for WNV antibodies. Chickens tested positive for antibodies between August and early October. Since chickens cannot pass the virus on to others, they are donated to charitable organizations for egg production or adopted by owners of the host properties at the end of each season.

## Human and Equine Disease Cases

Four human cases of WNV were reported by the Contra Costa County Department of Public Health in 2017. Due to patient confidentiality regulations, information on specific locations of residence is not available. The vast majority of mild cases go untested and unreported since they may be asymptomatic (no symptoms) or mistaken for 'the flu'.

Statewide, 536 human cases and 41 fatalities were reported in 2017, up from 442 cases and 19 fatalities reported the previous year. 391 of them were neuroinvasive cases. The California Department of Public Health reports that there are typically 30 to 70 non-neuroinvasive (West Nile fever) cases for every single reported case of neurological disease, so as many as 27,000 Californians may have had West Nile virus infections in 2017, the vast majority of which were never diagnosed or reported.

One equine case was reported in Contra Costa County by the California Department of Food and Agriculture; 21 positive horses in 13 counties were reported statewide. An effective vaccine for horses has been available for several years and the vast majority of cases involve unvaccinated horses. A human vaccine is not available.

## Research, Special Projects and Presentations

The District's Scientific Programs staff continued to work with the US Department of Agriculture, Agricultural Research Service on a project to determine the impact of invasive aquatic weed control on mosquito populations in the San Joaquin Delta, and to rear and evaluate potential biological control agents for the control of introduced water hyacinth, which has been choking Delta waterways. The District's preliminary conclusion is that navigable channels, where the majority of aquatic weed control activities are occurring, are not contributing significantly to mosquito populations due to tidal action and higher water flow rates.

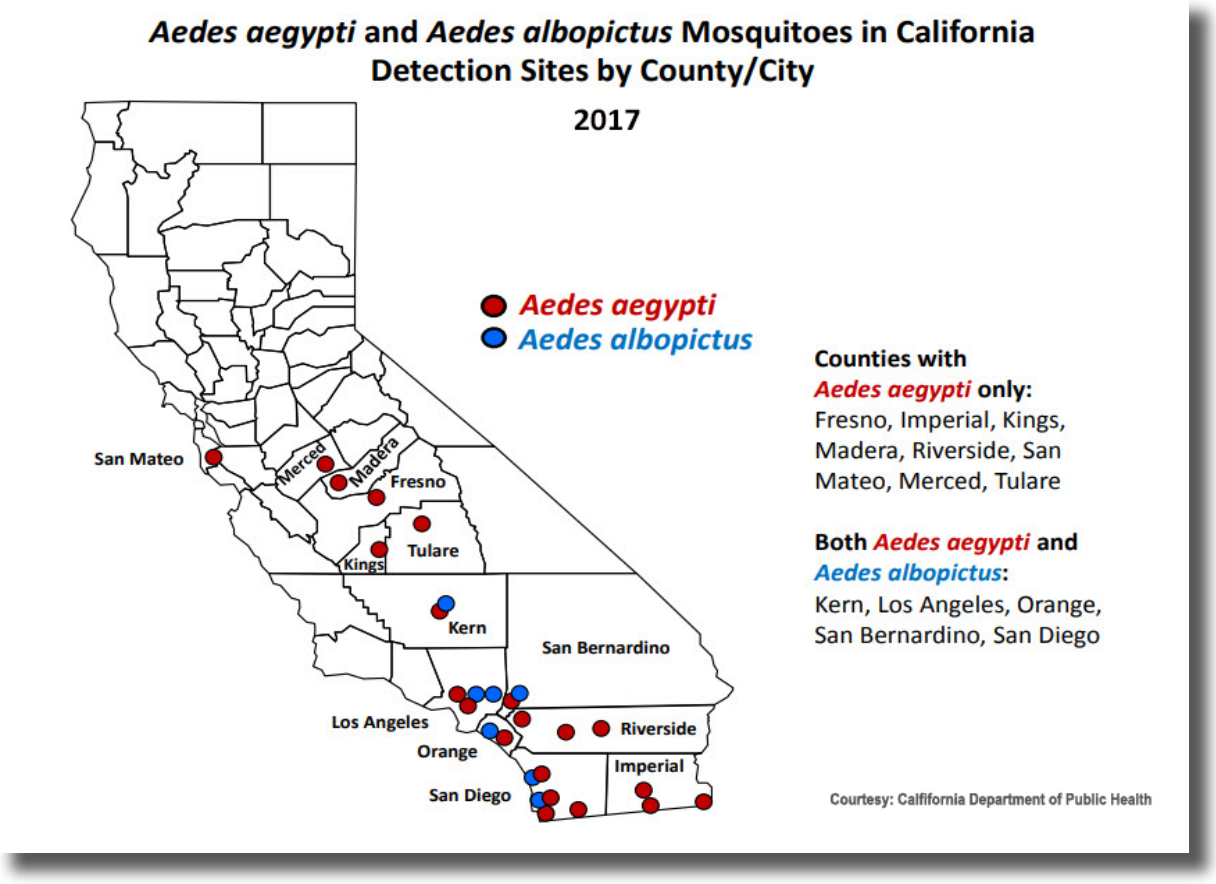
*Water hyacinth is an attractive floating aquatic plant that was introduced into the Delta from South America more than 100 years ago. The invasive plant can double in size every ten days in hot weather and can quickly become a dense floating mat of vegetation up to six feet thick. Mats can travel with river currents and with tidal movement and can also attach to structures.*

## Invasive Mosquito Species

In addition to the non-native Asian tiger mosquito (*Aedes albopictus*), which has been established in parts of the Los Angeles basin since at least 2011, vector control districts in Fresno, Madera, Tulare, Kern, San Mateo, Alameda, Los Angeles, Orange, Riverside, San Bernardino, Imperial and San Diego Counties have reported finding populations of the yellow fever mosquito, *Aedes aegypti* (map). Both of these species are similar in behavior, in that they are adapted to living around humans and lay their eggs in a wide variety of natural and artificial water containers. They are potential vectors of viruses that transmit human disease, including dengue virus, which has been on the increase worldwide, chikungunya virus, which spread explosively throughout the Caribbean, Central and South America in 2014, and Zika virus, which spread rapidly in South and Central America in 2015. In addition to numerous travel-related cases and a few reports of sexual transmission, four cases of local mosquito-borne transmission of Zika virus were reported in Florida and Texas during 2017.

The vector species are known for being difficult to control and causing significant nuisance issues. So far, attempts to eradicate these new mosquito populations have met with limited success. Recent cases of chikungunya, dengue and Zika diagnosed in California residents returning from the affected areas raise the concern that the invasive mosquitoes may spread these viruses locally in California.

In 2017 the District's comprehensive surveillance program did not detect the presence of any non-native mosquito species in Contra Costa County, nor have active populations been found in any other Bay Area counties since 2015. District technicians will continue to proactively search for them; however, since these are very much 'backyard' mosquitoes, it is essential for the public to be vigilant in eliminating any potential mosquito breeding sites on their property, reporting mosquito problems (especially mosquitoes biting during the day) to the District, and saving mosquito samples for identification.



# Mosquito Control Operations

## The Return of Rain

After five years of statewide drought, rain returned to California in 2017, refilling reservoirs and rivers and giving mosquitoes a wide selection of available rainwater where they could lay eggs. With the deluge of water that arrived in early 2017, overfilled ponds, rivers and streams spilled their banks and, with snowmelt from Sierra snowfall, these natural water sources stayed full for much of the year. The increase in water across the county prompted the District to increase preventive measures.

In residential locations, District inspectors and technicians responded to 1,891 requests for residential service in 2017, down from 2,354 requests for service in 2016. The decrease in service requests can be attributed, in part, to the end of the statewide drought. During the drought, as large water sources dried, numerous smaller water sources capable of producing mosquitoes were left behind and were difficult for District employees to find and treat. In contrast, large water sources in 2017 were often stocked with mosquitofish to eat mosquito larvae before they could develop into biting adults.

District employees also found many artificial containers on private property that residents used to collect and save water, creating mosquito habitat that led to more residential service requests. District employees encouraged residents to remove or reduce the number of containers to save rainwater and educated residents on the use of mosquito-proof rain barrels.

Along coastal areas of Contra Costa County, District employees trapped elevated numbers of biting adult mosquitoes in the spring of 2017. The large mosquito populations prompted the District to conduct adult mosquito control operations along the Martinez Waterfront, the Point Pinole Regional Shoreline, and at Bethel Island. In east Contra Costa County, where WNV has historically been prevalent, the District used an aircraft to apply larvicide to target mosquito larvae.

## The Risk of West Nile Virus Returns

During California's five-year drought, the first evidence of WNV appeared on average by late spring, but in 2017, the first evidence of the virus appeared in both birds and mosquitoes in late July. Trapped mosquitoes from Discovery Bay, Byron and Antioch were among the first to test positive for the virus. There were a total of nine mosquito samples, 19 dead birds, seven sentinel chickens and one horse that tested positive for WNV in 2017.

## Residential WNV Increases Exposure to Mosquitoes in High Risk Area

Historically, roughly 87 percent of the mosquitoes that test positive for WNV come from the eastern portion of the county. There are a number of potential mosquito sources in this region including large agricultural areas where seasonal flooding has been known to produce mosquitoes. As the District looks to the future, continued residential development in this area is a potential challenge for mosquito control and disease risk. Due to the proximity of potential mosquito sources and WNV activity to new residential areas, the District anticipates additional mosquito surveillance and control efforts will be needed in east Contra Costa County as the number of county residents continues to increase. In addition to the focus on mosquito operations, the District will also increase community outreach to educate new residents about WNV and the importance of mosquito control.

## Mosquito Zones and Special Projects

The District divides Contra Costa County into 10 mosquito control zones and assigns one vector control inspector or technician to each zone to oversee control efforts. In some zones, individual cities are divided between two or more zones. Each zone features its own challenges for mosquito control and prevention. In 2017, the zone leaders oversaw a number of projects to reduce mosquito activity along the shoreline and inland sources as well as above ground and underground sources.

Unmaintained infrastructure in residential areas has created mosquito sources where stagnant water may become trapped in clogged storm drains and catch basins. The stagnant water provides ample mosquito sources. In 2017, the District's Operations department worked with city and county officials in Richmond, Kensington, San Pablo, El Sobrante, El Cerrito, Crockett, Port Costa, Hercules, and Pinole, and shared important recommendations about habitat modification and mosquito control, including routine maintenance of drains and catch basins to prevent mosquitoes. The region primarily features established residential communities, but there are also areas of new construction, as well as industrial areas. Mosquito sources in this zone vary from urban and rural locations to wetlands, tidal marshes, and wastewater treatment plants.

The District's operations department continued to work with officials at oil refineries and reduced mosquito production by removing vegetation in selenium ponds. The department also worked with officials at the nearby sanitation plant to provide treatment of storage vaults. The Military Ocean Terminal in Concord received large amounts of rainwater prompting the

District inspectors to work with military officials to receive approval to perform inspections and treatments on a limited basis on the property. The District also performed larvicide treatments of marsh areas in Concord and Bay Point.

In  Pleasant Hill, Moraga, Lafayette, Martinez, and Walnut Creek tree holes were treated with absorbent to soak up rain water in order to prevent breeding of the Western Tree-hole Mosquito, *Aedes sierrensis*, a vector of dog heartworm.

The consequence of fresh water diluting tidal areas created a less productive habitat for some types of mosquitoes that prefer saltwater, while other species remained active. Mosquito control in areas of tidal action became challenging as mosquitofish that had once controlled mosquito larvae, were no longer able to survive in areas overrun by unmaintained tule mats and hyacinth growth. The vegetation prevents mosquitofish from reaching the larvae, instead providing protection to mosquito larvae that can develop into biting adult mosquitoes. While inspectors were able to place mosquitofish in many areas such as rainwater ponds, other areas of flooding prevented the use of this natural predator and required the use of the all-terrain vehicles to reach certain inaccessible locations of standing water.

The District  placed mosquitofish in horse troughs throughout Contra Costa County as needed to prevent mosquitoes, and periodically checked the troughs to make sure the fish were still present.

In east Contra Costa County, the operations department provided inspections and treatment of Bethel Island, Oakley, Jersey Island, Antioch, Brentwood and Knightsen. Annual flooding on Jersey Island requires applications of larvicide to prevent mosquitoes. Construction to rebuild levees surrounding the island continued in 2017 requiring a closer look at the area regularly to treat sources of mosquitoes as needed. The island is also home to a sanitation district that has been working to reduce mosquito production by eliminating uneven pastures that can collect standing water. Once the sanitation district completes the project, it is expected that the area will require minimal attention and treatment.

The flooding of nearby duck clubs to attract migrating ducks may also require regular inspection and treatment to prevent mosquitoes. The operations department worked with managers of the clubs to establish a flooding schedule so that mosquito pre-treatment could occur, but that has resulted in limited success. The same process is followed on areas where irrigation practices may produce mosquitoes into the summer and fall.

Some of the flooding associated with the increased rain in 2017 provided relief from mosquito production in some areas of east Contra Costa County, where areas that once featured ample vegetation no longer had visible vegetation due to an overabundance of water, allowing natural predators to reduce populations of mosquito larvae in the water. In addition, flooding has also helped move silt in other areas, so that water could flow through and not become a mosquito source.

*Vector Control Inspector Josefa Cabada places mosquitofish in a neglected swimming pool.*

# Fisheries

Mosquitofish (*Gambusia affinis*) are an effective tool for use in integrated vector management, as each surface feeding fish has the ability to eat mosquito larvae, thus preventing them from developing into adult mosquitoes with the ability of biting and potentially spreading mosquito-borne illness. The District places mosquitofish in water sources to reduce the risk of mosquitoes. The District also provides the fish to Contra Costa County residents for placement in water sources on private property including decorative ponds, neglected swimming pools, hot tubs, and horse troughs. The District produced approximately one million mosquitofish and distributed 77,336 mosquitofish in Contra Costa County in 2017.

*Sacramento hitch (Lavinia exilicauda exilicauda).*

In addition to rearing standard color mosquitofish the District's fish biologist, who oversees the District's mosquitofish program, continues to work with albino mosquitofish. On August 21, 1990 the biologist collected mosquitofish from a drainage ditch in East Contra Costa County. Females were isolated so the biologist could obtain their fry. This was done as part of the District's brood stock development program which includes collecting fish from different locations to increase genetic diversity. Approximately 500 fry were produced with one yellowish white fry through the process. Upon closer examination the yellowish fry was determined to be an albino.

Within a year after finding this female albino fry, the District's mosquitofish program developed a breeding population of albino mosquitofish. In the 27 years of rearing this color variant, the albino fish have been used in a variety of ways. They were used to estimate the number of standard mosquitofish in research ponds with a mark-release-recapture study. They have been used in schools to demonstrate the inheritance of a recessive gene. And they are used in ornamental ponds and water gardens where they can easily be seen. The District distributes albino mosquitofish upon request.

While mosquitofish are an effective tool for use in integrated vector management, the District continues to conduct research on California native fish species for use in mosquito control. This year the District's fish biologist determined that due to the low number of fish produced with our methods District is discontinuing projects that study and use the Sacramento hitch (*Lavinia exilicauda exilicauda*). The District continues to breed the California roach (*Lavinia symmetricus*) and will start research on the Hardhead (*Mylopharodon conocephalus*) in the future. This species has been found in Contra Costa County in limited areas.

*Albino Mosquitofish (Gambusia affinis)*

# Rats & Mice

## The Drought Ends, Increasing Food and Shelter for Rats and Mice

During California's five-year drought, rats and mice had fewer sources of food and water. This likely led to fewer healthy rats that had fewer offspring. Consequently, when rain returned, so did the vegetation and water that may have helped to increase rat and mouse populations. In 2017, the District received 1,337 requests for rat and mice services. The largest number of rat and mouse inspections were requested by residents of Walnut Creek (173), Lafayette (121), Concord (107), and Richmond (98).

In Contra Costa County, there are primarily two species of rats — the Norway rat and the roof rat. In communities along the Highway 24 Corridor including Lafayette, Orinda and Moraga, there is an additional rat—the wood rat—which can be found in the mature vegetation growth that is in the region. These rats can stay close to private homes and are known to build teepee-like structures.

Norway rats have the ability to hold their breath underwater and so they can be found in sewer lines. The District conducts sewer bating to control Norway rats. Roof rats are commonly found in neighborhoods as they possess exceptional climbing skills. They can be attracted to trees bearing citrus fruit, nut trees, bird seed, pet food, ivy and vines. These rats will climb trees, particularly those within four feet of a house or other structure, and jump onto the roof of the home in search of a poor fitting screen, a space around an antenna or cables, or any other small opening where they can climb into an attic.

## Vertebrate Zones and Special Projects

The District divides Contra Costa County into three vertebrate zones for rat and mouse services. The District assigns one vector control inspector or technician to each zone to oversee control efforts. In some zones, individual cities are divided between two or more zones. In 2017, the zone leaders oversaw a number of projects and resources to reduce rat and mouse activity in East County, Central County, and West County.

In the waterfront areas of western Contra Costa County, a non-toxic monitoring system was implemented to assess the rat population in the area and to determine the population's habits during the first six months of the year. The rats were less likely to eat the monitoring bait because of high competition from natural food sources including mussels and clams washed up during high tide.

*Vector Control Inspector David Obrochta conducts a residential rat inspection.*

In Moraga, a surveillance plan involving wood rats in the area was initiated on private and public property in an effort to find an effective control method to prevent these rats that will build teepee style nests and often feature a prominent flea population. The monitoring bait used did not appear to be preferred by the rats that instead found an ample supply of snails in the area.

Sewer lines across the county were inspected and bait was placed as needed. Ongoing construction projects involving upgrading infrastructure presented a challenge in these areas due to the disturbance of rat populations, prompting them to move to nearby neighborhoods and increasing requests for residential inspections.

In Central Contra Costa County, roof rats were the primary rat found in most neighborhoods. Cases of hoarding or extensive disrepair of a property required assistance from the District's vertebrate program. The District also worked with code enforcement officers as needed in specific vector-related situations

The vertebrate department worked with property managers and homeowners associations, upon request, to inspect apartment buildings and town homes for suspected cases of rats and mice. The District provided reports to property managers and homeowners associations with recommendations on changes to prevent rats.

The prolonged residential growth in eastern Contra Costa County has resulted in an increasing number of requests for rat and mouse inspections. New home developments that feature nearby golf courses often have vegetation that can provide rats with both food and shelter, allowing the rodent population to grow.

In general, common food sources that attract rats include bird feeders, pet food located outdoors and fruit trees.

The vertebrate department also continued to provide inspections and recommendations to commercial business owners and managers. In general, rats are primarily attracted to commercial locations due in part to garbage left in dumpsters without tight-fitting lids and lack of proper exclusion techniques to prevent rats from accessing buildings. In the shoreline marinas of Antioch, Oakley, and Pittsburg baiting was conducted to prevent rat-related damage to boats. The vertebrate department also worked with sanitation departments in the area to conduct sewer baiting to reduce the risk of rats. The baiting appeared to be successful as the agencies responsible for the sewage lines completed repairs on a number of lines in 2017.

*Vertebrate Inspector David Obrachta looks for signs of rats and mice during a residential inspection.*

# Skunks and Rabies Risk Reduction

The District provides inspections and advice to county residents who believe a skunk may be living on their property. Skunks can transmit the rabies virus by biting an animal or human. The virus infects the central nervous system and can lead to death if left untreated. Taking the appropriate measures to keep skunks from setting up dens on properties reduces the risk of rabies through contact.

There were 859 requests for skunk service in 2017 compared to 822 in 2016. The cities with the largest number of requests were Danville (138), Concord (94), Walnut Creek (94), and Lafayette (69). In 2016, the cities with the largest number of requests for skunk service were Danville (110), Concord (108), Walnut Creek (87), and Martinez (76).

## Vertebrate Zones — Skunks

The District divides Contra Costa County into two vertebrate zones for skunk services. The District assigns one vector control inspector or technician to each zone to oversee control efforts. Many of the District's other vector control inspectors and technicians are cross-trained to provide skunk services as well.

## Educating Residents to Reduce the Risk of Rabies

The District's skunk program is designed to reduce the risk of rabies in Contra Costa County. As such, the primary goal is to educate residents, landowners, agencies, school officials, and business owners on the steps they can take to prevent having skunks living on their properties, including instructions on installing wire mesh to block potential areas where skunks might build a den.

Skunks are attracted to fallen bird seed, fallen fruit, particularly figs from trees, and in many cases skunks cause lawn damage while searching for grubs. One of the most important messages the District provides is that any time food is left out for wildlife, that food is an attractant for skunks. The recommendation falls in line with the California Fish and Wildlife program Keep Me Wild.

## When to Trap

District inspectors work to educate the public and provide property inspections and advice on what to do to discourage skunks from taking up residence on private property. When a skunk resides in a den on the property, the District employee may determine the property warrants a live catch trap. Trapped skunks must be humanely euthanized in accordance with California law. In 2017 the District removed 314 skunks from Contra Costa County properties compared to 364 skunks removed in 2016. When the District loans a live catch trap to a property owner, and an animal other than a skunk is caught, that animal is released on the property. In 2017, 78 animals were released compared to 80 animals in 2016.

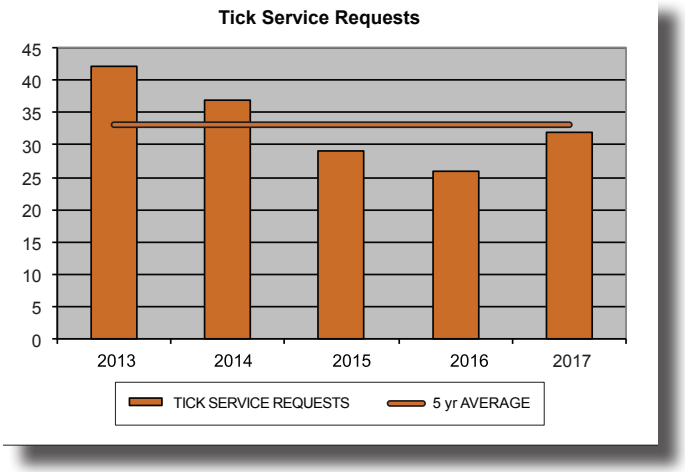
*Vector Control Inspector Jason Descans conducts a residential skunk inspection.*

# Ticks & Lyme Disease

Lyme disease is a bacterial infection caused by the bacterium *Borrelia burgdorferi*, which is transmitted by the western black-legged tick (also known as the deer tick). While Lyme disease is rare in Contra Costa County (on average there are two to four human cases reported per year), it can cause serious complications if not treated promptly.

District staff continues to identify ticks brought in by members of the public. Identification is important as only one of the four species of ticks that commonly bite people transmits *B. burgdorferi*. After careful consideration, the District entomologist and vector ecologist, along with biologists from the California Department of Public Health concluded that individual tick testing does not significantly reduce the risk of Lyme disease for patients since the data cannot confirm human disease. People who are concerned about the possibility of being infected with Lyme disease should contact their physician.

In 2017, there was a slight increase in the total numbers of tick related service requests compared to the five year average. Of the 32 ticks identified by District staff, 11 were western black-legged ticks, the vector of *B. burgdorferi* spirochetes.




## What to Do If You Are Bitten by a Tick

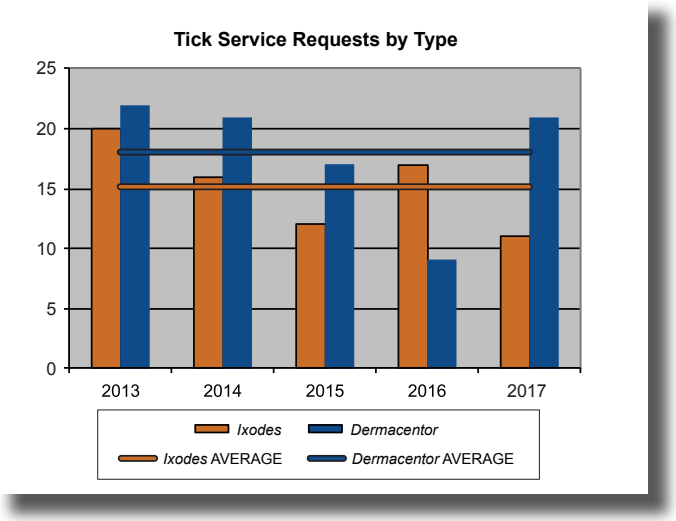
The risk of acquiring a tick-borne illness depends on many factors, including where you live, what type of tick bit you, and how long the tick was attached. Remove an attached tick using fine-tipped tweezers as soon as you notice it. If a tick is attached to your skin for less than 24 hours, your chance of contracting the bacterium that can cause Lyme disease is extremely small. To be safe, watch for signs or symptoms of Lyme disease such as rash or fever, and see a health care provider if these develop.

## Ticks of Contra Costa County

There are four species of common human-biting ticks in Contra Costa County.

- Western black-legged tick (*Ixodes pacificus*)
- Pacific Coast tick (*Dermacentor occidentalis*)
- American dog tick *(Dermacentor variabilis*)
- Brown dog tick (*Rhipicehalus sanguineus)*

Of these four, only the Western black-legged tick (*Ixodes pacificus)* is known to transmit *B. burgdorferi* in California. Adult females of the species are about 1/8” long and reddish-brown in color. Males are slightly smaller and brownish-black.



# *Yellowjackets*

Yellowjackets pose a risk to public health because they have the ability to bite and sting. And unlike a honey bee which can only sting once, a yellowjacket can sting multiple times, putting people, particularly those who suffer from an allergic reaction to stings and bites, at increased risk of injury.

Contra Costa County is home to four common species of yellowjackets including the western yellowjacket (*Vespula pensylvanica*) which builds nests underground—usually taking over abandoned rodent holes and subterranean voids. To protect public health from these biting and stinging wasps, the District provides inspections and treatment of these specific nests.

## End of Drought Creates Record-breaking Number of Yellowjacket Requests for Service

During California's five-year drought, vegetation died along with food and habitat for yellowjackets. As a result, many yellowjackets did not survive. Requests for groundnesting yellowjacket service decreased between the first and last year of the drought by 62.5 percent. In 2017; however, the number of requests for service rebounded to an unprecedented level, exceeding the District's 24 year average.

The District received 744 requests for yellowjacket service in 2016, the last year of the drought. In 2017, the District received 1,352 requests. During the busiest month of a typical yellowjacket season in Contra Costa County, the District receives an average of six to eight requests for inspection and treatment of ground-nesting yellowjacket nests per day. In 2017, the District received 16 to 18 requests per day on average.

The individual cities that experienced the largest number of requests for yellowjacket service in 2017 were Lafayette (227), Orinda (211), and Walnut Creek (209). In 2016, the same cities experienced the largest number of requests for yellowjacket service, but the number of requests were significantly less than 2017—Lafayette (167), Walnut Creek (121), and Orinda (100) in 2016.

For nearly a decade, the District has been able to respond to requests for yellowjacket services by primarily assigning one seasonal employee to respond to requests. In 2017, the program supervisor had to call in reinforcements; District inspectors and technicians made use of cross-training to respond to the large number of requests. The District also had to expand the usual response time for requests from 24 hours up to four business days.

## Protecting Public Health by Preventing Yellowjackets

While Lafayette, Orinda and Walnut Creek were home to the largest number of requests for yellowjacket service, the District received requests from residents in every city of Contra Costa County in 2017, illustrating just how widespread the yellowjacket population had rebounded after the drought, and how unexpected interactions with yellowjackets can be risk to public health anywhere within the county.

One example of how the increase in yellowjackets impacted outdoor activities in 2017 could be seen when the wasps threatened an outdoor wedding. When one county resident began setting up chairs for the backyard event, she found herself under attack by a colony of ground-nesting yellowjackets that had taken up residence in an elevated portion of the yard. The resident contacted the District and a District employee provided an inspection and treatment of the nest in time for the nuptials.

District employees also reported finding several large nests in 2017 and at least one employee found a few examples where yellowjackets that had built nests at the base of homes or other structures appeared to extended their nests into the siding. While this phenomenon was unusual in 2017, it will be something District employees will look for in the future to determine if this is a widespread adaptation or remains limited to specific nest locations.

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# Africanized Honey Bees

Contra Costa County's first detection of Africanized honey bees (AHB) (also known as "killer bees") was in July of 1997. The second was in December of 2008. Both incidents involved imported bees that hitched a ride on cargo ships. The bees were intercepted before they could escape and establish new colonies. The Contra Costa Mosquito & Vector Control District responds to public complaints of honey bee swarms and new hives in potentially hazardous locations.

In 2017, the District received 16 calls about honey bees. There was one report of a stinging incident associated with a 'hyper-aggressive' backyard beehive, but a sample of bees associated with this incident were determined to be ordinary European honey bees (EHB). Most of the calls received were due to the presence of a honey bee swarm passing through the area or resting in a neighborhood. These swarms are generally not a threat as the bees are simply in search of a new hive location.

Africanized honey bees do not look noticeably different from the typical EHB. Initial screening for AHB may be made by District scientists measuring the wing span of the bees and comparing them to those of the EHB, but they can only be positively identified through DNA analysis.

Africanized honey bees have an interesting history. In1950, researchers in Brazil bred them with EHB in an effort to make a "super bee" capable of surviving better and making more honey in tropical climates. Thus, the AHB was born. Unfortunately, some of those bees escaped the lab in 1957 where they naturally mated with other bees. Today, researchers say AHB are established as far north as the southwestern United States where they coexist with people and animals pollinating, making honey, and contributing to the environment.

There are differences between the two varieties of bees. Both spread in swarms, but AHB do so more often and further in distance than the EHB. They tend to be more protective of their queen, sending more bees to guard a hive, and they are less successful at surviving in areas with very cold winters that create a prolonged lack of food. It's their more aggressive behavior that differentiates them from their European cousins. Both will act to defend their hives from a threat; however, studies show that AHB are more protective of their hives. When swarming, both varieties tend to be non-aggressive as they do not have a hive filled with food and larvae to defend at that time. Africanized bees are more likely to react defensively to loud noises like those made by lawn mowers and power tools.

Like all honey bees, AHB will only sting once and then die; however, because they defend the hive more intensely, larger numbers of AHB may sting at one time. The venom from either bee variety is the same. The reason people or animals die from AHB stings is largely due to the number of stings---hundreds or thousands. Most of the victims of bee attacks have been dogs that were tied up and couldn't run away. Some people can suffer a serious allergic reaction from bee stings.

All bees are more aggressive when they feel that their hive is being threatened. But bees, even AHB, out foraging on flowers are just looking to gather food and are not interested in stinging anyone unless they are threatened or being swatted.

*An Africanized honey bee gathers nectar from a flower.*

# Public Affairs

## Community Outreach

The goal of public affairs is to encourage Contra Costa County residents to change behavior to reduce the risk of vector-borne disease. Community outreach is the mainstay of the District's public affairs department. With more than 1.1 million residents who live and work within Contra Costa County's more than 736 square miles, public cooperation is imperative when it comes to preventing vector-borne disease.

The District's public affairs program is designed to educate residents about their important role in integrated vector management. The approach is diverse and uses specific tactics that are consistently evaluated for maximum and cost-effective impact.

## Electronic Communication

The public affairs department publishes News Releases, Adult Mosquito Control Notifications, the Mosquito Bytes Newsletter, and this annual report online. Internet distribution of District publications is swift, succinct, and provides a sharable format making it a more efficient communication vehicle than traditional mail.

Members of the public may subscribe to the District's publications. In 2017, the District had 3,273 total subscribers. Of the subscribers to the District's online publications, 43 percent accessed the publications through mobile devices and 57 percent accessed them through desktop computers.

Electronic communication offers immediate and timely information about District activities and important messages. Adult mosquito control maps are interactive and describe, down to the street level, where and when District crews are conducting adult mosquito control. News releases provide breaking news about current WNV activity and use interactive maps indicating where and when WNV is confirmed. Contra Costa Health Services (CCHS) provides information regarding human cases of the virus. While the District works with the health department to understand possible virus transmission locations, the District only provides information related to vectors. The CCHS provides any information allowed by law regarding humans.

## Traditional Outreach

The public affairs department conducts paid advertising, provides presentations and participates in events by providing informational displays all in an effort to spread the District's messages and information through traditional outreach.

In 2017, the public affairs department conducted an advertising campaign entitled, "Mosquito Control is in (Y)our Hands" to symbolize the important partnership between the District and its residents. The theme was featured in digital advertising, signage, print advertising, and Internet advertising.

**Digital Billboard:** The public affairs department purchased digital advertising on a digital billboard located on the eastbound side of Highway 4 in Pittsburg. The billboard campaign was installed in July and remained in place through September. It was visible to eastbound traffic. Caltrans estimated 155,000 vehicles passed by the sign per month, providing ample viewing opportunities for commuters. The District's message appeared as part of a slideshow that gave commuters eight seconds to view the message at a time during rotations while the sign was illuminated from 6 a.m. until midnight, seven days a week.


*The District's 2017 advertising campaign featured this message on a billboard located eastbound Highway 4 in Antioch.*

**Signage**: The public affairs department purchased advertising signage on 10 BART station platforms in 2017. The stations were located in Contra Costa County and generated more than 4 million impressions.

**Print Advertising:** The East Bay Times newspaper is a publication that reaches approximately half of the county's 1.1 million residents. The public affairs department purchased seven front page ads in the East Bay Times that were placed across the bottom of the page for high visibility and easy readability during the months of June through September.

The Brentwood Press is a publication that specifically provides news stories from Antioch, Brentwood, Discovery Bay, and Oakley. The public affairs department purchased advertisements in this newspaper as well because these cities traditionally experience West Nile virus activity and the public affairs department recognized the importance of reaching that portion of the county with the District's messages.

The Valassis Wrap is a full color advertisement that holds other paper advertising publications together and is delivered via regular mail to more than half of all county residents. The public affairs department purchased this form of advertising in an effort to reach residents in central and western Contra Costa County.

**Internet Advertising:** Banner ads can be designed to appear on webpages visited by Contra Costa residents who enter specific keywords into an online search engine, such as, "swimming pools" or, "mosquitoes." The public affairs department purchased online advertising to appear on websites from June to September 2017.

In addition to paid advertising, the public affairs staff members also conducted 34 presentations to community groups and organizations, hosted three field trips at the District which include a presentation and tour, and provided an informational display at 14 events in 2017.

## Website

The District's award-winning website remains the No. 1 communication tool for constituents and media alike. The 300-page site also serves as an important reference tool for a worldwide audience. Public affairs staff manages the website to ensure timely and up-to-date information. In 2017, 52 percent of website visitors viewed the pages on a desktop computer, 40 percent viewed the website on a mobile device, and eight percent viewed website content on a tablet device.

Among the most visited pages of the District website, the service request page received 5,269 pageviews, information on rats and mice garnered 1,775 views, and information about all of the District's services and programs earned 1,741 pageviews in 2017.

## Social Media

Social media is a communication vehicle the District uses with the specific purpose of providing District messages and information to the public. In 2017, the public affairs department used Twitter to disseminate news releases and the Mosquito Bytes Newsletter to members of the public and the local news media.

## In a Minute Videos

Statistically, 80 percent of Internet users recall watching a video on a website they visited and of those people, 46 percent took the action recommended. With this in mind, the District creates and provides In a Minute videos.

The videos are designed to educate the public about how they can control vector control problems independently, while illustrating the vector control work conducted by District technicians and inspectors.

The videos are produced to quickly engage constituents efficiently and organically—they are not scripted or rehearsed. They are easily posted on Twitter and serve as educational tools on the website as well. In 2017, the most popular In a Minute videos were "Marking a Yellowjacket Nest for Service" with 489 views, "The Importance of Collecting a Mosquito Sample" with 191 views, and "Mosquito Counting/Species ID" with 177 views.

## Environmental

In addition to protecting public health, the Contra Costa Mosquito & Vector Control District is also dedicated to protecting the natural environment. Healthy wetlands support populations of natural predators which produces fewer mosquitoes than habitats modified or damaged by human activity. The District plays a leadership role in the conservation and restoration of Bay Area wetlands, protection of endangered and threatened species, and promotion of biorational (environmentally compatible) control methods in order to protect both human and environmental health.

## Continuing Education

The District employs vector control technicians and inspectors certified by the California Department of Public Health. In order to become certified, they are required to pass an exam in pesticide use and safety, mosquito biology and control; terrestrial invertebrate biology and control; and vertebrate biology and control. Certificates are renewed every two years provided the following continuing education requirements have been met during that period: 12 hours of pesticide use and safety, eight hours of mosquito control, eight hours of terrestrial invertebrates, and eight hours of vertebrate vectors. In addition to these basic requirements, the District conducts annual in-house training and frequent reviews and updates of policies and procedures at weekly and monthly staff meetings.

## Shop + Facility Maintenance

The District employs one mechanic responsible for all automotive and facility repair and maintenance. He maintains 44 field vehicles, three staff vehicles, 18 vehicle sprayers, two boats and their trailers, four 8-wheel ARGOs, four 4-wheel All Terrain Vehicles, 11 trailers, seven Ultra Low Volume sprayers, one catch basin mister, and one forklift. The mechanic designs and fabricates specialized equipment, provides most needed repairs and maintenance of grounds and equipment, such as electrical upgrades, plumbing repairs, solar panel maintenance, flooring and miscellaneous projects.

## Information Technology

The information technology systems administrator is responsible for all communication technology at the District including maintaining all aspects of the administration phone system, cell phones, computers, and internet services. The systems administrator maintains multiple virtual servers and approximately 40 workstations with associated software. The administrator also programs and maintains the District's specialized database known as VXS, which is used to record data for vector control surveillance, monitoring pesticide usage, workload management, and more.

## Administration

Administrative staff serve the residents of Contra Costa County by responding to telephone inquiries, scheduling service requests, compiling mandated reports and maintaining public records. Staff responsibilities also include processing service requests, contract billing, payroll and accounts payable, as well as providing administrative support. Working closely with city and county personnel, staff also correspond and work extensively regarding compliance and enforcement on vector control issues.


*The District is located in Concord, California.*

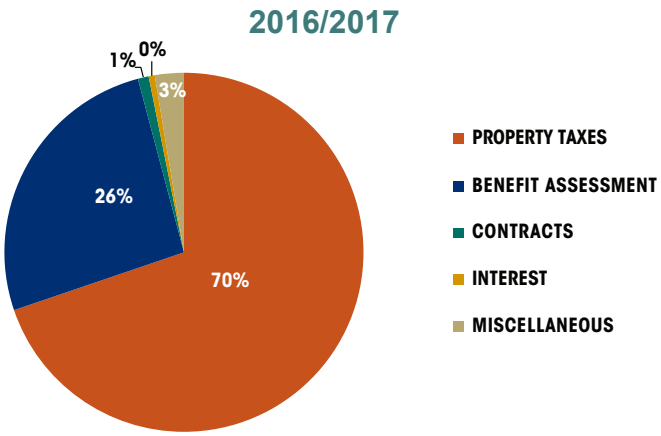
# Financial Statement

The Contra Costa Mosquito & Vector Control District depends on property tax revenues and benefit assessment charges in Contra Costa County to fund operations.

The District receives approximately 70 percent of the annual revenue from property taxes. This revenue stream rose approximately 2.5 percent in the fiscal year 2016/2017 as compared to fiscal year 2015/2016. The District continues to see signs that Contra Costa County property tax assessed values will continue to rise due to a regionally strong housing market.

Additionally, local property taxes earmarked for the District are diverted annually to the State of California's Educational Revenue Augmentation Fund (ERAF). In 1996, the District implemented a countywide benefit assessment to replace these lost funds. This nominal annual charge varies among four zones in Contra Costa County.

As mandated by government code, the District is annually audited by an outside firm. The firm audits the District's financial statements to obtain reasonable assurance that the financial statements are free of material misstatement. The firm also confirms that the District's financial statements conform to generally accepted accounting principles (GAAP), they review all financial disclosures, and the overall financial statement presentation. The District annually receives an Unqualified Opinion, which is the best opinion bestowed.




| FINANCIAL STATEMENT | | |
|---|---|---|
| **REVENUES** | **2015/2016** | **2016/2017** |
| Property Taxes | $4,771,963 | $5,401,903 |
| Benefit Assessment | 2,010,813 | 2,019,712 |
| Contracts | 34,932 | 75,372 |
| Interest | 13,764 | 42,710 |
| Miscellaneous | 279,567 | 201,794 |
| **TOTAL REVENUES** | **$7,111,039** | **$7,741,491** |
| | | |
| **REVENUES** | **2015/2016** | **2016/2017** |
| Salaries & Wages | $5,244,292 | $5,154,599 |
| Operations | 1,300,729 | 1,357,585 |
| Capital | 143,448 | 228,950 |
| **TOTAL EXPENDITURES** | **$6,688,469** | **$6,741,134** |

CONTRA COSTA
**MOSQUITO &VECTOR CONTROL**
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