

# 2016 ANNUAL REPORT



CONTRA COSTA  
**MOSQUITO  
& VECTOR  
CONTROL**  
DISTRICT

*Protecting Public Health Since 1927*

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## Healthy people...

who can live, work, and play in a healthy environment is the vision of the Contra Costa Mosquito & Vector Control District.

The District exists to reduce the risk of vector-borne disease or discomfort to the residents of Contra Costa County. Besides being nuisances by disrupting human activities including the use and enjoyment of public and private areas, certain insects and animals (vectors) may transmit a number of diseases. Most vectors are extremely mobile and cause the greatest hazard or discomfort away from their breeding site. Each potential vector has a unique life cycle and occupies a specific habitat. In order to effectively control these vectors and their related disease(s), the District employs an integrated vector management program. There are seven key elements required to deliver a successful control program for infectious or vector-borne diseases: workforce, laboratory, vector ecology and surveillance, information systems, communication, policy and evaluation, and preparedness and response. The following pages explain these elements in more detail with highlights of activities for the year 2016.

## Programs & Services

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

### Mosquitoes

Our county's diverse ecological regions 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. Upon request for service, a District employee will inspect residential and commercial property for mosquito problems and provide advice on controlling their populations. With **23 species of mosquitoes** inhabiting a variety of water sources, we can determine where to look if the homeowner or caller provides our employee with a mosquito sample. Simply swat and kill a mosquito (try not to squish it too much) and save it or tape it to a piece of paper for the District employee. Mosquitoes can transmit a variety of diseases including West Nile virus.

### Mosquitofish

**FREE** mosquitofish are available for private ponds, horse troughs, non-maintained swimming pools and spas, rain barrels, and more. Mosquitofish can eat up to 500 mosquito larvae per day.

### Rats & Mice

Homeowners, business owners or any group in Contra Costa County can request a site visit to assist them with rodent issues. District services include identification of rodent problems (rodent need not be present) and advice for prevention and control. District employees do not bait nor set traps, but provide valuable, detailed information, guidance, and recommendations. Rats can transmit various diseases through contamination from their droppings and urine.

### Skunks

In an effort to reduce the risk of rabies to humans by reducing the likelihood of skunk and human contact in residential areas, 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.

### Yellowjackets

The District provides extermination of ground-nesting yellowjackets only. Simply locate the nest and call the District for service. The nest's location must be identified and the location shared with District employees. This can be achieved by drawing a map, pointing a garden tool, or identifying the site with a marker (red sock, garden glove, etc.). Yellowjackets are beneficial insects that eat garden pests and pollinate crops through daily foraging; however, if aggravated, they can bite and sting repeatedly and painfully and their stings can be dangerous for those people allergic to their venom.

### Ticks & Lyme Disease

The District surveys public parks and other areas for the ticks that transmit Lyme disease. The District also provides tick identification services to the public and doctors. People who are concerned about possible Lyme disease infections should contact their physician. Information on Lyme Disease testing on ticks may be found by visiting our [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 staff work closely with residents and the media to inform and educate about important health topics. Staff provide general and tailored presentations to various groups and school children of 12 or more people. District personnel also participate in social media interaction, a variety of events, workshops, and community discussions.

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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.

## History

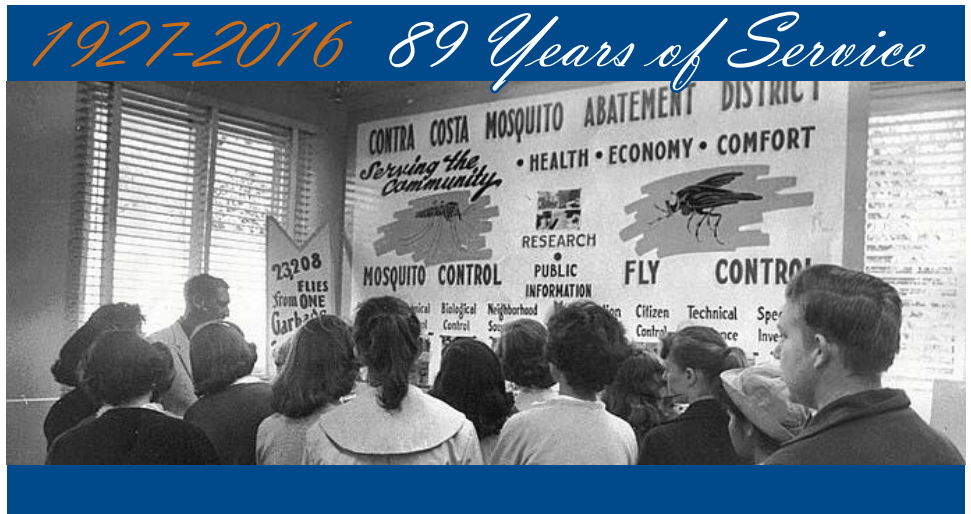
Contra Costa County encompasses some of the most diverse environments found in one area. This wide range of environments makes our county one of the most desirable places to live in Northern California. The Contra Costa Mosquito & Vector Control District plays a vital role in maintaining this environment while protecting the residents from insects and animals that can carry disease. The District helps to ensure Contra Costa County remains a great place to live where people can enjoy the outdoors.

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. The Native Americans were apparently smart enough to avoid 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. It was in the late 1800s that Dr. Walter Reed and Associates identified mosquitoes as the vector (carrier) of malaria and yellow fever. This discovery was important to the workers of the canal, as well as Californians because some of them had contracted malaria. Not only were mosquitoes a nuisance, they carried diseases as well.

In California, mosquito abatement activities in the early 1900s focused on controlling the mosquito that carries malaria and reducing the numbers of nuisance salt marsh mosquitoes. Before 1915, mosquito control in the state was financed by subscription and donation. In 1915, a bill was passed through the State Legislature and signed by the governor that provided 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, a severe nuisance mosquito. 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. So, the citizens of Contra Costa County, together with several waterfront industries, formed a committee in 1926 to address the need for mosquito control.



In 1926, Stover responded to requests from Contra Costa County and directed the first operations of Contra Costa Mosquito Abatement District (CCMAD #1), concurrently with his duties in Marin and San Mateo Counties. The purpose of the District was to control marsh mosquitoes in north central Contra Costa 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. 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 nearly 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 upon the death of Stover.

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. This virus was isolated from the brain of a dead child in 1938. Human cases of another virus, St. Louis encephalitis, were isolated in California in 1938 as well. Before the early 1940s, people thought that it was only the *Aedes* mosquitoes that transmitted disease. In 1941, *Culex tarsalis* was found to transmit the encephalitis virus.

In its early years, CCMAD #1 relied primarily on engineering methods of control such as creating ditch networks, dredging, building or repairing levees, installing tide gates and pumps. In 1927, 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.

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



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

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, Ernest Campbell, while serving as District manager/engineer for CCMAD #1, helped found and manage Northern San Joaquin Mosquito Abatement District.

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 the leadership of Ernest Campbell 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 Western equine encephalomyelitis the state had experienced. In 1952, there were 375 human cases of Western equine encephalomyelitis and 45 human cases of St. Louis encephalitis in California. There were eight reported human cases of Western equine encephalomyelitis 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 the creeks as well. In 1956, the District treated 1,080 miles of creek at a cost of approximately \$5.10 per mile. By the late 1950s, the District began to see mosquitoes developing 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 the 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.*

## *Timeline*

In April of 1955, CCMAD #1 expanded its program to include fly control. Contra Costa County in the 1950s was primarily a rural county with commercial rabbitries, poultry ranches, stables, cattle ranches, and orchards. 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, field employees of the District 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 St. Louis encephalitis in 1967 and Western equine encephalomyelitis in 1968. The District continued an active source reduction program into the 1970s. In 1970, the District started treating non-structural yellowjacket nests located in the ground.

Ernest Campbell retired in March of 1966 due to poor health. 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. However, in the 1930s, some ditching was conducted in the Richmond marshes under the supervision of Harold Gray, the manager of Alameda MAD. John Brawley retired in September 1976.

Brawley's replacement was Brad Anderson who became manager in November of 1976. His misfortune was becoming manager just before Proposition 13, which reduced funding for mosquito abatement districts throughout the state. CCMAD #1 lost 50 percent of its revenues. 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 chose to cease all services to the public except for 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. Employees who worked for the District in 1978 remember it as a lean and depressing time.

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.

In 1970 - CCMAD began treating ground-nesting yellowjacket nests.

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

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

In 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.

In 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 an indoor mosquitofish rearing greenhouse. 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 was 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 program, 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 Western equine encephalomyelitis in sentinel chickens and in mosquitoes collected in Contra Costa County. Fortunately, there were no human cases 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. Due to the leadership of the District manager and the Board of Trustees, the District was prepared for this event, unlike Proposition 13, 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 disease testing while the mosquito control program relied more on "biorational" methods (biopesticides and mosquitofish) that have minimal environmental impact. The District was considered to be in the forefront of wetland restoration and 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 was first detected on the East Coast of the United States and 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, West Nile virus reached California. The District detected West Nile virus in Contra Costa County for the first time in 2004 in dead birds submitted for testing. The first human cases were in 2005. The virus was also detected that year for the first time in mosquitoes. To date, every year since 2005, West Nile virus has been detected in the county with several human cases. In 2006, two people died from the virus.

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



*A technician sprays a sedimentation pond for mosquitoes. Date unknown.*



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# Contra Costa Mosquito & Vector Control District

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

## Personnel

### Administration

General Manager: Craig Downs

Assistant Manager: Ray Waletzko

Accounting & Benefits Specialist: Tina Cox

Administrative Secretary: Natalie Jones

### Laboratory

Scientific Programs Manager: Steve Schutz, Ph.D.

Vector Ecologist II/GIS Map Coordinator:  
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  
Brandon French  
Jeremy Tamargo  
David Wexler

#### Mosquito Control Operations

Program Supervisor: Greg Howard

#### Inspectors:

Reed Black  
Joe Hummel  
Tim Mann  
Patrick Vicencio

#### Technicians:

Christopher Doll  
Jeremy Shannon

#### Vertebrate Vector Control Operations

Program Supervisor: Jonathan Rehana

#### Inspectors:

Joe Cleope  
Jason Descans  
Steve Fisher  
Dave Obrochta  
Danielle Wisniewski

## *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 nonprofit organizations.
- Responsible directly to the people.
- Accountable - Accessible - Efficient.

## *Board of Trustees*



**Standing Left to Right:** H. Richard Mank, Secretary, El Cerrito; James Murray, Walnut Creek; Robert Lucacher, Moraga; Daniel Pellegrini, Martinez; Richard Means, Pleasant Hill; James Pinckney, Contra Costa County; Michael Krieg, Oakley; and Perry Carlston, Concord

**Kneeling/Seated:** Darryl Young, Contra Costa County; Diane Wolcott, Orinda; Lola Odunlami, Antioch; Sohelia Bana, Ph.D., Richmond; Peggie Howell, Vice President, Clayton; Warren Clayton, Pinole; and Chris Cowen, Contra Costa County

*Not pictured:* Richard Ainsley, Pittsburg; Randall Diamond, President, Danville; Jim Fitzsimmons, Lafayette; Sharyn Rossi, San Ramon; and Rolando Villareal, Brentwood



Sheila Currier, *Program Supervisor*; Ray Waletzko, *Assistant Manager*; Wayne Shieh, *IT Systems Administrator*; Andrew Pierce, *Community Affairs Representative*; Damien Clauson, *Vector Ecologist*; Eric Ghilarducci, *Vector Ecologist II*; Nola Woods, *Community Affairs Representative*; Steve Schutz, Ph.D., *Scientific Program Manager*; Craig Downs, *General Manager*; Jonathan Rehana, *Program Supervisor*; Greg Howard, *Program Supervisor*; Deborah Bass, *Public Affairs Manager*; and Tina Cox, *Accounting/Benefits Specialist*

*Not pictured: Chris Miller, Biologist; and Allison Nelson, Administrative Secretary*



Josefa Cabada, *VCI*; David Wexler, *VCI*; Jeremy Tamargo, *VCI*; Jason Descans, *VCI*; Tom Fische, *Mechanic II*; Danielle Wisniewski, *VCI*; Brandon French, *VCI*; Joe Cleope, *VCI*; Lawrence Brown, *VCI*; Steve Fisher, *VCI*; Patrick Vicencio, *VCI*; Jeremy Shannon, *VCT*; Tim Mann, *VCI*; Christopher Doll, *VCT*; Felipe Carrillo, *VCI*; and Joe Hummel, *VCI*

*Not Pictured: Dave Obrochta, VCI; and Reed Black, VCI*

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## *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 is a comprehensive program that incorporates several coordinated activities:

VECTOR SURVEILLANCE  
BIOLOGICAL CONTROL  
PHYSICAL CONTROL (HABITAT MODIFICATION)  
CHEMICAL CONTROL (PESTICIDE APPLICATION)  
VEGETATION MANAGEMENT  
PUBLIC INFORMATION & EDUCATION  
TRAPPING

### Service Area

Our 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 and Ryer 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 new residential communities. North County includes both the coastal marshlands and the established port and industrial cities from Martinez through Pittsburg 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 or 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 habitat, almost all land use categories in the District's service areas may be affected by our 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 field personnel, is reviewed and approved by the California Department of Public Health through a formal cooperative agreement that is renewed annually.

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.

For minor physical control activities, the District obtains five-year regional permits from the U.S. Army Corps of Engineers (with review by the San Francisco or Central Valley Regional Water Quality Control Boards and/or the U.S. Fish & Wildlife Service, as appropriate), and from the San Francisco Bay Conservation & Development Commission.

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

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## Description of Services

The integrated vector management 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 program essentially consists of eight types of activities:

Surveillance for 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.

**Public Education**— Encouraging and assisting reduction or prevention of vector habitats on private and public property.

**Physical Control**— Managing vector habitat, especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities.

**Vegetation Management**—Applying herbicides and other forms of vegetation management to improve surveillance or reduce vector populations.

**Biological Control**—Rearing, stocking, and provision to the public of the “mosquitofish” *Gambusia affinis*; and possible use of other predators or pathogens of vectors.

**Chemical Control**—Applying bacterial products *Bacillus thuringiensis israelensis* (Bti), *Bacillus sphaericus* (Bs), and Spinosad. Applying 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.

Descriptions of these activities, including their typical annual frequency and intensity, and general District policies and procedures to ensure that they result in no significant environmental impact are provided in the following pages.

## Purpose and Need

The District exists to reduce the risk of vector-borne disease or discomfort to the residents of our service area. Besides being nuisances by disrupting human activities and the use and enjoyment of public and private areas, certain insects and animals may transmit a number of diseases. The diseases of most concern in the service area are West Nile virus, Western equine encephalomyelitis, St. Louis encephalitis, dog heartworm, and malaria, which are transmitted by mosquitoes; rabies transmitted by skunks; plague and murine typhus transmitted by fleas; leptospirosis and hantavirus pulmonary syndrome associated with rats and other rodents; and Lyme disease, babesiosis, and ehrlichiosis transmitted by ticks.

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

## MOSQUITOES

Certain species of mosquitoes found in Contra Costa County can transmit malaria, West Nile virus, St. Louis encephalitis, Western equine encephalomyelitis, and potentially other encephalitis viruses. Another species of mosquitoes is also capable of transmitting dog heartworm. Although some of the 23 species of mosquitoes found in our county have not been shown to transmit disease, most species can cause human discomfort when the female mosquito bites to obtain blood. 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, technicians will inspect residential property for mosquito problems and provide recommendations to control their populations. With so many varieties of mosquitoes that inhabit a variety of water sources, it’s important that the homeowner or caller provides a mosquito sample to the technician. The technician is then able to determine what type of mosquito is present and where the mosquito may be originating. Mosquito sources located outside the residential property are treated appropriately.

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## MOSQUITOFISH

Mosquitofish (*Gambusia affinis*) are used throughout the world for effective mosquito control. They are capable of eating enormous amounts of mosquito larvae daily. Mosquitofish are an important, natural mosquito control tool.

Mosquitofish are available to the public free of charge at the District's Concord office for private ponds, horse troughs, non-maintained swimming pools and spas, rain barrels and more.

## GROUND-NESTING YELLOWJACKETS

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 since these species are aggressive toward people. The District does not provide a service for other species of yellowjackets, nor those that make their nest on or in structures. For ground-nesting yellowjackets, simply locate the nest and call the District for service. The nest's location must be identified and the location shared with the technician.

## AFRICANIZED HONEY BEES

Africanized honey bees (AHB) were first detected in California on October 24, 1994 and were detected and successfully intercepted in Contra Costa County (Crockett) in 1997 and 2008. AHB are not known to transmit disease and are no more venomous than European honey bees (EHB); however, AHB respond to threats more rapidly than EHB and will defend their hive with greater numbers of bees which could result in a massive number of stings to an individual. Although persons 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; for a child it can be substantially less. Normal 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.

## RATS AND MICE

Two introduced species of rats, the Norway rat and the roof rat, and the house mouse are present in the service area and are subjects of District action. In addition to being unsanitary, rats and mice can transmit a variety of organisms that 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 shorted 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 (rat or mouse need not be present) and advice for prevention and control. District employees do not bait nor set traps, but provide valuable, detailed information, guidance and recommendations. They also issue a formal, detailed report.

## SKUNKS

The two primary reservoirs and vectors of rabies in California are skunks and some species of bats. 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 the incidence of rabies by suppressing skunk populations, 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 specific criteria are met.

## TICKS

There are three species of common human-biting ticks in the District's service area. Of these three, only the Western black-legged tick (*Ixodes pacificus*) is known to transmit Lyme disease in California.

The District periodically surveys public parks and other areas for the ticks that transmit Lyme disease to monitor the risk to people. The District also provides tick identification services to the public and medical personnel.

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## OTHER ANIMALS OF IMPORTANCE

Although certain animal species such as bats, ground squirrels, fleas, and opossums will not be regularly controlled, 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.

Most of the vectors mentioned above are extremely mobile and cause the greatest hazard or discomfort away from their breeding site. Each of these potential vectors has a unique life cycle and most of them occupy different habitats. In order to effectively control these vectors, an integrated vector management program must be employed. District policy is to identify those species that are currently vectors, to recommend techniques for their prevention and control, and to anticipate and minimize any new interactions between vectors and humans.

### General Vector Management Strategy

The District's activities address two basic types of vectors—mosquitoes and other insects; and rats, mice, and skunks— but both share general principles and policies including identification of vector problems; responsive actions to control existing populations of vectors, prevent new sources of vectors from developing, and manage habitat to minimize vector production; education of land-owners and others on measures to minimize vector production or interaction with vectors; and provision and administration of funding and institutional support necessary to accomplish these goals. In order to accomplish effective and environmentally sound vector management, the manipulation and control of vectors must be based on careful surveillance of their abundance, habitat (potential abundance), pathogen load, and/or potential contact with people; the establishment of treatment criteria (thresholds); and appropriate selection from a wide range of control methods. This dynamic combination of surveillance, treatment criteria, and selection between multiple control activities in coordinated programs is generally known as integrated pest management. Due to the specific nature of our programs, we refer to this as integrated *vector* management.

The District's integrated vector management program, like any other integrated pest management program, by definition involves procedures for minimizing potential environmental impacts. The District's program employs integrated pest management principles by first determining the species and abundance of vectors through evaluation of public service requests and field surveys of immature and adult pest populations; and then, if the populations exceed predetermined criteria, using the most efficient, effective, and environmentally sensitive means of control. For all vector species, public education is an important control strategy, and for some vectors (rats, mice, ticks) it is the District's primary control method. In certain situations, water management or other physical control activities (historically known as "source reduction" or "permanent control") can be instituted to reduce vector breeding sites. The District also uses biological control such as the placing of mosquitofish in some settings. When these approaches are not effective or are otherwise inappropriate, then microbial or chemical pesticides are used to treat specific vector-producing or vector-harboring areas or vector populations.

In order to maximize familiarity by the operational staff with specific vector sources in the service area, the District is divided into mosquito and other arthropod zones and also into vertebrate vector zones (currently five). Each mosquito and other arthropod zone is assigned a full-time vector control technician, and sometimes an aide, whose responsibilities include minor physical control, inspection and treatment of known vector sources, finding and controlling new sources, and responding to service requests from the public. Each vertebrate vector zone is also assigned one or more vector control technicians and sometimes aides; responsibilities in these zones include control of skunks, rats, mice, and potentially other vertebrate vectors.

Vector control activities are conducted at a wide variety of sites throughout the District's service area. These sites can be roughly divided into those where activities may have an effect on the natural environment either directly or indirectly (through drainage), and sites where the potential environmental impacts are negligible. Examples of "Environmental Sites" in the service area include tidal marshes, duck clubs, other diked marshes, lakes and ponds, rivers and streams, vernal pools and other seasonal wetlands, stormwater detention basins, flood control channels, spreading grounds, street drains and gutters, wash drains, irrigated pastures, or agricultural ditches. Examples of "non-environmental sites" include animal troughs, artificial containers, tire piles, fountains, ornamental fish ponds, swimming pools, animal waste detention ponds, and non-natural harborage, such as wood piles, residential and commercial landscape, trash receptacles, etc.

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The intensity of chemical, biological, or physical control activities in the District service area in general, or in any particular vector source, varies seasonally and from year to year because of weather conditions, size and distribution of vector populations, disease patterns, prevention of pesticide resistance, and other variables. Therefore, the scope of work discussed in the sections below is illustrative of typical District activity levels, but in the future these activities are expected to show continuing variation.

### 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 integrated vector management 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. Therefore, the District's specific activities and their potential environmental impacts are described herein.

### PHYSICAL CONTROL (HABITAT MODIFICATION)

Dredging, installation of culverts or alternative engineering works, as well as other 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 performs these physical control activities 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. Major physical control activities or projects (beyond the scope of the District's five-year regional wetlands permits with the U.S. Army Corps of Engineers and the San Francisco Bay Conservation and Development Commission) receive individual California Environmental Quality Act reviews. Minor physical control activities are covered by the regional wetlands permits. These vary substantially from year to year, but typically consist of up to 2,000 feet of ditch maintenance.

### VEGETATION MANAGEMENT

The District periodically applies herbicides to reduce the mosquito habitat value of sites by improving water circulation or access by fish and other predators, or to allow access to standing water for inspections and treatment. Herbicides used by the District include Roundup® and Rodeo®, which are both based on the active ingredient glyphosate. Herbicides are applied in strict conformance with label requirements.

The District did not apply any herbicides during 2016. Some vegetation management was done using hand tools ("brushing") to improve access to inspection and treatment areas.

### BIOLOGICAL CONTROL

The District uses the mosquitofish *Gambusia affinis* in some types of mosquito larval habitat to provide biological control of mosquitoes through direct predation of larvae. Fish stocking conducted by District personnel complies with strict guidelines designed to ensure that no significant impacts can occur to native species. District staff are also conducting research on several California native fish species as alternative biological control agents.



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## CHEMICAL CONTROL

### MOSQUITO LARVICIDES

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. District staff apply public health pesticides to the site in strict accordance with the pesticide label instructions.

The District uses several natural bacterial products for control of larval mosquitoes. These include Bti (*Bacillus thuringiensis israelensis*), 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 of 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), or helicopter. Bs (*Bacillus sphaericus*) 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 ("Natular") 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 (Altosid), larvicidal oils, and Agnique. Methoprene, or Altosid, 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, or helicopter. 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. Agnique is the trade name for a monomolecular (one molecule thick) surface film larvicide, comprised of ethoxylated alcohol. It works 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 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 synthetic pyrethroids. Some products contain the synergist PBO (piperonyl butoxide) which improves their effectiveness against adult mosquitoes while reducing the amount of active ingredient needed. All materials are applied as ultra-low-volume (ULV) fogs by truck or potentially by aircraft. In addition to having low toxicity to humans, these materials are applied in very small amounts (approximately 1 ounce to 2 ounces 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 bees and other nontarget organisms would not be exposed.

Malathion is an organophosphate material which the District may use for direct control of adult mosquitoes. This is not a routine operational material for the District, and its use is only contemplated in emergency circumstances or in the event that mosquito populations in our area develop significant resistance to other adulticides.

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## OTHER INSECTICIDES

In addition to direct chemical control of mosquito populations, the District also applies insecticides to control bees and ground-nesting wasps 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 that are located inside a structure or wasps that are on or inside a structure, so if a technician finds that a bee or wasp nest is located inside a structure or a wasp nest is above ground, the resident will be given a referral list which contains the names of companies in Contra Costa County that are certified for structural control of bees and wasps. 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 to avoid any drift and harm to other organisms.

Pesticides that contain the active ingredient potassium salts of fatty acids (insecticidal soaps), such as M-Pede®, are used to control feral bees. Potassium salts of fatty acids are extremely low in toxicity. Drione® is used by the District against ground-nesting yellowjackets. This is an insecticidal dust containing pyrethrins, PBO (piperonyl butoxide) and silica. The potential environmental impact of this material is very small because the active ingredients include Pyrethrins, and Piperonyl Butoxide (discussed above), and the mode of application, deep into underground nests, 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 PEST 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 inspectors or technicians 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, our technicians will conduct an inspection of the property to determine what existing conditions might be attracting skunks and provide recommendations for habitat modification. If the problem persists in spite of these efforts, a trap may be provided. Members of the public with District traps on their property 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 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 media, various advertising outlets and the [District's website](#). Staff provide presentations to a plethora of groups and community organizations and disseminate health messages through events, health fairs, community newsletters, social media, city and county partnerships, and local groups.

## Mosquito & Vector Surveillance

Our 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 mosquito-borne diseases.
- Tick and Lyme disease surveillance.
- 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 our integrated vector management (IVM) program. **Twenty-three species of mosquitoes** are found in our county, and each one is different in terms of its habitat, biting habits, ability to transmit disease, flight range and appropriate control methods. Our 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 our operations team to plan and carry out efficient, effective and environmentally sound mosquito control strategies.

#### Larval Mosquito Surveillance

Field technicians and inspectors 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 2016, our laboratory staff counted and identified 44,838 mosquito larvae and pupae.

#### Adult Mosquito Surveillance

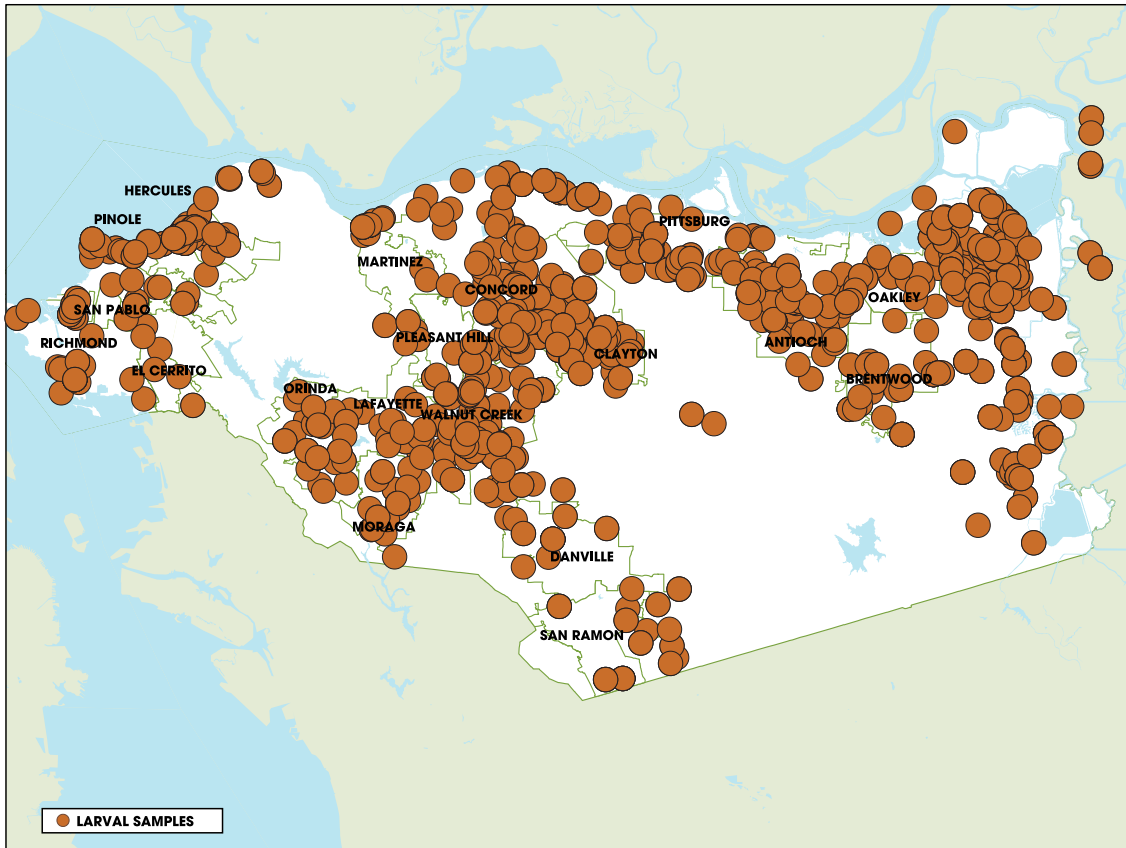
The District utilizes two types of traps to monitor adult mosquito populations throughout the county—New Jersey light traps and carbon dioxide traps (CO<sub>2</sub> traps)—at representative locations throughout the county.

Species	Count
Cx tarsalis	19,920
Cs incidens	9,191
Cx pipiens	8,207
Ae washinoi	1,402
Ae dorsalis	969
Cs inornata	930
Ae sierrensis	747
Ae melanimon	545
Ae nigromaculis	434
Ae squamiger	291
Cx stigmatosoma	276
Ae vexans	68
An punctipennis	37
Cx territans	30
Cx erythrothorax	24
An occidentalis	18
An franciscanus	14
Cx apicalis	14
Cx boharti	10
Cs particeps	7
Pupae*	1,804
<b>TOTAL</b>	<b>44,838</b>
*pupae not identified to species	

*Mosquito larvae identified in 2016 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 2016.*

**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. Samples are collected once a week by field technicians and returned to our lab 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<sub>2</sub> 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 technicians, etc.). In addition to collecting both day and night-flying mosquitoes, these traps also allow us to return the mosquitoes to our lab while still alive so they can also be tested for West Nile virus and other viruses. Counts can also be compared with regional averages to track population changes and target control activities.



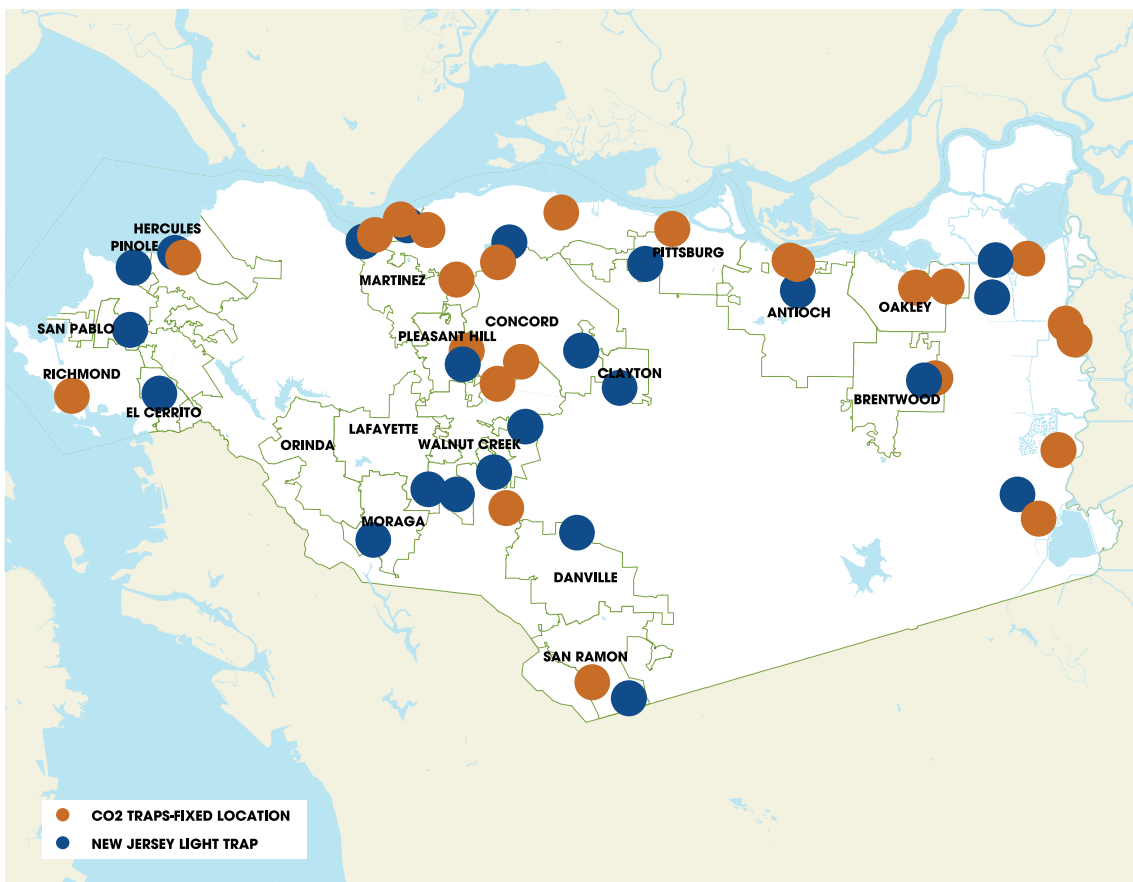
A CO<sub>2</sub> trap hangs ready to trap adult mosquitoes. Dry ice produces carbon dioxide, which simulates the breath of a person and attracts adult mosquitoes.

## Adult Mosquito Abundance Trends

Although we are 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 West Nile virus and other encephalitis viruses. 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 as far as five miles or more from its larval habitat so a single ‘bad’ pool can affect a large area. *Culex pipiens* prefer water high in organic material and are most common in sewer plants, dairy farm ponds and underground storm drains. This mosquito usually doesn’t 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.

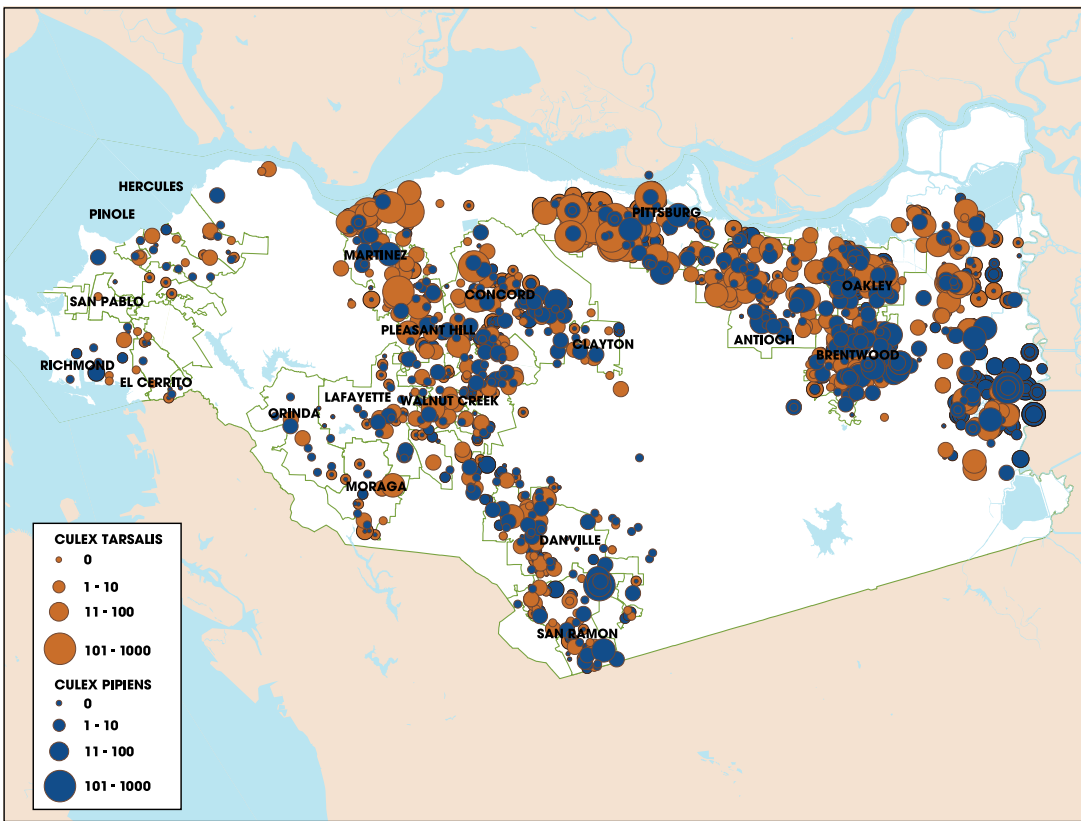


Adult mosquitoes trapped in the field are examined under a microscope in the District’s laboratory.



### FIXED ADULT MOSQUITO TRAP LOCATIONS IN 2016

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 per species to determine the risk of disease or nuisance to people.



**RANDOM ADULT MOSQUITO TRAP LOCATIONS IN 2016**

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.

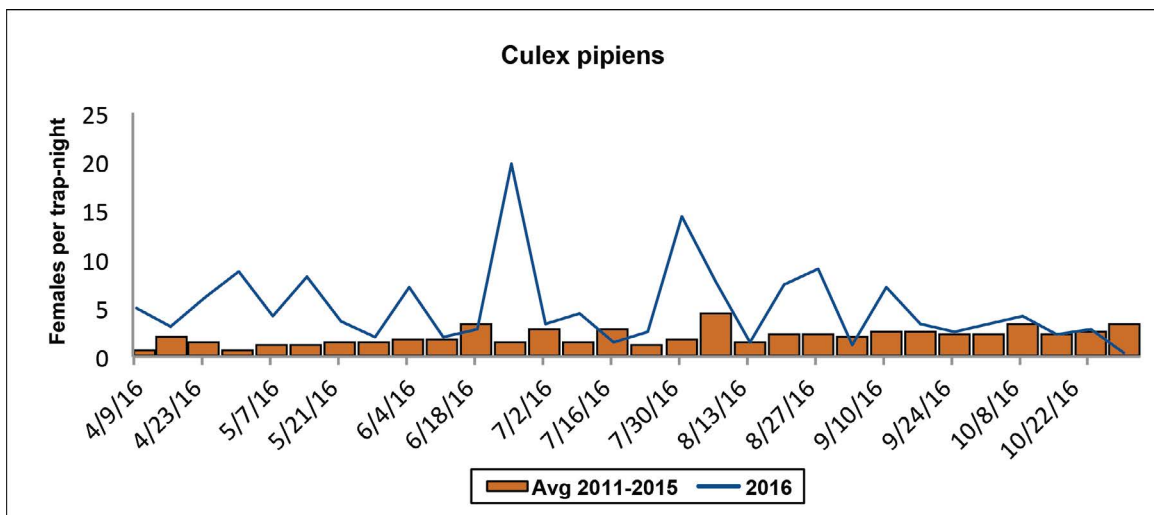
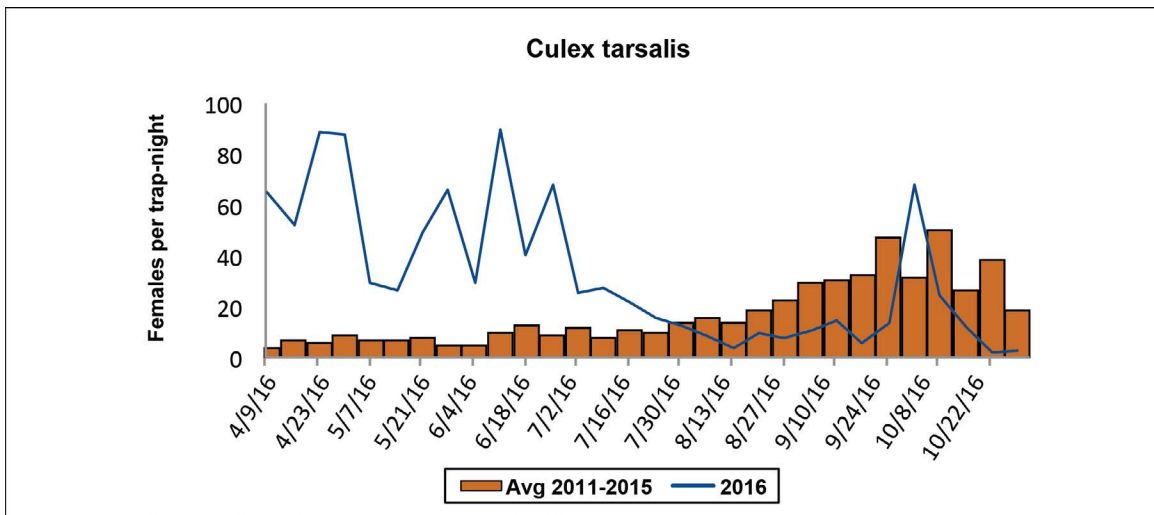
California's drought finally abated in 2016, with rainfall slightly above average and summer peak temperatures below average. County-wide populations of *Culex tarsalis* were above average early in the season (August through October.) One major larval source in an industrial part of the Martinez waterfront area was identified and treated, significantly reducing our average trap counts. *Culex pipiens* counts fluctuated, but were above average for much of the season. High *Culex tarsalis* counts and the presence of West Nile virus prompted several fogging operations in the affected areas.

A total of more than 36,000 adult mosquitoes were collected and identified in our random and fixed-location traps in 2016.

Species	Count
Cx tarsalis	25,283
Cx pipiens	3,520
Cs inornata	3,134
Ae melanimon	1,270
Cx erythrothorax	1,046
Ae dorsalis	634
Ae washinoi	603
Cs particeps	487
Cs incidens	332
An franciscanus	117
Ae squamiger	110
Ae sierrensis	82
Ae nigromaculis	62
Ae vexans	54
An freeborni	37
An punctipennis	16
Cx stigmatosoma	2
An occidentalis	1
TOTAL	36,790

Adult mosquitoes are counted and identified by species. (2016)

*Abundance of Vector Mosquito Species in Contra Costa County in 2016*

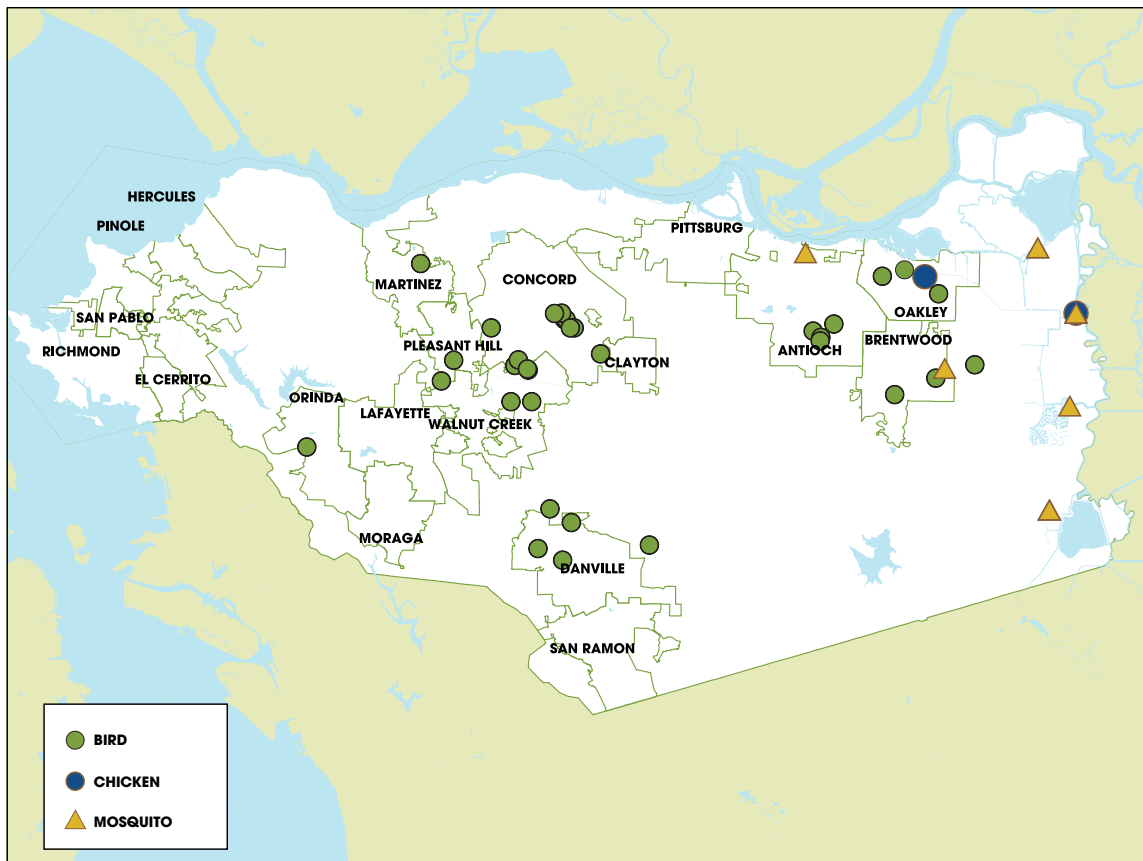


## Mosquito-Borne Disease Surveillance

Our laboratory conducts a comprehensive surveillance program for diseases transmitted by mosquitoes, including West Nile virus (WNV), Western equine encephalomyelitis (WEE) and St. Louis encephalitis (SLE) as part of California's statewide surveillance effort. We also collaborate 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 U.S. in 1999, has been the most prominent mosquito-borne disease here in California since its arrival in 2003, with over 5,500 reported cases and 229 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. Three human cases of SLE were reported in California in 2016, one each in Sacramento, Fresno and Kern Counties. The District last detected WEE activity in 1997, when

two chickens at our flock in the Martinez waterfront area tested positive for antibodies. Occasional travel-related human cases of Zika, dengue and chikungunya virus have been reported in Contra Costa County, but so far we have found no evidence of local transmission of these diseases nor 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 to others still occur here. We work 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.



Map of positive West Nile Virus Activity in Contra Costa County in 2016.



## 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. Some testing (for WNV only) can be done in our own laboratory, but the majority of samples are sent to the University of California Center for Vectorborne Disease Research 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 2016, 495 samples, comprising 15,612 mosquitoes were tested; 11 samples were positive for WNV (all *Culex tarsalis*). All of these samples came from East County, including Antioch, Brentwood, Holland Tract, Bethel Island, Discovery Bay and Byron. Fogging operations were conducted at Holland Tract, Bethel Island, Oakley, Discovery Bay, Pittsburg and the Martinez waterfront, to reduce the risk of West Nile virus cases and alleviate severe nuisance (biting) issues.



*District 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.*

## 2005 – 2016 SUMMARY OF ENCEPHALITIS VIRUS SURVEILLANCE

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mosquito Samples	Samples Tested	425	523	721	729	814	536	484	468	454	652	622	495
	Total No. Mosquitoes	20,309	24,358	28,290	23,502	27,436	16,820	14,321	11,571	12,730	17,999	21,533	15,612
	West Nile Virus Positive	4	20	28	31	17	4	7	19	13	25	8	11
Chickens	Blood Samples Tested	800	904	669	851	717	773	600	590	631	598	609	571
	Total No. Chickens	50	50	50	50	50	50	50	50	50	50	50	50
	Seropositive	18	24	5	15	13	4	0	7	8 <sup>^</sup>	15	18	5
Dead Birds	Total Reported	5,589	3,472	2,042	2,227	1,221	923	1,057	1,816	1,377	1,355	912	861
	Total Tested	518	388	158	115	80	32 <sup>*</sup>	74 <sup>*</sup>	106 <sup>*</sup>	123 <sup>*</sup>	115 <sup>*</sup>	49 <sup>*</sup>	76
	West Nile Virus Positive	94	92	29	88	45	8	43 <sup>+</sup>	66	68	44	11	33
Dead Squirrels	Total Tested	45	41	29	39	19	0 <sup>**</sup>	0 <sup>**</sup>	0 <sup>**</sup>	1	0 <sup>**</sup>	0 <sup>**</sup>	0 <sup>**</sup>
	West Nile Virus Positive	25	19	5	9	2	--	--	--	1	--	--	--

<sup>\*</sup>testing restricted to crows/jays only   <sup>\*\*</sup>squirrels not tested   <sup>+</sup> includes five 'chronic positive' birds   <sup>^</sup>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. Dead birds are reported by the public to the statewide WNV Hotline (1-877-WNV-BIRD) or [online](#). 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 2016 was restricted to corvid (crow family) birds only (crows, ravens, jays, magpies). Although we have occasionally found WNV positive individuals 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 the virus can be detected in our own laboratory the same day the bird was collected using a rapid screening test. During 2016, the WNV Hotline received 861 dead bird reports from Contra Costa County residents. Of those, 76 birds were collected for testing and 33 (43 percent) tested positive. Positive birds were scattered throughout Central County and East County with concentrations in Concord and Antioch.

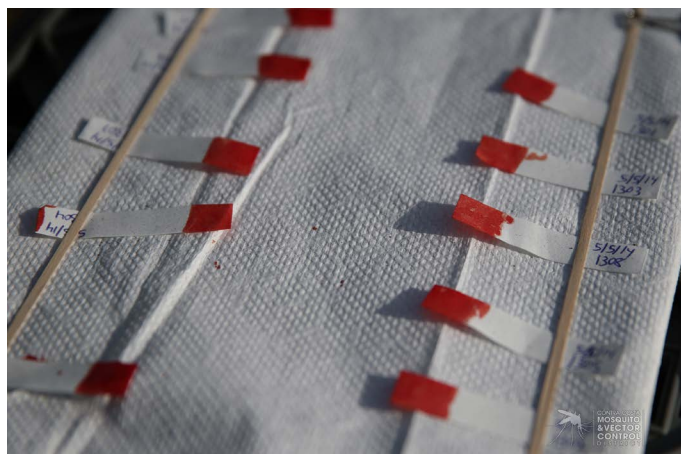


*District Scientific Programs Manager Steve Schutz, Ph.D. finishes testing a dead bird's saliva for West Nile virus.*

## 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 (10 at each of five flock sites) within the County. New young chickens are obtained from a commercial chicken farm each spring to insure 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 Lab in Richmond to be tested for antibodies to WNV, WEE and SLE viruses.

In 2016, five of our chickens (three on Holland Tract, two in Oakley) tested positive for WNV antibodies. Positive chickens occurred between mid-July and mid-August. 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.



*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.*

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## Human and Equine Disease Cases

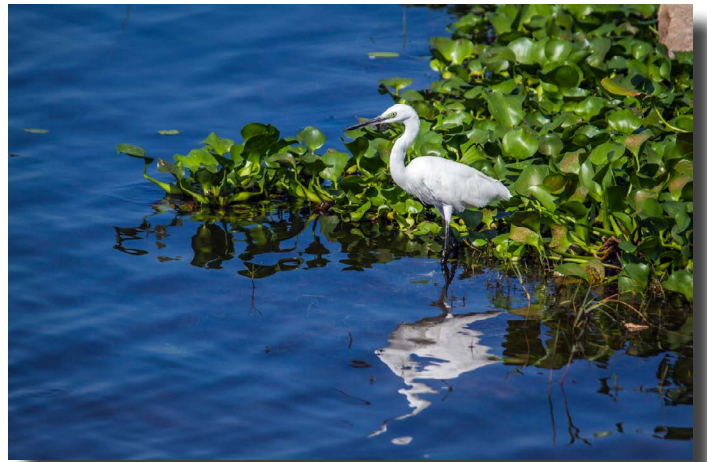
Four human cases of WNV were reported by the Contra Costa County Department of Public Health in 2016, one in west county, two in central county and one in east county. Due to patient confidentiality requirements, information on specific locations of residence, travel history, date of onset of illness and final outcome were not available. The vast majority of milder cases go un-tested and unreported since they may be asymptomatic (no symptoms) or mistaken for 'the flu'.

No equine (horse) cases were reported in Contra Costa County by the California Department of Food and Agriculture, although there were 21 cases reported statewide. An effective vaccine for horses has been available for several years and the vast majority of cases are unvaccinated horses. A human vaccine is not available.

Statewide, 421 human cases and 18 fatalities were reported in 2016, down from 801 cases reported the previous year. The majority, 314 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 reported case of neurological disease, so as many as 22,000 Californians may have had West-Nile related illnesses in 2016, the vast majority of which were never diagnosed or reported.

## Research, Special Projects and Presentations

Our Scientific Programs staff continued to work with the U.S. Department of Agriculture, Agricultural Research Service on a project to determine the impact of invasive aquatic weeds on mosquito populations in the San Joaquin Delta, and to rear and evaluate potential biological control agents for the introduced water hyacinth, which has been choking Delta waterways.



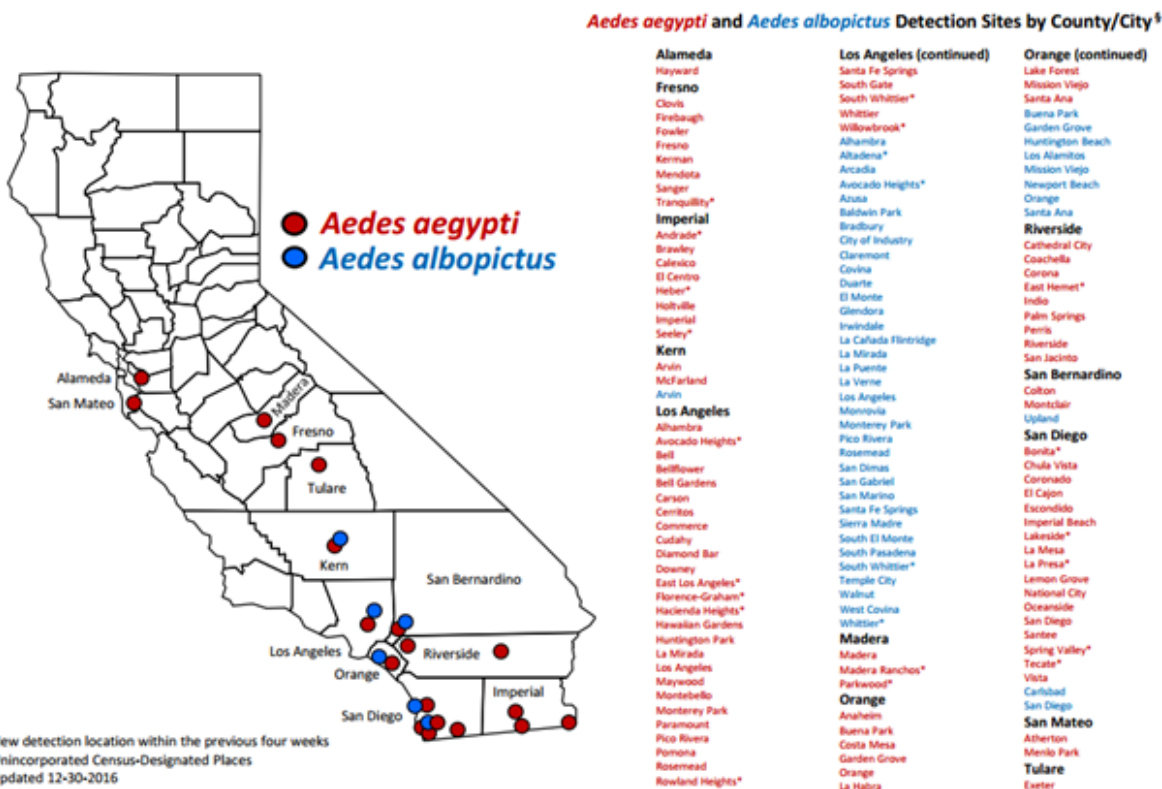
*Water hyacinth is an attractive floating aquatic plant that was introduced into the Delta from South America more than 100 years ago. The invasive plant can double in size every ten days in hot weather and can quickly become a dense floating mat of vegetation up to six feet thick. Mats can travel with 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* (see map, below). Both of these species are similar in behavior in that they are adapted to living around humans and laying their eggs in a wide variety of natural and artificial water containers. They are potential vectors of 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, several cases of local mosquito-borne transmission of Zika virus were reported in Florida and Texas during 2016. 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 these mosquitoes may spread these viruses locally in California. In 2016 our 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. Our technicians 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 us, and saving mosquito samples for identification.

### *Aedes aegypti* and *Aedes albopictus* Mosquitoes in California



## Mosquito Control Operations

### Conservation Efforts Create Mosquito Risk

The fifth year of California's statewide drought prompted many Contra Costa County residents to continue conservation efforts in order to save limited rain water. Those efforts, however, didn't always come without the risk of mosquitoes. In 2016, District employees reported seeing artificial containers such as cans and buckets holding water and often producing mosquitoes 241 times, up 43 percent compared to 2015. The discovery of the unintentional, yet efficient sources of mosquitoes, prompted District employees to provide additional education to residents on how to save rainwater without mosquitoes.

District employees found the various containers while conducting free inspections that are part of the District's larger mission to protect public health by controlling mosquitoes across the county. In 2016, District inspectors and technicians responded to 2,359 requests for service compared to 2,175 in 2015—an eight percent increase from year to year.

### Preventing Mosquito Problems Before They Happen

Partnering with other agencies and organizations is an important way for the District to achieve success in preventing mosquitoes. The Orinda City Council was instrumental in facilitating one such partnership between District personnel and the developers of a new home community where retention basins were being developed. Retention basins are designed to collect neighborhood water runoff from landscaping irrigation and allow that runoff to absorb into the ground. But these basins can also collect and hold water for longer periods of time. When not maintained, they can produce large numbers of mosquitoes. The collaboration of the agencies led to the prevention of mosquitoes in the new neighborhood.

The District also worked with builders, engineers and project managers in the City of Oakley to emphasize the need for design changes to reduce the risk of mosquito production at a 500-home development. Negotiations were successful and the new construction is proceeding appropriately toward good mosquito management.

### Underground Tank Produces Mosquitoes and Leads to an Increase in Requests for Service

Part of the reason for the increase in the number of requests for service was due to an underground grey water tank in San Ramon that produced mosquitoes putting residents in a nearby neighborhood at risk of mosquito bites.

Vandals damaged the seal on the tank that had previously prevented mosquitoes from accessing the water. The vandalism was unknown until nearby residents began contacting the District for mosquito inspections. Subsequently, service requests in San Ramon increased 26 percent compared to 2015.

During their inspections, District employees trapped mosquitoes at the scene that they identified as the two species known to transmit West Nile virus in Contra Costa County; however, none of the mosquitoes tested positive for the virus.

Following the inspections, trapping, and testing, District employees worked with the organization responsible for the tank to ensure the seal was repaired so that mosquitoes could no longer access the water. District employees plan to return to the location to confirm the repairs remain intact and that mosquitoes don't emerge from the tank.



*Vector Control Inspector Josefa Cabada inspects a residential backyard for mosquito sources.*

## California's Drought Continues to Raise the Risk of West Nile Virus

Each mosquitofish can eat up to 500 mosquito larvae per day. They are an efficient tool to prevent young mosquitoes from developing into adult mosquitoes capable of biting and spreading disease. District employees place these fish in carefully selected areas of water so that they can mitigate mosquito issues, but during the five years of California's drought, many areas that once supported the fish dried up. When sporadic rain returned to Contra Costa County, District employees had to revisit many areas to confirm the mosquitofish's presence or to restock them. Some of that work was done through direct visual inspection, while in other cases, through property managers, land owners, and various agencies.

Typically, once mosquitofish are established, they provide long-term control of mosquitoes. They are hardy, survive a variety of water and environmental conditions, and reproduce quickly and efficiently.



*District Biologist Chris Miller scoops up baby mosquitofish for rearing in a separate large container. The District produces more than 1 million mosquitofish per year to naturally combat mosquitoes.*

## New Message Aims at Better Maintenance by Homeowners of Neglected Swimming Pools

Neglected swimming pools are water features capable of producing more than one million mosquitoes and affecting people up to five miles away. In 2016, District personnel inspected 219 neglected swimming pools, nearly the same number of pools inspected in 2015—220.

Neglected swimming pools are notorious for producing copious amounts of mosquitoes that can pose a significant risk of mosquito-borne illness to entire neighborhoods. For years, the District's message directed members of the public to *report* neglected swimming pools so that District employees could inspect them, treat them for mosquitoes if present, or to stock them with mosquitofish for longer term control.

In 2016, the District changed the message from "report neglected swimming pools" to "maintain neglected swimming pools", a clearer message that illustrates that the onus of maintaining pools is on their owners. The District works to mitigate mosquito production to protect public health and welfare by treating the pool with mosquito control products or by stocking it with mosquitofish. The District does not tend to or clean swimming pools nor manage the water. Our efforts to control the mosquitoes do not change the quality or look of the pool water which means it may remain murky and green.

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## Mosquito Zones

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 2016, the zone leaders oversaw a number of projects and resources to reduce mosquito activity along the shoreline and inland sources as well as above ground and underground sources.

Zone one includes Hercules, Richmond and Pinole. The region includes economically diverse communities as well as coastal marshes, a number of regional parks and industrial areas. Unmaintained properties and swimming pools required attention throughout the year as did sanitation districts where the District inspector found mosquito production. A housing development in a former tidal marsh area of Hercules also necessitated several meetings with city and state officials to find an appropriate way to reduce overgrown vegetation in order to mitigate mosquito issues. The search for solutions is ongoing.

Zone two includes Martinez and Pleasant Hill where the inspector addressed several areas of potential mosquito production by monitoring and treating refineries, marshes and wetlands. In 2016, the inspector also found active mosquito production emanating from creeks and channels that had once dried due to the drought, but were once again flowing with water due to residential run off, drained swimming pools, and other agency maintenance that flushed pipes and machinery.

The cities of Antioch, Bay Point, Clyde, and Pittsburg are all part of zone three. Despite the continuing drought, rain water did return at certain times in 2016, reestablishing fresh water in areas that had become increasingly brackish and allowing tide predictions to regulate more efficient pre-treating of areas known for coastal mosquitoes.

Moraga, Orinda, Lafayette and part of Walnut Creek are within zone four where the inspector in charge of this zone oversaw mosquito control efforts involving catch basins, ponds, and neglected swimming pools. Due to established neighborhoods in these cities, older trees often feature tree holes where the mosquito that can transmit heartworms to dogs prefers to lay eggs. Twice in 2016, the zone four inspector, along with other District employees, conducted widespread treatment of tree holes to prevent mosquitoes and reduce the risk of dog heartworm in the areas.

Zone five includes Clayton, part of Walnut Creek and part of Alamo. Due to the drought, many of the usual sources in these areas remained dry in 2016. The inspector responsible for the zone found dry creeks in a number of areas, while larger areas of water still contained water and required monitoring and treatment during the year. A partnership with Mount Diablo State Park kept the zone leader apprised of mosquito production in the park's numerous horse troughs. Mosquitofish are placed in the troughs to eliminate mosquito larvae.

An increase in privacy fencing and gates limited access to a number of sources in zone six, which includes parts of Alamo, Walnut Creek, Alamo, Blackhawk, Danville, and Diablo. As more housing developments appear in the region, the zone inspector plans to continue communication with all responsible parties to ensure access to known and newly created mosquito sources. Within the zone, in 2016, the Blackhawk Homeowners Association cooperated with the inspector's request and alerted him when any unmaintained swimming pools appeared within the community.

Zone seven includes large agricultural areas in Oakley and nearby Jersey Island. The use of disc and laser leveling on pasture fields at Ironhouse Sanitary District on Jersey Island reduced the amount of mosquitoes coming from the area while levee construction near the island created a few small sources of mosquitoes. The zone inspector kept these areas under surveillance and control. In Oakley, after years of working with a land manager of two large fields to coordinate flooding and reduce mosquito production, the manager vacated the property, consequently, mitigating mosquito issues in the area. Within the city of Oakley, the zone inspector worked to reduce mosquito production by treating underground storm drains.

During property inspections, District employees request a sample of mosquitoes. The dead mosquito in a clear plastic bag allows the inspector to identify the species and that identification provides the inspector with important information on where to look for the types of sources the species prefers. While responding to requests for inspections in Discovery Bay in 2016, the zone eight inspector received a number of samples containing midges, not mosquitoes. Midges look like small mosquitoes, but they do not bite and are not a type of mosquito at all.

Elsewhere in Discovery Bay, the inspector set up traps that collected many mosquitoes, but the source could not be identified. In Byron, the higher cost of water due to the drought forced some land managers to cease operations in 2016. In other areas, farmers installed drip irrigation systems to reduce the amount of water used, which also reduced the number of mosquitoes associated with standing water on the land. Not all areas reduced the number of mosquitoes, though, as the inspector detected high numbers of mosquitoes in traps in Byron and Brentwood, prompting surveillance and control efforts when sources of mosquitoes could be located.

Zone nine includes Antioch, Pittsburg, Bay Point and the rest of Clayton where neglected swimming pools remain a major concern for mosquito production. Because this area of Contra Costa County is often a “hot zone” for West Nile virus activity, the zone nine inspector was very busy in 2016 stocking mosquitofish in neglected swimming pools, treating curbside storm drains and working with officials at the Pittsburg water treatment plant, the Pittsburg Golf Course and Keller Canyon to reduce mosquito production. At Keller Canyon, the lead operator kept cows out of ponds to reduce indentations in the soil made from cow hooves. The indentations fill with water and can produce copious amounts of mosquitoes.

Holland Tract, Bethel Island, and East Oakley are all in zone 10. As this zone lies largely below sea level, and the air temperature remains warm much of the year, there are many areas that can maintain levels of water and subsequently produce mosquitoes. Because this area produces large amounts of mosquitoes, the inspector spent most of his time conducting surveillance and control as well as educating land managers and property owners about ways to reduce mosquito production. A partnership with Contra Costa County Public Works helped to alleviate mosquitoes coming from the Stone Road area of Bethel Island. Work with duck club owners on Holland Tract led to successful mosquito control as well.

Zone 12 is comprised of the City of Concord. 2016 proved to be a very busy year for the technician who oversees this zone. There were 11 dead birds that tested positive for West Nile virus compared to just one in 2015. Due to the West Nile virus activity in the area, the technician conducted surveillance to find the source of infected mosquitoes; however, none of the trapped mosquitoes in the area tested positive for the virus. The evidence suggested the birds may have come from somewhere else before dying in Concord. The technician also worked to clear algae from Pine Creek canal because the algae was clogging the water and providing mosquitoes with a successful habitat.

In addition to the numbered zones in the mosquito program, one technician served as a “floater” — someone who could go to any zone to assist the zone leader or carry out a prescribed plan for surveillance and or control. During 2016, this technician primarily worked to assist inspectors and technicians in six of the 11 zones. The technician collected 290 larval samples and provided control in 215 sources.



*Vector Control Inspector David Wexler treats a flower vase in a cemetery.*



## Rats & Mice

### Sporadic Rain Increases Populations

While California continued into a fifth year of statewide drought in 2016, sporadic rain during the year kept the occasional hillside green longer than in the past few years. The increase in vegetation provided both food and habitat to rats and mice in Contra Costa County resulting in healthier rats and mice that were more likely to survive. Once the vegetation dried, however, the healthy rats and mice went in search of greener pastures. They found them in neighborhoods where landscaping irrigation kept some yards and plants hearty. Evidence of this trend can be seen in the increasing number of requests for residential service—1234 in 2016 requests compared to 903 the previous year.

### Lurking Underground

There are two primary species of rats in Contra Costa County, the Norway rat and the roof rat. The roof rat garners its name from its ability to climb and nest in high places, like trees or attics. Roof rats scour rooftops for tiny holes that it can chew or claw into. The openings need only be a few centimeters wide for the rat to gain access and build a home. On the contrary, the Norway rat prefers nesting near the ground or underground. The Norway rat can hold its breath and therefore swim great distances. Stories of Norway rats entering homes through toilets are not myths. Their penchant for water is why the District conducts sewer baiting to reduce rat populations underground thus reducing the risk that a rat ends up an unwelcome surprise to an unsuspecting restroom user.

In 2016, District employees conducted sewer baiting at 38 sources in 11 cities, down from the 44 sources in 11 cities in 2015. An increase in requests for rat and mouse inspections directed resources away from the sewers and to homes.

### Mistaken Identity Leads to Outreach Opportunities

The city with the largest number of requests was San Ramon (166), followed by Walnut Creek (119), Concord (111), and Richmond (102). In 2015, there were 74 requests from San Ramon. The increase, year to year, can be blamed on a case of mistaken identity that led homeowners in two different cities to contact the District for rat and mouse inspections.

In San Ramon, District employees found the offending animals were neither rats nor mice, but meadow voles. Meadow voles are small rodents that can be distinguished by their heavy body, short legs, hairy tail, small ears, and blunt nose. Voles are not vectors of a specific disease, but they can damage yards, fields and farms due to their burrowing. The same phenomenon also occurred in the city of Oakley, where service requests increased by 311 percent, but upon inspection, District inspectors found voles, not mice, were the culprits.

While the District employees performed the inspections, in addition to explaining the difference between voles, rats and mice, they also used the opportunity to offer important information on the District's other services to homeowners making the cases of mistaken identity opportunities for outreach.



*A meadow vole.*

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## Sharing Information Door-to-Door

Providing education to residents and business owners is an important way to improve prevention efforts and it is outreach that comes in different forms. The District shares information through printed materials, digital videos and information on our website, and sometimes it's as simple as going door-to-door. The enhanced program began in 2015 when District employees visited 19 neighborhoods. In 2016, District employees personally met with residents in 79 neighborhoods — a 315 percent increase from the previous year.



*District Inspector Dave Obrochta inspects a wood pile for evidence of rats or mice at a resident's home. Wood piles provide ample shelter for the rodents and should be kept about one foot off the ground.*

## Vacant Properties Prompt Infestations

In Richmond, where District employees responded to 102 requests for service — up from 73 requests in 2015 — calls were coming in describing the usually nocturnal rats as running rampant during daylight. Upon further inspection, District employees found the increase in requests for service was due to overpopulation in connection with an abundance of food and shelter at vacant and occasionally occupied properties. The District inspector in Richmond worked with local officials and educated residents about how to make homes less attractive to rats and mice.

## Looking Toward the Future

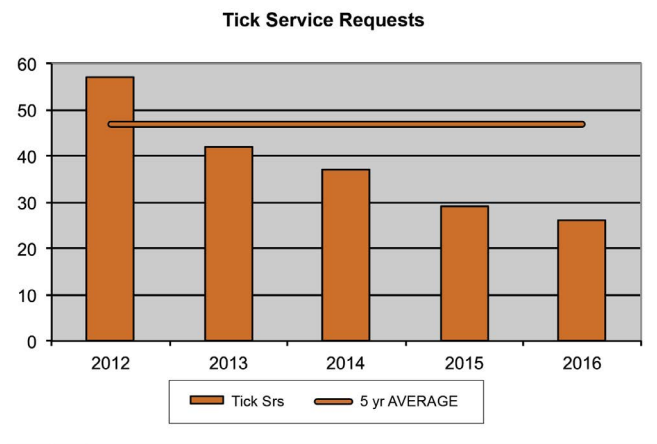
In the New Year, the District employees in the rat and mouse program are committed to educating members of the public on prevention efforts. They also plan to expand sewer baiting operations. As cities repair and replace aged sewer systems, the baiting program increases effectiveness, making efforts worthwhile for the District and residents alike.

## Ticks & Lyme Disease

Lyme disease is a bacterial infection 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. This is important because there are three species of ticks that commonly bite people, but only one (Western black-legged tick) transmits Lyme disease. The District does not test the ticks for the presence of Lyme Disease. People who are concerned that they may have contracted the disease should contact their physician.

The total number of tick related service requests in 2016 continued to decline as they have for the past five years. However, of the 26 ticks identified by our staff, 17 were Western black-legged ticks, an increase of 29 percent from last year.



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

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 getting 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.

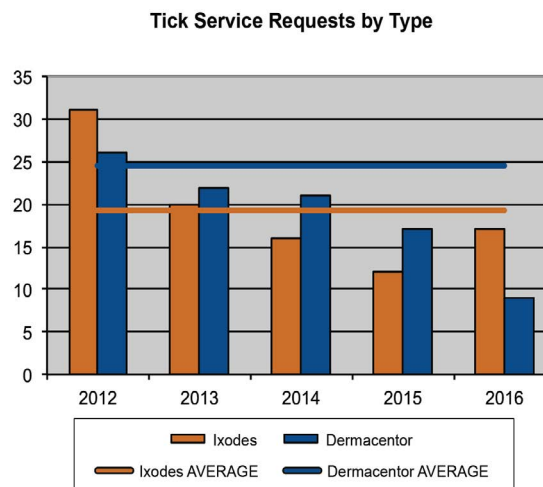
Your risk of acquiring a tick-borne illness depends on many factors, including where you live, what type of tick bit you, and how long the tick was attached. If you become ill after a tick bite, see a health care provider.

## Ticks of Contra Costa County

There are three 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*)

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



## Skunks & Rabies Risk Reduction

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. The District provides inspections and advice to county residents who believe a skunk may be living on their property. Education is the key service of the Rabies Risk Reduction program. Taking the appropriate measures to keep skunks from setting up dens on properties reduces the risk of rabies through contact.

### A Little Rain Gives Residents Hope and Skunks More Options for Survival

While still technically in a drought, California's average rainfall increased from **73 percent of normal precipitation in 2015** to **105 percent of normal in 2016**. The return of rainwater prompted some residents to become less attentive to conservation efforts, instead maintaining landscaping and water features. As renewed vegetation developed, it provided both food and shelter to skunks, which had already moved closer to populated areas during the drought. The improved amount of healthy grass seed, fruit-bearing trees and other foliage provided an ample food supply and helped to strengthen the skunk population.

### Rebounding Skunk Population and Improving Awareness Increases Requests for Service

A growing skunk population led to an increase in the number of service requests the District received in 2016. The District received 822 requests for service compared to 789 in 2015. Residents reported learning about the District's skunk service in a number of ways including through social media. When District employees arrived at various properties for inspections, they often heard from the residents that they learned about the District through various digital platforms.

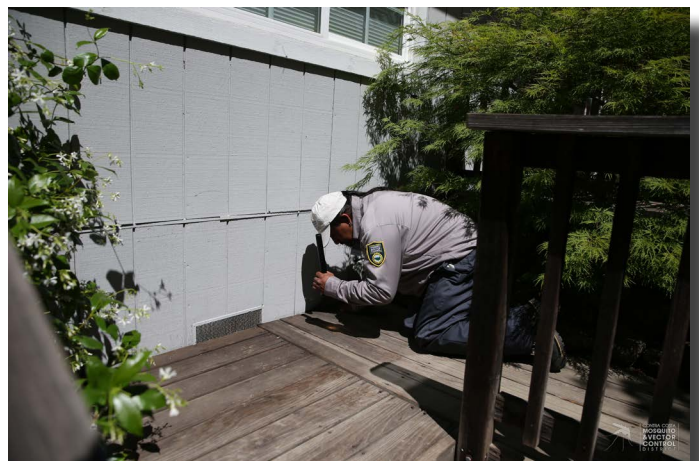
The cities that experienced the largest increase in service requests in 2016 were Danville (110), Concord (108), Walnut Creek (86), and Martinez (76). The increases also involved the number of skunks that were removed, once meeting specific criteria, by District inspectors. In 2016, District inspectors removed 364 skunks compared to 250 in 2015. In accordance with California code, relocating skunks is prohibited. Skunks are humanely euthanized.

### Encouraging Prevention One Resident at a Time

For the second year in a row, District employees shared information about the District's Rabies Risk Reduction program by conducting door to door meetings in neighborhoods known for increased skunk activity. District employees visited 15 neighborhoods in 2016, down from the 33 visited in 2015. The District plans to canvass more neighborhoods in the future.

### What You Don't Know Can Attract Skunks

Through conversations with residents, District employees discovered many citizens did not realize that putting food out for other animals feeds skunks and attracts them to residential areas. Often, District inspectors heard comments such as, "skunks don't like bird seed" or "I'm only putting food out for the feral cats." But, skunks will eat fallen bird seed, pet food, and fallen fruit from trees, just to name a few plentiful options found in neighborhoods. The key to preventing skunks from setting up dens in yards and reducing the risk of rabies is to not provide them with food and shelter, thus limiting contact with them.



*Vector Control Inspector Jason Descans inspects a deck for evidence of skunk activity.*

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## Yellowjackets

Yellowjackets pose a risk to public health because they have the ability to bite and sting. And, unlike a honey bee which features a detachable stinger, a yellowjacket's stinger remains in place, allowing yellowjackets to 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 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.

In 2016, a year in which rain began to return to California following the driest consecutive years of statewide precipitation on record, vegetation rejuvenated, increasing the number of small pest insects that serve as a food source for yellowjackets. The increased food and water supply led to a larger population which is reflected in the dramatic increase in the number of requests for yellowjacket service the District received in 2016. District employees responded to 744 requests for service in 2016, a 185 percent increase in the number of requests from the preceding year.

Within Contra Costa County, the cities where residents requested the largest number of inspections were Lafayette (167), Walnut Creek (121), Orinda (100), and Pleasant Hill (62). With the exception of Pleasant Hill, which replaced Moraga, all of the cities that experienced the largest number of service requests in 2016 also made the list in 2015.

### Larger Populations and Aggression Creates Challenges in Treatment

Prior to 2016, District inspectors witnessed usual yellowjacket behavior that included longer flight patterns and notable aggression. District staff speculate that they may have adapted their behavior due to the drought.

One example is when technicians found multiple nests that penetrated deep into the ground. After the initial treatment, the remaining yellowjackets were more aggressive. The inspectors suspect the yellowjackets may have been making use of underground tunnels which made the overall treatment more challenging.

At a treatment in parkland in Moraga, a District inspector found evidence that an animal had partially dug up the nest. This was unusual because animals usually destroy the entire yellowjacket nest as they eat young yellowjacket larvae. In this case, only half of the nest was destroyed and adult yellowjackets remained active and aggressive. The District employee suspects the animal may have given up due to the yellowjacket's hostility. In the end, the inspector treated not only the remaining part of the nest, but returned to the area when yellowjackets continued to assault passersby. A second inspection revealed another nest.

The increased level of wasp anger was also observed later in the yellowjacket season when each of the colonies queens left to fend for themselves. Queens at this time usually focus on creating more queens that will hibernate over the winter and establish new nests in the following spring. District inspectors reported finding these emerging queens late in 2016 and in cases where they made contact, the new queens were also particularly aggressive.

### In Spite of Return of Rain, Yellowjacket Activity Continued All Year

The District received requests for yellowjacket inspections during every month of the year in 2016, an increase from 2015 when the District only received requests during 10 months of the year.

The frequency of requests may not seem unusual considering the dramatic increase in service requests from 2015 to 2016; however, the fact the yellowjacket activity continued late into 2016 was another contradiction to known behavior of yellowjackets.

In October 2016, California's long awaited rains began to return. Past experiences with ground-nesting yellowjackets suggests the nests would fill with water and yellowjacket activity would decline. Surprisingly, District technicians not only witnessed yellowjackets flying in the rain, but they remained aggressive.

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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 2016, the District received ten 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 European honey bees. Initial screening for AHB is made by District scientists measuring the wing span of the bees and comparing them to those of the European honey bees, but they can only be positively identified through DNA testing.

Africanized honey bees have an interesting history. In 1950, researchers in Brazil bred them with European honey bees 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 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 shorter fuse 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 have that overprotective instinct toward their queen, 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. And 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 Africanized bees, out foraging on flowers are just looking to gather food and are not interested in stinging anyone unless they are threatened or swatted.



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

## Fisheries

The District produced approximately 1.8 million mosquitofish (*Gambusia affinis*) and distributed 122,380 in Contra Costa County in 2016.

In addition to rearing mosquitofish, the fish biologist continues to work with California native fish species for use in mosquito control: the California roach (*Lavinia symmetricus*) and the Sacramento hitch (*Lavinia exilicauda exilicauda*). He also works with the California Department of Fish & Wildlife and East Bay Regional Parks to assist in the preservation of a unique genetic strain of Sacramento perch from Jewel Lake in Tilden Park.

The fish biologist has worked with the California roach since 2009 and can consistently produce juveniles. The District produced 4,500 roach in 2016 and has focused efforts on Sacramento hitch. The fish biologist has worked with Sacramento Hitch (*Lavinia exilicauda exilicauda*) since 2011.

In 2016, the District produced 671 hitch. Spawning started February 11 with the last batch of eggs found March 29. Temperature ranged from 14 to 18 Celsius. Larval hitch take commercial feed at swim-up and are pretty easy to rear. The issue is the collection of eggs. The fish biologist uses egg traps with artificial "vegetation" in large and small tanks as this species will eat its own eggs. To get a better idea of spawning behavior, he video taped one spawning event. On February 13, 2016 at 7 a.m., hitch spawned close to the surface in a school with eggs being scattered throughout the tank. Later they were seen spawning over the egg trap.



Sacramento hitch fish spawning ([click here to view video](#)).

Eggs are non adhesive, approximately 2 mm in diameter, clear, and slightly negatively buoyant. Because of this, the egg traps only collect a small portion of the eggs produced. On December 6th, 2016, the fish biologist observed spawning behavior in the hitch tank and eggs in the water column. Forty hitch were collected and placed in a smaller tank with multiple egg traps. Fish were also checked for sexual maturity by trying to express eggs or milt (sperm). No eggs were expressed, but multiple males produced milt. This early spawning may have been triggered by a water change. As of January 3, 2017, no eggs had been found. In reviewing the spawning dates of April 1 to April 18, 2014 and February 16 to March 2, 2015, he concluded that hitch spawning season has been variable. This may indicate that this species has a long spawning season with small batches of eggs being produced over a long period of time. For the 2017 spawning season, high densities of hitch will be stocked in smaller tanks with multiple egg traps.

Evaluation of hitch as a mosquito predator was done on a limited basis due to limited field sites. One non-maintained swimming pool was stocked July 8, 2016 with 40 one-year-old fish. No breeding was found and the pond was unexpectedly drained September 27. Small scale trials conducted with hitch in aquaria illustrate that they readily consume mosquito larvae.

Aquarium spawning of the Jewel Lake strain Sacramento perch produced two batches of larvae from six pairs of perch. Larvae were stock by East Bay Regional Park District personnel in approved sites.

District personnel have been in talks with California Department of Fish & Wildlife regarding a permit to stock California native fish in the waters of Contra Costa County. This matter has been transferred to a committee and the District awaits the requirements to obtain a permit. Once the permit is obtained, District personnel hope to stock fish in a few selected sites and monitor survival and mosquito control efficacy.



Sacramento hitch fish being checked for sexual maturity.

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## Public Affairs & Community Outreach

### Community Outreach

The mission of the District's outreach program is to educate and consult residents about preventing and controlling vectors in their own spaces. The public affairs team accomplishes this with a diversified approach using various communication vehicles. The benefits of working with the media are that we reach a mass audience efficiently. In a past survey conducted by the District, we know that most of our constituents rely on media as their No. 1 choice to learn of District news. We take working with the media seriously and they in turn tell our story thoughtfully, broadcasting important health information.

Aside from broadcasting, we met our constituents at a plethora of events and presentations where we engaged one-on-one. Some of the fairs and events we participated in 2016 were the Lafayette Wine & Art Festival, the King of the County BBQ Fest in Martinez, Friends of Marsh Creek Science Walk, Richmond Healthy Village Festival, Concord and Pittsburg National Night Out, Heart of Brentwood, Concord Home & Garden Show, Discovery Bay Earth Day, Green Footprint, Pittsburg Health and Safety Fair, Concord Emergency Preparedness Faire, and more.

In addition to outreach at events, we provided presentations at Realtor meetings, schools, home owners associations, rotary clubs, garden clubs, city and county groups such as public works departments, as well as visitors to our facility. We provide presentations to any group of 12 or more free of charge.

### Website

Our newly revamped award-winning website remains the No. 1 communication tool for constituents and media alike. In fact, the 300-page site also serves as an important reference tool for a worldwide audience.

In-house website management ensures timely and up-to-the-minute delivery of messages. Now, mobile users can receive the same features and benefits as desktop users. Of the majority of our website traffic, mobile users now make up 35 percent of our website visitors and desktop users make up 57 percent.

The District's website remains the top choice of preferred communication and contact from constituents. It's one-stop shopping—learn the latest news on the vector front, when and where fogging for adult mosquitoes takes place, advice on vector prevention and control, and even submit a request for service from the vector control technicians.

### Traditional Outreach

Traditional outreach such as advertisements at BART, in newspapers, an in-home mail wrap, and outdoor billboards help the District reach the most people both publicly and at home. And now, electronic advertising can be counted in this category. It's a diversified approach for a diversified constituency.

To ensure the District is cost-effective, marketing phone numbers placed on each ad enable the public relations staff to understand what communication vehicles are most used and where time, money, and effort should be placed to ensure the most amount of residents benefit from them.



*Sign of the Times: For the first time, Zika virus is introduced into our outreach campaign as shown here in a Highway 4 billboard.*



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## Electronic Communication

Our electronic communication consists of [Media Releases](#), [Adult Mosquito Spray Notifications](#), and the [Mosquito Bytes Newsletter](#). About 49 percent of subscribers access them through their mobile devices and 51 percent access them through their desktop computers.

The electronic communication offers immediate and timely information about District activities and important messages. Adult mosquito fogging maps are interactive and describe, down to the street level, where and when our crews will be fogging. Media releases provide breaking news such as current West Nile virus activity, and our newsletter illustrates relevant vector prevention and control information each month.

For the third time, The District earned an All Star award from Constant Contact, the delivery system for the communication. The District was awarded the All Star award for communication efforts in 2016 as well as in 2011 and 2012. The award means that the District communicates effectively and efficiently, and that we do not spam our constituents. We strive to present informative and relative information that's worthy of readers' time.



Specifically, All Star winners must have high open rates. This translates to emails that are opened and not simply discarded. District open rates are consistently well above average for the industry. High click-through rates are proof that people click on the links, visit our website, and get more needed information. It's one way we can continue to educate our constituents about services they pay for through their taxes, offer sound advice for vector prevention and control, and so much more. Low bounce rates mean we don't spam our constituents. We only send communication to people who want to hear from us. We regularly manage our email subscriptions and weed out unused or old emails so we don't pay for email delivery to those that aren't being used. District bounce rates are classified as not only low, but "minuscule".

All Star Awards are only bestowed on less than five percent of Constant Contacts' more than half million customers. To see all of the public relations and marketing awards for the District, please [visit the web page](#).

## Quality Control

The District conducts quality control surveys to ensure constituents get the quality service they pay for through their taxes. Six out of ten customers are surveyed to understand the quality, responsiveness, and outcome of their service request. Surveys sent via United States postal service are complete with a postage paid return card for easy and convenient response by customers. Online surveys are sent to those residents who request service via the District's website.

Studies show that a two to five percent response rate to a survey is considered a successful response to gauge satisfaction. The District received a 34 percent response rate from constituents requesting service via the District's website and a 22 percent response rate from customers sent a survey via the United States post office. The District's customer service satisfaction across all of the District's vector services averaged 92.5 percent for 2016.

## 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.

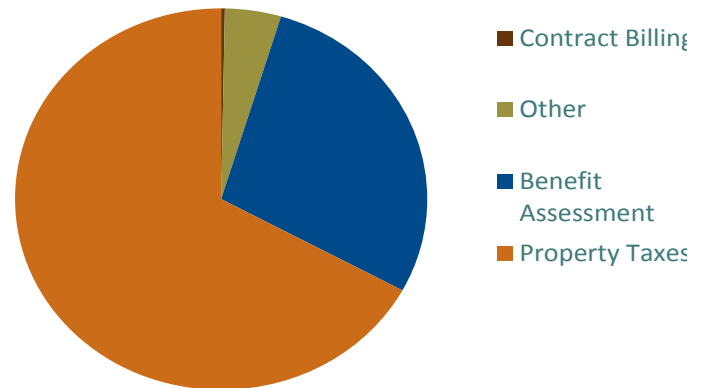
The District receives approximately two-thirds of its annual revenue from property taxes and this revenue stream rose approximately 8.2 percent in the fiscal year 2015/2016 as compared to fiscal year 2014/2015. This is in strong contrast to the dramatic drop the District saw in property tax revenue during the housing crisis. We continue to see signs that Contra Costa County property tax assessed values will continue to rise due to a recovery in the 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 according to benefit of our services and generates revenues that are used to provide mosquito and vector surveillance and control projects to the properties in Contra Costa County.

The District's board of trustees created a trust and adopted a policy to begin funding Other Post Employment Benefits , "OPEB". Under Government Accounting Standards Board recommendations, public agencies need to start funding future retiree health benefits. Based on studies completed by an independent outside actuary, the District currently contributes \$145,000 from reserves to this trust fund.

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, they review the accounting principles used, all financial disclosures, and the overall financial statement presentation. The District annually receives an *Unqualified Opinion*, which is the best opinion bestowed.

2015/2016



Revenues	2015/2016*	2016/2017**
Property Taxes	\$4,771,963	\$4,962,842
Benefit Assessment	2,010,813	2,011,686
Contracts	34,932	40,000
Interest	13,764	20,000
Miscellaneous	279,567	158,000
<b>Total Revenues</b>	<b>\$7,111,039</b>	<b>\$7,192,528</b>
Expenditures	2015/2016	2016/2017
Salaries & Wages	\$5,389,292	\$5,374,977
Operations	1,155,729	1,419,503
Capital	143,448	194,258
<b>Total Expenditures</b>	<b>\$6,688,469</b>	<b>\$6,988,738</b>
Transfer to reserve	422,570	203,790

\*Audited \*\*To be audited

## 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.

Last year, the Central Contra Costa Sanitary District recognized the District as a Water Quality Community Partner for 15 years of full compliance with their Industrial User Permit stating “your efforts to reduce pollutants entering the sewer system help us to achieve our mission of protecting public health and the environment.”

## 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, in addition to at least one of the following: Mosquito Biology and Control; Terrestrial Invertebrate (insect) Biology and Control; Vertebrate (animal) 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 38 field vehicles, three staff vehicles, 18 vehicle sprayers, two boats and their trailers, four eight-wheel ARGOs, four four-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 with city and county entities regarding compliance and enforcement on vector control issues.



*The District is located in Concord, California.*



***Protecting Public Health Since 1927***

155 Mason Circle • Concord, CA 94520

[www.ContraCostaMosquito.com](http://www.ContraCostaMosquito.com)