



2014 ANNUAL REPORT

 **CONTRA COSTA
MOSQUITO
& VECTOR
CONTROL
DISTRICT**
Protecting Public Health Since 1927

Table of Contents

Programs & Services	•3
Principles	•4
History	•5
Personnel	•9
Board of Trustees	•10
Inspectors & Technicians	•11
Administrative Staff	•11
Integrated Vector Management	•12
Mosquito & Vector Surveillance	•19
Mosquito-Borne Disease Surveillance	•24
Mosquito Control Operations	•28
Rats & Mice	•31
Ticks & Lyme Disease	•33
Skunks and Rabies Risk Reduction	•35
Yellowjackets	•36
Africanized Honey Bees	•38
Fisheries	•39
Public Affairs & Community Outreach	•40
Environmental	•42
Continuing Education	•42
Shop & Facility Maintenance	•42
Information Technology	•42
Administration	•42
Financial Statement	•43

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 2014.

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 your property for mosquito problems and provide advice on controlling their populations. With **23 kinds 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 at [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.

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 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.

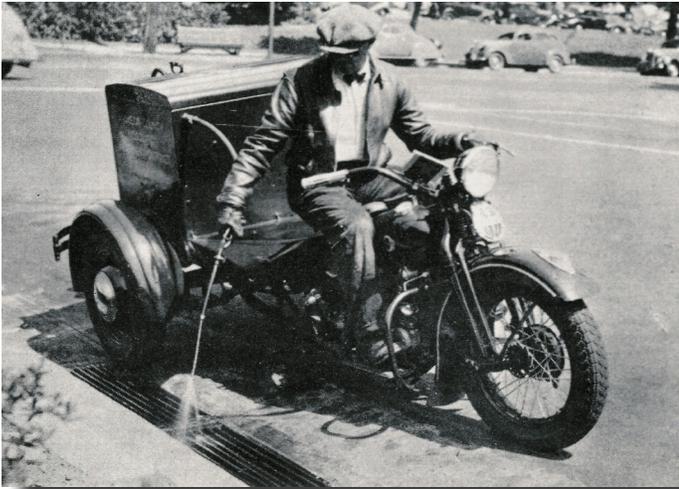


In 1926, Stover responded to requests from Contra Costa County and directed the first operations of Contra Costa Mosquito Abatement District (CCMAD #1), concurrently with his duties in Marin and San Mateo Counties. The purpose of the District was to control marsh mosquitoes in north central Contra Costa 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 more than 80 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.



Mosquitofish rearing. 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 more than 86 years, the District remains steadfast in protecting public health from vector-borne diseases.



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

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: Allison Nelson

Laboratory

Scientific Program 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: West
Program Supervisor: Sheila Currier

Inspectors:

Lawrence Brown
Josefa Cabada
Felipe Carrillo
Jeremy Tamargo
David Wexler

Technicians:

Brandon French

Mosquito Control Operations: East
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, self-governed 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: Jim Fitzsimmons, Lafayette; Chris Cowen, Vice President, Contra Costa County; Richard Ainsley, Pittsburg; James Pinckney, President, Contra Costa County; Daniel Pellegrini, Martinez; Richard Means, Pleasant Hill; Perry Carlston, Concord; Jeff Bennett, Hercules; and Michael Krieg, Oakley

Kneeling/Seated: Darryl Young, Contra Costa County; Lola Odunlami, Antioch; H. Richard Mank, Secretary, El Cerrito; Sharyn Rossi, San Ramon; Rolando Villareal, Brentwood; Peggje Howell, Clayton; Myrto Petreas, Ph.D., Moraga; and Randall Diamond, Danville

Not pictured: Sohelia Bana, Ph.D., Richmond; Warren Clayton, Pinole; Morris Jones, Walnut Creek; and Diane Wolcott, Orinda



Standing: Allison Nelson, Administrative Secretary; Jonathan Rehana, Program Supervisor; Tina Cox, Accounting/ Benefits Specialist; Marianne Reinmuth, Clerk/Receptionist; Nola Woods, Community Affairs Representative; Greg Howard, Program Supervisor; Damien Clauson, Vector Ecologist; Steve Schutz, Ph.D., Scientific Program Manager; Deborah Bass, Public Affairs Manager; Craig Downs, General Manager; and Ray Waletzko, Assistant Manager
Not pictured: Sheila Currier, Program Supervisor; Eric Ghilarducci, Vector Ecologist II; Chris Miller, Biologist; Andrew Pierce, Community Affairs Representative; and Wayne Shieh, IT Systems Administrator



Standing: Steve Fisher, VCI; David Wexler, VCI; Danielle Wisniewski, VCI; Tom Fishe, Mechanic II; Felipe Carrillo, VCI; Dave Obrochta, VCI; Joe Cleope, VCI; Christopher Doll, VCT; Reed Black, VCI; Jeremy Shannon, VCT; Patrick Vicencio, VCI; Lawrence Brown, VCI; Jason Descans, VCI; Jeremy Tamargo, VCI; Brandon French, VCT; and Joe Hummel, VCI
Not Pictured: Josefa Cabada, VCI; and Tim Mann, VCI

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.

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 and rodents 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.

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.

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 (currently 11) 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.

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 2014. 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.

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 the synthetic pyrethroid Resmethrin (Scourge). Both contain the synergist PBO (piperonyl butoxide) which improves their effectiveness against adult mosquitoes while reducing the amount of active ingredient needed. Both 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 oz. to 2 oz. of active ingredient per acre) and are non-persistent (break down rapidly in sunlight). Applications are generally conducted at night or before dawn, when the target mosquitoes are most active, but 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.

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 copy of a referral list which contains the names of all 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 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 program. **Twenty-three different 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 2014, our laboratory counted and identified 42,139 mosquito larvae and pupae.

Adult Mosquito Surveillance

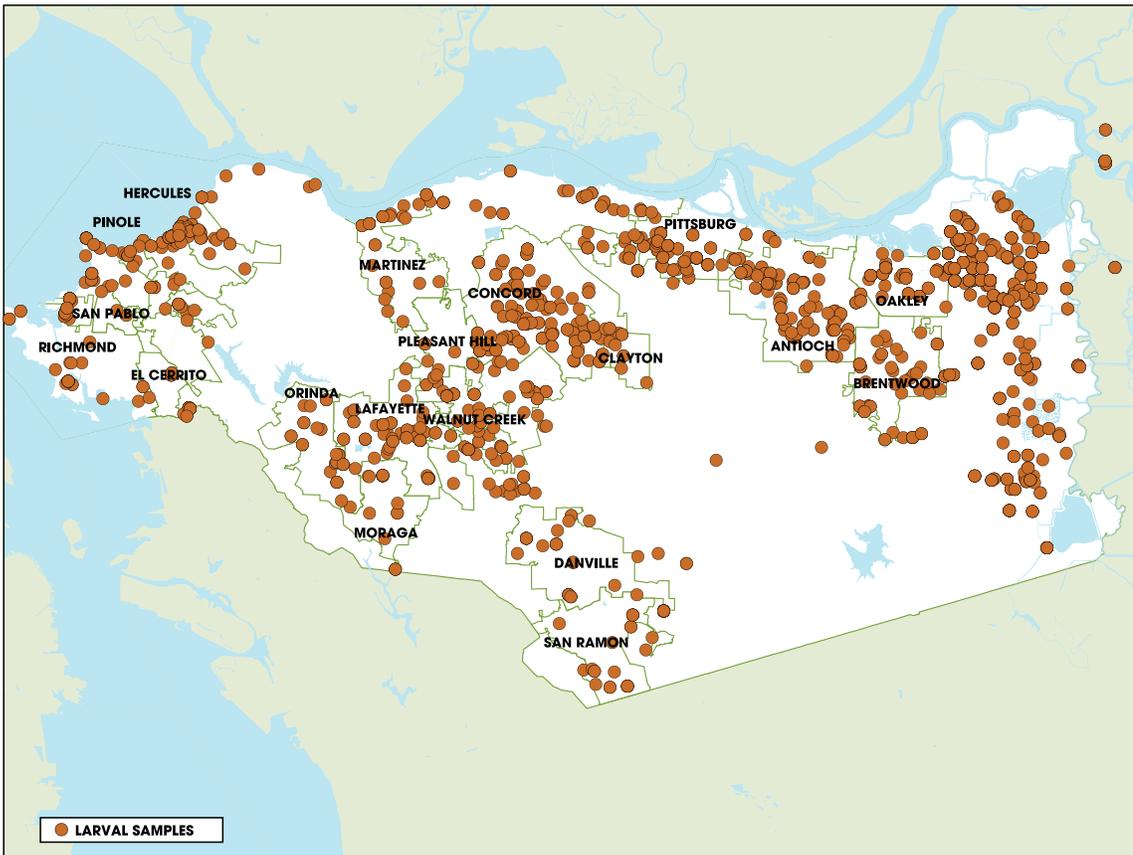
The District utilizes two types of traps to monitor adult mosquito populations throughout the county—New Jersey light traps and carbon dioxide traps (CO₂ traps)—at representative locations throughout the county.

Species	Count
Pupae*	2974
Cx tarsalis	14,550
Cx pipiens	9,485
Cx incidens	9,645
Cs inornata	856
Ae washinoi	572
Ae nigromaculis	1,379
Ae melanimon	456
Ae sierrensis	18
Cx stigmatosoma	275
Ae squamiger	270
Cx erythrothorax	48
Ae dorsalis	1,423
Ae vexans	97
An punctipennis	20
Cx apicalis	9
An franciscanus	45
Cx boharti	8
An occidentalis	9
TOTAL	42,139
*pupae not identified to species	

Mosquito larvae identified in 2014 by species.



Entomologist Steve Schutz, Ph.D. identifies and counts mosquitoes in the District laboratory



Locations of mosquito larval samples collected by the District in 2014.

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.

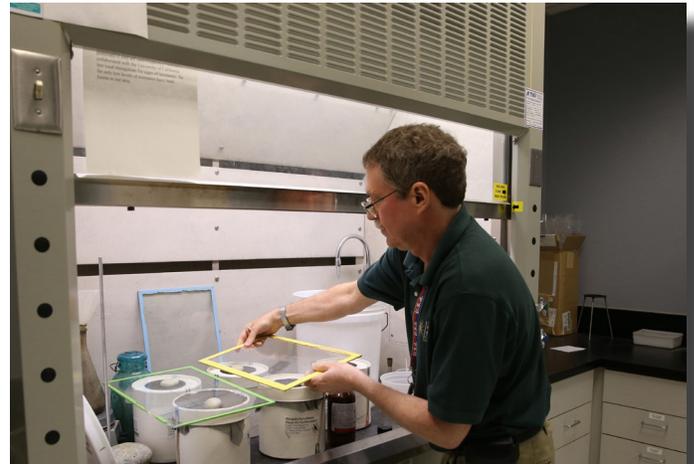
CO₂ traps are portable, battery powered, and use dry ice to produce carbon dioxide, which is a powerful attractant for mosquitoes, as well as a small LED light. Traps are set overnight once per week at 24 'fixed' locations throughout the county and as many as 12-30 variable locations that are chosen 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.



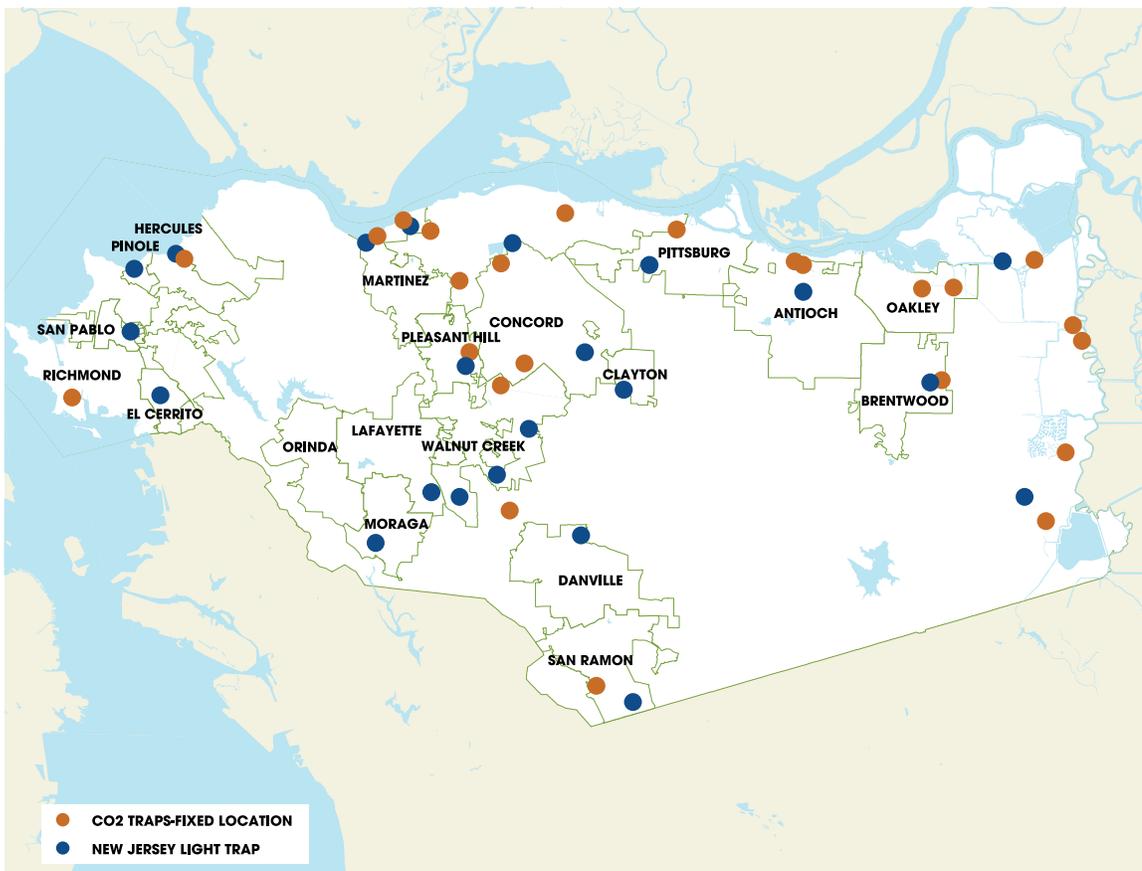
A CO₂ trap hangs ready to trap adult mosquitoes. Dry ice produces carbon dioxide, which simulates the breath of a person and attracts adult mosquitoes.

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 SLE 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.

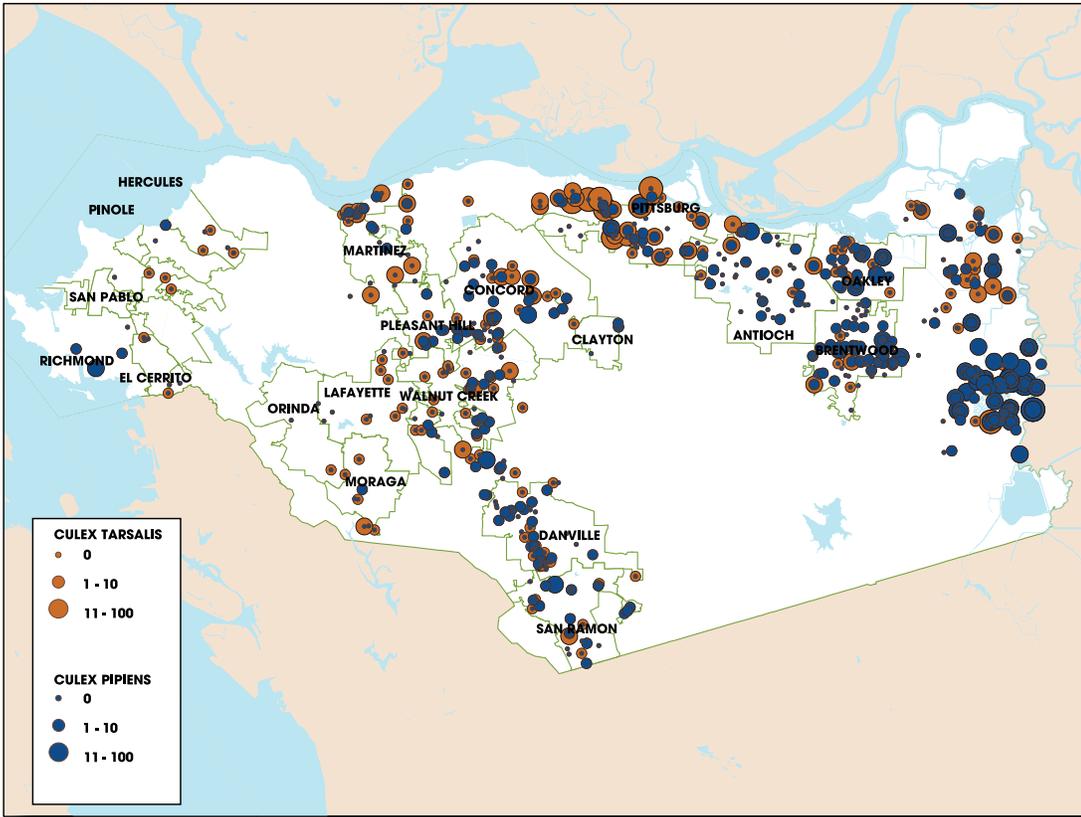


Entomologist Steve Schutz, Ph.D. anesthetizes adult mosquitoes prior to testing them for West Nile virus in the District laboratory.



FIXED ADULT MOSQUITO TRAP LOCATIONS IN 2014

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 2014

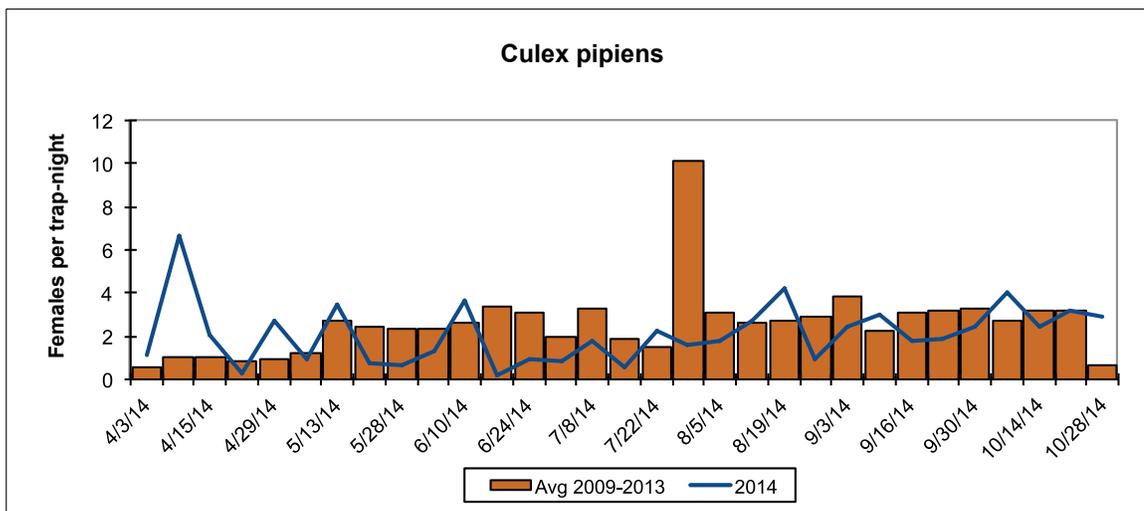
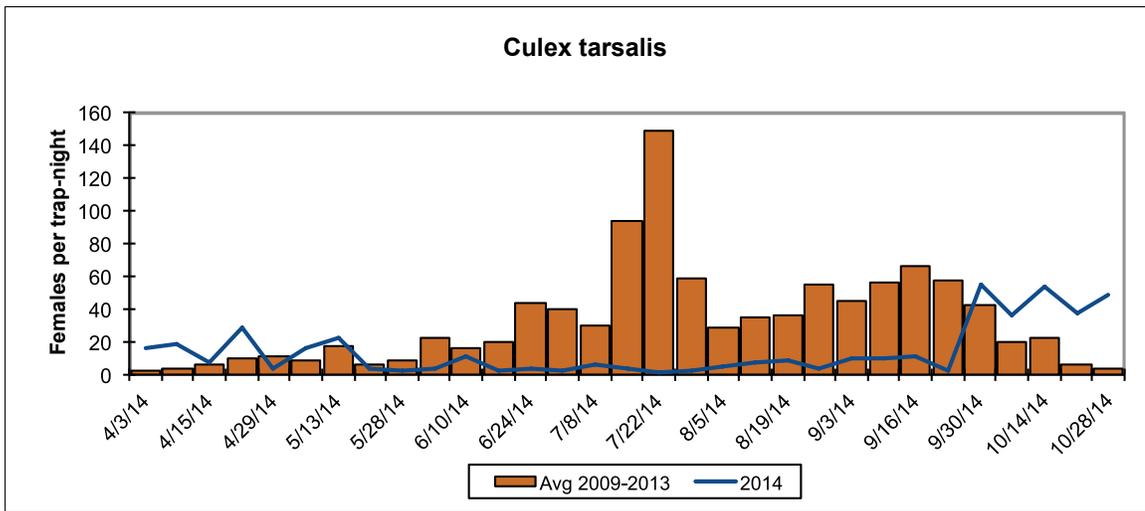
Random traps set throughout Contra Costa County capture mosquitoes for surveillance and control applications. *Culex tarsalis* and *Culex pipiens* are primary vectors of West Nile virus and other diseases.

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

Rainfall and summer temperatures continued to be below average in 2014, and county-wide populations of *Culex tarsalis* were well below average throughout most of our typical peak season (June through September), with some unusually high counts early and late in the season. *Culex pipiens* counts fluctuated, but were also mostly below average. Despite these lower *Culex* counts, 2014 saw a resurgence of salt marsh mosquitoes (*Aedes dorsalis*) along the Martinez and Pittsburg/Bay Point waterfronts, possibly related to increased salinity due to prolonged drought conditions. Although these mosquitoes are not known as disease vectors, they avidly bite humans during daylight hours and have a significant impact on outdoor activities. The high counts prompted several fogging operations in the affected areas.

Species	Count
Cx tarsalis	20,651
Cx pipiens	7,065
Cx incidens	546
Cs inornata	2,768
Ae washinoi	285
Ae nigromaculis	9
Ae melanimon	1,301
Ae sierrensis	60
Cx stigmatosoma	2
Ae squamiger	255
Cx erythrothorax	3,047
Ae dorsalis	11,440
Ae vexans	231
An punctipennis	7
Cs particeps	78
An franciscanus	29
An freeborni	10
An occidentalis	5
TOTAL	47,789

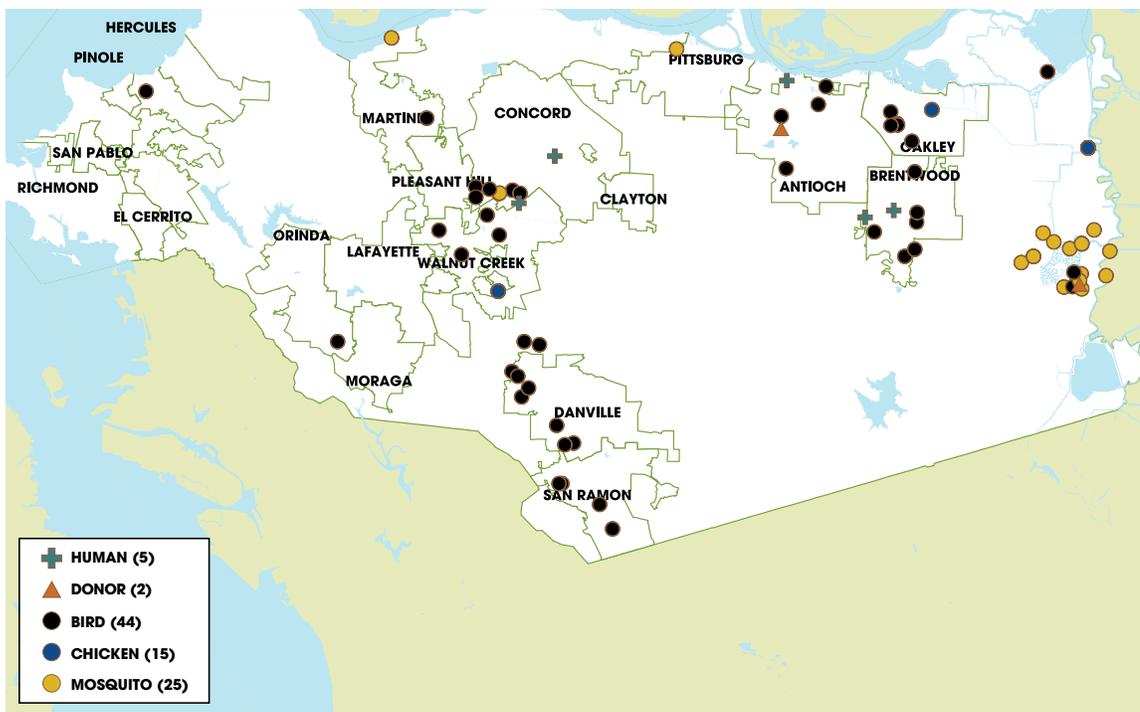
Abundance of Vector Mosquito Species in Contra Costa County in 2014



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 4,000 reported cases and 145 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, and could re-occur at any time. The District last detected WEE activity in 1997, when two chickens at our flock in the Martinez waterfront area tested positive for antibodies.

The San Francisco 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.



Positive West Nile Virus Activity in Contra Costa County in 2014

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 ten and fifty 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 2014, 652 samples, comprising 17,999 mosquitoes were tested; 25 samples were positive for WNV (15 *Cx. pipiens*, 10 *Cx. tarsalis*). The majority of these samples (20) came from Discovery Bay and adjacent agricultural areas. The remainder came from Martinez, Concord, Pittsburg and Knightsen. Fogging operations were conducted several times in Discovery Bay, as well as in Concord, Pittsburg, Bay Point, Bethel Island, and the Martinez waterfront, to reduce the risk of human cases and alleviate severe nuisance (biting) issues caused by salt marsh and pasture *Aedes* mosquitoes.



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 – 2014 SUMMARY OF ENCEPHALITIS VIRUS SURVEILLANCE

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

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

Dead Birds

The dead bird surveillance program represents a very successful collaboration between the California Department of Public Health, the District and the residents of Contra Costa County. 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 2014 was restricted to corvid (crow family) birds only (crows, ravens, jays, and 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 often be detected in our own laboratory the same day the bird was collected using a rapid screening test. Birds testing negative on our initial screening may be sent to the University of California for confirmatory testing. During 2014, the WNV Hotline received 1,355 dead bird reports from Contra Costa County residents. Of those, 115 birds were collected for testing and 44 (38 percent) tested positive. Positive birds were scattered throughout East and Central County.



District Entomologist Steve Schutz, Ph.D. uses a cotton swab to collect a dead bird's saliva for West Nile virus testing.

Sentinel Chickens

Chickens are naturally resistant to mosquito-borne viruses and they do pass the virus back to mosquitoes, but they also 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 ensure that they have not been previously infected. Blood samples are collected twice a month from April through October and submitted to the California Department of Public Health's Viral and Rickettsial Disease Lab in Richmond to be tested for antibodies to WNV, WEE and SLE viruses. In 2014, 15 of our chickens (nine on Holland Tract, two in Oakley and four in Walnut Creek) tested positive for WNV antibodies. The first positive sample came unusually early in the season (June 16th) and was the earliest positive sentinel chicken sample statewide in 2014. We typically don't see positive chickens until late July or 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.



District Ecologist Eric Ghilarducci soaks a paper sample with chicken blood from the chicken's comb. 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.

Human and Equine Disease Cases

Four locally acquired and one possibly non-locally acquired human WNV cases were reported by the Contra Costa County Department of Public Health. Two cases occurred in central county and two in east county. In addition, there were two positive blood donors in east county, neither of whom reported symptoms. All five symptomatic patients were hospitalized with the severe, neuroinvasive form of the disease and were listed as 'recovering' as of the last report we received. The vast majority of milder cases go untested and unreported since they may be asymptomatic (no symptoms) or mistaken for 'the flu'. Equine (horse) cases are no longer being tracked due to cutbacks in the statewide veterinary diseases surveillance program. An effective vaccine for horses has been available for several years; human vaccines are still not available. Statewide in 2014, 798 human cases and 14 fatalities were reported. Although this is not a record number of cases (there were 880 reported in 2008), 544 of them were neuroinvasive cases, more than in any previous year. The California Department of Public Health reports that there are typically 30 to 70 non-neuroinvasive (West Nile fever) cases for every case of neurological disease, so as many as 38,000 Californians may have had West-Nile related illness in 2014, the vast majority of which were never diagnosed or reported.

Research, Special Projects and Presentations

Biologist Chris Miller gave a talk at the 82nd Mosquito & Vector Control of California's Annual Conference in San Diego, CA entitled "Production of *Gambusia affinis* and California native fishes at the Contra Costa Mosquito and Vector Control District". In addition, we began working 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 that has been choking Delta waterways.

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, Los Angeles and San Diego Counties reported finding populations of the yellow fever mosquito, *Aedes aegypti* in 2014. In addition, Los Angeles County reported finding an Australian species, *Aedes notoscriptus*, the first time this species has been reported in North America. All of these species are similar in behavior, in that they are adapted to living around humans and lay their eggs in a wide variety of natural and artificial water containers. They are potential vectors of human disease, including dengue virus, which has been on the increase worldwide, and chikungunya virus, which spread explosively throughout the Caribbean, Central and South America in 2014, and are also known for being difficult to control and causing significant nuisance issues.

So far, attempts to eradicate these new mosquito populations have resulted in limited success. Recent cases of chikungunya and dengue diagnosed in travelers returning from the affected areas raise the concern that these mosquitoes may spread these viruses locally in California. In 2014, our comprehensive surveillance program did not detect the presence of invasive mosquito species in Contra Costa County. Our technicians will continue to proactively search for them. However, since they 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.

Mosquito Control Operations

California's Extreme Drought Led to Record Breaking West Nile Virus Rate

No sooner had 2014 begun when Governor Jerry Brown declared a state of emergency in response to California's historic, extreme drought. The significant lack of water created a natural reduction in the number of places where mosquitoes capable of transmitting West Nile virus could lay eggs, thus reducing at least part of the mosquito population as evidenced by the number of residential requests for mosquito inspections. In 2014, the District received 2,675 requests for mosquito services compared to 2,859 requests in 2013. Despite the smaller number of mosquitoes, the risk of West Nile virus was not diminished.

Mosquito surveillance conducted by the District's trained and certified inspectors and technicians observed that while many natural water sources were dry, the lasting water sources were, for the most part, in or near residential areas bringing the risk of disease within close proximity of residents. This forced insects and animals to congregate at remaining water sources placing mosquitoes capable of spreading disease directly with birds infected with West Nile virus. The result: California experienced the highest level ever of West Nile virus infected mosquitoes.

In 2014, the District's laboratory staff confirmed 25 groups of mosquitoes tested positive for West Nile virus—the highest number of infected mosquitoes in Contra Costa County in six years.

This trend could also be seen in the diverse distribution of dead birds that tested positive for West Nile virus in 2014. Birds are the reservoir for West Nile virus, so dead birds are often the first sign of the virus in a particular area. In all, the District's laboratory staff confirmed 44 dead birds from 14 cities within the county were infected with West Nile virus.

The District also tested chickens that were placed in five locations around the county to serve as sentinels because chickens have the ability to fight off West Nile virus infections, but maintain antibodies as evidence of the infection. When nearly half of the chickens in the flock located in Walnut Creek tested positive for West Nile virus antibodies in 2014, the District conducted door to door inspections in an effort to find the source of infected mosquitoes in the densely populated community.

The location of chickens that survived West Nile virus or infected birds that died due to the virus provided data that helped District supervisors direct focused mosquito prevention efforts. In 2014, those efforts concentrated on mosquitoes capable of transmitting West Nile virus, as well as other species that became abundant due to the drought.

Lack of Sierra Snowpack Created Challenges Along County Coastline

While the two species of mosquitoes (*Culex tarsalis* and *Culex pipiens*) that are the primary transmitters of West Nile virus in Contra Costa County prefer to lay eggs in anything that can serve as a water container, including buckets, birdbaths and neglected swimming pools, the county is home to a total of 23 species of mosquitoes that have differing preferences for habitat. The variety of mosquitoes is due to the diverse geography and climate within the county.

Along the county's shoreline, salt marsh mosquitoes (*Aedes dorsalis* and *Aedes squamiger*) lay their eggs in sand and soil found in the marsh. The high salt content in the brackish tide water activates the eggs to develop into new mosquitoes. During a typical year, one generation of mosquitoes emerges from the tidal water before the salinity is diluted due to the annual Sierra snowpack thaw. In 2014, however, California's historically low snowpack failed to dilute the salt content efficiently, allowing subsequent generations of mosquitoes to develop creating large, continuous populations that were attracted to nearby homes and businesses.

Neither salt marsh mosquito is a primary transmitter of disease, although each causes discomfort by actively seeking out people and large mammals to bite day and night. In response to their aggressive biting habits, the District fogged in the areas affected by these relentless species using truck-mounted ultra low volume sprayers 12 times in 2014. Surveillance performed prior to and after the fogging found a significant reduction in the adult mosquito population each time; however, without significant Sierra runoff, the saltwater continued to produce more new mosquitoes.

Ducks, Mosquitoes, and Interagency Communication

Due to the 10 to 20 mile flight range of the marsh mosquitoes, communities beyond the immediate shoreline also experienced the onslaught of biting insects, but the mosquitoes were not always emanating from within Contra Costa County. When District surveillance and inspections failed to find potential sources for salt-water-based mosquitoes that appeared near and east of Pittsburg, District supervisors contacted public health agencies from neighboring counties to determine if mosquitoes from those areas were flying into Contra Costa County.

The interagency communications revealed vegetation issues to the east that were producing mosquitoes arriving in east Contra Costa County, and ponds created for ducks north of the county resulted in mosquitoes crossing the Delta and arriving in northern Contra Costa communities.

The situation to the north involved the California Department of Fish and Wildlife's effort at Grizzly Island to flood specific areas to provide wetland habitats to migrating ducks that were facing a shrinking natural environment due to the drought. The result, however, was a surge of mosquitoes that flew across the Delta to the neighborhoods in and around Pittsburg. In 2014, the District fogged for adult mosquitoes using both hand-held and ultra low volume truck-mounted applicators. In the future, the District plans to develop a mutual plan with these agencies to minimize overflow mosquito activity that impacts county residents.

Cows Create Mosquito Issues

For decades, the District has worked with land owners within the county to encourage them to irrigate fields with an appropriate amount of water that allows them to dry within a few days to prevent mosquito development. Mosquitoes found in agricultural areas often need as few as five days to develop from egg to adult. If water remains past the initial development of pasture mosquitoes, the water can subsequently attract other species including those that can transmit West Nile virus.

In 2014, residents, primarily in the eastern portion of the county, began reporting abundant mosquitoes in the communities near hay fields. District employees discovered, due to the drought, cattle farmers were renting hay fields to feed their livestock because the drought had dried the natural vegetation usually available to the cows.

Upon closer inspection, District inspectors found the cows' hoof prints were preventing all of the water from dissipating from the fields, instead creating individual water sources for mosquitoes. Mosquitoes can lay up to 400 eggs at a time in just two tablespoons of water and so each indentation made by the cows had the ability to provide enough water for several hundred mosquitoes. District employees worked to educate the landowners about the issue and conducted mosquito control as needed.



Cows often leave hoof prints in the soil that fill with water and create individual breeding sites for mosquitoes

Mosquito Zones

To provide efficient mosquito control prevention to county residents and business owners, the District divided the county into 11 zones in 2014, increasing from 10 zones in 2013. Each zone was overseen by a trained and certified technician or inspector who served as zone leader who was primarily responsible for the day to day mosquito control operations in that particular area. Depending upon the geography, population and economic structure, the activities necessary to reduce the risk of mosquito-borne illness were quite diverse.

Along the Western edge of the county, communities feature marshland, industrial sites, and densely populated neighborhoods of both new and established construction. In 2014, the zone leader in this area worked with local officials to reduce the risk of mosquito-borne illness and gain access to more than 60 abandoned swimming pools on foreclosure properties. Each swimming pool has the potential to produce more than 1 million mosquitoes that can put people at risk of West Nile virus up to five miles away. To reduce that risk, the zone leader inspected and treated each neglected swimming pool with public health pesticides when necessary and placed mosquito-eating fish in the pools for long term mosquito prevention.

While featuring similar geographic, residential and industrial areas as the west, the northwest portion of the county also includes established communities with aged trees that serve as the habitat for the Western tree hole mosquito which is the vector of canine heartworm disease. To reduce the risk of heartworm in local dogs, the zone leader in this region worked with several other District inspectors to conduct widespread treatment of trees in local parks. This treatment involves using an absorbent in tree holes to prevent water from accumulating, thus denying mosquitoes a place to lay hundreds of eggs at a time.

Refineries, power plants and sanitation facilities along the county's northern coast proved to be sources of mosquito activity in 2014. The zone leaders in this area worked closely with personnel from each facility to reduce the number of mosquitoes that could pose a health risk to workers on site as well as residents in nearby neighborhoods. Part of the vector control challenge presented by these industries is inherent to their operations; they must maintain open water sources such as waste water ponds on each property. In cases where chemicals are contained within these water sources, mosquitofish cannot survive, so the zone leader must remain vigilant to conduct surveillance to detect the presence of mosquitoes and then use appropriate control methods to reduce the risk of mosquito-borne illness.

Throughout central and southern Contra Costa County, zone leaders worked to prevent mosquitoes primarily in residential areas. Tree hole mosquitoes occur in these areas and so zone leaders placed absorbent materials in the tree holes as needed. They also focused on residential sources and treated storm drains to prevent mosquitoes. During drought conditions, while many natural sources remained dry for much of the year, the catch basins that collect water that flows through gutters continued to receive runoff from landscaping sprinklers. One of the two types of mosquitoes that are known to transmit West Nile virus in the county prefer these underground locations and can put people at risk of infection within one mile of catch basins.

East Contra Costa County may be the most diverse section of the county as it features residential, industrial, coastal, and agricultural areas. In addition to the mosquito challenges that arose involving catch basins and neglected swimming pools in residential areas, the specialized ponds from industrial and agricultural areas involving damage from cow hooves, zone leaders also responded to citizen reports of numerous mosquitoes in the community of Bethel Island. A thorough investigation uncovered overwatered hay fields and flooded irrigated pastures. The zone leader and the District supervisor for that area worked with land owners and local officials to identify the responsible parties to alleviate future mosquito problems.

An Eye On the Future

The lack of water due to the California drought created numerous mosquito issues in 2014 and increased the risk that mosquitoes could become infected with West Nile virus.

If the drought continues into next year, it will be important for the District's mosquito technicians, inspectors and supervisors to maintain open lines of communication with neighboring counties to reduce the risk that mosquito-borne illness could travel into Contra Costa County. At the same time, communication with business owners, landowners and residents within the county will be more important than ever to encourage proper irrigation that reduces the risk of mosquitoes both above ground and below.

Rats & Mice

Commensal Nature Exasperated by Drought

Rats and mice are drawn to people by nature, but due to the diseases they are able to transmit through their **waste products** and **nesting materials**, their commensal relationship with humans is undesirable. That is why the Contra Costa Mosquito & Vector Control District provides free inspections and advice on how to make a home, yard or business less appealing to rats and mice in an effort to reduce the risk of **rodent-borne disease**.

In 2014, the District received 758 requests for service from members of the public, up from the 633 requests the District received in 2013. As the California drought dried natural sources of water, it is likely the number of service requests increased as rats and mice searched for water that was still available within neighborhoods. Four cities received 40 percent of the District's services: Concord, Walnut Creek, Danville and San Ramon.

In addition to the lack of water, the drought also dried vegetation, removing the natural habitat for the rats and mice and prompting them to seek irrigated landscaping for food and shelter. In many established areas, particularly properties where homeowners experienced California's previous drought from 1985-1991, drought-resistant vegetation can be found that can supply rats and mice with both shelter, and food through seedlings.



Vector Control Inspector Dave Obrochta uses a mirror to inspect a residential home for evidence of rats.

Generosity to Some, but Not All

Animal-loving residents often put out birdseed for birds, nuts for squirrels, and kibble for feral cats, but these well-intentioned actions of feeding strays and wildlife actually attracts rats and mice. To discourage rats and mice from considering these acts of generosity as a nightly buffet, the District encourages residents to take in cat food, remove nuts from fence lines, and sweep up fallen birdseed each evening.

Preventing Rats in Plumbing by Proper Use of Garbage Disposals

Included in the advice District employees share with homeowners is proper use of garbage disposals to reduce the risk of rats. Garbage disposals are designed to break up food so that it can flow easily down plumbing to the area's municipal pipes. For Norway rats, which can be found in areas close to water in Contra Costa County, sewer lines are a favorite habitat. The food that comes from garbage disposals provides them with ample sustenance. As the sewer lines are a common location for these rats, the District conducts sewer baiting to reduce the risk that the rat population would overrun the sewer lines, increasing the risk that they could get into plumbing within homes and businesses. In 2014, District employees conducted sewer baiting in 13 cities compared to 15 cities in 2013.

During these sewer treatments, District employees found large amounts of food that appeared to have been put down the disposal with very little breakdown, preventing the food from traveling very far from the home or business, thus attracting rats. The District recommends that garbage disposals be run with water and once the disposal is turned off, water should continue to run for at least 10 seconds in order to flush garbage from local pipes into the main system.

Strategic Information Effort

District employees share this advice with home and business owners daily as part of the inspection process. In 2014, members of the District's rat and mouse program also engaged in an effort to go door to door in neighborhoods where rat and mouse activity was high to provide widespread information to reduce the risk of rats and mice. The locations were chosen after District employees confirmed the presence of rats or mice on at least one property within a given neighborhood. That confirmation prompted the employee to visit neighboring homes, providing information on prevention and directions on how to receive District service if needed. The effort began in 2013 and increased by 17 percent in 2014. The goal for 2015 will be to increase the effort yet again.



Vector Control Inspector Dave Obrochta inspects under a homeowner's sink for signs of rats.

Changes in Public Health Pesticides

In July 2014, the State of California enacted new restrictions to prohibit over-the-counter sales of rodenticides known as second-generation products. While they are still available to public health employees, the District started removing these rodenticides from above ground locations, replacing them with public health pesticides that are less toxic and reduce the risk of secondary poisoning. The District now restricts usage of second-generation rodenticides to sewers and other underground locations to reduce access to these public health pesticides by non-target animals and people.

Looking to the future

As the District regularly re-evaluates policies and procedures to ensure an emphasis on environmental responsibility, the members of the District's rat and mouse program intend to think globally and act locally by focusing on educating members of the public about the simple and environmentally friendly things they can do to make their homes and yards unattractive to rats and mice. In the future, District employees will continue to emphasize the strategic information effort they began in 2013 with a goal of increasing outreach by another 15 percent over 2014. And the more county citizens know about how to reduce the risk of rats and mice in and around their homes, the more important steps they can take to keep their families and friends healthy by preventing rodent-borne illness.

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. The District has monitored the risk of Lyme disease by collecting and testing black-legged ticks from several locations in the county for more than 15 years. On average, only one or two in one hundred black-legged ticks test positive, although we have found a few locations where the rate is higher, and these tend to change over time.

District staff continue to identify ticks brought in by members of the public. This is important because there are three species of ticks that commonly bite people and only one (Western black-legged tick) transmits Lyme disease. We no longer test ticks for the disease since after careful consideration, the District entomologist and vector ecologist, along with biologists from the California Department of Public Health concluded that individual tick testing does not significantly reduce the risk of Lyme disease for patients since the data cannot confirm human disease. People who are concerned with possible Lyme disease should contact their physician.

Tick related service requests in 2014 continued to decline as was seen in 2013 and 2012. Of the 37 ticks identified by our staff, 16 were Western black-legged ticks, the vector of Lyme disease.



A dead Western black-legged tick (on its back) is identified in the District's laboratory. Western black-legged ticks are the one tick of three found in Contra Costa County capable of transmitting Lyme disease.

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.

Protect Yourself from Tick Bites

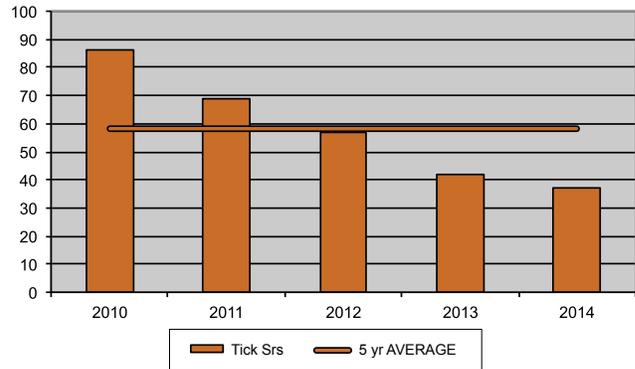
Know where to expect ticks. Western black-legged ticks live in moist and humid environments, particularly in or near wooded or grassy areas. You may come into contact with ticks during outdoor activities around your home or when walking through vegetation such as leaf litter or shrubs. To avoid ticks, walk in the center of trails.

Use a repellent with DEET on skin or clothing or permethrin on clothing and gear. Products containing permethrin can be used to treat boots, clothing and camping gear, and the permethrin can remain protective through several washings. Repellents containing 20 percent or more DEET (N, N-diethyl-m-toluamide) can be applied to the skin, and they can protect up to several hours. Always follow product instructions. Parents should apply repellents to their children, taking care to avoid application to hands, eyes, and mouth.

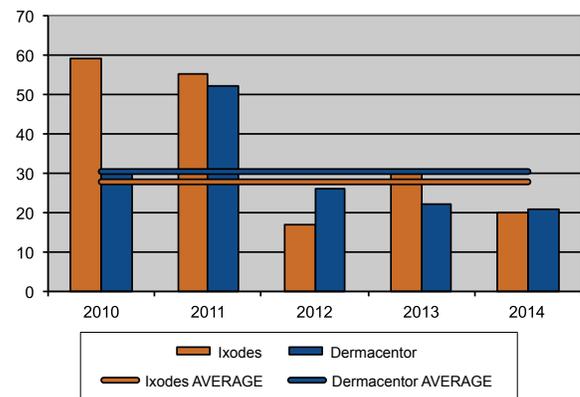
Prevent Ticks on Animals

Prevent family pets from bringing ticks into the home. Maintain your family pet under a veterinarian's care. Two of the ways to prevent ticks on dogs and cats are to apply a veterinarian-approved tick medication or by placing a tick collar on the animal. Be sure to use these products according to the package instructions.

Tick Service Requests



Tick Service Requests by Type



Skunks and Rabies Risk Reduction

Rabies

The rabies virus infects the central nervous system, ultimately causing disease in the brain and death when left untreated. It is transmitted to humans through the bite of an infected animal. In Contra Costa County, skunks are a known transmitter of rabies. Because skunks are attracted to residential areas due to their search for food and shelter, the Contra Costa Mosquito & Vector Control District provides free inspections and advice to deter skunk activity on private property to reduce the risk of rabies transmission to humans.

Service

In 2014, the District's trained and certified inspectors responded to 869 citizen requests for service, down from the 900 requests the District received in 2013. The cities where the majority of inspections took place were Walnut Creek, Danville, Concord, and Antioch. As a result of those inspections, District employees removed 320 skunks from private property in 2014, down from 490 in 2013. By law, the District may not relocate the skunks and they are therefore, humanely euthanized. The decrease in overall inspections and removal was due, at least in part, to the District's emphasis in 2014 on education.



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

Strategic Education

While the continuation of drought conditions in 2014 prompted skunks to seek food and habitat opportunities closer to private homes, the District intensified the effort to educate homeowners and business owners about how to make residential and commercial areas less attractive to skunks. District inspectors went door to door to talk one-on-one with residents in areas that have previously been known for increased levels of skunk activity. They also talked with school administrators, golf course employees, swim club staff, and various county supervisors. The inspectors pointed out specific items and areas that should be removed or altered to deter skunks. They emphasized the importance of removing pet food from outdoor locations and harvesting all fruit and vegetables that may be in a yard or on an industrial property. The inspectors also discouraged residents and workers from purposely leaving food items outside in an effort to feed wildlife.

The well meaning intentions of many citizens actually hurt wildlife according to the California Department of Fish and Wildlife program, [Keep Me Wild](#). When wild animals, including skunks, become accustomed to finding food provided by humans, they will eventually lose their natural hunting skills and be unable to survive in their natural habitats.

Early Activity

One area of increase in 2014 was the number of inspections District employees provided, specifically in the month of December. Compared to 2013, the number of inspections increased by 48 percent. The increase was due to changing weather that appeared to confuse the skunks and prompt them to begin mating activities slightly earlier than usual. Skunks typically begin mating once the rainy season begins in January or February; however, the heavy rain of December 2014 appeared to have encouraged the skunks to begin mating sooner rather than later.

Looking to the future

In the New Year, the Rabies Risk Reduction program will be focused on expanding the strategic education efforts begun in 2014. Consistent with the District's mission to protect and promote public health and welfare, District inspectors will continue to educate residents about the importance of making a property unattractive to skunks as a crucial way of protecting public health.

Yellowjackets

The Contra Costa Mosquito & Vector Control District provides inspections and treatment of in-ground yellowjacket nests on public and private property within Contra Costa County free of charge. In 2014, the District designated one vector control aide to provide the majority of yellowjacket inspections; however, at times of increased demand, 11 other District employees also responded to citizen requests.

Contra Costa County is home to four species of yellowjackets; the common yellowjacket (*Vespula vulgaris*) and the western yellowjacket (*Vespula pensylvanica*). Common yellowjackets build nests above ground and, for the most part, leave passing people and pets alone. Western yellowjackets on the other hand, build nests underground and are far more aggressive. When a person or animal walks on the ground above the nest, the vibration reverberates within the nest and alerts the yellowjackets inside to a potential threat. They exit the nest in a defensive posture—ready to sting and bite anyone or anything that threatens their colony.

The population of an underground yellowjacket nest typically ranges from 1,500 to 15,000 yellowjackets and is predicated upon the size of the hole in which they build the nest. Although they can build nests in between railroad ties, or in hollowed tree stumps, most often, yellowjackets build nests in abandoned rodent holes; building each nest to fill the capacity of the hole.

The California Drought Impacts Yellowjacket Population

District employees theorize the decrease in requests for service was a result of the California drought. Yellowjackets consume small pest insects. With the dry conditions created by the drought, many areas of vegetation that previously provided food and habitat to small insects died off. Presumably, a portion of the pest insects did as well. Natural water sources also dried leaving fewer options to yellowjackets for both food and water, which may have prevented part of the yellowjacket population from surviving to build new nests.

Survival rates appeared to improve among yellowjackets in nests located in larger holes, particularly those that were several inches or more below ground. The depth of the holes often provided yellowjackets protection from inclement weather, allowing the colony to grow quite large over a longer period of time. Among the deeper nests that District inspectors found in 2014, some were more than two feet underground. District employees observed a number of these nests were multigenerational suggesting the natural protection provided by the depth of the nest allowed the population to continue to grow for longer than one typical season.

North Concord Bart Station

The majority of inspections and treatments provided by the Districts are on private property within Contra Costa County, but District employees also provide service when a member of the public makes the District aware of a potential ground nest located on public property. In 2014, the District was notified of a potential nest at the North Concord BART Station.

The District's vector control aide inspected the site and treated the nest much to the relief of commuters who use the **North Concord BART station**.

In that case, ivy covered the entrance and exit points of the nest, which is fairly common. In 2014, older trees and vegetation obscured the location of many underground yellowjacket nests in central Contra Costa County, protecting them from rain and frost while allowing them to thrive in the communities of Lafayette, Walnut Creek and Orinda. These communities received 44 percent of the inspections supplied by District employees. In 2014, the District received 515 requests for yellowjacket service, down from 597 requests in 2013.



Vector Control Aide Heidi Budge treats a yellowjacket nest at the North Concord BART station.

Unusual East County Nest

Each season, the majority of the county's underground yellowjacket nests are found in the central and western parts of Contra Costa County. Less frequently, District inspectors find underground yellowjacket nests in the eastern part of the county primarily due to the region's extreme heat and clay soil or sand, which are less conducive to yellowjackets. In 2014, however, District employees were called to a property in Brentwood and upon inspection found a very large, deep nest that appeared to have been established for many years. It was camouflaged by pine needles and ivy and was particularly unusual because it was created within East county's principally hard soil. The yellowjackets were very aggressive as District inspectors worked to gain control over the nest. In the end, they succeeded, but not until they removed more than 10 gallons of nesting material.



Vector Control Aide Heidi Budge removes a large ground-nesting yellowjacket nest from a local park.

For the Future

District employees are often stopped and told about citizens' gratitude for the work the District's inspectors and technicians do to gain control over these underground yellowjacket nests. In the future, we will continue to provide that service as we also study the evolving design of many underground nests which can make treatment more challenging.

Most nests have a fairly central design; however, multiple entrance and exit points can be a sign that a nest is very large and that it has grown past the typical blueprint. Nowhere was this idea more clearly illustrated than at one very large nest in Danville that was obscured by juniper bushes. District employees had to work with the homeowner to remove vegetation so that they could reach the actual nest where they found three holes and evidence that the particular nest had been growing for many years.

In the new year, the District plans to advise homeowners to be aware that overgrown vegetation can promote yellowjacket nest activity and recommend items including pine needles be removed, and bushes be trimmed to allow sunlight to pass between the ground and shrubs. This practice could not only help reduce the attractiveness of the area to yellowjackets, it is already a successful way to reduce the risk of other vectors.

Africanized Honey Bees

Contra Costa County's first detection of Africanized honey bees (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. As the lead agency for these aggressive bees, the Contra Costa Mosquito & Vector Control District responds to public complaints of honey bee swarms and new hives in potentially hazardous locations.

In 2014, the District received two calls about Africanized honey bees. That's not surprising given that the bees are not colonized here, but the District is the lead agency to investigate possible importation. Most of the calls we receive are 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, but they can look dangerous and may sting - but only if provoked.

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



An Africanized honey bee rests on a leaf

Since Africanized honey bees have not colonized in Contra Costa County to date, the District advises homeowners who observe a swarm in their neighborhood to leave the bees alone if they do not pose an immediate risk to health and safety. To discourage bees from making their new home out of a residents' current home, homeowners should ensure the structure has no deficiencies that will allow bees to colonize, such as gaps or holes in the exterior of the house or missing screens that might allow the bees to find harborage in the walls.

District personnel work to educate individuals about the value of bees as pollinators and the difficulties that bee colonies have as they try to survive in our county. District staff provides homeowners with contact information for local beekeepers who have agreed to retrieve and relocate feral bee swarms or hives. District employees always strive to leave the hive intact and only treat swarm or hives if they pose an imminent threat to public safety.

Currently, Africanized honey bees are established as far north as Fresno, California; however, the bees can be unwittingly transported into Contra Costa County as evidenced by the previous incidents, or they may continue to move north into the county on their own. Either way, the District remains poised to respond and protect public health from this sometimes fatal vector.

Fisheries

The District produced approximately 986,000 mosquitofish (*Gambusia affinis*) and distributed 112,383 in Contra Costa County in 2014. We continue our efforts to spawn and to evaluate native fish species for use in mosquito control. This is the second year of spawning trials with a native Delta species, the Sacramento hitch (*Lavinia exilicauda exilicauda*). We are in our fourth year of tank spawning California roach (*Lavinia symmetricus*).

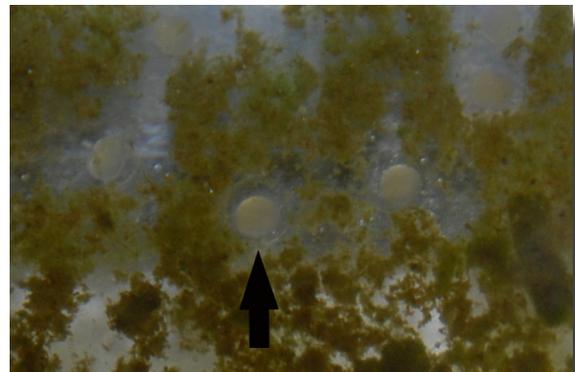
Hitch spawning trials were started March 18th, 2014 with 77 adult Sacramento hitch (3 years old). Fish were placed in a 12 feet by 3 feet circular tank with a constant flow of filtered (recirculated) water. The water temperature was 17 Celsius. Tanks were provided with three egg traps. Two were outfitted with garland attached to simulate submerged aquatic plants and one egg trap had rocks attached to mimic a rocky bottom. The fish were observed daily for spawning behavior and egg traps were checked for eggs every other day. On April 1st, 20 eggs and four larvae were found in one of the egg traps. Eggs were non-adhesive and approximately 2 millimeters in diameter. The eggs were found again on the 7th, 14th, and the 18th. All eggs were collected from the egg traps with garland attached. Some batches of eggs were not counted due to the amount of detritus in the egg traps. The eggs were placed in 20-gallon hatch tanks with an air stone. When larvae were free swimming, they were transferred to a 265-gallon grow-out tank. From these four spawning events, a total of 528 eggs were counted. Larvae were reared on salmon starter. On June 27th, 271 larvae were counted from the two grow-out tanks. We expected more eggs from this group. The small number of eggs collected may be due to starting the trials too late, the maturity of the fish, or the size of the spawning traps. We plan to add more egg traps and group them together to collect more eggs in 2015.

Spawning trials for California roach (*Lavinia symmetricus*) started March 24th, 2014. Roach were divided up into three spawning groups. The first group of approximately 400 4-year-olds were placed in a 12 feet by 3 feet circular tank. The next two groups were comprised of 100 3-year-olds stocked in two 265-gallon circular tanks. A current was provided in each tank and spawning traps were placed directly below the inflowing water. A large water change was made to the system and the eggs were found on the 25th in an egg trap in one of the 265-gallon tanks. The water temperature was 18 Celsius. The eggs were removed from the egg traps and placed in 20-gallon hatch tanks. The roach spawning continued through May 19th, 2014 and produced 6,500 larvae.

We continue to maintain a population of California roach (*Lavinia symmetricus*) and Sacramento hitch at the District. We will spawn this species as needed and are monitoring approximately 22 swimming pools that were stocked with roach in 2011 and 2012. The roach continue to control mosquito production in these pools. Pool trials with hitch fish will begin in 2015.



Hitch egg. Scale: 2 millimeters



Hitch eggs



9-month-old hitch fish

Public Affairs & Community Outreach

Key Messages

A common misconception among our public is that drought years are better for mosquito control. It's true that without water mosquitoes can't survive; however, drought conditions actually increase the risk of contracting West Nile virus. Healthy flowing creeks and rivers naturally flush mosquito eggs, though mosquitoes won't usually lay their fragile eggs in agitated water. Water-starved creeks, however, that cease to flow, create numerous puddles coveted by thirsty birds and mosquitoes and create an exponential opportunity for virus transmission. So, while there may be less water to help mosquitoes flourish, the ones that do thrive are likely infected.

Backyard water sources are also coveted by birds and mosquitoes and put virus transmission at our doorsteps. Neglected swimming pools remain a consistent and significant water source. Our **One Pool, One Million** public service announcement remains relevant and still impactful illustrating that one neglected swimming pool can produce up to 1 million mosquitoes and affect people up to five miles away. The video is aired on Contra Costa Television every year and also delivered on Twitter periodically.

We also highlighted the fact that West Nile virus cases are still grossly underreported, another yearly repeated message. Since few human cases are reported — five in Contra Costa County in 2014—residents often assume that the risk of getting the disease is low; however, the opposite is true. According to the Centers for Disease Control, for every severe case of the disease there are up to 70 cases of the non-severe form. These cases are known as West Nile fever and include mild to moderate symptoms of varying degrees such as malaise to partial paralysis. Indeed, these statistics reveal that up to 350 county residents may have suffered from West Nile virus, they just didn't know what caused their illness.

Adult Mosquito Fogging

The community showed support of our adult mosquito fogging operations this year more than ever as illustrated by requests for fogging operations in their neighborhoods. The shift from “why are you spraying?” to “when are you spraying?” questions prompts our same reply: We spray when necessary.

Residents are quite satisfied with our Adult Mosquito Fogging Notification, an award-winning publication developed especially for them. The unique, automatic email is sent to subscribers when they **opt in to receive the publication** from a single click on our homepage. The notifications offer specific, street-detailed interactive maps where residents can zoom in and out for clarity, click on important links, review the product label, and more.

Website

The District's award-winning website remains the No. 1 communication tool for constituents and is an important reference tool for a worldwide audience. This living document is updated on a daily basis to keep visitors informed of the latest information for vector control in Contra Costa County. Evaluation of the traffic on our nearly 300-page website illustrates viewers were mostly interested in, in order of highest traffic, our services and programs, employment opportunities, our contact information, current fogging schedules, placing a service request, West Nile virus activity, free mosquitofish, and reporting neglected swimming pools.

Updates in 2014 included making the site more easily accessible by mobile media such as phones and pads. To assess our site visitors' experience using the website, we learned in our poll that 90 percent of our visitors in the survey said it is “very informative and easy to use”. Ten percent of visitors responding to the survey said it was “too busy”. Minor adjustments made to the visual aspects of the site addressed the latter sentiment. Continued monitoring of visitor sentiment will enable staff to ensure the website remains a valuable and highly accessed tool.

Advertising

A portion of our outreach and education is delivered through paid advertising. Advertisements at all BART stations in the county help create awareness and keep the prevention of mosquitoes and West Nile virus top of mind. Ads on buses help us reach a very large portion of our residents throughout the entire county in a dynamic manner. All three bus companies displayed our advertisements on the back of their buses. We also deliver our messages to every home in the county via the post office at least three times during the height of mosquito season and in some areas four times. We utilize the highly impactful covers of some publications which ensures our message is seen.

In addition, our most popular weekly ads resulting in the most engagement are those in the Penny Saver publication. These ads, coupled with non-paid advertising and outreach activities result in a multi-tactic approach that ensures all of our constituents in Contra Costa County receive our public health messages. Each year, all of our outreach is evaluated and reassessed to ensure optimal reach, efficiency, and cost.



Bus tail ads, such as this one on County Connection, allow our public health messages to reach our community throughout Contra Costa County.

Social and Traditional Media

Mass communication by media is essential to our outreach efforts. We conduct extensive **media interviews**, working closely with media who genuinely and thoughtfully help us disseminate our messages. According to our research, our constituents rely on media for their news. Along with the traditional media, we use social media such as **Twitter** as an essential tool for us to get our messages sent immediately and exponentially. Often, the media retweet our news within one minute of posting, supplying residents with important information almost immediately.

Local blogs such as Claycord.com and EastCountyToday.net have played an important role in getting the public health messages out as well. These blogs engage our residents quickly, often invoking thoughtful conversations and shared awareness.

Service Request Surveys: Gauging Quality

Each week throughout the entire year, we mail surveys to assess our customer service and to inquire as to how we can exceed our constituents' expectations. Nearly six out of 10 people who use our services are surveyed and 21 percent responded to the survey in 2014. In the survey, 98 percent of those who received our services indicated that our service was provided in a timely manner; 91 percent agreed that we were professional and courteous (eight percent didn't respond); and 91 percent were satisfied with their service (four percent didn't respond).

Electronic Communication

Our electronic communication consists of **Media Releases**, **Adult Mosquito Spray Notifications**, and the **Mosquito Bytes Newsletter**. By far the most popular publication is the spray notification. The newsletter is the second most popular publication and the media releases are our third most popular. We continue to see very high open rates for our publications with the highest open rate for the spray notification at 38 percent, the newsletter open rate of 35 percent, and the media release at 31 percent. It must be noted that the average open rate for our industry is 24 percent. Collectively, our subscribers to these publications increased by 15 percent in 2014.

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.

No deed is too small when it comes to protecting the environment. The District has made many small changes that have added up to big differences. The District is a past recipient of an award for the water recycling program that ensures water from trucks using pesticide products is diverted from catch basins that carry water to creeks and waterways. Solar panels were installed to capture the sun's energy and support District operations. The District also installed a water filtering station for employees, eliminating disposable plastic water bottles from daily use.

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, 8 hours of Mosquito Control, 8 hours of Terrestrial Invertebrates, and 8 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 37 field vehicles, three staff vehicles, 18 vehicle sprayers, two boats and their trailers, five 8-wheel ARGOs, five 4-wheel All Terrain Vehicles, 11 trailers, seven Ultra Low Volume sprayers, one catch basin mister, and 1 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

Financial Statement

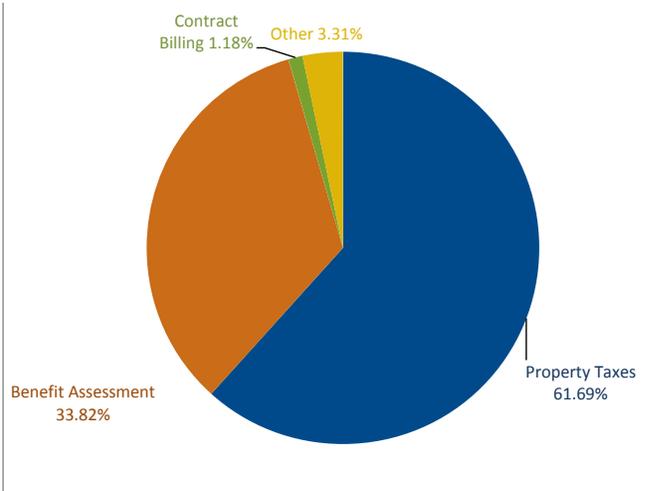
The Contra Costa Mosquito & Vector Control District depends on property tax revenues and benefit assessment charges in Contra Costa County to fund operations.

The District receives approximately two-thirds of its annual revenue from property taxes and this revenue stream rose approximately 4 percent in the fiscal year 2013/2014 as compared to fiscal year 2012/2013. 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. It is important to note that the District shows a one-time property tax spike of \$324,842 in fiscal year 2013/2014 due to reimbursement from the state of California for property taxes borrowed under Proposition 1A in 2010.

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. This contribution is a major reason for the necessary transfer from reserves noted in the District financial statements.

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.



Revenues	2013/2014*	2014/2015**
Property Taxes	\$3,823,276	\$4,014,439
Proposition 1A Reimbursement	324,842	---
Benefit Assessment	1,994,277	1,995,302
Contracts	83,797	60,000
Interest	24,498	13,000
Miscellaneous	44,352	146,000
Total Revenues	\$6,295,042	\$6,228,741
Expenditures	2013/2014	2014/2015
Salaries & Wages	\$4,991,190	\$5,238,289
Operations	1,276,870	1,396,401
Capital	89,336	181,040
Total Expenditures	\$6,357,396	\$6,815,730
(transfer from reserves)	(62,354)	(586,989)

*Audited **To be audited



Protecting Public Health Since 1927

155 Mason Circle • Concord, CA 94520

www.ContraCostaMosquito.com