# SAN MATEO COUNTY MOSQUITO & VECTOR CONTROL DISTRICT

*Protecting public health since 1916*

# ANNUAL REPORT 2020

Dear Residents,

I'm excited to share with you our 2020 annual report. This report contains updates on some key issues affecting the District and our work in San Mateo County.

One of the largest changes affecting the District in 2020 was the retirement of District Manager Dr. Chindi Peavey, who served as manager from 2015 until September 2020. Dr. Peavey's work during the past five years left the District in great shape both financially and operationally, setting us up for success in 2021 and beyond. I was happy to be selected to take over as District Manager after serving as Assistant Manager since 2013.

However, that wasn't the only change 2020 held for the District. The beginning of the COVID-19 pandemic in early 2020 brought adjustments to almost every aspect of life, and District operations were no exception. Shortages of personal protective equipment, flexibility for employees' COVID-related situations, and difficulties maintaining social distance were challenges to our normal operations. However, in adherence with orders from San Mateo County Health, we implemented a strict set of protocols to protect both District staff and the public from the risk of COVID-19 transmission while still allowing us to continue our essential work of reducing the risk of mosquito-borne and other vector-borne illness.

Along with the new threats posed by the COVID-19 pandemic, the District continued to keep a close eye on the risks posed by invasive *Aedes* mosquitoes as they spread through California. Despite increased mosquito surveillance throughout the County, there continue to be no detections of invasive *Aedes* mosquitoes in San Mateo County. However, they will almost certainly arrive in the near future.

While we don't know what 2021 will bring, I'm confident that our staff's dedication, perseverance, and can-do attitude will allow us to meet any challenges the coming year holds.

Sincerely,

**Brian Weber**
*District Manager*
San Mateo County Mosquito and Vector Control District

# ANNUAL REPORT 2020

## Contents



### *Resident's Remarks*

**"San Mateo County Mosquito and Vector Control is the best! I cannot think of another agency that enjoys its reputation for quality service in the community. Everyone who has ever dealt with this agency thinks they are fantastic! A great service."**

# ABOUT THE DISTRICT

## Our Vision

***"We are an agency that protects public health through a science-based program of integrated vector management, which is responsive to the community, and prepared to adapt to new challenges."***

## Our Mission

***"To safeguard the health and comfort of the citizens of San Mateo County through a science-based program of integrated vector management."***

## Our Goals

1. Reduce or eliminate host-seeking vector populations and maintain consistency in control operations by evaluating vector populations before and after they are carried out.
2. Use scientific methods to evaluate the distribution of vectors and vector-borne diseases in nature and work toward preventing the occurrence of human cases among District residents.
3. Engage in research and development to optimize the District's ability to carry out its mission with available resources.
4. Maintain a highly motivated, productive staff that is aware of, and has access to, the latest materials, technologies, and techniques in vector control.
5. Ensure residents are aware of the District's Integrated Vector Management Program and cooperate with recommendations to reduce populations of vectors and minimize the risk to human health posed by vectors.
6. Ensure that residents are aware of District services, utilize them as needed, and are satisfied with the service they receive.
7. Cultivate strong, mutually beneficial relationships with local, state, county, and federal agencies.
8. Conduct all aspects of District business in a transparent and accountable manner.
9. Adequately maintain the District's physical assets and keep them up to date with the best technology available.
10. Anticipate and be prepared to respond to future scientific, operational, and financial challenges.
11. Ensure that the Board of Trustees operates in an ethical manner, makes sound decisions based on current and complete information, and has the capacity to lead the agency effectively.
12. Ensure that District finances are adequately managed to provide for long term financial stability and sustainability.

# The Board of Trustees

As an independent special district, the San Mateo County Mosquito and Vector Control District delivers specific services to citizens within its boundaries under the guidance of its own Board of Trustees. The District's Board of Trustees consists of one resident from each city, appointed by their respective City Council, and one appointed by the County Board of Supervisors to govern the Mosquito and Vector Control District knowledgeably and effectively. They serve for a term of two or four years and are highly dedicated to this community service.

| CITY | REPRESENTED BY |
|---|---|
| Atherton | Mason Brutschy |
| Belmont | Wade Leschyn |
| Brisbane | Carolyn Parker |
| Burlingame | Joe Galligan |
| Colma | Laura Walsh |
| Daly City | Glenn R. Sylvester |
| East Palo Alto | Donna Rutherford |
| Foster City | Catherine Mahanpour |
| Half Moon Bay | Kati Martin |
| Hillsborough | Dr. D. Scott Smith |
| Menlo Park | Catherine Carlton |
| Millbrae | Dr. Muhammad Baluom |
| Pacifica | Peter DeJarnatt |
| Portola Valley | Raymond Williams |
| Redwood City | Kathryn Wuelfing Lion |
| San Bruno | Robert Riechel |
| San Carlos | Ross Graves |
| San Mateo | Ed Degliantoni |
| San Mateo County, at Large | Claudia Mazzetti |
| South San Francisco | Vacant |
| Woodside | Paul Fregulia |

**2020 BOARD OFFICERS**

**Board President**
Kati Martin

**Board Vice President**
Kathryn Wuelfing Lion

**Board Secretary**
Donna Rutherford

**Board Assistant Secretary**
Ross Graves

# District Staff

## ADMINISTRATION

Chindi Peavey, Ph.D.
*District Manager* (January – September)

Brian Weber
*District Manager* (October – December)
*Assistant Manager* (January – September)

Richard Arrow, CPA
*Finance Director*

David Kwan
*Information Technology Director*

Mary Leong
*Accountant*

Megan Sebay, MPH
*Public Health Education and Outreach Officer*

Devina Walker
*Office Administrator*

Paul Weber
*Facility Maintenance Coordinator*

## LABORATORY

Angie Nakano, MS, *Laboratory Director*
Tara Roth, Ph.D., *Vector Ecologist*
Cheryl Tina Sebay, *Vector Ecologist*
Theresa Shelton, M.Sc., *Laboratory Technician*

## OPERATIONS

Casey Stevenson, *Field Operations Supervisor*
David Allen, *Vector Control Technician*
Walter Bruj, *Vector Control Technician*
Stephanie Busam, *Vector Control Technician*
Eric Eckstein, *Vector Control Technician*
Sean Jones, *Vector Control Technician-Mechanic*
Kim Keyser, *Vector Control Technician*
Devon MacDonald, *Vector Control Technician*
Evan Ostermann, *Vector Control Technician*
Ryan Thorndike, *Vector Control Technician*

# SERVICE REQUESTS

## Resident Services

In addition to ongoing work to prevent the emergence of adult mosquitoes, the District provides a variety of services directly to residents upon request, including residential mosquito surveillance and larval control, delivery of mosquito fish to backyard water features, control of ground-nesting yellowjackets and wasps, property inspections and information on rodents and nuisance wildlife, pick-up of dead bird specimens for disease testing, identification of insects or ticks, educational presentations, and public outreach events.

District staff responded to a total of 3,127 requests for service during 2020 (Fig. 1). This was a smaller number of service requests than in the previous year, but more than the annual average for the previous five (5) years. The upward trend in annual number of service requests is likely due to a combination of factors, including improved outreach, resident awareness of services, and differences in vector populations caused by variations in climate.

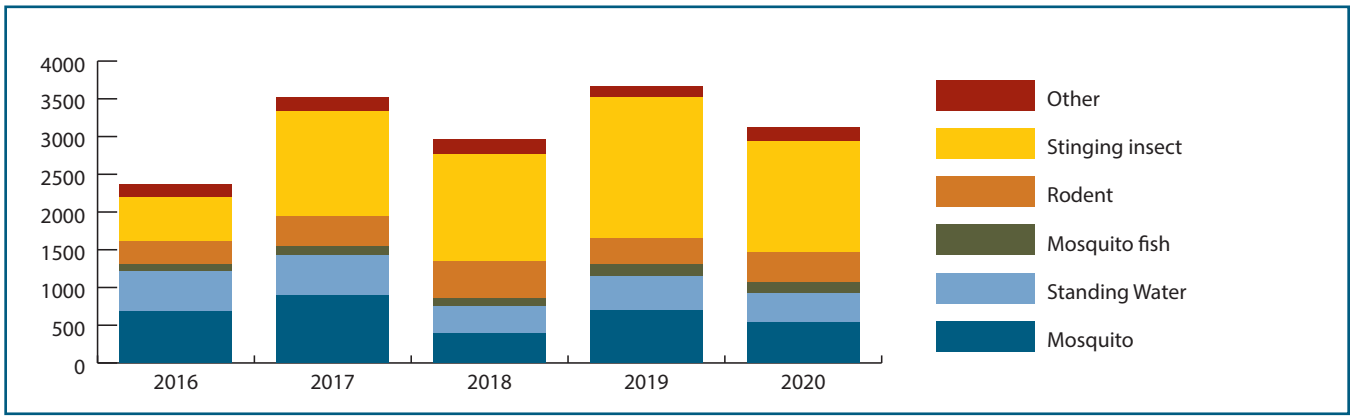



**Figure 1: Service Requests by category 2016-2020.**

As in previous years, the majority of service requests were received over the summer (Fig. 2), with a seasonal peak occurring during late summer as the area's warmest temperatures boosted mosquito populations. Likewise, warm weather allowed yellowjacket and wasp activity to rise, resulting in dozens of resident service requests during the warmest months of the year. As temperatures cooled in fall, mosquito populations decreased, despite the increased abundance of standing water left by seasonal rainstorms. In 2020, the number of service requests was also reduced beginning in spring when the COVID-19 pandemic led the District to restrict service requests that required technicians to have face-to-face contact with residents or to enter residents' homes.

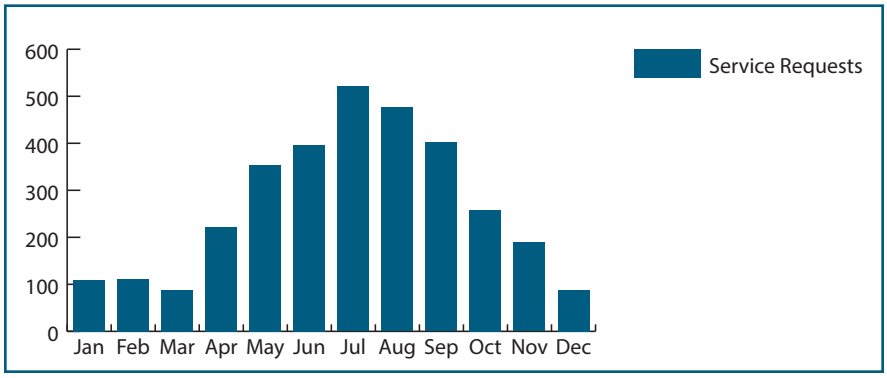



**Figure 2: Total number of service requests by month in 2020.**

# MOSQUITO PROGRAMS

## Mosquito Population Surveillance

The District laboratory uses traps to conduct surveillance year-round for both native and invasive mosquito species. The results of these trap collections are used to estimate population levels of various mosquito species in San Mateo County and to provide comparative data on changing mosquito populations from year to year. Mosquito population data are compared over time, and seasonally, at specific locations. These data are used to optimize mosquito control and disease surveillance efforts in response to seasonal challenges throughout the year.

Although mosquitoes are present in San Mateo County throughout the year (Fig. 3), each season brings new challenges. For example, *Aedes washinoi*, the freshwater mosquito, which breeds in shallow woodland pools, is most common in the spring and early summer, while *Culex erythrothorax*, the tule mosquito, begins emerging in early summer and requires a large larviciding effort to prevent its natural peak in the fall. However, *Culex pipiens*, the most common West Nile virus vector species in San Mateo County, makes up a large portion of local mosquito populations year-round, and is the biggest cause of mosquito-related complaints.

The total abundance of adult mosquitoes was above average during the 2020 calendar year, especially during summer and autumn months (Fig. 3). The higher-than-average numbers were caused by one species, *Culex erythrothorax*, the tule mosquito. Other species remained at or below average population levels. *Culex erythrothorax* is a seasonal mosquito that emerges from tule marshes in summer. The tules can make it difficult for larvicide materials to penetrate into mosquito breeding sites, and sometimes these mosquitoes will emerge in high numbers, despite the efforts of the District. The *Culex erythrothorax* population declined in abundance during autumn, as control measures took effect, temperatures dropped, and water sources diminished. The highest adult mosquito collection numbers were in September, which was later than usual, compared to the five-year average peak expected in July. A heat wave in the first half of September likely boosted late summer adult mosquito abundance.

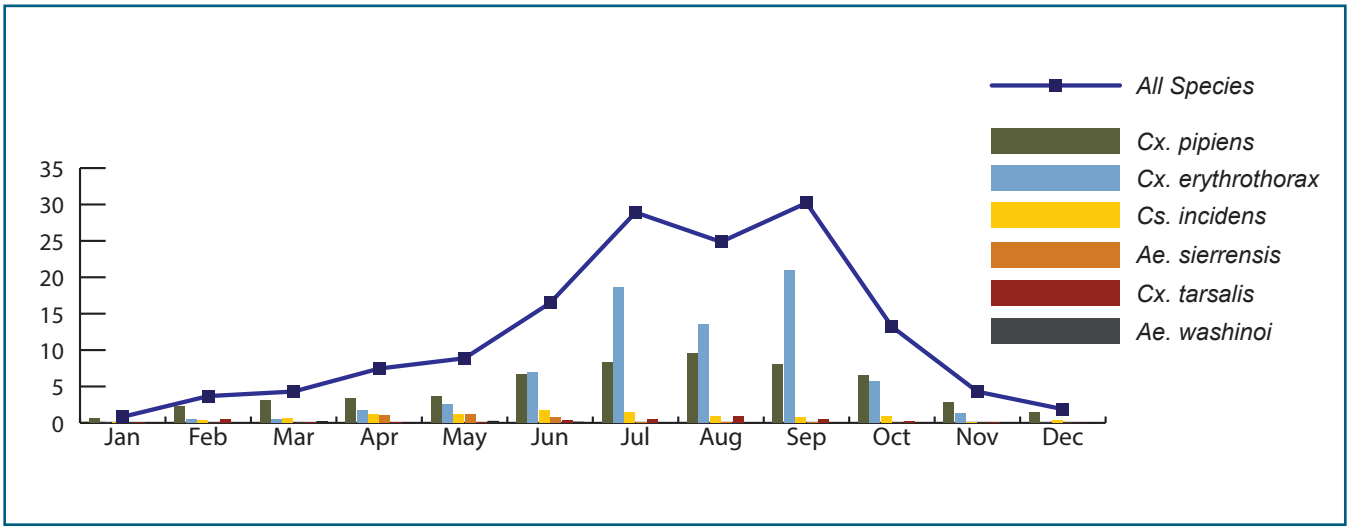



**Figure 3: Average number of common adult mosquito species collected in carbon-dioxide baited traps during 2020 compared to the sum of the averages of these species.**

## West Nile Virus Surveillance

The District's year-round surveillance program for West Nile virus is part of the California Vectorborne Disease Surveillance Gateway (CalSurv), the state-wide surveillance program for mosquito-borne encephalitis coordinated by the California Department of Public Health, the Mosquito and Vector Control Association of California, and the Davis Arbovirus Research and Training Lab at the University of California, Davis. This program includes surveillance for western equine encephalitis, St. Louis encephalitis, and other mosquito-borne viruses. These viruses are maintained through mosquito/bird transmission cycles. Surveillance for these viruses is carried out by multiple methods. The District tests carcasses of dead birds and live adult mosquitoes collected from specialized traps. The viruses are detected using real-time PCR and other molecular techniques. In addition, the District maintains two flocks of sentinel chickens, located in San Mateo and East Palo Alto, as a method for monitoring the transmission of virus by local mosquitoes.

During the 2020 West Nile virus season, a total of 85 birds were tested. There was one detection of West Nile virus in San Mateo County (Table 1): a dead American Crow collected from South San Francisco in late September. There were no other confirmed detections of West Nile virus in San Mateo County in 2020.

**Table 1: West Nile virus detections in San Mateo County 2016-2020.**

| DETECTION TYPE | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| Human Case | 0 | 0 | 0 | 0 | 0 |
| Sentinel Chicken Seroconversion | 0 | 0 | 0 | 0 | 0 |
| Mosquito Pools | 5 | 0 | 2 | 0 | 0 |
| Birds | 15 | 1 | 5 | 0 | 1 |

## Mosquito Trapping and Testing

Mosquito trapping for detection of West Nile virus is typically conducted when there is reason to believe the virus is present in adult mosquitoes in a particular geographical area, such as when bird carcasses test positive for West Nile virus or when a human case of West Nile virus is reported. *Culex* mosquitoes (the genus that transmits West Nile virus) are separated by species and pooled (combined into small groups) from each trap for testing. The results of mosquito testing for West Nile virus are used to plan mosquito control treatments. During 2020, the District laboratory tested 267 mosquito pools (Table 2), none of which were positive for any of the disease-causing pathogens (West Nile virus, western equine encephalitis, and St. Louis encephalitis) on the District's testing panel.

**Table 2: West Nile Virus Surveillance of Mosquito Samples, 2016-2020.**

| SAN MATEO COUNTY | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| Mosquito Pools Tested | 291 | 4 | 131 | 118 | 267 |
| Positive Mosquito Pools | 5 | 0 | 2 | 0 | 0 |
| Percent Positive Mosquito Pools | 1.7% | 0% | 1.5% | 0% | 0% |

These results were consistent with an overall low level of West Nile virus statewide, particularly in the San Francisco Bay coastal region. In San Mateo County, fewer dead birds were reported by the public than usual (243 in 2020 compared to a ten-year average of 383), which reduced mosquito surveillance as well. Since the first detection of West Nile virus in California in 2003, the level of activity has fluctuated, with repeated cycles of virus activity rising and falling every few years. West Nile virus activity in California has been low for the last three years. The cycles of West Nile virus activity are likely influenced by drought, which is associated with increased detections of virus.

# Control of Mosquito Larvae

The vast majority of the District's mosquito control program consists of controlling mosquitoes in the larval stage (larviciding). Mosquito larviciding is both efficient and cost-effective. This tactic eliminates mosquito larvae before they develop into adult mosquitoes capable of transmitting diseases to humans. Products used for control of mosquito larvae are specific to mosquitoes and have minimal to no effects on non-target animals. These products include bacterial larvicides, insect growth regulators, and mosquito fish. District technicians conduct mosquito inspections year-round, and only those sites actively breeding mosquito larvae or determined to be at high risk of breeding mosquito larvae are treated (Fig. 4).

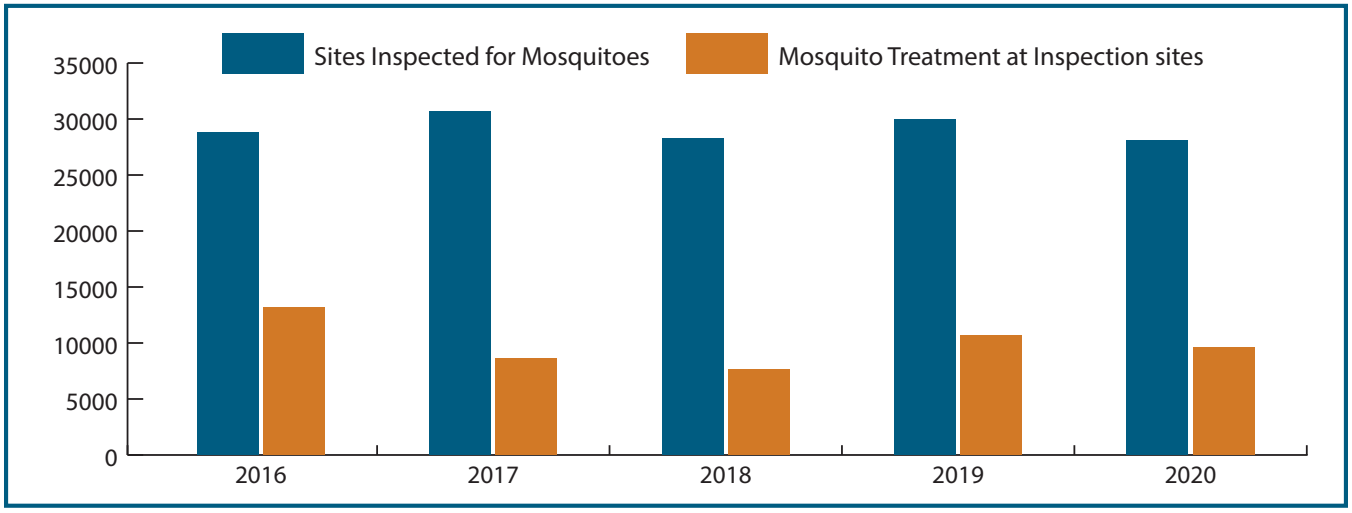



**Figure 4: Inspections and treatments for mosquito larvae, 2016-2020.**

The type of water source treated varies seasonally, with natural water sources – creeks, ponds, marshes, and impounds – treated frequently in response to winter and spring rain. In summer and fall, backyard water sources and municipal sources – including water treatment plants, storm drains, and ditches – make up the majority of the District's mosquito larvicide treatments. Salt marshes require treatment after king tides, when areas usually out of reach of tidal flushing are inundated by higher-than-usual water levels, leaving water standing and allowing large numbers of saltmarsh mosquito larvae to develop.

The County's storm water system also requires extensive treatment (Fig. 5) during the dry season (April through October). The District hires seasonal staff to complete the more than 200,000 treatments needed annually to keep these stormwater catch basins mosquito-free.

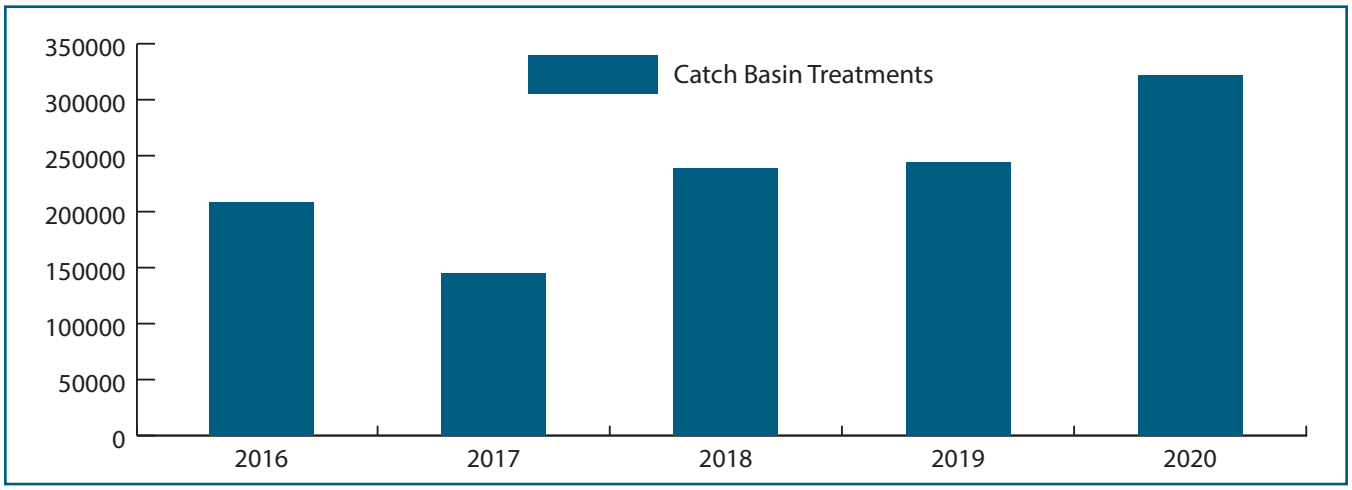



**Figure 5: Stormwater catch basin treatments, 2016-2020.**



In 2017, the District transitioned from a paper-based system to a GPS-based system for cataloguing all catch basins in the County to more precisely treat these potential mosquito sources. Each seasonal technician treats approximately 2,500 catch basins every week during the summer. Every catch basin is treated every 2 weeks so that mosquito larvae are continually controlled and risk of adult emergence is minimized. Residents are familiar with the white Jeeps that our seasonal staff drive to treat catch basins – these Jeeps have been specially modified by the District to efficiently and safely complete this important seasonal task.

## Control of Adult Mosquitoes

San Mateo County Mosquito and Vector Control District takes a preventative approach to mosquito control. Whenever possible, mosquitoes are controlled in their immature stages, before they emerge as biting adults capable of transmitting disease to humans. Sometimes, however, adult mosquito populations become a threat to human health, including when they are found to be infected with West Nile virus. When this happens, information collected through mosquito surveillance is used to make the decision on whether to reduce adult mosquito populations by conducting an adult mosquito control treatment. Adult mosquito control, or adulticiding, is used to quickly reduce the number of adult mosquitoes and interrupt the disease transmission cycle in an area with elevated West Nile virus activity. Adulticiding is always conducted in conjunction with intensified efforts to locate and reduce mosquito larvae in standing water, so that additional adult mosquitoes cannot emerge. No adult mosquito control was needed in 2020.

## Program Evaluation: Using Bird Roosts as Sentinel Sites for West Nile Virus

A major component of West Nile virus surveillance in California is the dead bird testing program, coordinated through the West Nile virus Call Center run by the California Department of Public Health. When a dead bird is reported in San Mateo County through the West Nile virus call center, the District sends a staff member to retrieve it, take a tissue sample, and test that sample in-house for West Nile virus, western equine encephalitis virus, and Saint Louis encephalitis virus. The District then reports back test results to the California Department of Public Health through the CalSurv reporting platform.

In 2020, the District lab conducted a small pilot study to test whether setting traps under roosting birds would enhance West Nile virus detections in the adult mosquito surveillance program. The study was developed as a multi-agency collaboration with Alameda Mosquito Abatement District and the California Department of Public Health.

For this study, roost sites had to be in an area that was at risk for West Nile virus (summer temperatures daily above 26°C, evidence of past West Nile virus activity, and mosquito breeding sources nearby). Roosts were confirmed by looking for bird excrement or other signs, and monthly 15-minute point counts of birds. Nearby historic mosquito surveillance sites were paired with each roost site to act as controls. One Reiter-Cummings modified gravid trap and one carbon dioxide-baited trap were placed at each site biweekly beginning the week of May 13th. Mosquitoes were identified to species, determined if they were bloodfed, gravid, or unfed, separated into pools and tested by qPCR for viruses. Only mosquitoes in the genus *Culex* are reported. Roosting sites were difficult to identify early in the year so data from May are not reported.

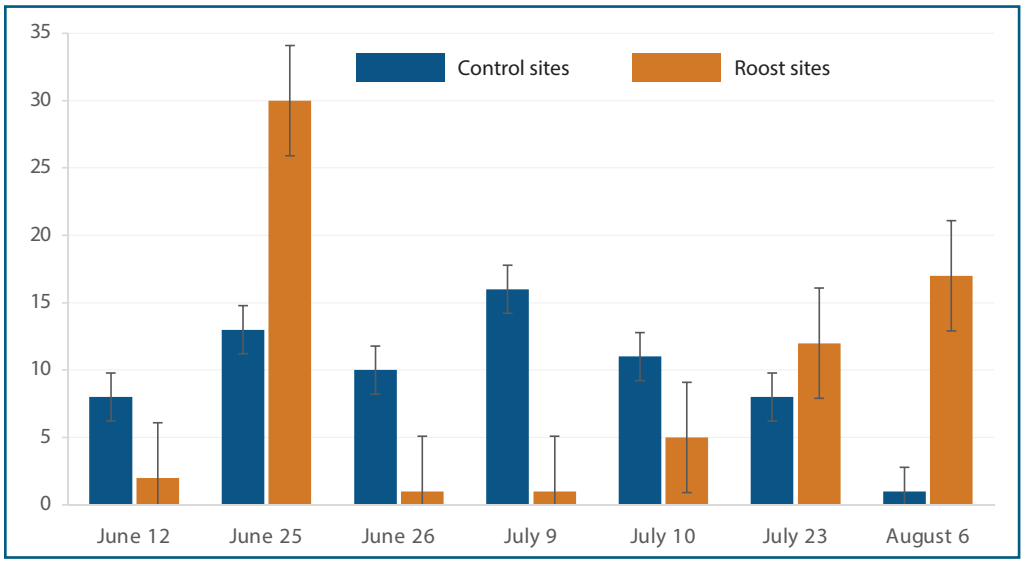



**Figure 6: Number of gravid and bloodfed *Culex* species mosquitoes collected in carbon dioxide-baited traps and Reiter-Cummings modified gravid traps from bird roost and control sites from June-August, 2020. Bars represent standard error.**

Staffing impacts due to the COVID-19 pandemic significantly restricted the ability of collaborating agencies to participate, and in the beginning of August the study was suspended. Overall, the District did not see evidence that setting traps under roosts increased the catch rate of gravid and bloodfed mosquitoes (Fig. 6). However, difficulties in identifying roost sites and seasonal changes in the population of *Culex* species. mosquitoes over time may explain some of the inconsistencies. The data showed that bird roosts may be useful as surveillance sites for mosquito-borne diseases; however, the difficulty in finding stable bird roosts makes it impractical to include them in the District's normal program. Carbon dioxide-baited traps collected significantly more testable mosquitoes than gravid traps (Table 3), confirming their value in the District's surveillance program. The District will continue to evaluate its program as new tools and information are available.

**Table 3: Total *Culex* species. mosquitoes collected from control and roost sites from June-August, 2020.**

| TRAP TYPE | CONTROL SITES | ROOST SITES | TOTAL COLLECTED |
|---|---|---|---|
| Carbon dioxide-baited trap | 409 | 142 | 551 |
| Reiter-Cummings modified gravid trap | 147 | 111 | 258 |
| Total Collected | 556 | 253 | 809 |

## Surveillance for Invasive *Aedes* Mosquitoes

Three species of non-native *Aedes* genus mosquitoes – *Aedes aegypti*, *Aedes albopictus*, and *Aedes notoscriptus* – have been identified in California to date. These species are concerning for vector control agencies across the state because they are highly invasive, difficult to control, and are vectors for a variety of diseases affecting humans, including Zika virus, chikungunya, dengue, and yellow fever. Allowing large populations of these invasive *Aedes* mosquito species to become established creates the risk that travel-acquired human cases of these diseases may lead to local outbreaks in California. Both *Aedes aegypti* and *Aedes albopictus* have been detected in San Mateo County in the past. Most recently, *Aedes aegypti* was found inhabiting a one square mile area in the city of Menlo Park in 2013. Following two years of intensive control efforts, there have been no detections of invasive *Aedes* mosquitoes in San Mateo County since May of 2015.

During the summer of 2020, invasive *Aedes aegypti* mosquitoes were detected for the first time in Butte, Santa Barbara, Shasta, Sutter, Ventura, and Yolo Counties, and *Aedes albopictus* was detected for the first time in Shasta County. As invasive *Aedes* species spread through the state (Fig. 7), San Mateo County Mosquito and Vector Control District is taking steps to prepare for its inevitable arrival in the near future. The District has created an invasive *Aedes* response plan and has entered into a mutual aid agreement with Alameda County Mosquito Abatement District and Marin-Sonoma Mosquito and Vector Control District to provide assistance in the event of a future invasive *Aedes* mosquito emergency.

In addition to collaborating with neighboring districts, the District conducts active surveillance for invasive *Aedes* mosquitoes. A variety of mosquito traps are used which are specific to invasive *Aedes*. These include ovicups, Biogents BG-Sentinel traps, and BG-GAT (Gravid *Aedes* Trap) traps. Additional surveillance is conducted in areas where there have been travel-acquired human cases of illnesses (chikungunya, dengue, Zika, and yellow fever) that can be transmitted by invasive *Aedes*. The District is alerted to these cases by the San Mateo County Health Communicable Disease Program. This ensures that there is no risk that the infection will be transmitted by mosquitoes locally. In 2020, all human cases of these diseases were acquired outside California by people who had travelled to other countries.

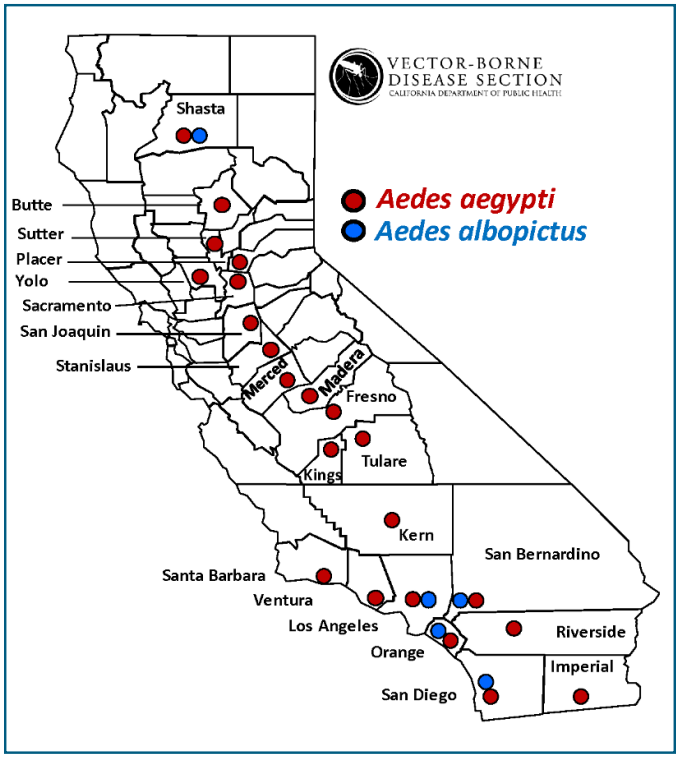



**Figure 7: California counties where invasive *Aedes* mosquitoes are currently found as of December 31, 2020. *Aedes notoscriptus* not included. (Map from California Department of Public Health)**

Invasive *Aedes* mosquitoes were not detected in any area of San Mateo County during 2020 (Fig. 8). However, the risk of introduction of invasive *Aedes* mosquito species from other parts of California remains high.

In 2020, laboratory staff aided other California mosquito abatement districts in identifying cryptic *Aedes* specimens using a PCR-based assay developed by District staff in 2019 and published in the 2020 MVCAC Proceedings. Through this technique, District staff identified a unique color morph of *Aedes aegypti* collected by Delta Vector Control District (which serves Tulare County). District staff also confirmed that eggs collected in ovicups by Alameda County Mosquito Abatement District were native tree hole mosquitoes (*Aedes sierrensis*), not invasive *Aedes* species. Rapid detection and response to invasions is critical for success in eradication and containment, and assisting other districts benefits San Mateo County as a unified effort is required to resist the spread of invasive *Aedes* mosquitoes.


**Figure 8: Invasive *Aedes* mosquito surveillance locations, 2020**

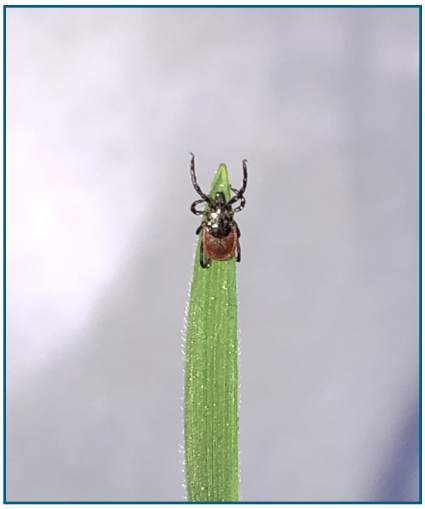
# RODENT PROGRAMS

## Rodent Service Requests

The District's vector control technicians responded to an average of 387 service requests related to rodents per year during 2015-2019. However, during 2020, the District responded to 408 rodent-related service requests (Fig. 1). These requests came from urban and suburban areas throughout the District's service area and were not concentrated in any particular city. The increasing number of requests for assistance with rodent infestations in 2020 may be part of the overall trend toward increased resident usage of District services.

## Rodent Control in Sewers and Creeks

In 2010, San Mateo County turned over a large portion of residential rodent control responsibilities to the District. The District oversees contracts between private pest control operators and several local cities and sanitary districts to provide rodent control in sewers and creeks. These control programs use tamper-resistant bait stations and a reduced-risk rodenticide to control commensal rats. The cities of San Mateo and San Carlos also contract directly with the District for rat control services along above-ground public storm control waterways and urban creekways. Between July and October of 2020, the District conducted 452 contracted rodent inspections and deployed 113 bait stations in San Carlos. In San Mateo, the District conducted 1,336 contracted inspections and deployed 334 bait stations. This work totaled 291 technician-hours for 2020.



# TICK PROGRAMS

## Surveillance for Ticks and Tick-Borne Disease

The San Mateo County Mosquito and Vector Control District conducts yearly tick collections following a water year cycle (October through September of the following year). Collected ticks are subjected to molecular testing via real-time PCR analysis for the three most commonly found tick-borne pathogens in the state of California that are carried by the western black-legged tick (*Ixodes pacificus*). The associated tick-borne diseases are Lyme disease (specifically the *Borrelia burgdorferi sensu lato* complex which includes *B. burgdorferi sensu stricto*, the agent of Lyme disease), hard-tick relapsing fever (caused by the pathogen *Borrelia miyamotoi*), and human granulocytic anaplasmosis (HGA) (caused by the pathogen *Anaplasma phagocytophilum*). All three diseases may be vectored by both nymphal and adult ticks.

Lyme disease is a bacterial infection that involves flu-like symptoms, a characteristic bulls-eye rash, and can lead to severe joint pain and neurological problems. Although it is found throughout the United States, the infection prevalence on the West Coast is significantly lower than in the Midwest or East Coast, due to differences in tick hosts and ecology. Hard tick relapsing fever is a bacterial disease that was first discovered in 2001 in Connecticut and was identified as a human pathogen in 2011. It has similar symptoms to Lyme disease but without the characteristic rash and the fever may reoccur multiple times before the infection clears. human granulocytic anaplasmosis is a bacterial infection that presents with fever, abdominal pain, aching joints, fatigue and other flu-like symptoms. The bouts of fever may reoccur multiple times. All three of these diseases, if identified early, can be treated with antibiotics.

Adult ticks are tested in groups, or "pools," of a maximum of five individuals. The results are reported as a minimum infection prevalence, or MIP. This is the standard way of expressing the proportion of vectors tested that are infected with a particular pathogen and assumes that only one tick in a given pool is infected. As prevalence values are highly dependent on the number of ticks collected, we sample 150 or more adult ticks per park, which increases the chance that our sample will represent the true prevalence. Sample sizes less than 150 are unlikely to be an accurate representation of the true prevalence.

**Table 4: Results from surveillance for tick-borne disease in *Ixodes pacificus* ticks collected from December 2019 through March 2020 from local parks.**

| Park Name | Number Collected | # BBSL positive pools | MIP BBSL | # BM positive pools | MIP BM | # AP positive pools | MIP AP |
|---|---|---|---|---|---|---|---|
| **Año Nuevo State Park** | 682 | 3 | 0.44% | 3 | 0.44% | 4 | 0.59% |
| **Butano State Park** | 225 | 3 | 1.33% | 0 | 0.00% | 3 | 1.33% |
| **Costanoa Recreational Area** | 71* | 0 | * | 1 | * | 0 | * |
| **Junipero Serra County Park** | 20* | 0 | * | 0 | * | 1 | * |
| **La Honda Open Space Preserve** | 37* | 1 | * | 0 | * | 0 | * |
| **Los Trancos Woods Open Space** | 300 | 1 | 0.33% | 4 | 1.33% | 0 | 0.00% |
| **Northern Hillsborough** | 153 | 0 | 0.00% | 0 | 0.00% | 1 | 0.65% |
| **Southern Hillsborough** | 273 | 2 | 0.73% | 3 | 1.10% | 0 | 0.00% |
| **Wunderlich County Park** | 100* | 1 | * | 2 | * | 0 | * |
| **Total** | **1,861** | **11** | **0.59%** | **13** | **0.70%** | **9** | **0.48%** |

* Indicates the number of ticks collected was insufficient to provide an accurate representation of the true prevalence of the diseases tested for and MIP estimates are unstable.

**Abbreviations:** MIP – Minimum Infection Prevalence, a measure of pathogen prevalence equal to the number of positive testing pools divided by the total number of ticks tested, expressed as a percentage; BBSL – *Borrelia burgdorferi sensu lato*; BM – *Borrelia miyamotoi;* AP – *Anaplasma phagocytophilum*

The COVID-19 pandemic restricted tick collection and testing during the 2019-2020 season (2019-2020 water year). A total of 1,861 *Ixodes pacificus* adult ticks were collected from 9 parks or open space areas (Table 4; Fig. 9). No nymphs were collected in 2020. County-wide, the District detected a minimum infection prevalence (MIP) of 0.59% for *Borrelia burgdorferi* sensu lato, 0.70% for *Borrelia miyamotoi,* and 0.48% for *Anaplasma phagocytophilum*. These values do not differ significantly from prior years. A total of 211 *Dermacentor* species were also collected and tested for *Francisella tularensis* (the bacterium that causes tularemia), but no positive pools were detected.

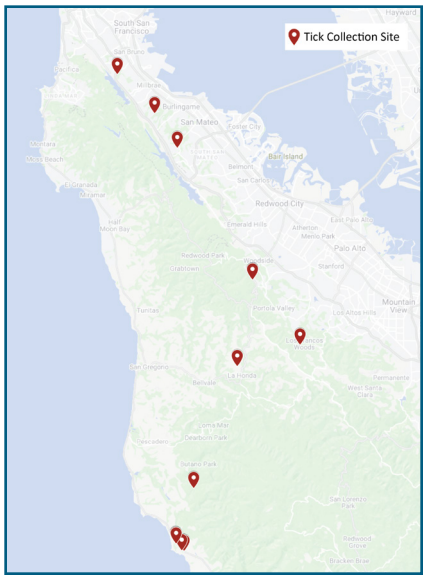



**Figure 9: Tick collection sites, October 2019 – September 2020 water year.**

Focus in 2020 was placed on tick surveillance in rural or open space-adjacent schools throughout San Mateo County in order to provide parents and staff with information on ticks and ways to mitigate risk. To this end, District staff evaluated, conducted tick flagging, and tested ticks from 24 elementary and middle schools throughout the County. The number of ticks present on school campuses varied by region, and schools with margins bordering open space had a higher likelihood of having ticks on campus than schools that were bordered by housing or landscaping. No disease-causing pathogens were detected in ticks collected from any of the school campuses sampled. Schools were given information on landscaping practices for tick mitigation (Figs. 10 and 11) and materials on ticks and tick-borne diseases were given to each school to distribute to parents and teachers.

**Figure 10: Prior to (left) and after (right) tick mitigation strategies implemented at a San Mateo County school. When grass is kept trimmed low, there is lower risk of adult ticks questing in the environment.**

**Figure 11: Prior to (left) and after (right) tick mitigation strategies implemented at a San Mateo County school. When a clear boundary is kept between a well-trimmed playing field and a vegetated natural area, there is lower risk of adult ticks questing on the playing field.**

# EDUCATION AND OUTREACH

## Publications and Scientific Presentations

Presented at the 2020 Mosquito and Vector Control Association of California Annual Conference – Published in the 2020 Proceedings.

**Field Evaluations of Mosquito Gravid Trap Bait Solutions**
**C. Tina Sebay, Theresa L. Shelton, Angie Nakano**

**Identification of Cryptic Mosquito Eggs Using Conventional PCR with Extraction Protocol Recommendations**
**Arielle Crews (2019 SMCMVCD Intern), Tara M. Roth**

**Diversity and Distribution of *Borreliae* in San Mateo County, CA 2018-2019**
**Arielle Crews, Tara M. Roth**

**Determination of LC-50 of Permethrin Acaricide in the Western Blacklegged Tick**
**A. Kacie Ring (2019 SMCMVCD Intern), Angie Nakano, Andrea Swei (SFSU)**

## Events and Public Presentations

The arrival of the COVID-19 pandemic early in 2020 led to the cancellation of many District presentations and events, including the 2020 Open House. However, the District was able to participate in several virtual presentations and events and continued to offer presentations and trainings to local groups via teleconference.

### *Resident's Remarks*

**"The team is amazing! One of the best public services out there. Many thanks!"**



# Public Health Education and Outreach

The District's integrated vector management program includes extensive public outreach aimed at improving public awareness of and participation in vector-borne disease prevention, including vector attractant/source reduction and behaviors to reduce the risk of vector-borne disease transmission.

A post-service online survey is used to collect information on where residents first heard about the District, how often and what kind of services were requested, and whether they were satisfied with those services. An invitation to complete the survey is sent to every resident who provides an email address when requesting service. More than 500 residents responded during 2020, rating their satisfaction with the District's services at 4.9 out of 5.

In 2020, the most important sources of referrals to the District (Fig. 12) were word-of-mouth (friends, neighbors, city and county staff, pest control professionals, and others) and internet sources (internet search results, internet advertising, and social media). Other sources of resident referrals included transit and television advertising, as well as outreach events.

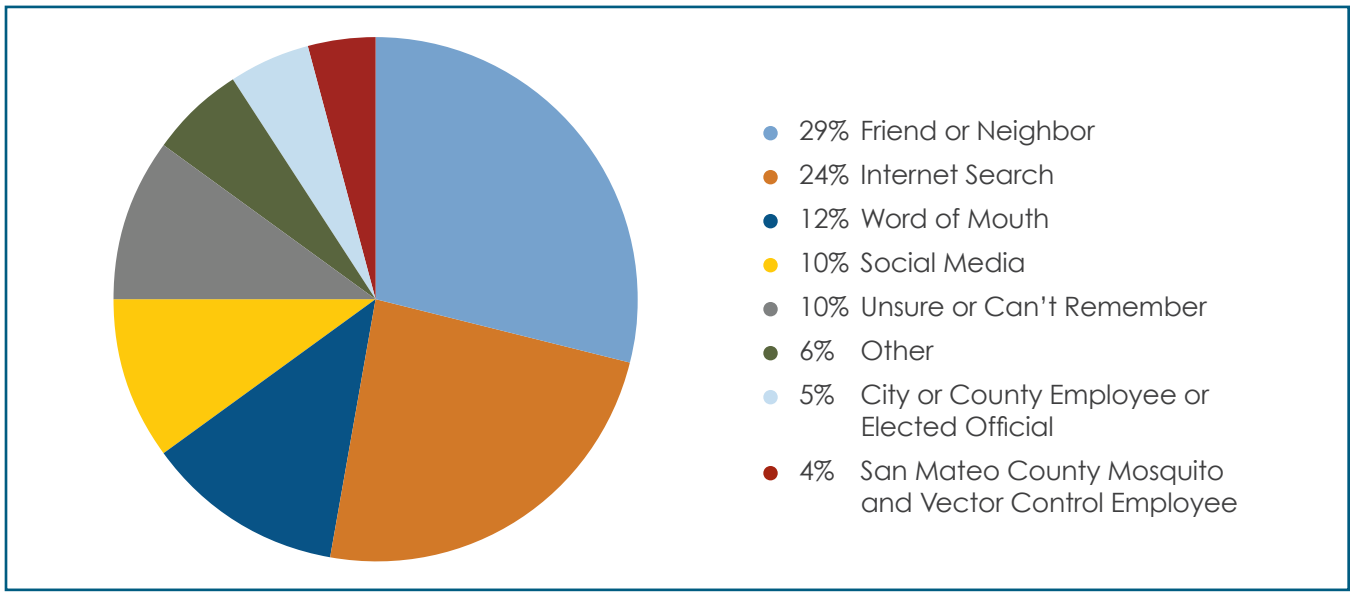



**Figure 12: Resident-reported source of referrals to the District during 2020**

The District website received more than 60,000 visits during 2020, an increase of 17% compared to the previous year. As in previous years, site visits were higher during summer, but website traffic rose earlier in the season in 2020 (Fig. 13), perhaps because residents obeying stay-at-home orders were more likely to notice pest issues than in previous years.

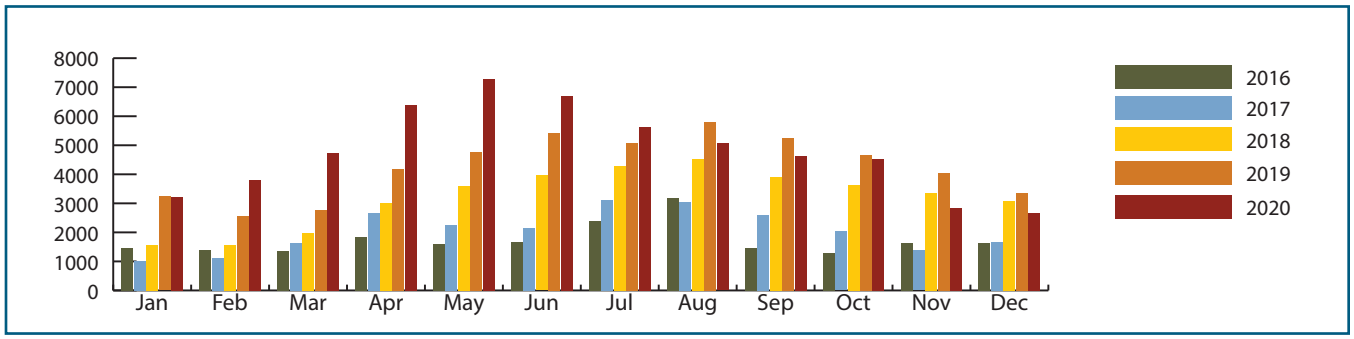



**Figure 13: User visits to the District website by month 2016 to 2020.**

# FINANCIAL REPORTS

In 2020, in addition to its Annual Financial Audit, the District published a Comprehensive Annual Financial Report (CAFR), which gives a deeper look into the District finances for Fiscal year 2019-20. The CAFR for FY 2019-20 can be found on the District website at **www.SMCMVCD.org/2020CAFR**.

## Financial Highlights for Fiscal Year 2019/2020

- The District's net position of $13,305,470 was an increase of 13.6%, or $1,590,640 from the prior year.
- Actual revenues exceeded budgeted projections by $432,528 (7.4%), primarily due to higher than expected Investment Earnings and Other Tax Revenue. Investment earnings increased significantly due to year end "mark to market" calculations required by GASB.
- The District realized "one time" proceeds of $2,009,380 from the sale of real property no longer required for operations.
- Total expenditures increased 6.9% or $312,708 from those of the prior year, primarily due to increases in Salaries and Benefits ($208,885) from normal cost of living increases as well as longevity adjustments. All other increases to expenditures ($103,823) were due to normal cost of operations.
- Other than capital leases, the District had no outstanding long term debt.
- District obligations for Other Post Employee Benefits (OPEB) are fully funded by an OPEB Trust established in 2015 (see note 6 of the financial statements in the CAFR).
- In fiscal year 2018-19, the District began accounting for Capital Expenditures in a separate Capital Projects Fund. These expenditures were previously accounted for in the General Fund in fiscal year 2017-18. The District's Long Term Capital Improvement Plan outlines how the District will budget to maintain its equipment and infrastructure.
- In fiscal year 2018-19, the Board established a Pension Rate Stabilization Reserve Fund to pay for potential unfunded liabilities that may arise in the future and cause increases in the District's Required Employer Contribution Rate. Such increases have arisen in the past due to changes in economic market conditions or actuarial assumptions used by the county pension fund.

### *Resident's Remarks*

**"Your representatives were friendly, informative, masked, and respectful of social distancing. Their community service made me feel better about the high taxes we pay! Thank you! Thank you!"**

## Balance Sheet

The Balance Sheet (Table 5) shows the composition of District assets, liabilities, and fund balances as of June 30, 2020 and 2019. Cash and investments make up the majority of the District's assets.

| | FY Ending 2020 | FY Ending 2019 |
|---|---|---|
| **ASSETS** | | |
| CASH AND INVESTMENTS | $9,995,706 | $6,573,610 |
| ACCRUED INTEREST RECEIVABLE | 39,472 | 39,604 |
| ACCOUNTS RECEIVABLE | 23,794 | 46,168 |
| OTHER RECEIVABLES | 24,060 | 22,588 |
| MATERIALS & SUPPLIES INVENTORY | 143,930 | 158,293 |
| DEPOSITS VCJPA | 512,623 | 485,069 |
| PREPAID ITEMS | 25,131 | 20,780 |
| **TOTAL ASSETS** | **$10,764,716** | **$7,346,112** |
| **LIABILITIES** | | |
| ACCOUNTS PAYABLE & ACCRUED EXPENDITURES | $95,256 | $139,533 |
| ACCRUED SALARIES & BENEFITS | 77,752 | 50,473 |
| **TOTAL LIABILITIES** | **$173,008** | **$190,006** |
| **FUND BALANCE RESERVES** | | |
| NONSPENDABLE | $169,061 | $179,073 |
| RESTRICTED | 110,425 | 105,707 |
| COMMITTED | 800,000 | 800,000 |
| ASSIGNED | 5,647,649 | 2,745,567 |
| UNASSIGNED | 3,864,573 | 3,325,759 |
| **TOTAL FUND BALANCE** | **$10,591,708** | **$7,156,106** |
| **TOTAL LIABILITIES AND FUND BALANCE** | **$10,764,716** | **$7,346,112** |

**Table 5: Balance sheet as of June 30, 2020**

# Statement of Revenues, Expenditures and Changes in Fund Balance

The statement of revenues, expenditures, and changes in fund balances shown in Table 6 shows the District's revenues and expenditures in FY 2019-20. From this statement and the explanation below, the reader can see how the District's operations are funded and what the funds are used for.

# Who Pays for Services

In Fiscal Year 2019-20, the District received $8.3 million of revenue (Table 6, Fig. 14) which included a one-time receipt of proceeds from the sale of property in the amount of $2.0 million. County property owners, who pay property taxes and assessments, are the source of almost all District revenue. The District's usual top three revenue sources – ad valorem property taxes, a special mosquito tax, and a benefit assessment – provide 60% of revenue. Property owners in the Southeast portion of the County pay for services through a small portion of the ad valorem property taxes (0.000018505 cents per $1.00 of property taxes) and a Special Mosquito Control tax of $3.74 per parcel. Property owners in the northern part of the County, on the coast, and in the mountainous areas pay a benefit assessment averaging $18.51 per Single Family Equivalent (SFE).

**CHANGES IN FUND BALANCES OF GOVERNMENTAL FUNDS**

| | FY ENDING 2020 | FY ENDING 2019 |
|---|---|---|
| **BEGINNING FUND BALANCE** | **$7,156,106** | **$5,864,430** |
| **REVENUES** | | |
| SERVICE ABATEMENT REVENUE | $241,271 | $233,273 |
| SPECIAL BENEFIT ASSESSMENT | 1,627,009 | 1,624,577 |
| SPECIAL MOSQUITO CONTROL TAX | 486,144 | 485,759 |
| PROPERTY TAXES | 2,797,860 | 2,629,658 |
| OTHER TAX REVENUE | 679,554 | 633,838 |
| INVESTMENT EARNINGS | 363,015 | 150,110 |
| OTHER REVENUE | 63,313 | 66,629 |
| PROCEEDS FROM SALE OF PROPERTY | 2,009,380 | - |
| CAPITAL LEASE FINANCING | 12,932 | - |
| **TOTAL REVENUE** | **$8,280,478** | **$5,823,844** |
| **EXPENDITURES** | | |
| SALARIES AND BENEFITS | $3,413,212 | $3,204,327 |
| MATERIALS AND SERVICES | 1,299,132 | 1,173,408 |
| CAPITAL IMPROVEMENTS | 101,733 | 120,149 |
| DEBT SERVICE | 30,799 | 34,284 |
| **TOTAL EXPENDITURES** | **$4,844,876** | **$4,532,168** |
| **NET CHANGE IN FUND BALANCE** | **$3,435,602** | **$1,291,676** |
| **ENDING FUND BALANCE** | **$10,591,708** | **$7,156,106** |

**Table 6: Changes in fund balance for Fiscal Year 2019/2020**

In fiscal year 2019-20, total revenues from all sources (excluding sale of real property; Fig. 14) increased by 7.7%, or $447,254 from the prior year. The District's revenue from ad valorem property tax increased by 6.4% or $168,202, while revenue received from the benefit assessment increased by $2,432.

## How Revenue is Used

Total annual operating expenditures in Fiscal Year 2019/2020 were $4.8 million (Table 6). As is typical for local government agencies, most District expenditures were for employee salaries and benefits (Fig. 15). The District's integrated vector management program reduces pesticide use but is labor-intensive and requires highly trained staff. Field staff conduct inspections and choose from a variety of control strategies and tools depending on the conditions present at a given site. Field and Laboratory staff monitor vector populations by trapping vectors and identifying the species present.

## Financial Reserves

As of June 30, 2020, the District reported a total fund balance of $10,591,708. At the end of the fiscal year, the District's unassigned fund balance is $3,864,573 that includes 60% of budgeted operating expenditures to provide working capital requirements from the beginning of the fiscal year on July 1, until the receipt of property tax revenue in November of each year.

| RESERVES & FUND BALANCE | FY Ending 2020 | FY Ending 2019 |
|---|---|---|
| Nonspendable | $169,061 | $179,073 |
| Pension Rate Stabilization | 110,425 | 105,707 |
| Public Health Emergency | 800,000 | 800,000 |
| Natural Disaster Emergency | 650,000 | 650,000 |
| Real Property Reserve | 4,100,000 | 1,350,000 |
| Cap. Asset & Equip. Replacement | 897,649 | 745,567 |
| Unassigned (Working Capital) | 2,829,819 | 2,647,211 |
| Unassigned | 1,034,754 | 678,548 |
| **TOTAL FUND BALANCE** | **$10,591,708** | **$7,156,106** |

**Table 7: Reserve fund allocation as of June 30, 2020**

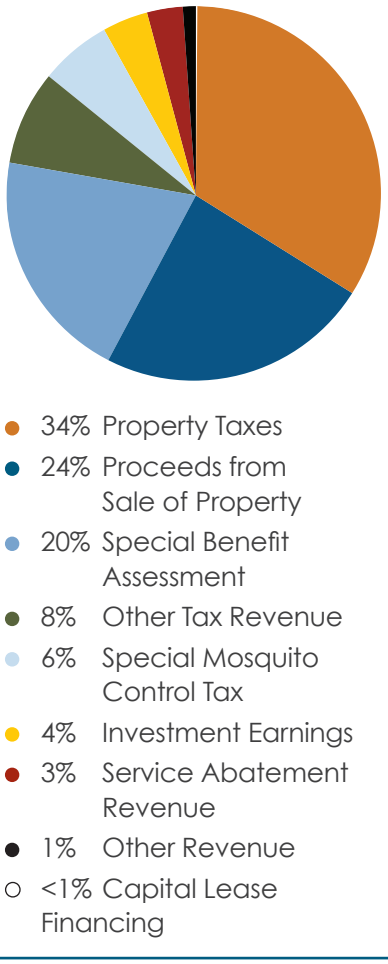



**Figure 14: Sources of Revenue for Fiscal Year Ending: June 30, 2020**

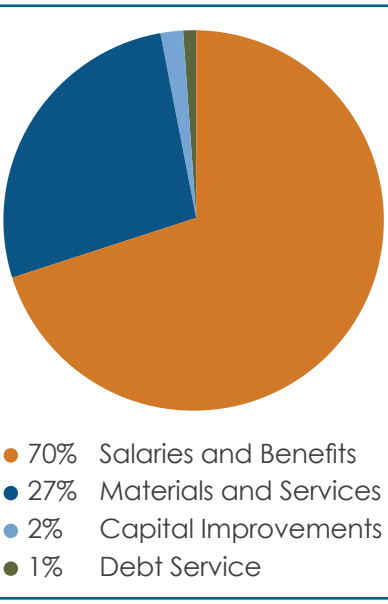



**Figure 15: Expenditures for Fiscal Year Ending: June 30, 2020**

# San Mateo County Mosquito & Vector Control District

Protecting Public Health since 1916

The mosquito control program in San Mateo County is one of the oldest in the United States. Control work was initiated in 1904, when the Burlingame Improvement Club asked entomologists from the University of California to assist them in developing a plan to fight the City's mosquito infestations. A control plan was developed which included ditching, repair of existing dikes and tide gates, and filling of low areas. These physical control measures were to be supplemented with oiling of the remaining standing water.

On April 8th, 2008, San Mateo County Board of Supervisors passed a resolution to transfer specific vector control operations and responsibilities to San Mateo County Mosquito Abatement District. Our Board of Trustees reviewed and approved the transfer of services resolution during the board meeting on April 9th, 2008. San Mateo County Mosquito Abatement District Board of Trustees also approved a name change to San Mateo County Mosquito and Vector Control District.

## OUR SERVICES
for San Mateo County Residents

- **Mosquito Control**
- **FREE Mosquitofish**
- **Insect and Tick Identification**
- **Yellowjacket Control**
- **Rodent & Wildlife Inspections**
- **Disease Surveillance**
- **Community Education**

SAN MATEO COUNTY MOSQUITO & VECTOR CONTROL DISTRICT

**(650) 344 - 8592**
**1351 Rollins Road**
**Burlingame, CA 94010**

**Monday-Friday**
**8a.m. to 4:30p.m.**
**www.smcmvcd.org**