Mosquito Control and Vector-Borne Disease in California: The Interjurisdictional Relationship of Water Management

Jared Dever, MPA, Director of Communications
Orange County Mosquito and Vector Control District

If California special districts collectively step back from our focus on individual district missions and objectives, we find a common element that challenges us all in different and often unique ways: water. From cemetery to flood districts; water management, mitigation, capture, or transference is part of our daily routine. Water can be thought of as the connective binding agent that links most, if not all, districts together. So it behooves us to understand how the decisions we make individually impact special districts collectively during our pursuit to provide the highest level of service to our constituents. In the world of mosquito control, proper water management practices are also the key to healthy communities, free of disease burden brought about by mosquito–borne illnesses.

To illustrate this, let's start with a quick Mosquito 101 lesson. Mosquitoes are the deadliest animals on the planet. They are responsible for more human morbidity and mortality than all other species of animal combined. All mosquitoes need stagnant water to complete their lifecycle, but water quality is largely irrelevant since there is a mosquito species evolutionarily tailored for nearly every water type. Mosquitoes can develop from egg to adult in minuscule volumes of water, and as quickly as five days given optimal environmental conditions. In pursuit of blood meals and stagnant water sources to lay their eggs, female mosquitoes can easily navigate through tiny openings in underground utility vault lids, underground sumps basins, manholes, and window and door screens.

In recent years, mosquito abatement and vector control districts in California have been faced with unprecedented threats and challenges. These include the introduction and proliferation of invasive mosquito species capable of transmitting Zika virus, Dengue fever, Chikungunya, and Yellow fever; compounding effects of sustained drought resulting in record West Nile virus infection rates; duplicative regulatory burdens; decreasing chemical and biological mosquito control options; and increased public and political scrutiny. These challenges have dramatically impacted most mosquito and vector control districts' modest budgets and future financial stability. Compounding these issues in many areas of the state are critical infrastructure assets that have reached, or are over, their designated service life, are poorly maintained, or are engineered and installed without appropriate consideration for mosquito production potential. These assets include CDS units, sumps, BMPs, and a host of other stormwater structures and rain capture devices. As these assets degrade, mosquito production sites can be formed in areas that are difficult or impossible to access with conventional mosquito control methods. Simply put, without the help and support of all special districts in California, mosquito abatement and vector control districts will not be able to provide the same level of public health protection in the coming years.

Fear not, we have a plan. Consult. Design. Build. Maintain.

The most effective, sustainable, and environmentally conscious method of mosquito control is not found at the tip of a spray nozzle or even the voracious jaws of a mosquito fish. It is found in the conceptual designs and engineering schematics of all types of infrastructure, whether new installation or rehabilitation of existing district assets. Consultation with your local mosquito abatement or vector control district during the initial stages of a project can help reduce or eliminate decades of costly mosquito control activities and the public health risk to your constituents. During the consultation, mosquito control professionals can provide guidance on grade, elevation, plant selection (if applicable), accessibility, residence time for captured water, and even building material selections that will help preclude mosquito production. Don't wait until the project has been formalized and submitted for plan check and review since making changes at that point in the process is costly and can significantly delay project completion. Even small projects that don't require formal plans to be drafted can benefit from mosquito and vector control district consultation. For example, your district plans to renovate the landscaping at a community center and would like to include several low impact development elements including rain capture devices, reclaimed water features, and a bio swale. We can recommend the preferred anti-mosquito rain barrel features, grade and permeability of the bio swale substrate and maintenance schedules for each.

It is not uncommon for special district construction, asset replacement, or renovation projects to take extended periods of time to complete due to the level of design complexity and regulatory compliance standards. Throughout the build or installation process, water management is of concern to mosquito abatement and vector control districts. Access to construction sites is often limited by safety and security protocols, while significant mosquito production sources are created above and below ground behind the construction site fence line. Mosquito abatement and vector control district technicians and surveillance staff need routine and unrestricted access to all areas where water is allowed to collect for more than a few days.

Even the most intelligently designed and skillfully implemented projects are subject to real world conditions such as natural subsidence, settling, erosion, vandalism, groundwater fluctuations, vegetation overgrowth, and clogging of pipes, basins and filters. For these and many other maintenance issues that develop overtime, formally drafted and implemented maintenance plans are paramount to the prevention of mosquito production. Storm water retention and urban water mitigation ponds are historically plagued by a number of maintenance and design related issues. While most of these features meet or exceed state standards for periodic rain event capture when they are built, a constant onslaught of residential, commercial, agricultural, and industrial runoff to these systems is the reality. The runoff quickly overwhelms these features with soils, green waste, trash and other pollutants that clog drains and filters; leading to water stagnation beyond the recommended 72-hour period. Invasive or unintended species of plants inevitably invade and overwhelm the plant species selected for proper pollutant uptake and removal. Once overgrown, chemical and biological mosquito control products become far less effective at reaching their target. In addition, access to the impounded water for larval mosquito inspection by district technicians is hindered. In the absence of routine and thorough maintenance, it is only a matter of time

before these water quality and flood management devices become significant mosquito production sites, and increase the abundance of disease incidence in surrounding communities.

Underground storm drain systems are one of the most cryptic and challenging mosquito production site types faced by mosquito abatement and vector control districts in urbanized areas. Underground storm drain systems are often damaged by earthquakes, soil subsidence and erosion, root intrusion, construction activities, and clogged by debris. A damaged or unmaintained underground storm drain creates the idea habitat for immature mosquito development and refuse for adult mosquitoes. These systems maintain a consistent temperature during the winter and summer months, have every few natural mosquito predators, and provide abundant nutrient-rich water for immature mosquitoes to rapidly complete their life cycle. To make matters worse, the most abundant species of mosquito found in these systems is also the most prolific and competent vector of West Nile virus. Even underground storm drains that are not damaged or clogged with debris may still be problematic for mosquito control efforts. Older building material choices, such as corrugated pipes, retain sufficient quantities of water to produce mosquitoes every three to four inches for the length of the system.

An example of the effort undertaken to control these systems can be found at the Orange County Mosquito and Vector Control District (OCMVCD). OCMVCD makes applications of larval mosquito control products to over 69,000 storm drain manhole access points, a treatment area of over 500 linear miles in the course of the spring and summer months.

Gutters and street drains are more conspicuous sources of mosquito production, but suffer from the same maladies of age that underground storm drains are subject to. The OCMVCD uses right-hand drive vehicles to apply larvicides to over 700 miles of damaged or improperly designed gutter segments in Orange County. Both underground and above ground mosquito control treatments are labor intensive and have high personnel, material, and equipment costs. But more importantly, these chemical mosquito control applications must be made until the damaged systems are routinely maintained, repaired, or replaced. The number of treatments, and subsequently the amount of public health pesticides entering our urban water conveyance systems could be reduced dramatically if proper maintenance is conducted.

Not all mosquito production sites are so obvious. Cemetery urns are periodically filled by turf irrigation water and must be dumped or inverted at regular intervals to prevent mosquito production in hundreds or thousands of micro-production sites. Utility vaults can hold irrigation or other residential runoff, but these assets present a much larger and more dangerous challenge for effective mosquito control. The utility vaults are (for good reason) difficult to access and may contain high voltage lines and sensitive equipment, and therefore go untreated by most mosquito abatement and vector control districts. Routine pumping of stagnant water from these vaults is the most effective mosquito control option.

As we progress deeper into an era of growing public mistrust and cynicism of politics, government agencies, and a general lack of faith in public service provision; special districts

should stand above the rest as the most efficient and effective form of direct taxation and representation in California. The purpose of this article is to provide a deeper understanding of some of the challenges faced by mosquito abatement and vector control districts, and serve to motivate all special districts to work collaboratively to find long-term solutions to mosquito production issues. If water is accepted as a common constant that connects all special districts in California, then we should endeavor to work together to correct critical infrastructure and plan smarter and healthier communities through design and maintenance.

The California Mosquito and Vector Control Association maintains a list of member agencies and a repository of mosquito control publications.

References: http://ipm.ucanr.edu/PMG/PESTNOTES/mosquitostormwater5.html

Special thanks to Marco Metzger, Ph.D. for his significant contribution to the statewide integrated pest management program guide for managing mosquitoes in stormwater treatment devices.