MEMORANDUM

TO: Local Agency Formation Commission
FROM: Stephen Lucas, Executive Officer
       Stephen Betts, Deputy Executive Officer
SUBJECT: Agenda Item 4.4 – Review of the Durham Mosquito Abatement District’s Probationary Sphere of Influence Boundary
DATE: January 29, 2020, for the meeting of February 6, 2020

BACKGROUND

On December 7, 2017, the Commission adopted a Probationary Sphere of Influence (PSOI) for the Durham Mosquito Abatement District (DMAD) as a part of the Municipal Services Reviews and Sphere of Influence Plans for the Mosquito Abatement Districts within Butte County. Prior to that date DMAD had Zero Sphere of Influence boundary as adopted by the Commission on January 6, 2005 (Resolution No. 17 2004/05). A condition of the DMAD PSOI required a subsequent review of DMAD’s service provisions to ensure that the District has adopted a comprehensive integrated pest management program and has created and maintained a comprehensive website.

Pursuant to conditions of the granting of the Probationary Sphere of Influence boundary to DMAD, Staff has reviewed the applicable service provisions, as discussed below. Staff recommends that the Commission consider the findings of this staff report and any public comments and provide direction to Staff.

ANALYSIS

The Municipal Services Review and Sphere of Influence Plans for the Mosquito Abatement Districts within Butte County, adopted by the Commission in 2017, reviewed the operations of the three mosquito abatement districts in Butte County (Butte County Mosquito and Vector Control District (BCMVCD), the Durham Mosquito Abatement District (DMAD), and the Oroville Mosquito Abatement District (OMAD)). Determinations and findings for each district were adopted as a part of the MSR/SOI Plan. Pursuant to the determinations and findings for DMAD, the Commission is now reviewing the DMAD Probationary Sphere of Influence for consistency with those determinations and findings.

The DMAD PSOI required a review of DMAD’s service provisions to ensure that the District has adopted and implemented a comprehensive integrated pest management program and has created and maintained a comprehensive website. Since approval of the DMAD PSOI, several notable events for DMAD have occurred:

1. On June 7, 2018, approximately 14,775 acres consisting mostly of rice fields were detached from the Durham Mosquito Abatement District and subsequently annexed to the Butte County Mosquito and Vector Control District (BCMVCD). The detachment resulted in DMAD’s service area becoming coterminous with DMAD’s Probationary SOI. The detachment/annexation project was the result of a determination found in the Mosquito
District’s MSR/SOI Plans. A map showing DMAD’s current service boundaries and the Probationary Sphere of Influence boundary is shown below.

2. On July 11, 2018, the DMAD Board of Trustees adopted an integrated mosquito management plan *(Exhibit D)*.

3. DMAD has created a website (http://durhammad.com/).

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Staff began the DMAD Probationary Sphere of Influence review in July 2019 with a letter to the DMAD District Manager explaining the process and asking that the District respond to the questions asked in the letter *(Exhibit B)*. The DMAD District Manager responded to that letter on August 14, 2019 *(Exhibit C)*. Staff met with the DMAD District Manager on January 23, 2020, to go over the District’s responses and to determine if there have been any recent changes to District’s operations.
MAD Integrated Mosquito Management Plan

The purpose of an Integrated Pest Management Plan (IPM) is to guide the use of environmentally sensitive pest management strategies and least-toxic control methods for the control of pests.\(^1\) Integrated Pest Management (IPM) is defined as managing pests (plants, fungi, insects and/or animals) in a way that protects human health and the surrounding environment and that improves economic returns through the most effective, least-risk option. Core elements of IPM should include:

- Use of least-toxic chemical pesticides
- Minimum use of chemicals
- Use of chemicals and pesticides only in targeted locations and for targeted species
- Routine inspection and monitoring
- Proactive communication

As previously noted, on July 11, 2018, the DMAD Board of Trustees adopted an Integrated Mosquito Management Plan (IMMP), which is attached to this staff report as Exhibit D. DMAD’s plan, which consists of nine pages, appears to cover all of the major elements of an integrated pest management plan and provides a large amount of information on how the District performs mosquito abatement services. As noted below, the District’s IMMP has not been posted to the District’s webpage.

DMAD Webpage

DMAD created a website (http://durhammad.com/) that contains basic information about the district, such as contact and location information, the names of the district Board of Trustees, spray zone maps, and information about mosquitoes and mosquito-borne diseases. The District’s webpage does not appear to be comprehensive since a significant amount of information about the district is not posted on the webpage. The information that the District should add to their webpage to make it a comprehensive and publicly useful webpage includes:

- Name of the District Manager and other key staff
- Past and current annual budgets
- Annual financial audit reports
- Employee compensation reports
- Board of Trustee meeting dates
- Board of Trustees current and past meeting notices/agendas and minutes
- Municipal Service Review/Sphere of Influence Plan
- Map of the District jurisdictional boundaries

The DMAD general manager recently indicated that he is open to posting some of the above listed information on the District’s webpage but doing so will require some time and expense to accomplish. Having a comprehensive webpage that provides a wide range of information about the District ensures that DMAD documents are easily accessible to the public and ensures that DMAD management and operations are very transparent to the public.

Conclusion

The Durham Mosquito Abatement District has created and adopted an Integrated Mosquito Management Plan (IMMP) and has created a webpage as required by the provisions of the probationary sphere of influence granted to the district. The District’s IMMP appears to include all of the normal elements of an integrated pest management plan and appears to adequately address the provisions of integrated mosquito abatement services to the parcels within the District. The District’s webpage does provide basic information about the district but does not appear to be comprehensive as it omits important information about the district.

SUGGESTED OPTIONS

The Commission Resolution (No. 02 2017/18) adopting the Mosquito Abatement Districts MSR/SOI Plan provided the following options to consider at this time:

5. At the end of the one year period, or sooner at the direction of the Commission, the Commission shall review the service provisions of the Durham Mosquito Abatement District to ensure that the District has adopted and implemented the comprehensive integrated pest management program and has created and maintained a comprehensive website. Should the Commission determine that the District has adequately implemented these measures, the Commission may give the District a traditional Coterminous Sphere of Influence boundary. Should the Commission determine that the District has not adequately followed through with these measures and/or determine that District services are inadequate, the Commission can remove the Probationary Sphere of Influence and give the District a Zero Sphere of Influence.

In consideration of the above finding, the following options are provided for the Commission’s consideration. Option No. 1 can be approved by the Commission at the February 6 hearing, but Options 2 and 3 will require a noticed public hearing prior to the Commission’s final action on DMAD’s sphere of influence boundary.

1. **Additional Time** - Determine that the Durham Mosquito Abatement District has not sufficiently complied with the requirements of the District’s Probationary Sphere of Influence but grants additional time to DMAD to comply with the requirements of the Probationary Sphere of Influence with regards to creating a more comprehensive webpage.

2. **Coterminous Sphere** - Determine that the Durham Mosquito Abatement District has adequately implemented the requirements of the MSR/SOI Plan and Probationary Sphere of Influence and replace the probationary sphere of influence boundary with a coterminous sphere of influence boundary.

   This action would indicate the DMAD meets the minimum service standards for mosquito control services and should remain in existence.

3. **Zero Sphere** - Determine that the Durham Mosquito Abatement District has adequately complied with the requirements of the District’s Probationary Sphere of Influence, but the District still does not provide adequate mosquito abatement services as described in the recent MSR and the probationary sphere of influence should be replaced with a zero sphere zero sphere of influence boundary.

   This action is an acknowledgement that the Commission determines that the MSR clearly established that the District cannot provide mosquito abatement services on par with the
Butte County Mosquito and Vector Control District and should be dissolved and its territory annexed into the BCMVCD.

**ACTIONS REQUESTED:**

1. Open the hearing to the public and receive any additional comments.
2. Consider Suggested Actions.
3. Approve Option No. 1 or direct Staff to bring the item back to the Commission at a future hearing if either Option 2 or Option 3 is chosen by the Commission.

**Exhibits:**

A. Butte LAFCo Resolution 02 2017/18 adopting the Mosquito Districts MSR/SOI Plans
B. Butte LAFCo Executive Officer letter to DMAD District Manager, dated July 24, 2019
C. Letter from DMAD District Manager, dated August 14, 2019
D. DMAD Integrated Mosquito Management Plan
RESOLUTION NO. 02 2017/18

ADOPTION OF MOSQUITO ABATEMENT DISTRICTS MUNICIPAL SERVICE REVIEWS AND WRITTEN DETERMINATIONS, AND ADOPTION OF SPHERE OF INFLUENCE PLANS

WHEREAS, a municipal service review mandated by Government Code Section 56430 and a sphere of influence update mandated by Government Code Section 56425 for the three mosquito abatement districts within the County of Butte have been conducted by the Local Agency Formation Commission of the County of Butte (hereinafter referred to as “the Commission”) in accordance with the Cortese-Knox-Hertzberg Local Government Reorganization Act of 2000 (Government Code Sections 56000 et seq.); and

WHEREAS, at the times and in the form and manner provided by law, the Executive Officer has given notice of the public hearing by the Commission on this matter; and,

WHEREAS, the Executive Officer, pursuant to Government Code Section 56428 and 56430, has reviewed this proposal and prepared a report, including his recommendations thereon, and has furnished a copy of this report to each person entitled to a copy; and

WHEREAS, this Commission held public hearings regarding the Public Review Draft Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans on August 3, September 7, October 5, November 2, and December 7, 2017, and at the time and place specified in the notice of public hearing and as continued open by the Commission;

WHEREAS, at the above noted hearings, this Commission heard and received all oral and written protests; the Commission considered all plans and proposed sphere of influence amendments, objections and evidence which were made, presented, or filed; and all persons present were given an opportunity to hear and be heard in respect to any matter relating to the proposal, in evidence presented at the hearing; and

WHEREAS, acting as Lead Agency pursuant to the California Environmental Quality Act (CEQA) Guidelines, the Commission finds that the Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans are Categorically Exempt from the provisions of CEQA under Section 15308, “Information Collection” and under Categorically Exempt from the provisions of CEQA under Section 15361(b)(3) – General Rule Exemption, respectively; and

WHEREAS, Municipal Service Review determinations for each Mosquito Abatement District are made in conformance with Government Code Section 56430 and local Commission policy; and

WHEREAS, Sphere of Influence determinations for each Mosquito Abatement District are made in conformance with Government Code Section 56425 and local Commission policy; and

WHEREAS, based on presently existing evidence, facts, and circumstances considered by this Commission, including the findings as outlined above, the Commission adopts written determinations as set forth. No changes to the Butte County Mosquito and Vector Control District’s existing Sphere of Influence boundary is proposed and the Oroville Mosquito
RESOLUTION NO. 02 2017/18

Abatement District shall continue to have a Zero Sphere of Influence boundary. The Commission grants a Probationary Sphere of Influence boundary to the Durham Mosquito Abatement District as shown in the DMAD MSR section and as shown in the staff memorandum for the Commission’s December 7, 2017, meeting. The Probationary Sphere of Influence boundary for the Durham Mosquito Abatement District is subject to the following conditions:

1. The Durham Mosquito Abatement District shall adopt a comprehensive integrated pest management program within six months of the Commission’s approval of the Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans. The Durham Mosquito Abatement District shall continuously implement the provisions of the adopted integrated pest management program;

2. The Durham Mosquito Abatement District shall create a comprehensive website within six months of the Commission’s approval of the Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans. The Durham Mosquito Abatement District shall keep the website current;

3. Within two (2) months of Commission’s adoption of the Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans, the Durham Mosquito Abatement District and/or the Butte County Mosquito and Vector Control District shall submit an application to LAFCo to detach the rice field area of the Durham Mosquito Abatement District from that district and annex the rice field area to the Butte County Mosquito and Vector Control District.

4. The Probationary Sphere of Influence shall be for a period of one year from the date of adoption of the Mosquito Abatement District’s Municipal Service Reviews/Sphere of Influence Plans.

5. At the end of the one year period, or sooner at the direction of the Commission, the Commission shall review the service provisions of the Durham Mosquito Abatement District to ensure that the District has adopted and implemented the comprehensive integrated pest management program and has created and maintained a comprehensive website. Should the Commission determine that the District has adequately implemented these measures, the Commission may give the District a traditional Coterminous Sphere of Influence boundary. Should the Commission determine that the District has not adequately followed through with these measures and/or determine that District services are inadequate, the Commission can remove the Probationary Sphere of Influence and give the District a Zero Sphere of Influence.

6. During the probationary period, the Butte County Mosquito and Vector Control District and the Durham Mosquito Abatement District will have an overlapping Sphere of Influence boundary. Should the Commission give the Durham Mosquito Abatement District a coterminous Sphere of Influence boundary, the Sphere of Influence boundary for the Butte County Mosquito and Vector Control District shall be modified to remove the overlapping Sphere of Influence area.

NOW, THEREFORE, BE IT RESOLVED, that pursuant to powers provided in §56425 and §56430 of the Cortese-Knox-Hertzberg Local Government Reorganization Act of 2000, the Local Agency Formation Commission of the County of Butte adopts written determinations as set forth in the Mosquito Abatement District Municipal Service Reviews and Sphere of Influence Plans, dated November 27, 2017, and adopts the Mosquito Abatement District Municipal Service Reviews and Sphere of Influence Plans, adopted by the Commission on December 7, 2017.
RESOLUTION NO. 02 2017/18

PASSED AND ADOPTED by this Local Agency Formation Commission of the County of Butte, on the 7th day of December 2017 by the following vote:

AYES: Commissioners Lotter, Onken, Connelly, Lando, Dahlmeier, Lambert & Chair Leverenz

NOES: None

ABSENT: None

ABSTAINS: None

ATTEST:

[Signature]

Clerk of the Commission

[Signature]

CARL LEVERENZ, Chair
Butte Local Agency Formation Commission
Aaron Amator, District Manager  
Durham Mosquito Abatement District  
P.O. Box 386  
Durham, CA 95938  

Re: Durham Mosquito Abatement District Municipal Service Review and Sphere of Influence Plan (LAFCo File No. 17-07) Recommendations and Determinations

Dear Aaron:

The Butte Local Agency Formation Commission (LAFCo) adopted Resolution No. 02 2018/19 on December 7, 2017, approving the Municipal Service Review (MSR) and Sphere of Influence Plan (SOI) update for the Durham Mosquito Abatement District (DMAD).

The MSR/SOI Plan resulted in the DMAD being given a probationary sphere of influence that would be revisited by the Commission to determine if:

1) The District has complied with the LAFCO’s findings discussed below; and

2) A revision to the probationary sphere of influence is warranted.

Please review the following determinations/recommendations and provide a response to the associated questions.

1. The Durham Mosquito Abatement District shall adopt a comprehensive integrated pest management program within six months of the Commission’s approval of the Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans. The Durham Mosquito Abatement District shall continuously implement the provisions of the adopted integrated pest management program.

   Has the District adopted a integrated pest management program? If yes, please provide a copy of the document with its adopting resolution. If no, why not?

2. The Durham Mosquito Abatement District shall create a comprehensive website within six months of the Commission’s approval of the Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans. The Durham Mosquito Abatement District shall keep the website current.

   It appears the District has created a website at http://durhammad.com. The site has useful contact, educational and operational information and is a good start.
Does the District have a plan for additional information to be added such as the IVMP, meeting notices, agendas/minutes, bylaws, a map of the District, budgets/audits, employee compensation reports and the District MSR/SOI Plan?

3. Within two (2) months of Commission’s adoption of the Mosquito Abatement Districts Municipal Service Reviews/Sphere of Influence Plans, the Durham Mosquito Abatement District and/or the Butte County Mosquito and Vector Control District shall submit an application to LAFCo to detach the rice field area of the Durham Mosquito Abatement District from that district and annex the rice field area to the Butte County Mosquito and Vector Control District.

The Rice Fields Annexation was initiated by the Butte County and Vector Control District and completed/recorded (Resolution 13 2017/18) on February 19, 2019. No DMAD action required.

4. At the end of the one year period, or sooner at the direction of the Commission, the Commission shall review the service provisions of the Durham Mosquito Abatement District to ensure that the District has adopted and implemented the comprehensive integrated pest management program and has created and maintained a comprehensive website. Should the Commission determine that the District has adequately implemented these measures, the Commission may give the District a traditional Coterminal Sphere of Influence boundary. Should the Commission determine that the District has not adequately followed through with these measures and/or determine that District services are inadequate, the Commission can remove the Probationary Sphere of Influence and give the District a Zero Sphere of Influence.

Upon receiving and reviewing the District’s response to this inquiry, the Commission will schedule a hearing to evaluate and discuss the response and potentially take action to amend the District’s MSR/SOI Plans.

6. MSR DETERMINATION 6-2: GOVERNMENTAL STRUCTURE: The District has a single full-time employee – the District Manager - who is responsible to manage all District functions. If the District Manager has an extended absence for any reason such as an illness or vacation, the District would be effectively without leadership, and services would be drastically impacted. The District Board should address this concern and adopt a contingency plan for an extended absence that may involve contractual services provided by the BCMVC.

Has DMAD addressed this concern? If yes, please provide the contingency plan or policy. If not, why not?
Given the great public health and safety risks associated with mosquito borne diseases, the Commission continues to have a high level of concern for all mosquito abatement services provided in the County. We are hopeful that the DMAD has taken the MSR/SOI Plan update with the seriousness it deserves and has implemented proactive steps to address the above referenced concerns. We look forward to receiving your response in a timely manner, but will expect a response no later than September 1, 2019. If you have any questions, please contact our office at your convenience.

Sincerely,

Steve Lucas

Stephen Lucas
Executive Officer

cc: LAFCO
August 14, 2019

Butte Local Agency Formation
Commission 1453 Downer Street,
Suite C Oroville, CA 95965

Re: Durham Mosquito Abatement District Municipal Service Review and Sphere of Influence Plan. (LAFCo File No. 17-07) Recommendations and Determinations

Dear Mr. Lucas:

The following is a response to LAFCo’s letter dated July 24, 2019.

1. DMAD adopted an IMP program within the time allotted to do so. The program was built to suit the needs of the Durham Community. A copy of the DMAD’s IMP program is attached.

2. A comprehensive website was created within the allotted time. The website contains maps of the district as well as covered spray zones. It also contains information on local mosquito-borne diseases and helpful tips on preventative measures to minimize risk of high mosquito populations on their property. The district will add its IMP program as well as meeting dates and times before the end of 2019 to website.

3. No DMAD action needed.

4. DMAD has completed all requirements.

5. Before the letter dated July 24th, 2019, LAFCo had not requested a contingency plan from DMAD if the district manager was absent. Although DMAD does not have anything in writing, there are policies and procedures in place if/when the district manager is absent. We have a part time employee. He has worked for us for seven years. He assists with fogging, but is capable of covering all day to day aspects of the manager’s job. If the manager is on vacation, or had to miss work with a health-related malady, the part time technician would cover day to day operations. Further, DMAD has an office Manager who has worked for the district for several years who can cover all office issues and day to day tasks needed to keep district going and operating efficiently and effectively. If the manager was to vacate his position for good DMAD would hire a qualified applicant just like any other business would. Further, DMAD has received several applications in recent years requesting information about potential openings for certified technician jobs. During the next few months, DMAD will work on writing a contingency plan in the event of the manager’s absence. DMAD has accomplished what LAFCo has asked of us.

Sincerely,

Aaron Amator
DMAD District Manager
INTEGRATED MOSQUITO MANAGEMENT PLAN

Passed & adopted at a regular meeting of the Board of Trustees of the Durham Mosquito Abatement District, on July 11, 2018.

The proposed Integrated Mosquito Management (IMM) Policy & Plan will continue to evolve as new issues emerge and based on Durham Mosquito Abatement District resources.

BACKGROUND INFORMATION

Western Equine Encephalitis (WEE), Malaria, and West Nile Virus (WNV) are all mosquito-borne Arboviral diseases. The West Nile Virus is a pathogen which is a subgroup of Japanese encephalitis. Up until 1999, W.N.V. had never before been documented in the Western Hemisphere. In August of 1999 a hospital in Queens, New York notified the State Department of Health that they had diagnosed six cases of encephalitis. At first the disease was misdiagnosed as the St. Louis Encephalitis (S.L.E.). Local health officials noticed before and concurrent with this outbreak, an increase of dead birds, especially crows. On September 7, 1999, exotic birds in the Bronx Zoo started dying. Cause of death was encephalitis and inflamed hearts. Tissue samples were then forwarded by the USDA to the Centers for Disease Control and Prevention (CDC) in Atlanta. DNA analysis from the dead birds eventually led to the identification of the encephalitis as being WNV. This diagnosis was later confirmed by the University of California in Irvine, CA after testing tissue samples from the deceased victims of New York.

West Nile Virus can infect a wide range of vertebrates including, horses, cattle, birds, as well as humans. In humans though, WNV generally produces a milder form of the disease. Symptoms are a rapid onset of fever (100 – 104 degrees Fahrenheit) lasting 5-6 days, muscle pain and weakness, stiff neck, breathing, problems, headache, pain associated with eye movement, swollen lymph nodes and rash. WNV can infect the heart, pancreas, and liver as well as the brain. Severe cases tend to be limited to older patients or patients with weakened immune systems. Some people can become infected with the disease and not display a single symptom.

Also see (Best Management Practices for Mosquito Control in California and the California Mosquito-borne Virus Surveillance and Response Plan)
I. Current Surveillance Programs

A. New Jersey Light Trap Program

1. Currently DMAD has 4 light traps located throughout the District of DMAD.
2. Once a week contents of all 4 traps are collected and brought back to the office for analysis.
   a.) The mosquitoes are separated from the rest of the trap's contents one trap at a time.
   b.) After separating the contents, the different species of mosquitoes are identified and counted.
   c.) The identification results and mosquito count are then recorded and filed in DMAD's records.
   d.) The results are sent to the California Department of Health Services.

B. Encephalitis Virus Surveillance Program (E.V.S. Traps)

1. E.V.S. traps are designed to attract & capture live mosquitoes that are used to develop "mosquito pools."
   a.) The "mosquito pools" contain 50 female mosquitoes and are shipped overnight to U.C.
       Davis, where the mosquitoes are tested for W.E.E. or S.L.E. and/or W.N.V.
   b.) The E.V.S. traps are small units that are suspended from a tri-pod stand, which contain a
       small light and dry ice (as a source for carbon dioxide, CO2) to attract live mosquitoes.
       These traps are placed at three representative locations throughout the DMAD at dusk.
   1. Once the mosquitoes are attracted, a fan in the unit pulls the live mosquitoes into a
      net or sock unit which hangs below the entire unit.
      a.) This sock unit keeps the mosquitoes alive until they can be collected the following morning.

2. After collection of all of the sock units, the live mosquitoes are brought to the office
   in order to create a mosquito pool.

   a.) At the office, the live mosquitoes are anesthetized (put to sleep) and removed from the sock.
   b.) Once anesthetized, the females are removed and identified.
       1.) After segregated and identified, 50 mosquitoes are counted for 1 mosquito pool.
       2.) Each pool is placed into a small vial, with dry ice and then placed inside a
           Styrofoam container to be shipped to U.C. Davis Disease Research lab.
       3.) Mosquito Pools are collected when virus activity is high. There is typically several months out of the year when virus activity peaks.

C. West Nile Virus Dead Bird Surveillance Program
Durham Mosquito Abatement District
P.O. box 386
Durham, CA 95938

1. This Program requires a permit from the United States Fish & Wildlife Service.
2. Only trained personnel picks up dead birds (i.e., Crows, Blue Jays, Magpies, Ravens, Black Birds, etc..) dead Lagomorphs (rabbits and hares), and dead Rodents (e.g. Tree Squirrels) within DMAD.
3. All dead birds are sent to U.C. Davis Arbovirus Research Lab for testing
4. Only birds that have died within 48 hours of pick up will be tested.
5. All dead corvids will be vec-tested in house before shipping to the lab for confirmation.

The District follows an IMM plan, where various methods to control mosquitoes are used.

1. Public education and outreach programs to educate the public about eliminating mosquito breeding sources on their ranches or around their homes, protecting themselves from mosquito bites with repellents, clothing, and avoiding mosquitoes when they are most active. DMAD does also do public events to educate its residents. When asked, DMAD does training in Durham Schools to educate youngsters.

2. DMAD technicians carefully check each mosquito breeding source and determine the most effective control method for each situation. The technicians choose between physically changing the environment so mosquitoes don’t breed and or placing mosquitofish in the source to eat mosquito larvae, or applying specific pesticides regulated by the environmental protection agency to curb mosquito breeding. All larvacides and adulticides are chosen and used in a manner that minimizes risks to humans, wildlife, and the environment.

3. Thresholds

Treatment thresholds are established for mosquito developmental sites where potential disease vector and/or nuisance risks are evident. Therefore, only those sources that represent imminent threat to public health or quality of life are treated. Treatment thresholds are based on the following criteria:

- Mosquito species present
- Mosquito state of development
- Nuisance or disease potential
- Mosquito abundance
- Flight range
- Proximity to populated areas
- Size of source
Treatment thresholds for larvicide, pupicide, and adulticide applications for DMAD.

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<tr>
<th>County</th>
<th>Treatment Thresholds</th>
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<tr>
<td></td>
<td>Larvicide</td>
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<td></td>
<td>Dipper 1</td>
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<td>Durham</td>
<td>All Areas</td>
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</tbody>
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1. Average Number per Dip.
2. Average Number Landing per Pant leg per Minutes.
3. Per trap Night, based on Weekly index of Adult females.

4. **Selection of Control Strategy**

When thresholds are exceeded an appropriate control strategy is implemented. Control strategies are selected to minimize potential environmental impacts while maximizing efficacy. The method of control is based on the above threshold criteria but also:

- Habitat type
- Water conditions and quality
- Weather conditions
- Cost
- Site accessibility
- Size of site and number of other developmental sites

**CONTROL STRATEGIES**

1. **SOURCE REDUCING**

Source reduction includes elements such as physical control, habitat manipulation and water management, and forms an important component of the DMAD IMM program.

2. **PHYSICAL CONTROL**

The goal of physical control is to eliminate or reduce mosquito production at a particular site through alteration of habitat. Physical control is usually the most effective mosquito control technique because it provides a long term solution by reducing or eliminating mosquito development sites and ultimately reduces the need for chemical applications.
Historically (circa 1903), the first physical control efforts were projects undertaken to reduce the populations of salt marsh mosquitoes in marshes near San Rafael, CA. Two years later, similar work was undertaken in the marshes near San Mateo. Networks of ditches were created by hand to enhance drainage and promote tidal circulation. Since then, various types of machinery have been used since then to dig ditches necessary to promote water circulation. In recent years, a number of environmental modification projects have been undertaken in collaboration with the U.S. Fish and Wildlife Service (USFWS) to reduce potential mosquito developmental sites and enhance wildlife habitat. Re-circulation ditches allow tidewater to enter the marsh at high tide and drain off at a low tide. Water remaining in the ditch bottoms at low tide provides habitat for mosquito-eating fish. These projects have reduced the need to apply chemical on thousands of acres of salt marsh in the San Francisco Bay.

Physical control programs conducted by the DMAD may be categorized into three areas: “maintenance”, “new construction”, and “cultural practices” such as vegetation management and water management.

Maintenance activities are conducted within seasonal wetlands, ditches, canals, and in some creeks adjacent to these wetlands. The following activities are classified as maintenance:

- Removal of sediments from existing water circulation ditches
- Repair of existing water control structures
- Removal of debris, weeds and emergent vegetation in natural channels
- Clearance of brush for access to streams tributary to wetland areas
- Filling of existing, non-functional water circulation ditches to achieve required water circulation dynamics and restore ditched wetlands.

New projects, such as wetland restoration, excavation of new ditches, construction of new water control structures, all require review and assessment under CEQA. Since this can be a time-consuming and expensive proposition, DMAD tries to work with landowners and resource groups to manage their lands in a manner that does not promote mosquito development. DMAD staff review proposals for wetlands construction to assess their impact on mosquito production. The district then submits recommendations on hydrological design and maintenance that will reduce the production of mosquitoes and other vectors. This proactive approach involves a collaborative effort between landowners and DMAD. Implementation of these standards may include cultural practices such as water management and aquatic vegetation control.

3. Biological Control

Biological control agents of mosquito larvae include predatory fish, predatory aquatic invertebrates and mosquito pathogens. Of these, only mosquitofish are available in sufficient quantity for use in mosquito control programs. Natural predators may sometimes be present in numbers sufficient to reduce larval mosquito populations. Biological control is sometimes used in conjunction with selective bacterial or chemical insecticides.
Durham Mosquito Abatement District  
P.O. Box 386  
Durham, CA 95938  

Mosquitofish  

The mosquitofish, *Gambusia affinis*, is a natural predator of mosquito larvae used throughout the world as a biological control agent for mosquitoes. Although not native to California, the mosquitofish are now ubiquitous throughout most of the state’s waterways and tributaries, where they have become an integral part of aquatic food chains. They can be stocked in mosquito larval sources by trained district technicians or distributed to the public for stocking in backyard ornamental ponds and other artificial containers.

4. Chemical Control

Pesticides that control mosquito larvae are called larvicides. Four types of larvicides (bio-rational, surface oil, growth regulating, and chemical products) encompassing seven active ingredients that are registered for use in California. Larvicides are applied by hand from backpack sprayer or vehicle-mounted engine-driven blowers, or by aircraft depending on the product, the formulation, and the target habitat. Applicators of any of these products must be certified by the CDPH.

A. Bio-rational Products

Bio-rational products exploit insecticidal toxins found in certain naturally occurring bacteria. These bacteria are cultured in mass and packaged in various formulations. The bacteria must be ingested by mosquito larvae so the toxin is released. Therefore bio-rational products are only effective against larvae since pupae do not feed. The bacteria used to control mosquito larvae have no significant effects on non-target organisms.

Two biological products that are used against mosquito larvae singly or in combination are *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Manufactured *B. thuringiensis israelensis* contains dead bacteria and remains effective in the water for 24 or 48 hours; some slow release formulations provide longer control. In contrast, *B. sphaericus* products contain live bacteria that in favorable conditions remain effective for more than 30 days. Both products are safe enough to be used in water that is consumed by humans.

B. Surface Agents

Mosquito larvae and pupae breathe through siphons that extend above the water surface. Surface agents such as highly refined mineral oils or monomolecular films (alcohol derivatives) can spread across the entire surface of the water and prevent mosquitoes from breathing. Depending on the product, the film may remain on the water’s surface from a few hours to a few days. Surface films are the only available products that are effective against fully developed larvae and pupae. Using surface agents may be restricted in sensitive habitats or where runoff may enter sensitive habitats.

C. Insect Growth Regulations
Insect growth regulators (IGRs) disrupt the physiological development of larvae thus preventing adults from emerging. The only product currently used for controlling mosquito larvae is methoprene. The effective life of these products varies with the formulation. Methoprene can be applied in granular, liquid, pellet, or briquette forms. There are no such restrictions to using methoprene. IGRs for mosquito control can be used in sources of water that are consumed by humans.

5. Adult Control

Adult mosquitoes can only be controlled with pesticides, known as adulticides. Many mosquito control programs in California include adulticiding as an integral component of the IPM program. Adulticiding falls into two categories – barrier applications and ultra-low volume (ULV) applications. Barrier applications target resting mosquitoes by applying pesticides to vegetation and structures. Barrier applications are typically applied on small properties.

ULV applications are used to control adult mosquitoes over large areas. Tiny oil water droplets carrying an “ultra-low volume” of insecticide are emitted from specialized equipment mounted to trucks or aircraft. The droplets kill adult mosquitoes on contact. ULV applications are made after sunset or before sunrise to coincide with the time that mosquitoes are most active, when non-target insects are least active, and when temperature inversions are most likely to occur. The applications are considered when most mosquito populations must be reduced immediately to halt disease transmission. Multiple applications are usually required for successful reduction of mosquito numbers.

Adult mosquitoes are controlled when mosquito-borne disease activity is documented and/or thresholds are reached or exceeded. Thresholds are based on local sampling of the adult mosquito population and/or when the risk of mosquito-borne disease increases above levels established by the statewide WNV surveillance and response plan. Thresholds are an integral component of mosquito control because they provide a range of predetermined actions based on quantified data. Thresholds also establish expectations and boundaries for responses that ensure appropriate mosquito control activities are implemented timely. The threshold for adult mosquito control can change depending on several factors including:

- How local citizens tolerate nuisance mosquitoes by evaluating public service requests.
- Overall mosquito abundance
- Presence of mosquito-borne disease in the region.
- Abundance of mosquito species that are vectors of disease.
- Local acceptance of adult mosquito control activities.
- Climate data.

Adverse effects from ULV applications are rare; however, people with health problems should be aware when and where the applications are being conducted. This information can be obtained by contacting the local vector control agency. Chemicals currently registered for ULV applications against mosquitoes in California (as of December 2007) include organophosphates (e.g., malathion and naled), pyrethrins (e.g., pyrethrum), and pyrethroids (e.g., resmethrin, sumithrin,
and permethrin). Formulations of both pyrethrins and pyrethroids include the synergist piperonyl butoxide (PBO), which increases their activity against mosquitoes.

A. Organophosphates

Malathion and Naled are neurotoxins. Malathion is typically used early and late in the season.

B. Pyrethrins

Pyrethrins are natural insecticides derived from chrysanthemum flowers. Adult mosquitoes are rapidly paralyzed and killed on contact. Pyrethrins degrade rapidly by sunlight and chemical processes. Residual pyrethrins from ULV applications typically remain less than one day on plants, soil, and water.

C. Pyrethroids

Pyrethroids are manufactured pyrethrins. They have very low toxicity to birds and mammals but are toxic to fish if misapplied.

6. EVALUATION OF THE EFFICACY/RESISTANCE OF BMPS

The efficacy of particular BMP strategies can be determined by sampling local populations of mosquitoes and assessing the risk of mosquito-borne disease transmission. The information can also be used to better characterize the most effective and efficient strategies for an individual location or land-use type. Factors such as treatment costs, proximity to densely populated areas, mosquito-borne disease activity, species present, treatment options, and ability to collaborate with local vector control agencies should be considered when evaluating the best approach for a particular location. After BMPs have been implemented, they should be continuously evaluated. Surveillance for potential sources of mosquitoes and mosquito-borne virus transmission should be ongoing.

A. Basic resistance management techniques can include:

1. Do not use the same class of chemical against both immature and adult mosquitoes.

2. Apply pesticide according to manufacturer’s recommendations. Do not underdose.

3. When possible, utilize a different chemical class at the beginning and end of treatment season

4. If possible, assess susceptibility at the beginning and sometime during the mosquito season

B. Resistance management can also involve utilizing surveillance methods following larvicide or adulticide applications to continually check for control efficacy.
7. **RECORD KEEPING**- Operators/applicators record the following for each application and maintain the records for the time specified by the lead regulatory agency:

   A. Applicator’s name, address and pesticide applicator certification number (if applicable)

   B. Application date and time of day

   C. Product name and EPA registration number

   D. General location of application and approximate size of area treated

   E. Amount of material applied

   F. Application rate

*If a Mosquito-borne Arboviral Emergency is documented and/or a County Emergency is declared within Butte county, refer to the State of California Emergency Response Plan.*