RECEIVED
NOV 14 2011
DIVISION OF WATER QUALITY

ATTACHMENT G – NOTICE OF INTENT

WATER QUALITY ORDER NO. 2011-0002-DWQ
GENERAL PERMIT NO. CAG 990004

STATEWIDE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT FOR BIOLOGICAL AND RESIDUAL PESTICIDE DISCHARGES TO WATERS OF THE UNITED STATES FROM VECTOR CONTROL APPLICATIONS

I. NOTICE OF INTENT STATUS (see Instructions)

Mark only one item ☒ A. New Applicator ☐ B. Change of Information: WDID# _____

☐ C. Change of ownership or responsibility: WDID# _____

II. DISCHARGER INFORMATION

A. Name			
Owens Valley Mosquito Abatement Program			
B. Mailing Address			
207 W. South St.			
C. City	D. County	E. State	F. Zip Code
Bishop	Inyo	CA	93514
G. Contact Person	H. Email address	I. Title	J. Phone
Jenn Sarten	J.sarten@inyocounty.us	Admin. Sec.	760-873-7860

III. BILLING ADDRESS (Enter Information *only* if different from Section II above)

A. Name			
B. Mailing Address			
C. City	D. County	E. State	F. Zip Code
G. Email address	H. Title	I. Phone	

IV. RECEIVING WATER INFORMATION

A. Biological and residual pesticides discharge to (check all that apply)*:

1. ☐ Canals, ditches, or other constructed conveyance facilities owned and controlled by Discharger.
   Name of the conveyance system: _____

2. ☑ Canals, ditches, or other constructed conveyance facilities owned and controlled by an entity other than the Discharger.
   Owner's name: Los Angeles Dept. of Water and Power
   Name of the conveyance system: Bishop Creek Canal, Big Pine Canal LA Aqueduct, Owens River (Lower)

3. ☑ Directly to river, lake, creek, stream, bay, ocean, etc.
   Name of water body: Owens Lake, Owens River and tributaries, Klondike lake, Tinnemaha Res., Blackrock, Goose Lake, Billy lake.
   * A map showing the affected areas for items 1 to 3 above may be included.

B. Regional Water Quality Control Board(s) where application areas are located (REGION 1, 2, 3, 4, 5, 6, 7, 8, or 9): Region 6
(List all regions where pesticide application is proposed.)

A map showing the locations of A1-A3 in each Regional Water Board shall be included.

V. PESTICIDE APPLICATION INFORMATION

A. Target Organisms: ✓ Vector Larvae ✓ Adult Vector

B. Pesticides Used: List name, active ingredients and, if known, degradation by-products
See Attachment 2

C. Period of Application: Start Date March 15th, 2012 End Date October 31, 2012

D. Types of Adjuvants Added by the Discharger: N/A

VI. PESTICIDES APPLICATION PLAN

A. Has a Pesticides Application Plan been prepared?*
☒ Yes ☐ No

If not, when will it be prepared? _____

* A copy of the PAP shall be included with the NOI.

B. Is the applicator familiar with its contents?
☒ Yes ☐ No

VII. NOTIFICATION

Have potentially affected governmental agencies been notified?

☑ Yes ☒ No – Not yet.

* If yes, a copy of the notifications shall be attached to the NOI.

VIII. FEE

Have you included payment of the filing fee (for first-time enrollees only) with this submittal?

☐ Yes ☒ NO ☐ NA We paid earlier this year.

IX. CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment. Additionally, I certify that the provisions of the General Permit, including developing and implementing a monitoring program, will be complied with."

A. Printed Name: Jerrold Ozer

B. Signature: _____ **Date:** 11/4/2011

C. Title: Manager OVMAP

X. FOR STATE WATER BOARD USE ONLY

WDID:	**Date NOI Received:**	**Date NOI Processed:**
Case Handler's Initial:	**Fee Amount Received:** $	**Check #:**

Attachment 2

V.B. Pesticides Used for Vector Control

Trade Name	**Active Ingredient**
Larvicides	
BVA Oil	Mineral oil

*** This product is used as a sticking agent, per label instructions, for the production of VectoBac TP sand granules. 200 lbs of sand are mixed with 56 ounces of BVA oil and 8.6 lbs of Vectobac technical powder to yield 211.85 lbs of finished product. Label application rates vary from 5 to 20 lbs per acre of finished product which equals 1.3 to 5.3 ounces of BVA Oil per acre.***

Altosid SBG (granules)	(S)-Methoprene
Altosid 30 (briquettes)	(S)-Methoprene
Altosid XRG (granules)	(S)-Methoprene
Altosid XR (briquets)	(S)-Methoprene
Vectobac TP (technical powder)	*Bacillus thuringiensis, subsp. Isrealensis*
Vectobac G (granules)	*Bacillus thuringiensis, subsp. Isrealensis*
VectoLex CG (granules)	*Bacillus spaericus* Serotype H5a5b, stain 2362
VectoMax CG (granules)	*Bacillus thuringiensis, subsp. Isrealensis* and *Bacillus spaericus* Serotype H5a5b, strain 2362
Fourstar briquettes	*Bacillus thuringiensis, subsp. Isrealensis* and *Bacillus spaericus* Serotype H5a5b, strain 2362
Agnique MMF (monomolecular film)	Poly (oxy-1,2-ethanediyl), α-isooctadecyl-ω-hydroxyl (100%)
Adulticides	
Zenivex E20	Etofenprox
Pyrenone 25-5 Public Health Insecticide	Pyrethrins, PBO
Evergreen Crop Protection EC 60-6	Pyrethrins, PBO

Pesticide Application Plan for the Owens Valley Mosquito Abatement Program in accordance with
WATER QUALITY ORDER NO. 2011-0002-DWQ
GENERAL PERMIT NO. CAG 990004
STATEWIDE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
(NPDES) PERMIT FOR BIOLOGICAL AND RESIDUAL PESTICIDE
DISCHARGES TO WATERS OF THE UNITED STATES
FROM VECTOR CONTROL APPLICATIONS

The Discharger shall develop a Pesticides Application Plan (PAP) that contains the following elements:

1. **Description of ALL target areas, if different from the water body of the target area, in to which larvicides and adulticides are being planned to be applied or may be applied to control vectors. The description shall include adjacent areas, if different from the water body of the target areas;**

   See attached map.

   The Owens Valley Mosquito Abatement Program (OVMAP) operates in about 1200 square miles from the Inyo/Mono county line in the north to State Hwy 190 in the south; the base of the White Mountains in the east to the Eastern slope of the Sierra Nevada in the west.

2. **Discussion of the factors influencing the decision to select pesticide applications for mosquito control;**
   Please see the Best Management Practices for Mosquito Control in California and Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley.

3. **Pesticide products or types expected to be used and if known, their degradation by-products, the method in which they are applied, and if applicable, the adjuvants and surfactants used;**
   Please see Attachments E and F within NPDES Permit for Biological and Residual Pesticide Discharges to Waters of the U.S. for Vector Control Applications. Products may be applied by hand, truck, backpack, hand can, helicopter, or airplane according to label directions.

4. **Description of ALL the application areas* and the target areas in the system that are being planned to be applied or may be applied. Provide a map showing these areas;**
   Any site that holds water for more than 96 hours (4 days) can produce mosquitoes. Source reduction is the OVMAP's preferred solution, and whenever possible the agency works with property owners to affect long-term solutions to reduce or eliminate the need for continued applications as described in Best Management Practices for Mosquito Control in California, Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley, and Suggested Irrigation Practices for the Reduction of Mosquito Breeding in the Owens Valley. The typical sources treated by this agency include:
   - Irrigated pastureland

- Riparian areas of the Owens River from several miles North of Bishop to Owens Lake. These treatments are never directly to the river but to areas that, due to flooding, fill beyond the banks of the river itself forming stagnant pools.
- Alpine Wetland Meadows
- Stagnate Settling Ponds
- Underground Vaults and Drainages
- Roadside ditches with standing water
- Golf Course Features
- Snowmelt Pools, sloughs, and Ponds
- Residential Standing Water Features
- Manmade Drainages
- Ponds and lakes (rarely)

5. **Other control methods used (alternatives) and their limitations;**
With any source of mosquitoes or other vectors, the OVMAP's first goal is to look for ways to eliminate the source, or if that is not possible, for ways to reduce the potential for vectors. The most commonly used methods and their limitations are included in the Best Management Practices for Mosquito Control in California.

See page 10, Non-Chemical Larval Control Measures, in Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley for specifics.

6. **How much product is needed and how this amounts was determined;**
The need to apply product is determined by surveillance. Actual use varies annually depending on mosquito abundance. The pesticide amounts presented below were taken from the OVMAP's 2010 PUR as an estimate of pesticide use in 2011. Other public health pesticides in addition to those listed below may be used as part of the agency's best management practices.

Pesticide Name (from label)	EPA Registration Number	Amount applied	Units
Pyrenone 25-5	432-1050	63	gal
Zenivex E20	2724-791	5	gal
Agnique MMF	53263-28	40	gal
Altosid SBG	2724-489	62	lbs
Altosid XR-G	2724-451	391	lbs
Fourstar briquetes	83362-3	66	lbs
Vectobac TP	73049-13	528	lbs
GB-1111	8329-72	13	gal
BVA 2 oil	70589-1	13	gal
VectoBac G	73049-10	395	lbs
Vectolex CG	73049-20	1000	lbs
Vectomax CG	73049-429	305	lbs
Altosid 30-day pellets	2724-448	112	lbs

7. **Representative monitoring locations* and the justification for selecting these monitoring locations**
   Please see the MVCAC NPDES Coalition Monitoring Plan

8. **Evaluation of available BMPs to determine if there are feasible alternatives to the selected pesticide application project that could reduce potential water quality impacts; and**
   Please see the Best Management Practices for Mosquito Control in California.

9. **Description of the BMPs to be implemented. The BMPs shall include at a minimum:**
   The OVMAP's BMPs are described in the Best Management Practices for Mosquito Control in California and in the California Mosquito-borne Virus Surveillance and Response Plan. Specific elements have been highlighted below under items a-f.
   a. **measures to prevent pesticide spill;**
      All pesticide applicators receive annual spill prevention and response training. Agency employees ensure daily that application equipment is in proper working order. Spill mitigation devices are placed in all vehicles and pesticide storage areas.

   b. **measures to ensure that only a minimum and consistent amount is used**
      Application equipment is calibrated at least annually as required by the Department of Pesticide Regulations (DPR) and the terms of a cooperative agreement with the California Department of Public Health (CDPH).

   c. **a plan to educate Coalition's or Discharger's staff and pesticide applicator on any potential adverse effects to waters of the U.S. from the pesticide application;**
      This will be included in our pesticide applicators annual pesticide application and safety training, continuing education programs, and/or regional NPDES Permit training programs.

   d. **descriptions of specific BMPs for each application mode, e.g. aerial, truck, hand, etc.;**
      The OVMAP calibrates truck-mounted and handheld larviciding equipment each year to meet application specifications. Management reviews application records daily to ensure appropriate amounts of material are being used. Ultra-low volume (ULV) application equipment is calibrated for output and droplet size to meet label requirements. Aerial larviciding equipment is calibrated by the Contractor. Aerial adulticide equipment is calibrated regularly and droplet size will be monitored by the agency to ensure droplets meet label requirements. Airplanes used in urban ULV applications and the primary airplane used for rural ULV application is equipped with advanced guidance and drift management equipment to ensure the best available technology is being used to place product in the intended area. If a secondary airplane is used in rural ULV applications it will be equipped with an advanced guidance system.

e. **descriptions of specific BMPs for each pesticide product used; and**
Please see the Best Management Practices for Mosquito Control in California for general pesticide application BMPs, and the current approved pesticide labels for application BMPs for specific products.

f. **descriptions of specific BMPs for each type of environmental setting (agricultural, urban, and wetland).**
Please see the Best Management Practices for Mosquito Control in California.

10. **Identification of the problem. Prior to first pesticide application covered under this General Permit that will result in a discharge of biological and residual pesticides to waters of the US, and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, the Discharger must do the following for each vector management area:**

a. **If applicable, establish densities for larval and adult vector populations to serve as action threshold(s) for implementing pest management strategies;**

The OVMAP staff only applies pesticides to sources of mosquitoes that represent imminent threats to public health or quality of life. The presence of any mosquito may necessitate treatment, however higher thresholds may be applied depending on the agency's resources, disease activity, surveillance data, or local needs. Treatment thresholds are based on a combination of one or more of the following criteria:

- Mosquito species present
- Mosquito stage of development
- Pest, nuisance, or disease potential
- Disease activity
- Mosquito abundance
- Flight range
- Proximity to populated areas
- Size of source
- Presence/absence of natural enemies or predators
- Presence of sensitive/endangered species or habitats.

b. **Identify target vector species to develop species-specific pest management strategies based on developmental and behavioral considerations for each species;**
Please see the Best Management Practices for Mosquito Control in California, Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley, and the California Mosquito-borne Virus Surveillance and Response Plan.

c. **Identify known breeding areas for source reduction, larval control program, and habitat management; and**

Any site that holds water for more than 96 hours (4 days) can produce mosquitoes. Source reduction is the agency's preferred solution, and whenever possible the agency works with property owners to implement long-term solutions to reduce or eliminate the need for continued pesticide applications as described in the Best Management Practices for Mosquito Control in California, Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley, and Suggested Irrigation Practices for the Reduction of Mosquito Breeding in the Owens Valley.

d. **Analyze existing surveillance data to identify new or unidentified sources of vector problems as well as areas that have recurring vector problems.**
This is included in the Best Management Practices for Mosquito Control in California and the California Mosquito-borne Virus Surveillance and Response Plan that the agency uses. The OVMAP continually collects adult and larval mosquito surveillance data, dead bird reports, and monitors regional mosquito-borne disease activity detected in humans, horses, birds, and/or other animals, and uses these data to guide mosquito control activities.

11. **Examination of Alternatives. Dischargers shall continue to examine alternatives to pesticide use in order to reduce the need for applying larvicides that contain temephos and for spraying adulticides. Such methods include:**
    a. **Evaluating the following management options, in which the impact to water quality, impact to non-target organisms, vector resistance, feasibility, and cost effectiveness should be considered:**
        - **No action**
        - **Prevention**
        - **Mechanical or physical methods**
        - **Cultural methods**
        - **Biological control agents**
        - **Pesticides**

    If there are no alternatives to pesticides, dischargers shall use the least amount of pesticide necessary to effectively control the target pest.

    Please see Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley and Suggested Irrigation Practices for the Reduction of Mosquito Breeding in the Owens Valley.

    Implementing preferred alternatives depends a variety of factors including availability of agency resources, cooperation with stakeholders, coordination with other regulatory agencies, and the anticipated efficacy of the alternative. If a pesticide-free alternative does not sufficiently reduce the risk to public health, pesticides are considered, beginning with the least amount necessary to effectively control the target vector.

b. **Applying pesticides only when vectors are present at a level that will constitute a nuisance.**

Please see Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley and Suggested Irrigation Practices for the Reduction of Mosquito Breeding in the Owens Valley.

12. **Correct Use of Pesticides**

Coalition's or Discharger's use of pesticides must ensure that all reasonable precautions are taken to minimize the impacts caused by pesticide applications. Reasonable precautions include using the right spraying techniques and equipment, taking account of weather conditions and the need to protect the environment.

This is an existing practice of the OVMAP, and is required to comply with the Department of Pesticide Regulation's (DPR) requirements and the terms of our California Department of Public Health (CDPH) Cooperative Agreement. All pesticide applicators receive annual safety and spill training in addition to their regular continuing education.

13. **If applicable, specify a website where public notices, required in Section VIII.B, may be found.**

www.inyomonoagriculture.com

References:

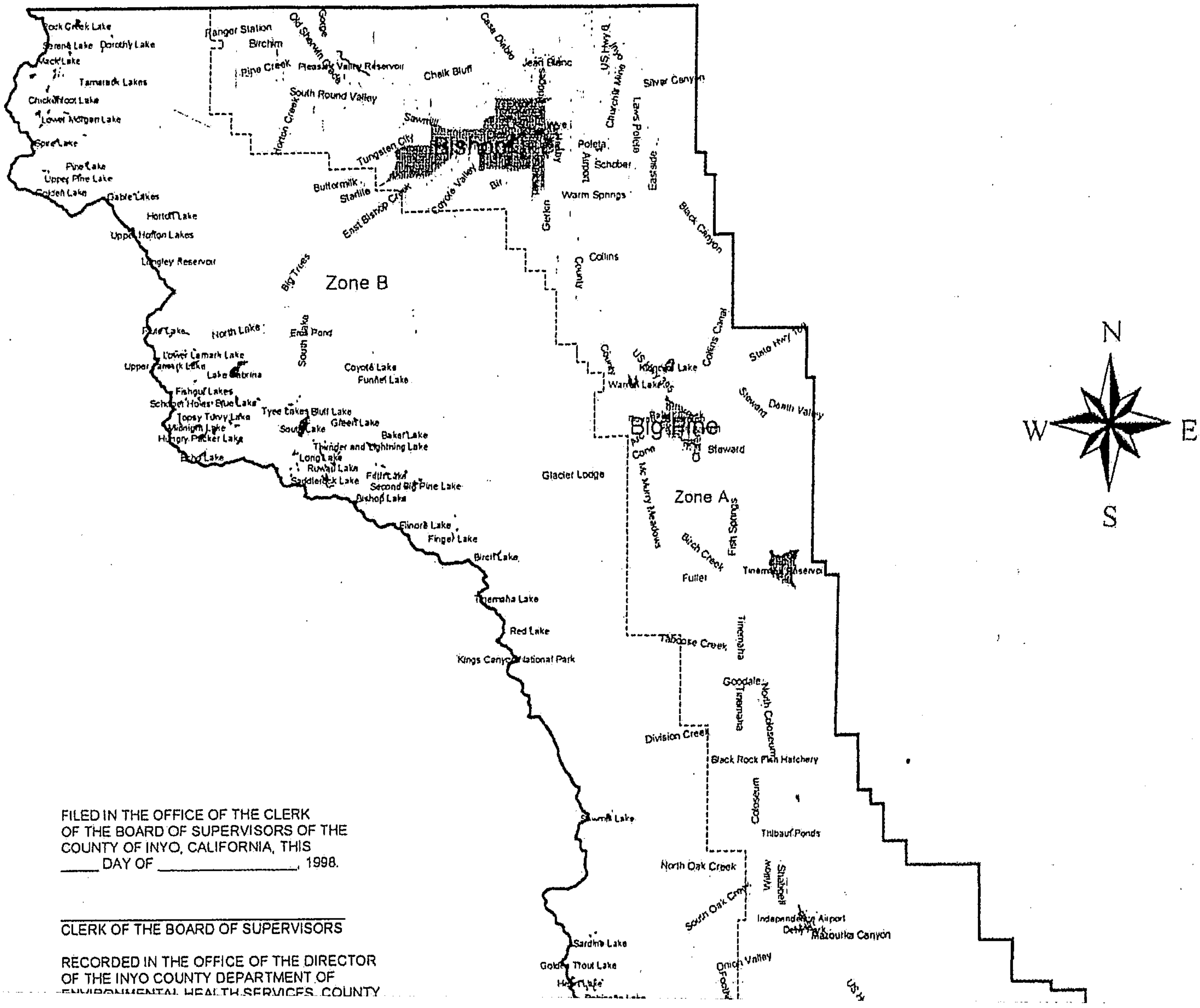
Best Management Practices for Mosquito Control in California. 2010. Available by download from the California Department of Public Health—Vector-Borne Disease Section at http://www.westnile.ca.gov/resources.php under the heading *Mosquito Control and Repellent Information*. Copies may be also requested by calling the California Department of Public Health—Vector-Borne Disease Section at (916) 552-9730 or the OVMAP at (760) 873-7853.

California Mosquito-borne Virus Surveillance and Response Plan. 2010. [Note: this document is updated annually by CDPH]. . Available by download from the California Department of Public Health—Vector-Borne Disease Section at http://www.westnile.ca.gov/resources.php under the heading *Response Plans and Guidelines*. Copies may be also requested by calling the California Department of Public Health—Vector-Borne Disease Section at (916) 552-9730 or the OVMAP at (760) 873-7853.

MVCAC NPDES Coalition Monitoring Plan. 2011.

Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley. 2010.

Suggested Irrigation Practices for the Reduction of Mosquito Breeding in the Owens Valley.



FILED IN THE OFFICE OF THE CLERK
OF THE BOARD OF SUPERVISORS OF THE
COUNTY OF INYO, CALIFORNIA, THIS
_____ DAY OF _________________, 1998.

____

CLERK OF THE BOARD OF SUPERVISORS

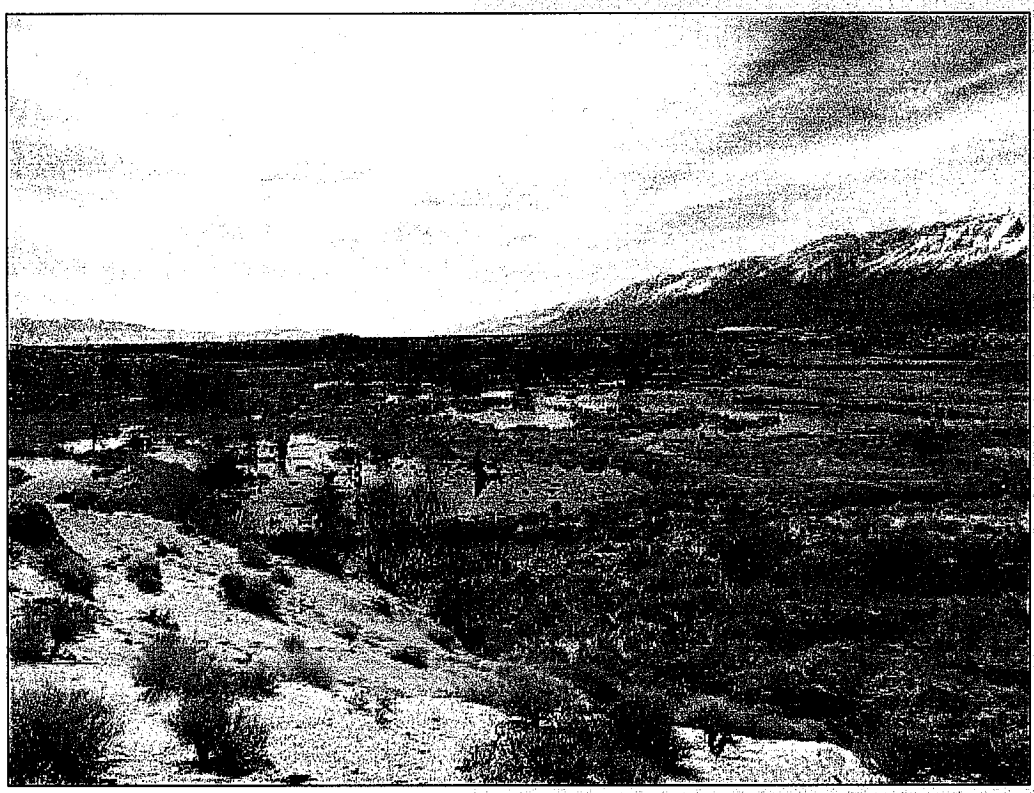
RECORDED IN THE OFFICE OF THE DIRECTOR
OF THE INYO COUNTY DEPARTMENT OF
ENVIRONMENTAL HEALTH SERVICES, COUNTY

Owens Valley Mosquito Abatement Program

Integrated Pest Management Strategies for the Control of Mosquitoes in the Owens Valley

February 2008

Revised March 2010



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PREFACE

The Owens Valley Mosquito Abatement Program (OVMAP or the Program) has as its primary mission to enhance public health and comfort through providing safe, effective, and economical mosquito control in the Owens Valley made possible by way of area wide, responsive service.

The means of achieving the Program mission will vary from year to year depending on many variables. Mosquito growth rates, weather conditions, snow pack, disaster response, disease risk mitigation, etc... all work in conjunction to make the job of mosquito abatement quite complex and often unpredictable. This document is offered as a mosquito management *guideline* for Program staff and as general information for those interested in the process of mosquito abatement in the Owens Valley. The Board of Supervisors, area residents (taxpayers and tourists alike), and many others can benefit from having the control methodology of the OVMAP in a concise and readable format.

It is important to note that these are not hard and rigid rules but guidelines to generally follow. Professional judgment should be applied by all trained, qualified employees of the Program. At times, conditions will arise that are unprecedented and require a decision that falls outside of these general guidelines. To act on such a decision is quite acceptable, as long as the action is within current laws and regulations and approved by the OVMAP Manager, to meet the primary mission of the Program.

This document is drawn from 25 years of surveillance in the Owens Valley, accepted mosquito control tactics used throughout California, and the California Department of Public Health document "California Mosquito-Borne Virus Surveillance and Response Plan" April 2008. The later is not a description of mosquito control methodology but rather works in tandem with control in "[providing] a semi-quantitative measure of virus transmission risk that could be used by local agencies to plan and modulate control activities." Many, but not all, of the disease surveillance tools used in the State plan are directly applicable to conditions in the Owens Valley and have become integral in our ability to gauge local control response levels based on disease transmission risk.

Since the arrival of West Nile virus to the western United States, the task of mosquito-borne disease surveillance has been performed by the Inyo County Environmental Health Department. If surveillance showed increased disease risk, OVMAP was notified of the results and then went ahead with control operations. More recently, some of these surveillance tasks have been taken up directly by the OVMAP, eliminating a link in the chain, and making the control response immediate.

Whoever does the surveillance, mosquito-borne disease prevention strategies must be based on a well planned, area wide integrated pest management based program.

INTEGRATED PEST MANAGEMENT (IPM)

IPM refers to the systematic, repeated application of pest surveillance and control technology to reduce the economic impacts of diverse insects, pathogens, nematodes, weeds, and animals that damage agriculture (Sterner, R., 2008). An IPM program like this one tailored to mosquitoes is called an Integrated Mosquito Management Program (IMMP).

We don't have to look too far back in the records to see that mosquito abatement in the Owens Valley in the 60's and 70's revolved around heavy reliance on organophosphate chemicals and diesel fuel as the weapons available for control. The treatments being done at the time were largely reactive to adult mosquitoes entering communities and surveillance was limited to adult mosquito densities. In fact the same can be said throughout much of the State.

Thankfully, those days are behind us. Modern IMMPs use chemicals as a last resort, when all else fails or when dealing with mosquito-borne disease emergencies. Education (both public and employee), good surveillance (both population and disease monitoring), non-chemical control measures, safe biological larvicides, and insect growth regulators are all critical to a successful IMMP and are exhausted before adulticides are even considered. Achieving great control without even starting an adulticiding fogger would be a perfect year.

EDUCATION

Public Education

Public education plays a key role in any IMMP. Without this component, a good program would be incomplete. There is a common misconception that mosquito control equals "spraying" or "fogging", referring to adulticiding. In reality, adulticiding makes up a small portion of the OVMAP when as explained above, our best efforts at other control methods have failed or we are in the midst of a mosquito-borne disease outbreak.

Keeping the public aware of control operations that aren't as audible or visible as adulticiding, as well as current mosquito conditions, source reduction procedures, disease threats, and bite prevention measures are all ongoing through the use of the usual media channels such as local Radio, TV, and Newspaper. We also use other media and events such as the Inyo Mono Agriculture website, the Tri County Fair, community get-togethers, and one-on-one conversations. Field staff are encouraged to engage inquiries with courtesy and look at a one-on-one conversation in the field as an opportunity to share the parts of the IMMP that are not as well known by the public.

Several times a year, we will try to get into local classrooms with programs that educate and engage students. For example, Home Street Middle School's science programs have a series of

classes on ecology and habitat. Small groups of students work with an aquarium based aquatic ecosystem, adding different organisms daily. This hands-on curriculum provides a great opportunity for OVMAP staff to make available mosquito larvae for the ecosystem and a talk about mosquito biology and control, a true symbiotic relationship.

Employee Education

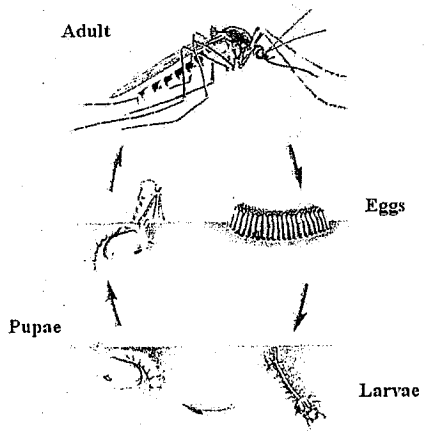
In a report written by Ben Keeney (Inyo County Health Department Mosquito Control Agency) titled "Prevention and Control of *Culex tarsalis* In Owens Valley 1969 Season (sic)", Mr. Keeney writes, "The basic problem of the present mosquito control program is the difficulty of securing adequate personnel. Seasonal nature of the work and modesty of the wage where unskilled men are expected to perform a sophisticated duty reduce the desirability of the job." He then continues "[higher wages would] interest help which would return year to year. This would build a backlog of skill and experience in the entomological aspect so important to the work."

40 years ago Mr. Keeney understood the importance of having seasonal employees return year after year and today we have reached that goal. Currently, we have an arrangement with the Inyo County Water Department's Salt Cedar Program (active during the winter months) to utilize OVMAP seasonal employees during the mosquito off season. Once the Salt Cedar Program season ends, the employees return to us with no down time when mosquitoes become active in the spring. This is an ideal situation to gain that cumulative knowledge base so essential to both programs. In the interest of work quality, efficiency, and safety using potentially hazardous chemicals and equipment, interdepartmental relationships like this should be sought after and continued.

Full time employees are encouraged to study for and pass the California Department of Public Health Vector Control Technician exams in categories A (pesticide use and handling) and B (mosquito abatement). Upon successfully passing the exams, licensed technicians are required to fulfill continuing education requirements in both categories through State approved seminars, programs, and recorded media.

MOSQUITO LIFE CYCLE

Mosquitoes have a complex life cycle. In order to implement a successful IMMP, "one must first know well the mosquito". W.B. Herms.



From this diagram showing a typical standing water mosquito's life cycle, you can see several stages. This is a complete metamorphosis common among the Dipterans (the flies), the Order of insects mosquitoes belong to. With mosquitoes, all of the life stages besides the adult require water to grow.

Picture: University of Georgia

After mating and a blood meal, the female mosquito seeks out a suitable water source which to lay a clutch of eggs, typically up to a couple hundred of them.

With few exceptions, the protein from your blood is needed to produce each clutch of eggs she will produce during her lifetime. To hunt for the necessary blood meal, she can detect movement, sense exhalations in the form of carbon dioxide and lactic acid, and/or identify odors from long distances. Male mosquitoes typically subsist on nectar from flowers and some species play small roles in pollination.

There are about 12 common species of mosquito in the Owens Valley and several others that are not as widespread. These species can be broadly divided into two groups; "standing water" mosquitoes and "flood water" mosquitoes. Generally speaking for the Owens Valley, the floodwater species are the more pestiferous day biters and the standing water are more likely to transmit mosquito borne disease.

Flood water species lay their eggs in fresh mud. The eggs can stay in the dried mud for several years in very harsh, parched conditions waiting for the next rain or flood event. Long ago, these hydrologic events typically occurred once or twice a year in the spring as local rivers and creeks, swollen with runoff, would spill their banks into floodplains worth of awaiting mosquito eggs. These days, with monthly flood irrigations of the many pastures of the Owens Valley during the summer, we are lucky enough to get many hatches of floodwater mosquitoes per pasture during this time period; unfortunate, but also predictable.

Standing water mosquitoes will seek out suitable water to lay eggs. Some lay many single eggs on the water's surface and others lay eggs in collective rafts of many eggs. It doesn't take much water to raise a lot of these mosquitoes. Without a source of water they must look elsewhere, so it is important as part of the IMMP Public Education section to ask citizens to actively look for, and empty where practical, sources of water on their private property.

The eggs she's deposited will hatch, after going through a process called embryonation, into larval mosquitoes. The larvae breathe air through a siphon at the very end of their abdomen from the surface. They feed by relying on oral brushes to pull bits of organic matter into their mouths. So, they essentially hang upside down adhering to the surface tension of the water while they breathe, then dive toward the bottom to feed and evade predators.

As they grow they will go through four molts or "instars", each one slightly larger in size than the last. The growth rates of larval mosquitoes depend on the species, the amount of food available, and the temperature of the water. In midsummer, when temperatures are at their highest, growth rates from egg to adult can be less than a week leaving a very short window for larval surveillance and control operations.

Pupation takes place after the larva reaches maturity (after the 4^{th} instar). Inside the pupa, massive changes are taking place as the larva transforms into an adult mosquito. There is no way for the pupa to eat as even its mouthparts are changing into the well known piercing and sucking proboscis. The breathing siphon of the larvae is replaced with two "trumpets" on the pupa's head which they adhere similarly to the water's surface tension.

After a few days at the most, the pupa hatches into an adult. The newly hatched adult stands on the water's surface while its wings dry and the cycle begins anew.

FIELD SURVEILLANCE

The stage of life we find in the field along with growth rates, population density, proximity to communities, and disease transmission potential largely dictates the control methods employed. OVMAP utilizes the following surveillance means and methods in its IMMP.

Larval Surveillance

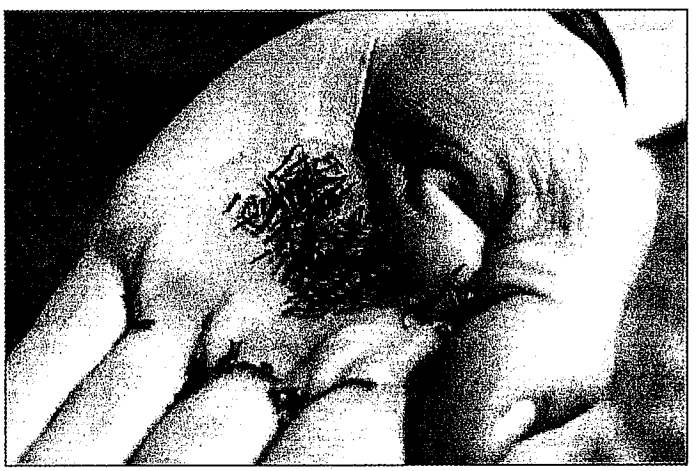
Surveillance in the Owens Valley starts with these early stages of the mosquito life cycle and finding those sources of water that harbor them. Each technician is given a "zone" to control. Once assigned, it is largely up to the technician to schedule surveillance to each and every

source within that zone. The collection of sources within a zone are a compilation of years of exploring by past field technicians. New sources are added when found as well as sources that are only present in the wettest years.

As discussed above, the Owens Valley is a dry country that requires irrigation. Most of the larval sources in the Owens Valley are formed during the pasture irrigation process. The Los Angeles Department of Water and Power (LADWP) allotment of irrigation water for the irrigation season (April 1-September 30) is 5 acre-feet per acre of land on wet leases. 1 acre-foot of water is an acre of land with a foot of water on it, or 43,560 cubic feet of water, or 325,851 gallons of water, so a big ranch receives a lot of water over the mosquito season. To date we know of thousands of sources ranging in size from kiddy-pool size holes to multi-acre tule ponds, many of them within a stone's throw of schools and large neighborhoods.

As the water spreads out over the land, the bulk of it does what it's supposed to do and waters the feed for the cattle and nurtures the trees and other plant life in the valley. Some of it however, on its way into the ground, creates vast ponds that stay filled with water for weeks providing ideal mosquito habitat. Most of the irrigated pastures provide at least a few perfect sources for female mosquitoes (both standing and floodwater) to lay their eggs in. Couple this with the vast stretch of meandering river that runs down the middle of this Valley and you have the 1700 square miles within the boundary of the Owens Valley Mosquito Abatement Program.

A steady flow at the Upper Owens River of less than 400 cubic feet per second is very controllable with the current IMMP, but throughout the year the river fluctuates due to snowmelt and summer storms. If the flow reaches 600 cubic feet per second, the river spills its banks into thousands of ancient river channels and oxbows forming stagnant ponds that can last for months. Conditions like this quickly overwhelm efforts at targeting mosquito larvae in these sources. This is why, despite our best efforts, mosquitoes will always be a part of mid-summer fishing down at the river. At that point we do our best at keeping them from migrating into local communities.



This picture shows a small sample of 4th instar flood water mosquito larvae from a multi-acre river oxbow. Larval surveillance is made via a standard 1 pint dipper.

Several "dips" are made in each source until a good representation of larval density and instar can be determined. We almost always find larvae. No larvae may mean we have visited a source too late or too early to see larval development.

OVMAP treatment thresholds (the numbers found while dipping to trigger treatment) on larval mosquitoes varies with species and time of year and is found in Appendix B.

Adult Surveillance

To protect public health you have to be proactive. Adult mosquito surveillance allows OVMAP to be one step ahead and is accomplished with several trap types, technician reports on landing rates, and citizen complaint calls. Complaint/ service call protocol is outlined in the Appendix.

New Jersey Light Traps (NJLT):

NJLT's are the day-in-day-out work horses of this IMMP's adult mosquito surveillance. They are very simple to operate, consisting of a light source and a strong fan to pull in photophilic (light loving) mosquito species into a collection jar. These traps are not selective and will take any insect attracted by the light. Because of their non-selectivity, these traps require some time to sort and process the sample.

OVMAP operates 11 NJLTs throughout the mosquito season collecting samples weekly.

CDC Mini Light traps:

CDC mini light traps are a smaller version of the NJLT and are run on 6V lantern batteries instead of 120v AC current making them very versatile and portable. These traps are placed for a single night.

EVS CO_2 Baited Traps:

These traps are similar to the CDC Mini Light traps except that they have a smaller light source and rely on CO_2 as an attractant for blood-seeking female mosquitoes.

Dry ice is placed under the trap which sublimates in to Carbon Dioxide gas. This gas travels with the wind, attracting female mosquitoes back to the source much like a chum slick in the ocean attracting sharks to a fisherman. The blood seeking females mistake the Carbon Dioxide for the exhalations of a possible blood meal. Once near the trap she is further attracted to the intake fan by a small light.

Landing Rates (Leg Counts)

Landing rate counts are a way of determining the extent of a hatch or migration of adult mosquitoes or to quickly ascertain the validity of a service call. Field technicians will enter a shaded area and count blood-seeking adult female mosquitoes that alight on their body. These numbers are then given to the Program Manager who will, together with other field data, use them in triggering adulticiding treatments. Threshold guidelines for landing rates are in Appendix A.

This method should only be performed during the day for floodwater mosquitoes. Under no circumstances should anyone perform this surveillance method with potentially disease carrying, standing water species such as Culex tarsalis.

Disease Surveillance

Disease surveillance in an IMMP can be defined as determining if local mosquitoes are carrying harmful, disease causing pathogens within their bodies. There are several methods utilized across California to accomplish this, two of which are included in this IMMP.

Encephalitis Virus Surveillance (EVS):

For the surveillance of West Nile virus, EVS traps are set in locations known to harbor the species *Culex tarsalis*. This species, of the common species found in the Owens Valley, is the one most capable of spreading West Nile virus as well as other encephalitis viruses like St. Louis, and Western Equine encephalomyelitis. The State protocol for submittal is outlined on page 5 of the "California Mosquito-Borne Virus Surveillance and response Plan" located in Appendix D of this document.

Locally acquired mosquitoes returning from the lab positive for encephalitis virus infection will most likely justify and trigger an adulticiding operation, details of which are discussed in depth below.

Dead Bird Program:

OVMAP will participate in the State run Dead Bird Program for as long as the program remains in operation. Residents, as part of the Public Education section of this IMMP, are asked to call the Dead Bird Hotline 1-877-WNV-BIRD (1-877-968-2473). Upon calling, the resident will be asked several questions regarding species and condition of the bird. If the bird meets submittal requirements then a fax will be sent to the Inyo County Environmental Health Department. The

bird will be inspected and sent to a State facility for testing. Results are emailed within a week of specimen arrival. A positive dead bird will trigger EVS trapping in vicinity of report.

Findings of either positive dead birds or positive mosquitoes for a mosquito-borne disease will be reported to the Director of Environmental Health and to the Inyo County Public Health Physician. A decision will be made on risk reduction measures to be taken in addition to control measures, including but not limited to, making a press release.

Large Numbers of Adult Culex tarsalis

Sometimes large numbers of this troublesome species are encountered when trapping. Simply having high abundance of this species is considered a risk. Depending on location and time of year, abundance alone may justify an adulticiding operation. Trap based data is found in Appendix A.

NON-CHEMICAL LARVAL CONTROL MEASURES

Once a source is found and documented it is checked for mosquito activity once or twice weekly. If larvae are present with densities exceeding thresholds then control measures are taken. The OVMAP IMMP hierarchy of control begins with non-insecticidal measures such as source reduction and fish planting.

Source Reduction/Elimination

If a source of water can be eliminated all together then a lasting solution to a mosquito problem can be achieved. In such a dry climate where green vegetation stands in contrast to the surrounding brown, eliminating a source is often not the best or most popular option. Frequently, a balance can be made by employing good water management, where enough water in applied to sustain a healthy and desired greening but not enough to cause lasting mosquito problems.

Leaks and breeches in ditches and waterways are found frequently in the field. These sources are almost always dealt with by calling LADWP and reporting the location. LADWP is very quick to act in these situations and the source eliminated within days.

In the field, we often find that patience is the best source reduction. When an irrigation begins, water can quickly pond and begin to breed mosquitoes. Larvae are "dipped" regularly in moving irrigation water. Field technicians are encouraged to wait as long as possible to make a chemical treatment of the source for 3 reasons:

1. Materials used in larviciding are less or even non-effective in moving water.
2. When the irrigation stops, sources often dry up quickly requiring less material to treat or perhaps dry entirely needing no treatment at all.
3. With floodwater species, waiting to treat until the 3rd or early 4th instar is a wise decision most of the time. The source may shrink in size and standing water mosquitoes in the area may lay eggs that hatch into early instar larva if treatment is postponed. When a treatment is finally made, several species will be controlled with one treatment.

Source reduction is very applicable on a homeowner level. Again, homeowners are encouraged through the public education portion of this IMMP to be active in searching out small sources breeding mosquitoes on their property. These sources can be as small as a cat food can sized container filled with rain water to a "green" swimming pool needing chlorine maintenance. The latter can lead to very localized foci for disease transmission, breeding large numbers of disease transmitting mosquitoes and attracting disease carrying birds to a small backyard.

Mosquito Fish

Mosquito fish (*Gambusia affinis*) play an important role in this IMMP, however, a few conditions must be met before introducing a foreign predator into a habitat.

Gambusia's common name is a misnomer since mosquito fish will eat many different insects, arthropods, amphibians, and other fish if they can fit them around their upturned mouths. The introduction of mosquito fish to sensitive habitats will almost always result in these adaptive and hardy fish out-competing small native fishes and negatively impacting the local ecology. This fact has led to the cynical transformation of the genus to "*Dambusia*" in many parts of the world.

For this reason we are very careful as to where we plant mosquito fish:

- The source must be contained, having fish proof outlets and inlets, or preferably, no inlet or outlet at all.
- The source should not be so ephemeral that it will dry up before the fish have a chance to work.
- The source should be void of larger predatory fish or at least have adequate safe harborage should the larger fish be present.

Field technicians must double check with the OVMAP Manager, inspect the source, and in finding conditions other than ideal, may decide against fish planting.

CHEMICAL CONTROL MEASURES FOR LARVICIDING

Should a source be not suitable for reduction/ elimination or fish planting, larvicides are the next step on the IMMP hierarchy of control. Threshold limits for mosquito larvae are located in Appendix B of this document.

Several materials are used to treat mosquito larvae by the OVMAP. The first two are biological larvicides. Biological larvicides are those such as bacteria, viruses, hormones and pheromones which are used in a manner similar to chemical pesticides. These pesticides are subject to registration. Classical biological controls, including parasites and predator species (mosquito fish) are not subject to such pesticide registration processes.

The Bacteria *Bacillus thuringiensis israelensis* (Bti)

This bacterium is remarkable in its selectivity only affecting mosquito larvae and a few related species. This means that any of the other insects in the treated water, and there are many, will suffer no ill effects from the application of this product.

The mode of action has to do with crystalline inclusions that the bacteria make within their cell wall. The product formulation we use is not the entire bacteria but bacterial spores and these insecticidal crystals derived from the Bti bacteria. These crystals, once ingested by mosquito larvae and broken down in the gut, have very potent insecticidal properties, rapidly lysing the cells that make up the lining of the larva's digestive tract. This action results in a mixing of hemolymph (insect blood) and digestive enzymes that quickly kills the larvae.

The key is that the crystals only break down in an alkaline, or a high pH, gut. An alkaline digestive system is found in only a very few animals, most digest food with the help of acids. Not so with mosquito larvae. They are part of a super-family of insects (primitive flies) with an alkaline gut making this family and only this family susceptible to the toxins within the Bti.

The down side to treating mosquito larvae with Bti is that it is very labor intensive. The Bti only persists in the environment for a few days making repeated and properly timed treatments necessary. Bti is applied by hand or with hopper/spreader equipped all terrain vehicles.

A sand and Bti mixture is made as needed by OVMAP field technicians. The recipe per batch is located in Appendix C.

***Bacillus sphericus* (Bs)**

Bs is similar to Bti but offers a longer residual, lasting up to 14 days in the water. The longer residual is possible because this product is the actual bacteria, opposed to Bti which is just bacterial spores, which can in fact grow within the carcasses of dead mosquito larvae and then reenter the environment if conditions permit.

Bs, however long the residual, is somewhat less effective on floodwater mosquitoes than Bti and is more inclined to produce resistance after prolonged use.

Bs is applied by hand following label rates. In large applications, an adjustment to existing Bti spreading equipment is possible to achieve the desired application rate.

(S)-Methoprene

(S)-Methoprene is an insect growth regulator (IGR). IGRs work by mimicking hormones found within larval mosquitoes. At times during larval development, certain insect hormones are present or absent inside the larvae as they molt between instars or from forth instar larvae to pupae. By artificially keeping mimics of these hormones in the water column at these critical stages of development, we can disrupt the life cycle to the point where very few viable adults emerge.

Timing is critical with (S)-Methoprene applications as single brood formulations are very susceptible to degradation by the sun's ultra violet light. If applied too early, there won't be enough product concentration in the water at the right time to have the desired effect and may ultimately result in insect resistance.

(S)-Methoprene applications should be made in the early fourth instar of larval development and are typically applied only by hand. In large applications, an adjustment to existing Bti spreading equipment is possible to achieve the desired application rate. Many sizes and formulations are available from wettable powders to briquettes. Formulations with an XR or XL refer to "extra residual" with the ability to provide control for several months in a source. Large applications of any (S)-Methoprene formulation would be quite expensive and should be approved by the OVMAP Manager before these actions are taken.

Aerial Application

The application of larvaciding products with aircraft may become necessary in the future should inaccessible stretches of the Owens River, particularly the Lower Owens, begin to raise disease causing mosquitoes in vast numbers. If this application method were required, it would not be unprecedented in the Owens Valley. Very heavy snowpack in the winter of 1968-69 left the Valley virtually underwater in the spring and early summer of 1969. Federal disaster relief funds were used to contract a helicopter and pilot from the west side of the Sierra ultimately treating most of the Owens River floodplain from the air with the organophosphate "Fenthion".

CHEMICAL CONTROL FOR PUPAE

Controlling pupae presents a problem. As described in the Life Cycle, pupae do not eat making applications of materials that only work upon ingestion (Bti, Bs) useless.

One solution is the application of surface films which alter the water's surface tension making it very hard for pupae and larvae to attach their trumpets and siphons. The pupae and larvae work very hard to stay on the surface and breathe, becoming exhausted and eventually drowning.

Benefits of surface film control measures include a long residual (up to 21 days in ideal conditions) and its effect on ovipositing females. Should a gravid (with eggs) female mosquito alight on a water's surface that has been treated with a surface film, she will break through the altered surface tension and drown. Similarly, if a treatment is made late and pupae do manage to hatch they will not be able to rest on the water's surface to complete the process.

CHEMICAL CONTROL FOR ADULT MOSQUITOES

Adulticiding (Spraying)

"Spraying" or "fogging" refers to the practice of adulticiding for mosquito control. This IMMP does utilize adulticide as part of the program as a last resort if adult mosquito populations exceed threshold limits (Appendix A) or lab results show elevated disease risk.

OVMAP has two tools with which to apply adulticiding chemicals. Two large London Fogger 1820 truck mounted foggers and a small London Fogger "Colt" hand-held fogger. Both pieces of equipment produce an Ultra Low Volume (ULV) aerosol fog of droplets in the 5 to 20 micron

range. Droplets larger than this tend to fall to the ground too quickly while smaller droplets dissipate before they have a chance to act.

Different species are active during different times of the day. Effort should be made to make adulticiding applications at times when target mosquitoes are most active.

Proper application of an adulticide fog requires specific weather conditions be met prior to application. Every trigger available may point to the need to adulticide but if the weather isn't cooperating, we cannot make the application.

A weather phenomenon known as temperature inversion, coupled with temperatures above 50 degrees F, a light breeze less than 10 miles per hour, at a time when the target species is most abundant would be ideal conditions for a ULV adulticide treatment. A temperature inversion happens when a layer of cool air is trapped close to the ground by a layer of warm air above it. With such specific, narrow parameters to a treat within, a program that relied too heavily on treating adult mosquitoes in this manor would be inefficient to say the least.

Excessive winds and warm ground temperatures are the two meteorological factors that hinder adulticiding efforts in the Owens Valley. High winds in excess of 10 MPH will cause ULV fogs to drift through target areas before the material has a chance to act on the target species and warm ground temperatures cause an updraft that quickly disperses adulticide fogs. While not ideal in terms of target mosquito abundance, we are often forced to attempt adulticiding operations in the very early morning when winds are calm, the ground cools, and an inversion forms.

Should conditions arise where fogging operations must be attempted in the evening and in residential areas, such as a disease epidemic, then 2 technicians will be present for each piece of adulticing equipment in the field. This extra pair of eyes and hands will be helpful when residents out and about in the evening hours force the technicians to shut equipment down more frequently than in the early morning hours.

Adulticiding during the day can be effective for fresh, small hatches or when weather conditions permit.

Other non weather related drawbacks to adulticiding are:

- The control offered by the chemicals used if fogging is temporary, providing no residual control, and must be repeated if more adult mosquitoes move into an area.

- The chemicals involved are very expensive.
- Mosquitoes may develop a resistance to the chemicals with repeated use.
- The chemicals are not selective. They will kill anything with an exoskeleton that will succumb to the dosage rate applied. Studies have shown that whether or not an insect is susceptible to the dosage rate applied is a function of the size of the insect. Insects and other arthropods the same size or smaller than your typical adult mosquito are more likely to succumb to the effects of the pesticide than something the size of a dragonfly.

Barrier treatments

Best Management Practices can be defined as methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources.

Since the National Pollutant Discharge Elimination System now applies to mosquito larvicides as well as adulticides applied over waters of the United States, it behooves OVMAP to utilize control methods that do not and cannot enter waters of the United States. Barrier treatments are just such a method.

At times it may be advantageous to apply chemical barrier treatments (Suspend SC, Deltamethrin) across known migration routes as a way to keep mosquitoes away from getting into communities. Mosquitoes are known to move from breeding areas along green ways and sloughs in search of a blood meal. By laying down swaths of insecticide in several places across these routes, OVMAP can impede migratory progression.

Check with the OVMAP Manager before any barrier application is made.

ULV Call List

We are granted a Notice of Intent (State Health and Safety Code) exemption through our cooperative agreement with the State Department of Public Health. However, if anyone within the OVMAP boundary would like a call prior to adulticide is applied, there is a list only requiring a name and a phone number to be reached. Every effort will be made to contact the residents on the list however, during an emergency pre-notification may not be an option.

LOGGING OF CHEMICAL USE

Logging of all chemical use is the legal responsibility of the OVMAP. Technicians are to record each treatment as accurately as possible. Application records must be held for at least 2 years and contain the following data:

- Date and time of application
- Target pest
- Product applied (name and EPA reg. #)
- Amount used
- Location of application
- Area treated
- Equipment used
- Applicator name

These data are collected, tallied and sent to the State Department of Pesticide Regulation. They are also used in predicting future needs of the Program based on snowpack and associated runoff.

WHAT DO WE DO IN THE WINTER?

First of all, our crew of five or six shrinks to just three in the winter to reflect the less aggressive nature of the work performed this time of year. If routine winter maintenance takes a little longer than expected it's manageable. If summertime mosquito control work takes a little longer than expected the phone will start ringing with service calls from irritated residents who can't walk to their car without being bitten several times, or worse, somebody getting sick.

During the summer there is precious little time to do anything more to our equipment than basic and necessary maintenance to keep things running. The off-season is when we can really dig in and strip down our ATVs and amphibious vehicles. The equipment is run through water all summer long and needs the attention to detail that time only the winter can afford to spare us. This care and attention is paid to all the equipment we have, from backpack sprayers, to our mosquito traps, to the pickup trucks we drive from source to source.

We also have to perform maintenance on the paths we use to access and treat the mosquito sources. With all the water in these places, plant growth is feverish. Without this important maintenance, after a few years, we would not even be able to get our products where they need to be. This work is a cooperative effort between the LADWP, the California Department of Forestry (Owens Valley Conservation Camp), and the OVMAP staff.

Ideas had during the season that would make our work more efficient or safer are turned into a reality during this time. Training programs, public education plans, website development, treatment protocols, integrated pest management strategies, space management, and material application techniques are all discussed and refined. As an example, if we acquire a new piece of equipment like an ATV, it is a stock machine, it is not ready for the trauma we put it through nor is it outfitted with the application hardware needed to accurately distribute mosquito

control products. We fabricate most of these modifications in-house or with the help of other county departments such as the Road Department to cut back on high costs associated with "one-off" customization.

The early spring is also the time we perform calibrations and in-house inspections to make sure we are operating within County, State, and Federal laws for pesticide application, storage, and disposal. It is essential, both practically and legally, that our application rates are within pesticide label ranges for the pests we are treating.

In summary, we go-go-go from April through September with little time to do anything but kill as many mosquitoes as we can in the most safe and effective manner. The off season is a time slow the pace just bit, debrief the season; what worked, what didn't, and adapt the program to best meet the needs of the communities we serve, to repair and rejuvenate our tired equipment, and maybe even our tired bodies.

APPENDIX A

LANDING RATE, TRAP-BASED, AND SERVICE REQUEST FOGGING THRESHOLDS AND TRIGGERS:

As noted in previous sections, adulticiding is not an automatic response to mosquito hatches, migrations, or complaint calls. Detailed surveillance must be completed prior to adulticide treatments by experienced field technicians. Adulticide fogs must be applied at labeled rates and frequency, in acceptable weather conditions, and during times when target species are present.

In an effort to create Standard Operating Procedures for, and justification of, chemical applications used in mosquito control, the following triggers will be used as guidelines and part of a larger formula to reach the Program's primary mission of protecting public health.

Many factors influence the decision to apply adulticide. A threshold number exceeded will not in itself prompt an adulticiding event but will be added to other factors influencing the decision and justifying the application. Probably the most influential factor is proximity to communities. High landing rates within a residential area for example, will be weighted more than high landing rates far removed from people. *All of these thresholds can be lowered with evidence of local disease transmission.*

LANDING RATES

Landing rates of at least 1 female mosquito per minute in a residential area could trigger an adulticiding application. Technicians should conduct the surveillance over several minutes. As an example, 3 mosquitoes in a five minute period would fall under this threshold but 5 mosquitoes in 5 minutes would meet the minimum limit.

SERVICE REQUESTS (*aka: Complaint Calls*)

General residential:

1. The request should be reconnoitered as soon as possible and with high priority. Typically, the technician working the zone the call originates will make the visit. Detailed notes taken on landing rates and if no mosquitoes encountered, then a setting of a CDC mini light trap may be prudent (refer to CDC Mini Light Trap numbers below).

2. 2 service requests per day or 4 in 3 days in a particular geographic area should send an alarm that something is wrong. If cross checking with light trap data and leg counts does

not validate the request then a CDC Dry Ice Baited trap will be used. Should this prove an absence of mosquitoes then no action will be taken.

"Event Specific" service requests:

A call comes in requesting service for an event, i.e. a wedding at the river or an Community level event such as Fiesta de Lone Pine.

1. Hands-on assessment 48 hours before the event.
    a. Leg counts in calm, low wind, as close to the scheduled time of the event as possible. For example: the event is scheduled for 5 – 6 PM and should have an assessment done in this time frame.
    b. CDC mini light trap set for events to take place in the evening or at night. Refer to thresholds.
2. How the issue is best addressed based on the findings of the assessment?
    a. No action needed based on the facts.
    b. Fog or Barrier treatment. Maybe a barrier treatment for a small party and both fogging and barrier for a countywide event.
    c. Education for the participants?
3. Implementation of a plan based on facts.

TRAP DATA (*thresholds based on female mosquitoes only*)

1. **New Jersey Light Trap**
    A. Aedes melanimon ——————>42, 6 per trap night (ptn)

    B. Culex tarsalis——————>42, 6 ptn, April- 2nd week in June
    >28, 4 ptn, 3rd week in June – Sept.
    >14, 2 ptn, WNV + pools in area.

    C. Other species sum total——————>84, 12 ptn

2. **CDC Mini light traps**
    These traps, by their portable nature, won't always lend themselves to convenient fogging locations, therefore, each location should be evaluated separately for adulticiding efforts should the numbers below be reached in a single trap night.

    Often, these traps are placed very close to the source. Potential to migrate to nearby communities should be included when considering action.

A. Aedes melanimon ——————————>50 ptn

B. Culex tarsalis——————————>50 ptn

(If the trap is at complaint area then threshold is the same as for the New Jersey Trap.)

3. CO_2 Baited traps. These traps are largely used to collect samples to be sent for testing. It isn't always possible to wait for test results when large numbers, particularly *tarsalis*, are encountered. Should positive results come back, additional sampling is warranted to ensure tarsalis numbers are below Positive Threshold levels.

A. Aedes melanimon ——————————>100

B. Culex tarsalis——————————>80
>5 with WNV (+) results

If WNV test results show positive mosquitoes in the area, fogging at dusk is the preferred timeframe, especially in non-residential areas, and weather permitting. Again, if this is the case a 24-hour notice may not be possible in order to protect public health and 2 technicians per fogger in residential areas during evening shifts.

COLT HAND-HELD MINI FOGGER USE GUIDELINES:

The Colt Mini Fogger is a small hand-held, gas powered (2-cycle), ULV generator that has a 1.5 liter capacity and a maximum application rate of 4 ounces per minute. It is a machine for small jobs in hard to reach places, ideal for small hatches in pastures.

When a technician comes upon a fresh hatch of adult mosquitoes in the field, the mosquitoes are often resting together on vegetation in the area. They will stay like this for some time. This is a perfect time to apply a ULV fog with the Colt Mini Fogger during the day if winds are not too high before the mosquitoes have a chance to move.

Check with the OVMAP manager first before the Colt is used.

APPENDIX B

LARVAL MOSQUITO DIP COUNT THRESHOLDS

Only the most common mosquitoes of the Owens Valley are detailed here. Timing treatments is a skill that comes with time in the field. So many variables exist in the field that influence the decision to treat that trying to list them would be futile.

Often times, 1st year seasonal employees will treat any instar of any species. Over time the employee develops the knowledge base that makes making in-field treatment decisions a lesson in efficiency. This working knowledge enables the seasoned mosquito abatement technician to carry a much larger workload often using less material and saving pesticide costs.

GENUS

Culex

Culex tarsalis larvae, because of their disease transmission potential, are zero tolerance. Does this mean treatment of *tarsalis* 1st instar larvae is mandatory? Not at all, if the technician is patient, more gravid females will lay in the source giving a later treatment a greater kill value per pound of material with no adult emergence.

Culex erythrothorax is a species that can transmit West Nile virus but is not an immediate threat. This species tends to stay close to its larval habitat as an adult, thus the common name, the Tule Mosquito. As a result, larval numbers can build to large densities before treatment is necessary.

Culex erythrothorax larvae look quite similar to their cousins the *tarsalis* so making a positive identification is very important. When in doubt, bring the sample in for ID with the microscope.

Aedes

Aedes melanimon and *nigromaculus* are the most common flood water mosquito in the Owens Valley. Often times, after heavy winters and a high river, weekly light trap counts will number in the thousands. Larvae will hatch as soon as water hits the egg-filled dry mud. Often in a single pasture technicians will find late instar larvae at the top of the pasture where the irrigation begins and early instar larvae at the bottom catch ditch making surveillance of the entire pasture essential to get the big picture.

As a general rule, there is a zero tolerance policy on this entire Genus because of its day-biting, pestiferous nature. With the *Aedes* however, as explained in the larval surveillance section, waiting to treat until the 3rd or early 4th instar is a wise decision most of the time. The source may shrink in size and standing water mosquitoes in the area may lay eggs that hatch into early

instar larva if treatment is postponed. When a treatment is finally made, several species will be controlled with one treatment saving time and material.

Culiseta

Culisteta inornata are a species that don't readily bite humans. For this reason they are not specifically targeted by this IMMP. They can be a good indicator species however, if found in abundance in a source, there is a good chance there are other standing water species present.

Anopheles

Anopheles freeborni are pestiferous often biting throughout the day. They are capable of transmitting Malaria and responsible for the deaths of millions of people in other parts of the world. They are also one of the earliest species that overwinter as adults to emerge (February) and begin to seek a blood meal. For this reason, they are a primary target of this IMMP and have a zero tolerance for larvae.

Species not specifically mentioned

If species not specifically mentioned in this section are encountered in the field at numbers exceeding 3 per dip, control actions should be implemented.

Regardless of the species encountered in the field, the prudent technician will begin at the lowest rung of the IMMP hierarchy ladder of treatment and ask the following questions:

- What formed the source? A leak? Irrigation? Bad water management?
- Will the source dry up naturally?
- Is the source a good candidate for mosquito fish?
- What will happen if the mosquitoes are allowed to hatch?
- Does this species pose a disease risk?
- Is it a good candidate for extended release formulations?
- What is the current growth rate?
- How best do I treat this source?
- Should I discuss this with the OVMAP Manger before I implement?

Once a plan of action is determined all that's left to do is follow through and schedule a return visit in a few days to make sure the treatment was effective.

APPENDIX C

BTI FORMULA

- 200 lbs #16 Silica sand
- 56 ounces Golden Bear 1111 Larviciding oil
- 8.6 Lbs Vectobac Technical Powder

1. The sand and the GB-1111 are added to a rotating mixer (cement of equivalent) and mixed thoroughly for 5-10 minutes making sure the oil has coated the sand particles evenly.
2. While the mixer is still running, add slowly the required amount of Vectobac technical powder.
3. Continue mixing until powder is distributed evenly.

Makes four 50 lb buckets and applied at a rate of 8 lbs per acre. The label allows for treatments of 5 to 20 lbs per acre.

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Suggested Irrigation Practices for the Reduction of Mosquito Breeding in the Owens Valley

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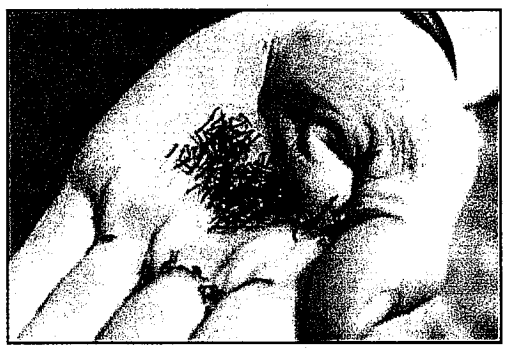
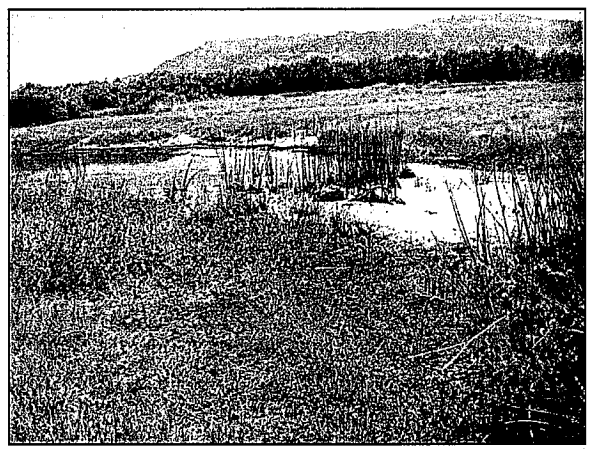
This document is not a Best Management Practice for irrigation in the Owens Valley. The Owens Valley Mosquito Abatement Program makes no claim to expertise on the subject of irrigation. However, this *is* a document detailing the mosquito problem in the Owens Valley as well as steps you can take to increase the efficacy of mosquito control treatments OVMAP applies to your property or lease. After all, the water management decisions you make, can have huge consequences in terms of mosquito production throughout the Owens Valley.

Many believe that all mosquitoes need stagnant water to reproduce, which is true for many species, where gravid females seek out suitable water sources, within which, to lay their eggs.



There are species however, the floodwater mosquitoes, that lay eggs at the base of vegetation within a floodplain or in fresh mud from a receding water source. Once dried within the flood plain boundary, these eggs resist desiccation and can wait years for new water to rewet the parched soil. Over time, these egg banks become flush with literally millions of eggs just waiting for the next inundation to hatch and grow. If conditions are optimal the resulting hatches can be huge, remaining pestiferous for weeks after, with the number of insects landing on you at any one time near the source in the thousands.



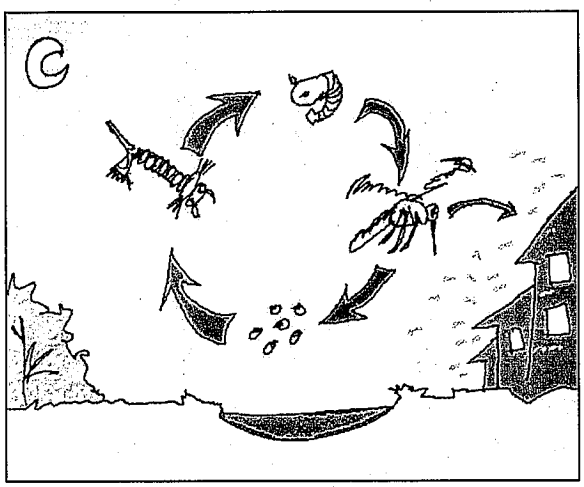
Floodwater mosquitoes, aside from their pestiferous nature, do pose some disease transmission risk. Western Equine Encephalomyelitis, St. Louis encephalitis, and California Encephalitis have all been isolated from *Aedes melanimon*, the most abundant local floodwater species. *Aedes melanimon* may also play a role in secondary transmission of the endemic West Nile Virus. We are ever vigilant and always concerned about mosquito-borne disease. In fact, in 2003, the Inyo County Department of Environmental Health Services identified a positive pool of *Aedes melanimon* for California Encephalitis while conducting routine WNV surveillance.

Long ago, flood events of a magnitude large enough to affect mosquito production were solely weather related and seasonal in nature,

corresponding with runoff of the sierra snowpack. These days, floodwater mosquitoes have adapted well to the monthly pasture irrigation cycles so common in the Owens Valley. Each round of pasture irrigation has become, in essence, a small scale spring runoff that, though relatively small in acreage, will produce millions of mosquitoes if pasture production is looked at cumulatively. Not only have they adapted very well to pasture irrigations, but also to artificial river fluctuations with the Owens River itself being the largest single source of floodwater mosquitoes in the Owens Valley.

When the Owens River volume is augmented out of the Pleasant Valley Reservoir to numbers above 400 CFS (cubic feet per second), the flow begins to move beyond the river bank and find its way into old, dry river channel. It is these ancient channels that hold the vast egg depositories.

In pastures, the eggs are often held in large, slow ditches or tail water ponds.



Every one of the eggs in a source will not hatch on every flood event. Scores will, but the remainder, for reasons of species survival, will not hatch during this flood event. The eggs that became inundated, yet failed to hatch, will require another period of drying before they are conditioned and ready to hatch again.

This gives the OVMAP the break it needs to make safe, effective, biological larvaecide treatments so long as the water level doesn't rise in the near term. If the water slowly rises, then eggs will gradually and continually hatch as the water creeps upward. This scenario is worst case as an initial treatment of larvaecide is only effective for a few days leaving larvae that hatched later, due to creeping water levels, able to grow unabated. Additionally, if water levels rise rapidly soon after a treatment, dilution of the active ingredient may render the entire treatment useless.

The materials OVMAP treats mosquito larvae with are not kill-on-contact products and must be ingested by the larvae. After enough product has been taken in, it works to paralyze the digestive tract by lysing holes from the inside-out, ultimately causing death through starvation or septicemia.

Once hatched, conditions for larval growth are based on day length, food availability, and average daily temperature, all of which are increasing as we move into summer. During midsummer, when growth factors are optimal, development from egg to adult can happen in as little as 5 days. This leaves precious little time to plan and apply an effective larvicidal treatment, especially over the many acres comprising Owens Valley ranches. As such, a sizable irrigation in June, July, and August can

be devastating in terms of adult mosquito production.

This is the root of mosquito production on pastureland. If irrigation water is allowed to run through any one head gate without moving the water around within the receiving field for greater than the time it takes for mosquito larvae to develop (5-7 days), then larvae will continue to hatch as water levels creep upward. Additionally, treatments applied for control will become uselessly diluted or washed away entirely, and some mosquitoes will inevitably emerge into biting adults.

After emergence, adult floodwater mosquitoes can migrate many miles in search of a blood meal utilizing humid riparian corridors to travel through. Strong winds will compound the situation, pushing mosquitoes along far faster than they can fly unaided, as well as, impeding our ability to apply adulticides effectively.

As implied above, this floodwater mosquito cycle has been going on apparently since there was a spring runoff or an Owens River, and is nothing new. These days, however, we have almost total control over our irrigation practices. There will always be emergencies when water is scarce and heads are tiny, but much of this unwanted mosquito production and subsequent pesticide application could be avoided with timely and considerate irrigation practices where feasible.

We covet good communication with the Owens Valley ranching community and welcome any opportunity to discuss mosquito management strategies in order to better serve the needs of the people living in and visiting the valley.