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 CITY OF LONG BEACH DEPT. OF HEALTH & HUMAN SERVICES BUREAU OF ENVIRONMENTAL HEALTH-VECTOR CONTROL PROGRAM			
B. Mailing Address 2525 GRAND AVE, RM 220			
C. City LONG BEACH	D. County LOS ANGELES	E. State CA	F. Zip Code 90815
G. Contact Person LAMAR H. RUSH	H. Email address LAMAR.RUSH@LONGBEACH.GOV	I. Title VECTOR CONTROL COORDINATOR	J. Phone (562)570-4090

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. CITY OF LONG BEACH DEPT OF PUBLIC WORKS & WATER DEPT.
   Owner's name: _____
   Name of the conveyance system: STORM DRAIN AND CATCH BASIN SYSTEM

3. ☒ Directly to river, lake, creek, stream, bay, ocean, etc. SEE ATTACHED MAP
   Name of water body: _____

   * 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 4
(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: X Vector Larvae X Adult Vector

B. Pesticides Used: List name, active ingredients and, if known, degradation by-products
SEE ATTACHMENT A

C. Period of Application: Start Date MARCH 2011 End Date UNTIL EXPIRATION

D. Types of Adjuvants Added by the Discharger:
NONE

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

* 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 Submitted previously ☐ NO ☐ NA

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: RONALD ARIAS

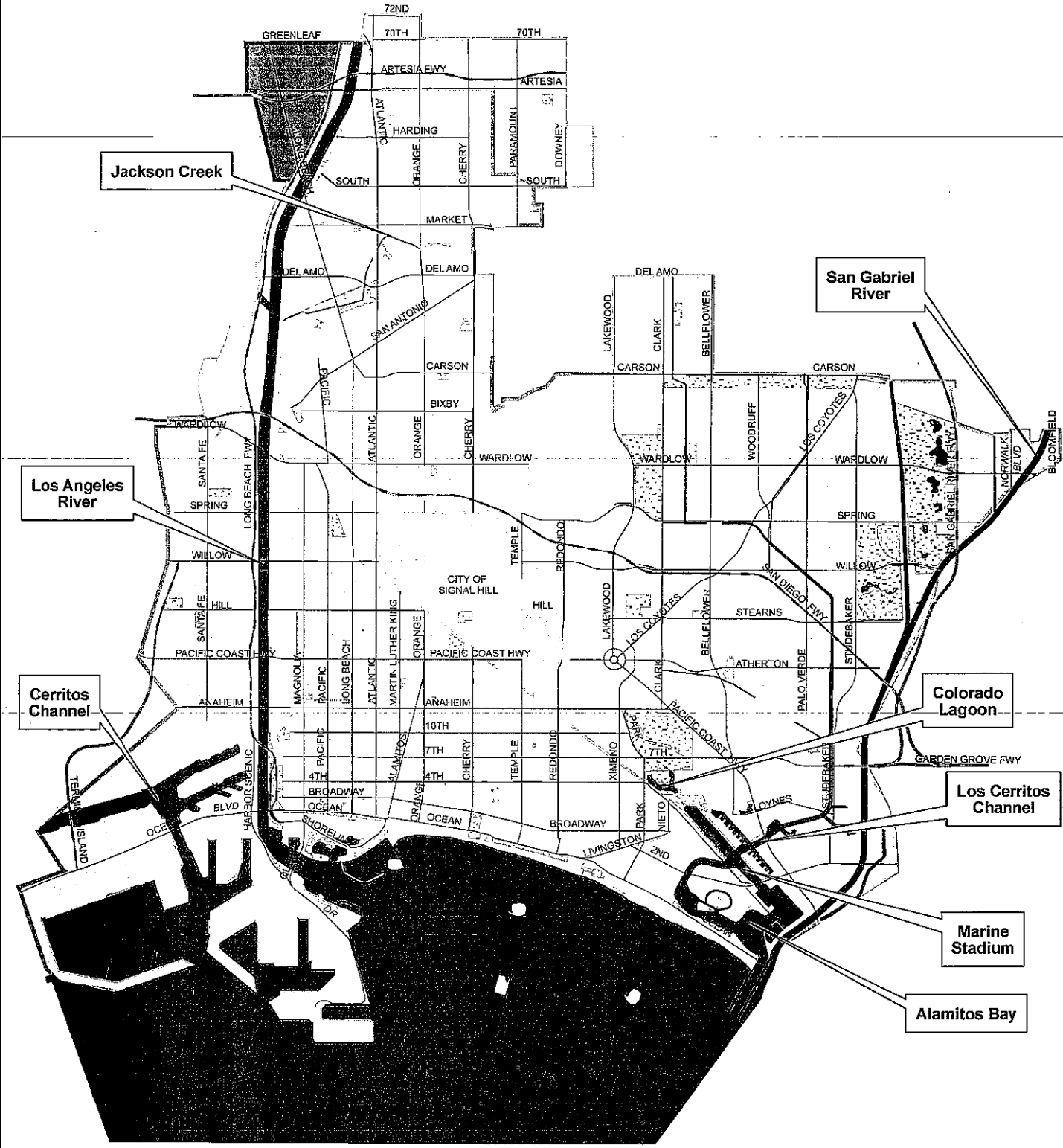
B. Signature: Ronald R. A. **Date:** 6-1-11

C. Title: DIRECTOR

X. FOR STATE WATER BOARD USE ONLY

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

City of Long Beach
Department of Health and Human Services
Bureau of Environmental Health
Vector Control Program



City of Long Beach Department of Technology Services GIS CLBVector_110311.mxd

ATTACHMENT A

CITY OF LONG BEACH
DEPT OF HEALTH & HUMAN SERVICES
VECTOR CONTROL PROGRAM

LIST OF PESTICIDES USED:

Trade Name	Active Ingredient
Larvicides:	
Agnique MMF	Poly (oxy-1,2-ethanediyl), α-(C_{16-20} branched and linear alklyl)-ω-hydroxy
BVA-2	Highly refined petroleum distillate
GB 1111 (Golden Bear)	Aliphatic petroleum hydrocarbons
Altosid Liquid Larvicide (A.L.L.)	(S)-Methoprene
Altosid Pellets	(S)-Methoprene
Altosid SBG (Granule)	(S)-Methoprene
Altosid 30 (Briquets)	(S)-Methoprene
Altosid XR (Briquets)	(S)-Methoprene
Altosid WSP (Pellets)	(S)-Methoprene
Vectobac G (Granule)	*Bacillus thuringiensis*, subsp. *Israelensis*
Vectobac CG (Granule)	*Bacillus thuringiensis*, subsp. *Israelensis*
Vectobac 12AS (Liquid)	*Bacillus thuringiensis*, subsp. *Israelensis*
Vectolex CG (Granule)	*Bacillus sphaericus* Serotype H5a5b, strain 2362
Vectolex WDG (Dried Concentrate)	*Bacillus sphaericus* Serotype H5a5b, strain 2362
Vectomax CG	*Bacillus sphaericus* Serotype H5a5b, strain 2362 and *Bacillus thuringiensis*, subsp. *Israelensis* Serotype H-14 Strain AM65-52
Adulticides:	
Anvil 10+10 ULV	3-Phenoxybenzyl-(1RS, 3RS; 1RS, 3SR)-2,2 dimethyl-3-(2-methylprop-1-enyl) cyclopropanecarboxylate Piperonyl Butoxide
Scourge (4%)	Resmithrin Piperonyl Butoxide
Biomist 4+12 ULV	Permethrin Piperonyl Butoxide

NOTE: Any pesticides not on this list, and included in the State BMP or LBDHHSVCP BMP, will not be used in, over, or near the waters of CA or the US by the City of Long Beach DHHS Vector Control Program.

CITY OF LONG BEACH

DEPARTMENT OF HEALTH AND HUMAN SERVICES

2525 GRAND AVENUE • LONG BEACH, CALIFORNIA 90815 • (562) 570-4000

March 11, 2011

NOTICE TO POTENTIALLY INTERESTED AGENCIES

California Department of Fish & Game
Caltrans
Coastal Commission
Department of Pesticide Regulations
Regional Water Control Board Region 4
LA County Department of Public Works
LA County Agricultural Commissioner
City of Signal Hill
City of Long Beach Department of Public Works
City of Long Beach Dept of Parks, Recreation, & Marine
City of Long Beach Airport
City of Long Beach Water Department
City of Long Beach Gas & Oil Department
Port of Long Beach
US Army Corp of Engineers

Subject: **City of Long Beach Department of Health and Human Services Vector Control Program Notice of Intent to continue to apply Aquatic Larvicides and Adulticides for Vector Control as part of the Program's Integrated Vector Management Program.**

Pursuant to the provisions stated in the National Pollutant Discharge Elimination System (NPDES) Permit Order No. 2011-0002-DWQ, General Permit No. CAG990004 adopted on March 1, 2011, by the State Water Resources Control Board, notice is hereby given that the City of Long Beach Department of Health and Human Services Vector Control Program intends to continue to perform larvicide, ultra low volume (ULV) adulticide, as well as barrier adulticide applications as part of its Integrated Vector Management Program.

The Program's activities are conducted year-round within the 66 square miles of the City of Long Beach in Los Angeles County. Treated areas may be under the control of the City of Long Beach Public Works, Water, Airport, Parks Recreation and Marine, and Gas and Oil Departments, as well as LA County DPW, Caltrans, Port of Long Beach, and the Army Corp of Engineers.

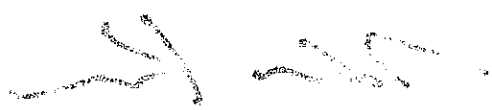
Applications are made in an effort to protect the public's health from vector-borne diseases, are based on key vector and arbovirus surveillance indicators and in strict compliance with pesticide label requirements. The following materials may be used:

Trade Name	Active Ingredient
Larvicides:	
Agnique MMF	Poly (oxy-1,2-ethanediyl), α-(C_{16-20} branched and linear alklyl)-ω-hydroxy
BVA-2	Highly refined petroleum distillate
GB 1111 (Golden Bear)	Aliphatic petroleum hydrocarbons
Altosid Liquid Larvicide (A.L.L.)	(S)-Methoprene
Altosid Pellets	(S)-Methoprene
Altosid SBG (Granule)	(S)-Methoprene
Altosid 30 (Briquets)	(S)-Methoprene
Altosid XR (Briquets)	(S)-Methoprene
Altosid WSP (Pellets)	(S)-Methoprene
Vectobac G (Granule)	*Bacillus thuringiensis*, subsp. *Israelensis*
Vectobac CG (Granule)	*Bacillus thuringiensis*, subsp. *Israelensis*
Vectobac 12AS (Liquid)	*Bacillus thuringiensis*, subsp. *Israelensis*
Vectolex CG (Granule)	*Bacillus sphaericus* Serotype H5a5b, strain 2362
Vectolex WDG (Dried Concentrate)	*Bacillus sphaericus* Serotype H5a5b, strain 2362
Vectomax CG	*Bacillus sphaericus* Serotype H5a5b, strain 2362 and *Bacillus thuringiensis*, subsp. *Israelensis* Serotype H-14 Strain AM65-52
Adulticides:	
Anvil 10 + 10 ULV	3-Phenoxybenzyl-(1RS, 3RS; 1RS, 3SR)-2,2 dimethyl-3-(2-methylprop-1-enyl) cyclopropanecarboxylate Piperonyl Butoxide
Scourge 4%	Resmithrin Piperonyl Butoxide
Biomist 4+12 ULV	Permethrin Piperonyl Butoxide

If you have any questions regarding this Notice of Intent, please contact Lamar Rush, Vector Control Coordinator, at the Long Beach Health and Human Services Department at 2525 Grand Avenue, Long Beach, CA 90815, phone (562)570-4090.

Sincerely,

Nelson Kerr, MPA, REHS
Bureau Manager, Environmental Health



City of Long Beach
Department of Health & Human Services
Vector Control Program
Pesticide Application Plan

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
2. Additional target areas, other than water bodies, would include:

    1. Flood control channels, basins, freeway drains, pump stations, storm drains, and any other conveyance for water runoff in an urban/ suburban area.
    2. Roadside low-spots, backyard pond and pools.

3. **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.

4. **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. Also, please see attachment A (List of Pesticides Used) provided with NOI. Products may be applied by hand, truck, backpack, or hand can, according to label directions.

5. **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 Long Beach Health and Human Services Vector Control Program's (LBDHHSVCP) preferred solution, and whenever possible the program 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.
   The typical sources treated by this program include:

All water within the contiguous boundaries of the City of Long Beach subject to periodic breeding of mosquitoes, biting midges or non-biting midges and require either routine or occasional treatment with pesticides labeled for use to control their immature stages.

1. Any and all navigable waters in Long Beach City that breed mosquitoes and midges.
2. Flood control channels, basins, freeway drains, pump stations, storm drains and any other conveyance for water runoff in an urban/suburban area.
3. Roadside low-spots, backyard pond and pools.

6. **Other control methods used (alternatives) and their limitations;**
With any source of mosquitoes or other vectors, the LBDHHSVCP'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.
Specific methods used by the agency include stocking mosquito fish (*Gambusia affinis*), educating residents that mosquitoes develop in standing water and encouraging them to remove sources of standing water on their property, and working with property owners to find long-term water management strategies that meet their needs while minimizing the need for public health pesticide applications. LBDHHSVCP never applies Mosquito adulticides over permanent bodies of water, lakes, rivers permanent streams, natural ponds, commercial fish ponds, swamps, marshes or estuaries. LBDHHSVCP always complies with application requirements as indicated on the label of the product.

7. **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 LBDHHSVCP'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.
The amount of product anticipated for use in 2011:
Golden Bear-1111, 25 gallons
Vectolex CG, 300 lbs.
Biomist 4+12 ULV, 1.5 gallons

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

9. **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

10. **Description of the BMPs to be implemented. The BMPs shall include at a minimum:**
The LBDHHSVCP's BMPs are described in the Best Management Practices for Mosquito Control in California, Best Management Practices and Monitoring Plan For the City of Long Beach Department of Health and Human Services Vector Control Program 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 LBDHHSVCP calibrates truck-mounted and handheld larviciding equipment each year to meet application specifications. Supervisors review 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. This Program does not administer or contract for aerial adulticiding treatments.

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.

11. **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 LBDHHSVCP 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 Program'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 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 Program's preferred solution, and whenever possible the Program 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.

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 Program uses. The LBDHHSVCP continually collects adult and larval mosquito surveillance data, dead bird reports, and sentinel chicken test results, 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.

12. **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.

    The LBDHHSVCP uses the principles and practices of Integrated Vector Management (IVM) as described on pages 26 and 27 of the Best Management Practices for Mosquito Control in California. As stated in item #10 above, locations where vectors may exist are assessed, and the potential for using alternatives to pesticides is determined on a case-by-case basis. Commonly considered alternatives include: 1) Eliminate artificial sources of standing water; 2) Ensure temporary sources of surface water drain within four days (96 hours) to prevent adult mosquitoes from developing; 3) Control plant growth in ponds, ditches, and shallow wetlands; 4) Design facilities and water conveyance and/or holding structures to minimize the potential for producing mosquitoes; and 5) Use appropriate biological control methods that are available. Additional alternatives to using pesticides for managing mosquitoes are listed on pages 4-19 of the Best Management Practices for Mosquito Control in California.

    Implementing preferred alternatives depends on 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.**

    The LBDHHSVCP follows an existing IVM program which includes practices described in the California Mosquito-borne Virus Surveillance and Response Plan and Best Management Practices for Mosquito Control in California.

A "nuisance" is specifically defined in California Health and Safety Code (HSC) §2002(j). This definition allows vector control agencies to address situations where even a low number of vectors may pose a substantial threat to public health and quality of life. In practice, the definition of a "nuisance" is generally only part of a decision to apply pesticides to areas covered under this permit. As summarized in the California Mosquito-borne Virus Surveillance and Response Plan, the overall risk to the public when vectors and/or vector-borne disease are present is used to select an available and appropriate material, rate, and application method to address that risk in the context of our IVM program.

13. 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 LBDHHSVCP 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.

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

http://www.longbeach.gov/health/wnv_info/default.asp

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 LBDHHSVCP at (562) 570-4090.

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 LBDHHSVCP at (562) 570-4090 .

MVCAC NPDES Coalition Monitoring Plan. 2011. [In development at the time of this draft]

Best Management Practices and Monitoring Plan For the City of Long Beach Department of Health and Human Services Vector Control Program. 2010. Copies may be requested by calling the LBDHHSVCP at (562) 570-4090.

Best Management Practices and Monitoring Plan For The City of Long Beach Department of Health and Human Services Vector Control Program

FOR WATER QUALITY ORDER NO 2011-0002-DWQ STATEWIDE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FOR BIOLOGICAL AND RESIDUAL PESTICIDE DISCHARGES TO WATERS OF THE UNITED STATES FROM VECTOR CONTROL APPLICATIONS GENERAL PERMIT NO. CAG990004

Background

The Long Beach Health and Human Services Vector Control Program (LBDHHSVCP), within the jurisdiction of the Region 4 Water Quality Control Board, is seeking coverage under the General Permit as a public entity that applies aquatic pesticides for vector control to waters of the United States.

According to the California State Water Quality Control Board's document "California Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (http://www.waterboards.ca.gov/water_issues/programs/state_implementation_policy/docs/final.pdf), the District may receive an exception from meeting the priority pollutant criteria/objectives of the document from the Regional Water Quality Control Board (RWQCB) if it :

1. complies with the California Environmental Quality Act (CEQA)

2. is necessary for resource or pest management i.e., vector or weed control, pest eradication, or fishery management

The statutory mandates that govern how the LBDHHSVCP operates are found in the California Health and Safety Code (Sec 2000-2007, 2040-2060).

Extensive research has indicated that the pesticides the LBDHHSVCP applies directly to water to kill mosquito larvae have little or no lasting environmental impact. *Bacillus thuringiensis* var. *israelensis, B. sphaericus,* s-methoprene, and surfactants degrade rapidly in the environment, leaving negligible residue. When integrated with other strategies, e.g., managing habitat and using mosquitofish, these aquatic pesticides are part of effective best management practices (BMPs).

As required by the General Permit, we present and discuss our BMPs and monitoring plan. The Long Beach Vector Control Program uses environmentally safe practices to control vectors and minimize impact to non-target organisms. Aquatic pesticides are applied at rates that do not alter the physical parameters of the environment, i.e., temperature, salinity, turbidity, and pH. This monitoring plan presents and justifies exemptions to requirements of the General Permit.

Best Management Practices

The Long Beach Department of Health and Human Services Vector Control Program is empowered to act as a public health agency as a result of legislation incorporated in the California State Health and Safety Code.

The Vector Control personnel who apply pesticides are licensed by the CDPH and pesticide use is reported to the County of Los Angeles Agricultural Commissioner (CAC) according to an annual Memorandum of Understanding among the DPR, CDPH, and CAC, and vector control agencies pursuant to Health and Safety Code Section 116180. The CAC conducts an annual inspection of the LBDHHSVCP to ensure we are complying with the provisions of the cooperative agreement.

The US Environmental Protection Agency (USEPA) and DPR require that aquatic pesticides undergo tests for toxicity and meet specific requirements before the pesticide is registered for application to surface waters. The USEPA has found that applying properly registered aquatic pesticides does not threaten people and the environment. The effects of these pesticides on water quality will be mitigated by complying with the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), using BMPs, and monitoring.

The LBDHHSVCP's best management practices are based on integrated vector management (IVM) strategies. The components of the programs are:

1. Public education
2. Surveillance of vector populations
3. Disease surveillance
4. Determining thresholds
5. Selecting control method(s)
6. Training and certifying applicators

1. Public Education

LBDHHSVCP staff utilizes various outreach techniques to reach residents, gain cooperation, and change behavior so the risk of mosquito-transmitted disease is reduced. Many behavioral elements such as maintaining properties to eliminate standing water, reducing urban runoff, and preventing trash accumulation in natural areas can reduce the need to apply public health pesticides. To ensure the widest reach, multilingual methodologies ranging from direct contact to large-scale media campaigns are used.

A. Community Outreach
Information and programs are provided to local civic groups, community service groups, homeowner associations, local businesses, and at community safety/health fairs, senior centers and others.

B. Media Outreach
Residents are kept informed through local and regional media outreach via press releases, press conferences, and local and regional media campaigns including public service announcements and paid media advertising.

2. Surveillance of Vector Populations

Surveillance limits pesticide use to areas where mosquito populations may affect public health. The 13 species of mosquitoes known in Los Angeles County differ in their biology, susceptibility to larvicides, and ability to create nuisances and transmit disease. Information on the species, density, and stages present is used to select an appropriate control strategy based on integrated vector management.

A. Larval Surveillance

Vector Control Technicians are assigned to zones within the LBDHHSVCP. They maintain a database of sites, which are known to produce mosquitoes and inspect them regularly. They also search continuously for new sources of standing water and mosquitoes. Treatments are based on the abundance, species, and stage of mosquitoes present.

B. Adult Mosquito Surveillance

Identifying all sources of mosquito larvae is impossible but we do our best to employ various surveillance techniques. Populations of adult mosquitoes are also sampled by trapping and tested for infections with viruses that can be transmitted to humans. The spatial and seasonal abundance of adult mosquitoes is monitored and compared to historical data. Control operations are concentrated in areas where adult populations are above seasonal averages and/or where disease activity has been identified.

C. Service Requests

Reports of standing water (i.e., neglected pools or mosquitoes from residents) allow staff to gauge the success of control efforts and locate new sources of mosquitoes. When requests for service are received, Vector Control Technicians visit the area, interview residents, and search for sources of mosquitoes.

3. Disease Surveillance

A. Adult mosquitoes, and sentinel chickens are tested regularly for infections with mosquito-borne viruses. Control operations are concentrated in areas where the risk for human disease is elevated.

B. The LBDHHSVCP works with the County of Los Angeles Acute Communicable Disease Control Unit to keep abreast of trends in arthropod-borne diseases. We increase control and surveillance activities when elevated risk or incidence of disease is detected in our jurisdiction.

4. Determining Thresholds

Thresholds are established so that only sources, which represent threats to public health or quality of life, are treated. They are based on the following criteria:

- Species of mosquito present
- Stage of mosquito present
- Nuisance or disease potential
- Abundance
- Flight range
- Proximity to humans
- Size of source
- Presence/absence of natural predators
- Presence of sensitive/endangered species

Current and historic data are compared and control measures are based on whether conditions pose a risk to public health.

The LBDHHSVCP also uses the California Department of Public Health California's Mosquito-Borne Virus Surveillance and Response Plan as a guide to assess the potential for human illness and determine control strategy: http://www.westnile.ca.gov/resources.php. This document is revised annually.

5. Selecting Control Methods

When thresholds are exceeded, a control strategy is selected which minimizes environmental impacts while maximizing efficacy. The method of control is based on threshold criteria and:

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

A. Source Reduction

Source reduction includes elements such as physical control, habitat manipulation, and water management.

1. Physical Control
   Mosquitoes can be controlled by physically altering their habitat. This long-term solution reduces or eliminates sites where mosquitoes develop and ultimately reduces the need to apply pesticides.

   The LBDHHSVCP usually cooperates with other agencies (e.g., County of Los Angeles Department of Public Works) to conduct activities, which can include:

   - Sediment removal from flood control channels
   - Repairs to existing water control structures
   - Removing debris, weeds and vegetation from natural waterways
   - Clear brush from margins of waterways
   - Limit or rotate flow for ground water recharge

   The LBDHHSVCP makes a concerted effort to establish relationships with organizations that propose new projects such as wetland restoration so sources of vectors are not created or provisions are made to control them in the future

2. Biological control

   Fish, aquatic invertebrates, and pathogens all prey on mosquito larvae. Only mosquitofish can be reared in sufficient quantity to use as a control agent. Natural predators are rarely numerous enough to control mosquito larvae. Biological control agents are sometimes used together with bacterial or chemical insecticides.

   i. Mosquitofish (*Gambusia affinis*)

      Mosquitofish (*Gambusia affinis*) are used worldwide as a biological control agent for mosquitoes. They are not native to California, but are now ubiquitous in most of the State's waterways and have become an integral part of the aquatic food chain.

      Mosquitofish self-propagate, have a high reproductive potential, and thrive in the shallow, vegetated waters preferred by many species of mosquitoes. They prefer to feed at the surface where mosquito larvae concentrate. These fish can be readily mass-reared or collected from sources and redistributed.

      In many cases, mosquitofish are preferable to habitat modification or pesticides, particularly in altered or artificial aquatic habitats. The LBDHHSVCP distributes them to the public for ornamental ponds and other artificial containers like water barrels and horse troughs but does not place mosquitofish into waters of the US.

ii. Aquatic Invertebrates

Aquatic invertebrates, including diving beetles, dragonfly and damselfly naiads, backswimmers, water bugs and hydra are natural predators of mosquito larvae. When natural predators are sufficiently abundant, additional measures to control mosquitoes, including applying pesticides may be unnecessary.

Predatory aquatic invertebrates however are often not abundant enough to control mosquito larvae, particularly in disturbed habitats. Most are general feeders and will seek other prey if it is available and more accessible. Seasonal abundance and developmental rates often lag behind mosquito populations. There are currently no suitable mass-rearing techniques or commercial sources for aquatic invertebrates.

B. Bacterial Insecticides

Bacterial insecticides contain naturally produced proteins. They are toxic to mosquito larvae when ingested in sufficient quantity. Although they are biological agents, these products are labeled and registered by the Environmental Protection Agency (EPA) as pesticides.

1) *Bacillus thuringiensis* var. *israelensis* (*Bti*)
Product names: Vectobac® 12AS, Vectobac® G, Vectobac® TP

Bacillus thuringiensis var. *israelensis* (*Bti*) is highly target-specific and has significant effects on mosquito larvae and closely related insects, i.e., blackflies and some midges. It is available in a variety of formulations (liquid, granular, and pellet) so it can be applied by various methods and equipment. *Bti* has no measurable toxicity to vertebrates. The hazard classification on the label of *Bti* is "CAUTION". *Bti*'s insecticidal properties come from a combination of five different proteins. They have varying modes of action and act synergistically so resistance has not developed.

Mosquito larvae must ingest *Bti* for it to be effective. Pupae and late 4th stage larvae do not feed and cannot be controlled by *Bti*. Low water temperature inhibits larval feeding behavior so *Bti* is less effective in cooler weather. High organic conditions also reduce the effectiveness of *Bti*.

Bti leaves no residues, begins to degrade within 24 hours after it is applied, and is unlikely to affect water quality. There are no established standards, tolerances or USEPA-approved tests. Other strains of *Bacillus thuringiensis* occur naturally and are common in aquatic habitats.

2) *Bacillus sphaericus* (*Bs*)
Product names: Vectolex® CG, Vectolex® WDG, Vectolex® WSP

Bacillus sphaericus (*Bs*) is a bacterial pesticide with attributes similar to *Bti* but it is more effective in water with a high organic content. It may actually cycle in habitats containing high densities of mosquitoes, reducing the need for repeated applications. The hazard classification on the label of *Bs* is "CAUTION".

Bacillus sphaericus must be consumed by mosquito larvae and is therefore not effective against late 4th instar larvae or pupae. It is also ineffective against certain mosquito species. *Bs* is toxic to mosquitoes because of a single toxin rather than the complex that is produced by *Bti*. Consequently, resistance to *Bs* has developed much more quickly.

Surveillance on the stage and species of mosquitoes present increases the effectiveness of *Bs*. Resistance can be delayed by rotating *Bs* with other pesticides.

Bacillus sphaericus occurs naturally and is environmentally safe. It leaves no residues. At the application rates used in mosquito control programs, *Bs* is unlikely to affect on water quality. There are no established standards, tolerances or EPA approved tests.

C. Chemical Control Using Larvicides

1. S-Methoprene

Product Names: Altosid® briquettes, Altosid® liquid larvicide, Altosid® pellets, Altosid® SBG, Altosid® XR briquettes, Altosid® XRG

S-methoprene is a larvicide that mimics an insect growth hormone and prevents mosquitoes from becoming biting adults. It can be applied as liquid or solid or combined with *Bti* or *Bs*. S-methoprene is an effective component of an integrated management program since larvae survive as prey and remain in the food web. This material degrades quickly in sunlight and when applied as a liquid it is effective for three to five days. S-methoprene is also added into inert, charcoal-based carriers such as pellets and briquettes so it can be time-released for up to 150 days. Different formulations provide options for treatment in a wide range of environmental conditions. S-methoprene is not toxic to vertebrates and most invertebrates when exposed at concentrations used by mosquito control.

S-methoprene is only effective against mosquito larvae. Monitoring its effectiveness is difficult since larvae do not die. S-methoprene is more

expensive than most larvicides.

Surveillance and monitoring provides information on stages of mosquitoes present, timing of applications, and efficacy of treatments. S-methoprene does not have a significant impact on water quality. It is rapidly degraded in the environment and is not known to have persistent or toxic breakdown products. The hazard classification on the label of s-methoprene is "CAUTION". It is applied at levels far below those that can be detected by any currently available test. S-methoprene has been approved by the World Health Organization for use in drinking water containers.

2. Surfactants

Product Names: GB-1111, Agnique® MMF

Surfactants are either petroleum (GB-1111) or alcohol (Agnique®)-based materials that form a thin layer on the surface of water. They kill surface-breathing insects by mechanically blocking their respiratory mechanism.

Surfactants are the only materials that kill mosquito pupae. Agnique® MMF forms an invisible monomolecular film. The material spreads across the water surface and into inaccessible areas. GB-1111 is a refined petroleum product that forms a visible film on the water. It is highly volatile and evaporates in 24-48 hours. The hazard classification on the label of GB-1111 and AGNIQUE® MMF is "CAUTION". AGNIQUE® MMF is labeled "safe for use" in drinking water.

The action of surfactants is indiscriminate. Surface-breathing natural predators of mosquitoes may be affected. In general, surfactants are used only after other control strategies have been ruled out.

D. Chemical Control Using Adulticides specifically Pyrethroids

Product names: Biomist 4 + 12 ULV, Anvil 10 + 10 ULV, Scourge 4%

Adult mosquitoes can only be controlled with adulticides. Many mosquito control program in California include adulticiding as an integral component of their 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 typically cover relatively small areas and are applied to alleviate specific problems rather than an area wide adult mosquito problem.

ULV applications are used to control adult mosquitoes over large areas. An ultra-low volume (typically less than 2 oz/acre (140 ml/ha) total volume) of tiny

oil or water droplets carrying an insecticide are emitted from specialized equipment mounted to trucks or aircraft. The droplets kill adult mosquitoes on contact. ULV applications are made after sunset and 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. These application are employed when mosquito populations must be reduced immediately to halt disease transmission. Multiple applications in a particular area may be utilized when the objective is to kill a high enough proportion of older adult mosquitoes to break a disease transmission cycle.

Adverse effects from ULV applications are rare; however, people with health problems should be aware when and where the application 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 June, 2010) include organophosphates (e.g. malathion and naled), pyrethrins, (e.g. pyrethrum) and pyrethroids (e.g. resmethrin, sumithrin, permethrin, and etofenprox). With the exception of the active ingredient etofenprox, formulations of both pyrethrins and pyrethroids include the synergist piperonyl butoxide (PBO), which increases their activity against mosquitoes.

1). Organophosphates

Malathion and naled are neurotoxins that act by blocking the enzyme cholinesterase, inhibiting neurologic transmission. Malathion or naled may be used as rotational products with pyrethroid insecticides to help prevent development of pesticide resistance.

2). Pyrethrins

Pyrethrins and pyrethroids are neurotoxins that act by causing uncontrolled firing of neurons. Pyrethrum is a natural insecticide derived from chrysanthemum flowers. Adult mosquitoes are rapidly paralyzed and killed on contact. Pyrethrins are degraded rapidly by sunlight and chemical processes. Residual pyrethrins from ULV applications typically remain less than one day on plants, soil, and water.

3). Pyrethroids

Product names: Anvil 10 + 10 ULV, Biomist 4 + 12 ULV, Scourge 4%

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

E Cultural Practices

Stormwater BMP and wetland design/maintenance criteria have been developed and adopted by the LBDHHSVCP. These criteria are shared with various governmental agencies and private parties involved in the planning process for projects having the potential to create mosquito breeding problems. Guidelines for the following source types are included and are considered cultural control techniques:

* Drainage construction and maintenance practices
* Dredge material disposal sites
* Irrigated pastures
* Permanent ponds used as waterfowl habitat
* Permanent water impoundments
* Marshes
* Sedimentation ponds and retention basins
* Utility construction practices
* Above and below ground stormwater treatment practices

The Long Beach Department of Health and Human Services Vector Control Program also provides literature and educates homeowners and contractors about eliminating sites that produce mosquitoes from residential property. These sources include rain gutters, artificial containers, ornamental ponds, abandoned swimming pools, tree holes, septic tanks, and other impounded waters.

1) Water Management

Water Management consists of techniques to control the timing, quantity, and flow of water in managed wetlands to control populations of mosquitoes. The LBDHHSVCP has established guidelines for water management based on information from the University of California Agricultural Extension Service (UCAES). The Vector Control Program provides these guidelines to property owners to promote proper irrigation techniques for wetlands to reduce mosquito populations.

2) Vegetation Management

Removing vegetation helps water circulate and increases access for natural predators; both help reduce mosquito breeding. Vegetation management is achieved almost entirely through cooperative efforts of property owners. Vector Control Technicians rarely use hand tools.

Vegetation protects mosquito larvae and adults from predators, wind, and wave action. Managing vegetation enhances the

effects of these factors and reduces the need for pesticides. Several factors can limit vegetation management including: sensitivity of the habitat, presence of special status species, seasonality, size of the site, density and type of vegetation, species of mosquito, and weather.

6. TRAINING AND CERTIFICATION

The California Department of Public Health (CDPH) Vector-Borne Disease Section certifies, tests, and trains all staff who either applies pesticides or oversees the application of pesticides. The Mosquito and Vector Control Association of California (MVCAC) provides training materials and examinations are conducted by the CDPH.

Certified staff must obtain continuing education units (CEUs) in Laws and Regulations (12 units) and Mosquito Biology (8 units) every two years. Eight units each in Terrestrial Invertebrate and Vertebrate Control are optional each two-year cycle.

The Mosquito and Vector Control Association of California (MVCAC) provides opportunities to earn CEUs. Training programs are approved by the CDPH.

Members of the MVCAC operate under the California Health and Safety Code and the California Government Code (Division 1, Administration of Public Health, Chapter 2, Powers and Duties; also Part 2, Local Administration, Chapter 8, State Aid for Local Health Administration; Division 3, Pest Abatement, Chapter 5, Mosquito Abatement Districts or Vector Control Districts, Sections 2000 - 2910). Members of the MVCAC that are signatories to the California Department of Public Health Cooperative Agreement pursuant to Section 116180, Health and Safety Code) are required to comply with the following:

1) Calibrate all application equipment using acceptable techniques before using, and to maintain calibration records for review by the County Agricultural Commissioner.

2) Calibrate at least annually all equipment used by the LBDHHSVCP.

3) Maintain copies of calibration records at the LBDHHSVCP.

4) Maintain for at least two years for review by the County Agricultural Commissioner a record of each pesticide application showing the target vector, the specific location treated, the size of the source, the formulations and amount of pesticide used, the method and equipment used, the type of habitat treated, the date of the application, and the name of the applicator(s).

5) Submit to the County Agricultural Commissioner each month a Pesticide Use Report on Department of Pesticide Regulation form PR-ENF-010. The report shall include the manufacturer and product name, the registration number from the label, the amount of each pesticide, the number of applications of each pesticide, and the total number of applications per month.

6) Report to the County Agricultural Commissioner and the Department of Health Services any conspicuous or suspected adverse effects from applications of pesticides on humans, domestic animals and other non-target organisms, or property.

7) Require employees to be properly certified by the California Department of Public Health to apply pesticides to control vectors, and maintain records that document certified employees receive a minimum of 20 hours of continuing education hours every two years.

8) Receive regular inspections by the County Agricultural Commissioner to ensure compliance with state laws and regulations relating to pesticide use.

The LBDHHSVCP also complies with the requirements of other agencies, e.g., local fire departments, California Department of Fish and Game, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and others who have jurisdiction and oversight over our activities. We work closely with these agencies to comply with their requirements.

Monitoring Plan for the Long Beach Health and Human Services Vector Control Program

Introduction

The Long Beach Department of Health and Human Services Vector Control Program (LBDHHSVCP) within the jurisdiction of the Region 4 Water Quality Control Board (RWQCB) is seeking coverage under the General Permit for discharges of aquatic pesticides to waters of the U.S.

This monitoring plan consists of ongoing best management practices (BMPs), record-keeping, and reporting. Records shall be kept of all pesticide applications made to waters of the U.S. by LBDHHSVCP staff. These records shall include the site, material, concentration, quantity applied, habitat type, approximate water surface area, and the date and time for each application. LBDHHSVCP shall report monthly to the Los Angeles RWQCB on its aquatic pesticide applications, summarizing the recorded data to indicate the quantity of each pesticide active ingredient applied to each habitat type within the City of Long Beach that drains to each major final receiving body. If any non-standard larvicides or herbicides are required, the Los Angeles RWQCB will be promptly notified so a supplemental monitoring plan can be developed.

The State Water Resources Control Board (SWRCB)'s General Permit provides that monitoring exemptions may be appropriate for vector control projects involving microbial larvicides, thin film larvicides and methoprene. Thus, the LBDHHSVCP's monitoring plan and BMPs do not include water sampling and water quality analysis or testing.

In order to ensure that the most environmentally sensitive methods are being employed, we will annually review our BMPs to incorporate new practices and less toxic methods and materials as they become available. Changes or revisions to our BMP will be reported annually.

Types of Sources Treated

Directing our main efforts at controlling mosquito larvae allows us to localize treatments and use the least toxic alternatives. Adult mosquitoes may occasionally be targeted for control. However, since pesticides must be applied over a greater area and are less selective we avoid using them whenever possible.

There are 13 species of mosquitoes in the County of Los Angeles (Table 1) that are distributed variably and develop in several types of sources. Mosquitoes generally cannot survive in water that flows substantially or has a disturbed surface. Species are distributed based on their tolerance to salinity, degree of organic pollution, and temperature.

Climate and Seasonality

Most of the precipitation in the Los Angeles Region falls from November through May, and summer temperatures can exceed 100°F. The weather and seasonal patterns of rainfall and temperature influence how mosquitoes are distributed and thus how and when pesticides are applied. For example, waterways that flow during winter are usually treated in summer after the flow has receded. Similarly, mosquitoes are generally flushed out of storm drains during winter so these sources are typically treated only during the summer months.

Aquatic Pesticides and Assessment of Potential Impacts

The LBDHHSVCP uses aquatic pesticides, which fall into the three categories: bacterial, chemical, and surfactants. Table 2 summarizes the amount of these products applied annually.

A. Bacterial Larvicides

Bacterial larvicides contain proteins within spores of bacteriae that are toxic to mosquito larvae when ingested in sufficient quantities. These products are labeled and registered by the Environmental Protection Agency (EPA) as pesticides and are considered chemical control agents despite originating from natural sources.

1. *Bacillus thuringiensis* var. *israelensis* (*Bti*)

Advantages: *Bti* is highly target-specific and significantly affects larvae of mosquitoes and closely related insects such as blackflies and midges. It is available in a variety of formulations (liquid, granular, and pellet) so it can be applied by a variety of methods and equipment. *Bti* has no measurable toxicity to vertebrates and is classified by EPA as "Practically Non-Toxic". *Bti* formulations contain a combination of five different proteins within a larger crystal. These proteins have varying modes of action and act synergistically so the likelihood is remote that mosquito populations will become resistant.

Disadvantages: Bacterial larvicides must be ingested in sufficient quantities to be effective. Pupae and late 4th stage larvae do not feed and cannot be controlled by *Bti*. Low water temperature inhibits larval feeding behavior, reducing the effectiveness of *Bti* during cooler months. Water with high concentrations of organic material reduces the effectiveness of *Bti*.

Solutions to Disadvantages: Increasing the frequency of surveillance for larvae can ensure that bacterial insecticides are applied during the appropriate stages of development.

Impact on water quality: *Bti* is generally regarded as environmentally safe. Strains of *Bacillus thuringiensis* occur naturally in aquatic habitats. *Bti* leaves no residues and degrades quickly. At the application rates used in mosquito

control programs; this product is unlikely to have any measurable effect on water quality. There are no established standards, tolerances or EPA approved tests for *Bti*.

Product names: Acrobe®, Bactimos® pellets, Teknar® HP-ID, Vectobac® 12AS, Vectobac® G, Vectobac® TP.

Formulations and dosages There are five basic *Bti* formulations available: liquids, powders, granules, pellets, and briquettes. Liquids are produced from a concentrate with a particle size of 2-10 microns which are suitable for mosquito larvae to ingest.

The particle size of powders is not always uniform. Clumping can cause particles to settle and prevent larvae from ingesting the material. Powders must be mixed with water before they are applied. *Bti* granules, pellets, and briquettes are formulated from *Bti* primary powders and an inert carrier. The hazard classification on the label of *Bti* is "CAUTION".

Bti is applied by the LBDHHSVCP as a liquid or sometimes bonded to an inert substrate, e.g., corn cob granules, to assist penetrating vegetation. *Bti* can be applied by hand, ATV, or aircraft and persists in the environment for three to five days. Mosquitoes are usually killed within 48 hours after they ingest *Bti*.

Currently three commercial brands of *Bti* liquids are available: Aquabac® XT, Teknar® HP-D, and Vectobac® 12AS. Labels for all three products recommend using 4 to 16 fl oz/A in unpolluted, low organic water with low populations of early instar. The Aquabac® XT and Vectobac® 12 AS labels also recommend increasing the rate from 16 to 32 fl oz/A when late 3rd or early 4th instar larvae predominate, larval populations are high, water is heavily polluted, and/or algae are abundant. The recommendation to increase dosages in these instances also is seen in various combinations on the labels for all other *Bti* formulations discussed below.

Bti liquid may also be combined with s-methoprene liquid which allows the LBDHHSVCP to use less of each product.

There are currently two popular corncob granule sizes used in commercial formulations. Aquabac® 200 G, Bactimos® G, and Vectobac® G are made with 5/8 grit crushed cob, whereas Aquabac® 200 CG (Custom Granules) and Vectobac® CG are made with 10/14 grit cob. Aquabac® 200 CG is available by special request. The 5/8 grit is much larger and contains fewer granules per pound. The current labels on *Bti* granules recommend using 2.5 to 10 lb./acre in "cleaner" water and 10 to 20 lb./acre in "organic" or polluted waters.

2. *Bacillus sphaericus* (*Bs*)

Advantages: *Bacillus sphaericus* (*Bs*) is a bacterial pesticide with attributes

similar to those of *Bti*. The efficacy of this bacterium is not affected by organic pollution in water. It may establish a natural cycle in habitats with high density of mosquitoes so fewer applications are needed.

Disadvantages: *Bs* must be consumed and is not effective against late 4th instar larvae or pupae. *Bs* is also ineffective against species of mosquitoes that develop in salt marshes, seasonal forest pools, or tree holes. *Bs* is toxic to mosquitoes because of a single toxin rather than a complex as with *Bti*. This more simplistic mechanism makes it easier for mosquitoes to develop resistance, which has been reported in Brazil, Thailand and France where *Bs* was used as the sole control method for extended periods of time.

Solutions to Disadvantages: Information obtained from larval surveillance can help limit its use to sources with susceptible mosquitoes. The development of resistance can be delayed by rotating *Bs* with other larvicides.

Impact on water quality: At the application rates used in mosquito control programs, *Bs* is unlikely to have any measurable effect on water quality. It is a naturally occurring bacterium that is present in most aquatic environments. There are no established standards, tolerances or EPA approved tests for *Bs*.

Product names: Vectolex® CG, Vectolex® WDG

Formulations and dosages Vectolex® CG contains 50 BSITU/mg *(Bacillus sphaericus* International Toxic Units/mg) on a 10/14 mesh ground corn cob carrier. The hazard classification on the label of Vectolex® CG is "CAUTION". It is intended for use in polluted or highly organic source of mosquito larvae such as dairy waste lagoons, sewage lagoons, septic ditches, tires, and storm sewer catch basins. Vectolex®-CG is designed to be applied by hand or truck-mounted blower or aerially at 5-10 lb/acre to control 1st to 3rd instar larvae.

B. Chemical Pesticides

S-Methoprene (larvacide)

Advantages: S-methoprene is a larvicide that mimics a growth regulator of insects. It can be applied as a liquid or solid or combined with *Bti* or *Bs*. S-methoprene is effective in integrated vector management strategies since larvae remain available as prey. It breaks down quickly in sunlight and in a liquid formulation is effective for only 24 hours. S-methoprene can be impregnated into charcoal-based carriers such as pellets and briquettes for longer residual activity ranging from 30 to 150 days. The different formulations provide options for treatment under a wide range of environmental conditions. S-methoprene is nontoxic to all vertebrates and most invertebrates at concentrations used to control mosquitoes.

Disadvantages: S-methoprene is effective against mosquito larvae.

Monitoring for effectiveness is difficult since mortality is delayed. S-methoprene is more expensive than most other larvicides and cannot be used in vernal pools and certain aquatic habitats.

Solutions to Disadvantages: Surveillance and monitoring can determine which stage of mosquito larvae are present so that applications can be timed to maximize their efficacy.

Impact on Water Quality: S-methoprene does not significantly impact water quality. It is effective against mosquitoes at levels that cannot be detected by any currently available test. Studies on non-target organisms have shown that methoprene is non-toxic to all vertebrates and most invertebrates when exposed to concentrations used to control mosquitoes.

Product Names: Altosid® Liquid Larvicide, Altosid® Single Brood Granule, Altosid® Pellets, Altosid® Briquettes, Altosid® XR Extended Release Briquettes

Formulations and dosages: S-methoprene has a half-life of about 48 hours in water and plants and ten days in soil. Various formulations maintain an effective level of active material (0.5-3.0 parts per billion) in the mosquito habitat which minimizes the cost and impact of repeated applications. Currently, five formulations of s-methoprene are sold under the trade name of Altosid®: Altosid® Liquid Larvicide (ALL) and Altosid® Liquid Larvicide Concentrate, Altosid® Briquettes, Altosid® XR Briquettes, and Altosid® Pellets. The hazard classification on the label of s-methoprene is "CAUTION".

Altosid® Liquid Larvicide (ALL) & ALL Concentrate are microencapsulated liquid formulations that differ in their concentrations of active ingredients (AI). ALL contains 5% (wt/wt) s-methoprene; ALL Concentrate contains 20% (wt/wt) s-methoprene. Inert ingredients encapsulate the s-methoprene which allows it to be released slowly and prevents it from being degraded by ultraviolet light.

The maximum rate they can be applied is 0.0125 lb. AI (4 fl oz ALL and 1 fl oz ALL Concentrate per A mixed in water and dispensed by spraying with conventional ground and aerial equipment). In sites with a mean depth of one foot, this is equivalent to a maximum concentration of 4.8 ppb. The actual concentration is substantially lower because the encapsulation does not allow the active ingredient to disperse instantly into the water.

Cold, cloudy weather and cool water slow the release and degradation of the active ingredient as well as the development of the mosquito larvae.

Altosid® Briquettes contain 4.125% s-methoprene (0.000458 lb. AI/briquette, 4.125% (wt/wt)), plaster (calcium sulfate), and charcoal. Briquettes release s-methoprene for about 30 days under normal weather conditions. The recommended application rate is 1 briquette per 100 sq ft in non-flowing or

low-flowing water up to 2 feet deep. Typical treatment sites may include storm drains, catch basins, ornamental ponds and fountains, waste treatment and settlement ponds, transformer vaults, abandoned swimming pools, and construction and other man-made depressions.

Altosid® XR Briquettes consist of 2.1% (wt/wt) s-methoprene (0.00145 lb AI/briquette) embedded in hard dental plaster (calcium sulfate) and charcoal. XR Briquettes contain three times more AI as the "30-day briquette". The harder plaster and larger size allow sustained release for up to 150 days in normal weather. The recommended application rate is 1 to 2 briquettes per 200 sq. ft. in no- or low-flow water conditions, depending on the target species. Many applications are similar to those with the smaller briquettes, although the longer duration s-methoprene is released makes this formulation economical in sources like small swamps and marshes and beds of aquatic vegetation.

Altosid® Pellets contain 4.25% (wt/wt) s-methoprene (0.04 lb. AI/lb.), dental plaster (calcium sulfate), and charcoal in a small, hard pellet. They slowly release s-methoprene as they erode. In normal weather, this can occur for up to 30 days of being constantly submerged. Application rates range from 2.5 lbs to 10.0 lbs per A (0.1 to 0.4 lb. AI/A), depending on the target species and/or habitat. At maximum rates, the slow release of material means that the concentration of active ingredient in the water at one point never exceeds a few parts per billion.

The target species are the same as those listed for the briquette and liquid formulations. Target sites include pastures, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, woodland pools, flood plains, tires and other artificial water holding containers, dredge spoil sites, waste treatment ponds, ditches, and other man-made depressions, ornamental pond and fountains, flooded crypts, transformer vaults, abandoned swimming pools, construction and other man-made depressions, tree holes, storm drains, catch basins, and waste water treatment settling ponds.

Altosid® XR-G Granules contain 1.5% (wt/wt) s-methoprene. They are designed to slowly release s-methoprene as they erode. In normal weather, control lasts up to 21 days. Label application rates range from 5 to 20 lbs per A, depending on the target species and/or habitat. The species are the same as listed for the briquette formulations. Listed target sites include meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, woodland pools, tires and other artificial water holding containers, dredge spoil sites, waste treatment ponds, ditches, and other natural and man-made depressions.

Pyrethroids (adulticides)

Adulticiding (aerial or ground) ULV aerosol control is rarely used by LBDHHSVCP to control adult mosquitoes.

This program is concerned with environmental and residential impact of applying aerial or ground ULV aerosols in this urban environment.

LBDHHSVCP will initiate adult mosquito control when action levels or thresholds are reached or exceeded. Thresholds are based on local sampling of the adult mosquito population or when the risk of mosquito borne disease increases above levels established by this Program, often following guidelines established in the California Mosquito borne Virus Surveillance and Response Plan.

Advantages: Aerial and ground adulticiding is a very effective technique for controlling most mosquito species in most areas economically and with negligible non target effects. It is the methodology normally recognized by most mosquito control programs in California.

Disadvantages: Any mosquito adulticiding activity that does not follow reasonable guidelines including timing of application, avoiding sensitive areas, and strict adherence to the pesticide label, risks affecting non-target insect species and other animals.

Impact on Water Quality: These products should not be applied over permanent streams, lakes, rivers, natural ponds, commercial fish ponds, swamps, marshes, estuaries or waters of the US.

Formulations and Dosages: ULV aerosols do not require large amounts of diluents for application and are therefore much cheaper, and may be environmentally safer. The material is handled and transported in a concentrated form. The droplet spectrum is rather wide (sub-micron to aprox 50 microns in diameter) can be difficult to change and may settle into non-target areas more readily than other types of sprays.

C. Surfactants

Surfactants are either petroleum (GB-1111) or alcohol (Agnique® MMF) based and forms a thin layer on the water surface that kill mosquito larvae by suffocating them.

Advantages: These are the only materials that kill mosquito pupae. Agnique® forms a monomolecular film that is not visible. The spreading action of the surfactant across the water surface can carry it to inaccessible areas. Agnique® is labeled "safe for use" in drinking water.

Disadvantages to Use: Surfactants are indiscriminate, and may also affect aquatic predators of mosquitoes if they are present. GB-1111 forms a visible film on the water surface.

Solutions to Disadvantages: Surfactants are used when mosquito pupae are present and when there is no other alternative available.

Product Names: GB-1111, Agnique® MMF

Formulations and dosages

GB-1111 is highly refined oil that evaporates with 24-48 hours. This material is classified as "non-volatile". The hazard classification on the label of GB-1111 is "CAUTION". It contains 99% (wt/wt) oil and 1% (wt/wt) inert ingredients. The dosage rate is 3 gallons per acre or less for clean water. Up to 5 gallons per acre may be used when treating areas with high organic content.

GB-1111 provides effective control on a wide range of mosquito species. It is typically applied by hand, ATV, or truck.

Agnique® MMF is the trade name for a surface film larvicide made of ethoxylated alcohol. The hazard classification on the label of Agnique® MMF is "CAUTION". According to the label, Agnique® MMF has very low vertebrate toxicity; an average persistence in the environment of 5-14 days at label application rates; and no toxic breakdown products, skin irritation, carcinogenicity, mutagenicity, or teratogenicity has been reported. Because of its similar mode of action and effectiveness against pupae, Agnique® can be used as an alternative to GB-1111, especially where the temporary sheen associated with GB-1111 might be objectionable.

Assessment of Existing or Potential Impact of Pesticides Used by the LBDHHSVCP

Mosquito control is perpetual since the goal is to manage, not eradicate mosquito populations. Sources of larvae are inspected continuously and treatments are applied as necessary to maintain public health. The materials used by the LBDHHSVCP to control mosquitoes are applied at extremely low dosages and are not known to have measurable impacts on water quality. The existing water quality however influences what materials are used and how effective they are.

Physical control (manipulation of drainage, flow etc.) enhances water circulation which

directly reduces mosquito populations while improving habitat for natural predators of mosquito larvae. Limiting the time water stands makes it impossible for mosquito larvae to develop into adults.

The BMPs used by the LBDHHSVCP to control mosquitoes attempt to eliminate the impacts to water quality which NPDES permits monitor. These include:

Dissolved oxygen: Materials used in mosquito control are applied at volumes of several ounces (s-methoprene) to less than 10 gallons (surfactants) of active ingredient per acre. Measurable effects on dissolved oxygen at these dosage rates are extremely unlikely.

Temperature: Materials used in mosquito control are generally applied at or near ambient temperature; any affect on water temperature is unlikely.

pH: Materials used to control mosquito larvae are neither strongly acidic or basic. Measurable effects on pH are unlikely.

Turbidity: Existing turbidity at a source of mosquitoes may influence which materials are selected and how effective they are. At the application rates used in our programs, measurable effects on turbidity are unlikely.

Hardness: Materials used in mosquito control do not have a high mineral content. At the dosage rates used in mosquito control measurable effects on water hardness are unlikely.

Electrical conductivity: Materials used in mosquito control do not have high concentrations of chlorides or other ions. At the dosage rates used in mosquito control measurable effects on conductivity are unlikely.

Pesticide residues: Materials used by LBDHHSVCP degrade quickly in the environment. Slow-release formulations of s-methoprene are specifically designed to be released in small amounts of active ingredient over time, and *Bacillus sphaericus* may establish natural cycles under favorable conditions. There are currently no EPA-approved laboratories or protocols for detecting residues of larvicides we use. Monitoring populations of mosquito larvae (which is one of our BMPs) is the most sensitive method for determining whether residual larvicides are present.

Evaluation of the Long Beach Department of Health and Human Services Vector Control Program Best Management Practices (BMPs)

Pesticides are only one of the LBDHHSVCP's BMPs that incorporate physical and biological means to control and continuously monitor mosquito populations. Each BMP is summarized below.

Physical Control and Water Management

Cost: High. Requires specialized equipment and expertise, and is labor intensive.

Disadvantages: High cost; potentially disturbing habitats of endangered species; potentially disturbing regulated wetlands; extensive permitting process.

Solutions to Disadvantages: Require landowners to monitor and maintain property to prevent mosquitoes from breeding.

Relative usefulness: Used whenever possible because it is a permanent solution. Biological or chemical control is used if physical control is not feasible or while working toward a solution based on physical control.

Biological control

Mosquito fish

Cost: Low

Disadvantages: Non-native fish may compete with native species in natural sources

Solutions to Disadvantages: Use only where impact to native species is minimal

Relative usefulness: Can be effective in specific conditions, i.e., if a source is suitable and physical or chemical control is not feasible or applicable

Bacterial pesticides

Bacillus sphaericus* and *B. thuringiensis* var. *israelensis

Cost: More expensive than traditional chemical pesticides but less costly than physical control.

Disadvantages: Requires careful monitoring of mosquito populations and knowledge of their ecology. Not effective against some species or some stages or in some sources. Short duration of control; requires frequent re-

treatments. Relying on a single product may cause mosquitoes to become resistant.

Solutions to Disadvantages: Surveillance of mosquitoes; appropriate training for LBDHHSVCP staff; rotating products, investigating new materials

Relative usefulness: These agents are considered when physical control is not acceptable and fish cannot be stocked or maintained. These agents can be used together with fish.

Chemical Control using s-methoprene and surfactants

Cost: Less costly in the short term than physical control

Disadvantages: Requires careful monitoring of mosquito populations and knowledge of their ecology. Not effective against some species or some stages or in some sources. Short duration of control; requires frequent re-treatments. Relying solely on s-methoprene may cause mosquitoes to become resistant.

Solutions to Disadvantages: Surveillance of mosquitoes, appropriate training for LBDHHSVCP staff, rotating products, investigating new materials

Relative usefulness: These materials are considered when physical control is unacceptable and fish cannot be stocked or maintained. S-methoprene and Agnique® can each be used with fish. Decisions on whether to use these materials or bacterial pesticides are based on stage and species of mosquitoes present, quality of water, and access.

Training and Certification

Section 116180 of the California Health and Safety Code allows California Department of Public Health (CDPH) to "enter into a cooperative agreement with any local district or other public agency engaged in the work of controlling mosquitoes, gnats, flies, other insects, rodents, or other vectors and pests of public health importance, in areas and under terms, conditions and specifications as the director may prescribe."

The LBDHHSVCP has signed a cooperative agreement with DHS. The LBDHHSVCP agrees to:

1) Calibrate all application equipment using acceptable techniques before using, and to maintain calibration records for review by the County Agricultural Commissioner.

2) Calibrate at least annually all equipment used by the Program.

3) Maintain copies of calibration records at the Health Department.

4) Maintain for at least two years for review by the County Agricultural Commissioner a record of each pesticide application showing the target vector, the specific location treated, the size of the source, the formulations and amount of pesticide used, the method and equipment used, the type of habitat treated, the date of the application, and the name of the applicator(s).

5) Submit to the County Agricultural Commissioner each month a Pesticide Use Report on Department of Pesticide Regulation form PR-ENF-010. The report shall include the manufacturer and product name, the registration number from the label, the amount of each pesticide, the number of applications of each pesticide, and the total number of applications, per county, per month.

6) Report to the County Agricultural Commissioner and the Department of Health Services any conspicuous or suspected adverse effects upon humans, domestic animals and other non-target organisms, or property from pesticide applications.

7) Require employees to be properly certified by the California Department of Public Health to apply pesticides to control vectors, and maintain records that document certified employees receive a minimum of 20 hours of continuing education hours every two years.

8) Receive regular inspections by the County Agricultural Commissioner to ensure compliance with state laws and regulations relating to pesticide use.

TABLE 1. Species of mosquitoes found by The Long Beach Department of Health and Human Services Vector Control Program

Aedes melanimon
Aedes sierrensis

Anopheles franciscanus
Anopheles hermsi

Culex erythrothorax
Culex pipiens quinquefasciatus
Culex restuans
Culex stigmatosoma
Culex tarsalis
Culex thriambus

Culiseta incidens
Culiseta inornata
Culiseta particeps

TABLE 2. Annual aquatic pesticide usage by the LBDHHSVCP 2007-2009

Pesticide	2007	2008	2009	2010
Altosid Liquid Larvicide(oz.)	219.5	32.5		
Altosid Pellets (lb)	16.2			
Altosid Briquettes (lb)	22.58			
Altosid XR briquettes (lb)		2.55	.3	
Altosid SBG (lb)		3		
GB-1111 (gal)	255	129.58	20.2	30.5
Vectobac 12AS (gal)	9.31	3.75		
Vectolex CG (lb) Biomist 4 + 12 ULV	73	212	82.1	140 1.5 gal