

LAKE SAN MARCOS

PESTICIDE APPLICATION PLAN

Prepared on Behalf of:

Citizens Development Corporation
1105 La Bonita Drive
San Marcos, California 92078

Prepared in support of Coverage Under:

GENERAL PERMIT NO. CAG990004
STATEWIDE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
(NPDES) PERMIT FOR BIOLOGICAL AND RESIDUAL PESTICIDE DISCHARGES TO
WATERS OF THE UNITED STATES FROM VECTOR CONTROL APPLICATIONS
(WATER QUALITY ORDER 2016-0039-DWQ)

Submitted to:

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I. Introduction

This Pesticide Application Plan (PAP) has been prepared in compliance with the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Biological and Residual Pesticide Discharges to Waters of the United States from Vector Control Applications (Permit) (State Water Resources Control Board [SWRCB] 2016). Amongst the provisions of the Permit is the submission of a PAP, and this document is a comprehensive plan that identifies the setting, approach, monitoring, and reporting for use of aquatic pesticides at Lake San Marcos (Lake), San Diego County, California. The text of the Permit is included as Appendix A.

An immediate action in the planning stages is the application of pesticide for the purposes of treating nuisance aquatic insects. This proposed effort is unrelated to ongoing remediation of the lake for nutrient impairments (see below) being undertaken in close coordination with the Regional Board.

From a more general perspective, the use of pesticides is considered a tool within a larger set of lake management practices. The Lake owner, Citizens Development Corporation (CDC), has undertaken to manage the Lake environment in order to promote and maintain the beneficial uses of the Lake. This Plan includes descriptions of the Lake environment, a description of nuisance conditions present at the Lake, important management of Lake resources, the decision process for how the use of pesticides will be implemented, and the monitoring and reporting of the use of approved pesticides.

An inherent part of the activities covered by this Plan will be establishing a balance between impairing natural resources and managing the Lake environment with products designed to treat nuisance conditions. CDC recognizes that the nuisance conditions are seasonal in nature and that the appropriate use of pesticides will require ongoing assessment of parameters such as water temperature, biological conditions, and seasonal progression (and senescence) of pests. This Plan seeks to describe how CDC will establish a balanced approach and be a responsible steward of state water resources.

1.1. Lake Setting

Lake San Marcos lies within a developed unincorporated area of northern San Diego County. The Lake is a finger lake running north to south with several embayments on either side of the upper part of the Lake (Figure 1). The Lake is a recreational resource valued by boaters, the sport fishing community, guests, and area residents. The Lake is used as a source of irrigation water for an adjacent golf course; withdrawal is balanced by replenishment with groundwater.

The upper approximately two-thirds of the lake is developed, and the margins of the lake consist of landscaped grounds or armored shorelines. Many residences along the margin of the lake include boat docks (typically with pontoon or duffy boats), and the

Figure 1. Bathymetry of Lake San Marcos (2012)



hotel complex on the eastern shoreline includes a boat marina. In contrast to the upper Lake, the lower two-thirds of the Lake lies in a steep canyon and is bounded by chaparral-vegetated slopes. The dam is located at the southern end of the Lake. When full, the Lake is 56 acres in area and holds approximately 509 acre-feet of water (DBSA 2016). The historical average sedimentation rate estimated based on available bathymetric surveys (e.g., Ball, 1974; Tierra Data 2013) is around 2 cm/year.

The Lake is located at the southern boundary of the Richland Hydrologic Subarea within the San Marcos Hydrologic Area of the Carlsbad Hydrologic Unit in northern San Diego County, and is an impoundment of San Marcos Creek (Creek). The Creek drains a watershed of approximately 18,540 acres (DBSA 2016). The watershed area drains into the Lake at uneven rates throughout the year: during the summer the Creek can run dry for several months, while in the winter there is a base flow which increases significantly during storm events (DBSA 2016).

1.2. Overview of the Regulatory History

The Lake is regulated by two state agencies. The SWRCB regulates water rights issues related to diversion of San Marcos Creek waters by the dam. The Regional Water Quality Control Board (RWQCB) oversees issues related to water quality throughout the watershed, including the Lake. Water rights have been granted to CDC by the state and are the subject of an ongoing process to update CDC's license.

Several beneficial uses have been designated for Lake San Marcos including: Agricultural Supply (AGR) (i.e., irrigation), Human Health (Contact Water Recreation [REC-1]), Non-Contact Water Recreation (REC-2), Aquatic Dependent Wildlife (Support Warm Water Ecosystems (WARM), and Wildlife Habitat (WILD). The Richland hydrologic subarea (904.52), in which the Lake lies, has been exempted from municipal and domestic supply (MUN) uses, and is therefore not subject to drinking water standards.

The RWQCB is also responsible for determining how the beneficial uses are impaired by pollution under the CWA, and has recommended the Lake be listed for several impairments under CWA Section 303(d). Water quality standards used to determine impairment have been designated in the San Diego Region Basin Plan (Basin Plan, RWQCB 1994). The Lake has been listed as impaired for ammonia as nitrogen and for nutrients (RWQCB 2009), but the 2014 updates to the 303(d) list adopted by the RWQCB also include phosphorus and copper (RWQCB 2016) (Note: although the 2016 report has been approved by the RWQCB, it has not been approved by either the SWRCB nor the U.S. Environmental Protection Agency [EPA], and the report therefore retains draft status). Impairments of the Lake are summarized in Table I.

The Lake is subject to the *Water Quality Control Plan for the San Diego Basin* (Basin Plan) narrative objectives, which directs prevention of "plant nuisances" (Regional Water Quality Control Board [RWQCB] 1994). The RWQCB has issued two documents to encourage progress on finding a remedy. The first was the Investigative Order R9-2011-0033 (Investigative Order), which directed CDC to monitor the lake, evaluate the resulting data, and develop recommendations to address eutrophic conditions. These goals have

been accomplished and documented in the *Remedial Investigation/Feasibility Study Report, Upper San Marcos Creek Watershed and Lake San Marcos (RIFS)* (DBSA 2016).

In 2017, the RB adopted Resolution R9-2017-0038, “A Resolution Supporting a Path Forward for Nutrient Load Reductions in Lake San Marcos and the San Marcos Creek Watershed.” CDC continues to work with the upstream municipal parties (Cities of Escondido and San Marcos, County of San Diego, and Vallecitos Water District) on that path.

The nutrient impairments listed in Table I are consistent with the general eutrophic conditions observed at the Lake, and may contribute to nuisance insect issues at the Lake. Water quality nutrient impairments at the Lake are being addressed through the RIFS process referenced above; several remedies have been identified at the Lake (and in the Watershed) and are in the planning and/or pilot stages.

RIFS-remedies are designed to specifically address water quality conditions (DBSA 2016). Measures included in this Plan are distinct from the RIFS-remedies and will be tools to address midge or mosquito populations.

Table I. Lake San Marcos Listings under CWA 303(d)

Constituent	Criterion	Listing Date	Listing Type
Ammonia (as Nitrogen)	0.025 mg/L (as Nitrogen), unionized	2006	2014 Water Quality Limited Segment
Nutrients	Narrative	2006	2014 Water Quality Limited Segment
Phosphorus	0.025 mg/L ¹	2006	2014 Water Quality Limited Segment
Copper	3.1 ug/L (CCC) ²	2014	Proposed New Listing
Phosphorus	0.025 mg/L ¹	2014	Proposed New Listing

¹ Concentration not to be exceeded more than 10 percent of the time.

² Criterion derived from the California Toxics Rule per Basin Plan (RB 2016); value presented is not hardness-corrected; CCC - criterion continuous concentration.

mg/L – milligrams per liter

ug/L – micrograms per liter

2. Target Areas

The Lake is understood to have exhibited nuisance conditions due to hospitable conditions throughout the Lake. These conditions typically arise in the late spring as water warms, at which time the adult phases of the insects develop into their respective non-aquatic flying forms. These conditions have historically arisen to the nuisance level as reported by residents and guests throughout the Lake. Therefore, the target area is the entire lake.

3. Selection of Pesticides for Vector Control

Fish populations have historically been robust and are presumably applying feeding pressure on insect populations. However, predation by fish has typically not resulted in an observable effect on target populations; the nuisance threshold is exceeded on a predictable annual basis.

Selection of the pesticide will be chosen based on:

- Seasonal progression of seasonally favorable conditions for nuisance conditions (e.g., warm water);
- Observations of target species (larval or adult life stages);
- Evaluation of habitat areas which support sufficient natural predators for control of nuisance conditions; and
- Likelihood of a specific pesticide (biological or non-biological) or application method to have an affect on target species.

Historical experience with pesticides, conditions at specific application areas (if applicable, e.g., subareas of the Lake), and prior success with various pesticide formulations and application techniques will also be considered.

4. Pesticides to be Used at Lake San Marcos

Application of pesticides at Lake San Marcos will be undertaken using the primary best management practices (BMPs) included in Section G of the Order: (1) that the area and duration of impacts caused by the discharge of biological and residual pesticides be minimized; and (2) that the treatment will allow for restoration of water quality and protection of beneficial uses of the receiving waters to pre-application quality following completion of an application event. An application schedule and notifications will be undertaken in compliance with provisions of Section VIII of the Permit.

Pesticides included in this plan area detailed in Table 2. Applications may be undertaken by hand, from a vessel, or with the use of a backpack system consistent with label directions.

• *Table 2. Pesticides Covered by this Plan*

Pesticide (Active Ingredient)	Trade Product Name	EPA Registration No.	Method of Application
<i>Bacillus sphaericus</i>	Spheratax VectoLex (various formulations)	84268-2, 73049-20, 73049-57	Liquid or Granular Application
<i>Bacillus thuringiensis</i> , subspecies <i>israelensis</i>	Aquabac, Vectobac (various formulations)	62637-3, 73049-10, 73049-38	Liquid or Granular Application
<i>Bacillus sphaericus</i> and <i>Bacillus thuringiensis</i> , subspecies <i>israelensis</i>	VectoMax (various formulations)	73049-429	Pouch or Granular Application
EcoVia EC	<i>Botanical Insecticide, Generic</i>	EPA-Exempt	Liquid Application
(S)-Methoprene	Altosid (various formulations)	2724-451, 2724-448, 2724-392 2724-446	Liquid or Granular Application

5. Application Areas

The Lake includes several subareas that may be treated differentially based on conditions, type of pesticide, and application method; subareas include:

- Shallow basins in the northernmost portion of the Lake and/or the side embayments/malls;
- Shallow areas along the shoreline of the Lake;
- Areas protected from or exposed to wind due to position on the lake (i.e, with prevailing wind from the west/southwest;
- Open water areas in the north-central portion of the Lake; and
- Open water deep areas of the Lake in the south.

Under this plan, all areas of the Lake shown in Figure I will be subject to appropriate pesticide application.

6. Other Control Methods

Lake San Marcos is currently managed as a catch-and-release fishery. As stated above, the fishery is robust and likely predating on pests. However, this predation pressure is insufficient to manage the incidence of nuisance pests. Modification of the fishery to the extent that control might be achieved is not a feasible strategy due to conflicts with a variety of current beneficial uses.

Physical controls, such as lowering the water level of the lake through water balance management (draw down), may have the benefit of drying habitat areas along the margins of the Lake and temporarily reducing suitable habitat, but pest habitat would then shift downslope and nuisance control objective not achieved. In addition, draw down would likely result in visual and odor aesthetic issues, and potentially affect lakeshore habitat values in the lower lake. Lake draw down is not a viable control strategy.

Tracking the incidence of pests will be key to their management. The Lake will be monitored for the conditions likely to promote pest populations. This control measure will ensure that pesticides are not applied during (1) times not conducive to pests (seasonally, generally November through March), (2) areas not conducive to promoting pest populations (e.g., actively flowing waters), or (3) areas deemed inhospitable to pests (e.g., areas with active fish predation, or observations indicating a lack of pests).

Additional measures may be undertaken in the surrounding areas to mitigate incidence of pests (e.g., use of EcoVia EC, a botanical oil-based product exempted by EPA [Table 2]). However, non-aquatic applications are outside of the scope of the Permit.

Judicious use of outdoor lighting at night may address some nuisance conditions due to their attractive effect; however, maintaining darkness in areas where nuisance conditions are present would not reduce the insect population, but simply encourage an even spatial distribution. Nonetheless, lighting controls may be employed to reduce the level of nuisance.

7. Product Application

Pesticide application doses will be determined using best professional judgment to obtain the desired effect while minimizing application of pesticide. Prior to application, an assessment of the magnitude of nuisance (or potential nuisance for preventative applications) will be undertaken based on seasonal weather, Lake conditions, observations of conditions which may be early season indications of a developing nuisance (e.g., presence of midges or mosquitos below a nuisance threshold). Observations may include reports from residents of surrounding communities or guests at the Lake.

Pesticide label instructions will be used as guidance for determining the magnitude and extent of treatment (but in no instance will label instructions exceeded). As an example, treatment of the Lake with the *Bacillus thuringensis* product Aquabac 200g has used the label recommendations as a basis for determining appropriate treatment levels “for control.” On that basis, up to 10 pounds of product per acre may be applied, and

application of up to 20 pounds of product is the maximum dosage under conditions “when late third and early fourth instar larvae predominate, larval populations are high , or water is heavily polluted and/or algae are prevalent” (from the Aquabac 200g product label).

8. Monitoring Program

Records will be kept by CDC of all pesticide applications to Lake San Marcos. These records shall include the date and location of application; map of application areas; the name of applicator; flow or dosing rate of the target area; and pesticide used, product information, and product concentration data as appropriate. A pesticide application log (Permit Section VIII.E) will be recorded for each application event; and example log is included in Appendix B.

As stated in the Permit (Section VI, B.1.a), microbial pesticides have undergone extensive testing and are registered with the USEPA. USEPA has determined that biological controls do not pose risks to humans or wildlife when applied according to label instructions, and thus are exempt from a receiving water monitoring trigger under this plan.

One non-biological option for treatment is the use of S-methoprene (Table 2). Methoprenes function as insect growth regulators, and rapidly degrade in the environment (EPA 2001). Methoprene is “of low toxicity and poses very little hazard to people and other non-target species,” is “practically non-toxic to terrestrial species including mallard ducks and quail,” and poses “minimal acute and chronic risk to freshwater fish, freshwater invertebrates and estuarine species” (EPA 2001). Receiving water monitoring is not proposed under this plan.

Ingredients included in EcoVia EC (a botanical oil-based insecticide listed in Table 2) is exempt from EPA registration and similarly do not pose a risk to humans or wildlife. Receiving water monitoring is not included in this Plan.

9. Evaluation of BMPs

Best Management Practices for Mosquito Control in California will be used as a source of information and provide guidance for BMPs under this plan.

10. Best Management Practices

Measures to Prevent Pesticide Spills

All pesticide applicators receive annual spill prevention and response training. Applicators will be responsible for ensuring that equipment is in working order, and spill mitigation equipment will accompany pesticides during transport and in storage areas.

Measures to Ensure that a Minimum amount of Pesticide is Applied

Application equipment will be properly calibrated and deployed in a manner which ensures that application rates are consistent with label instructions.

Education Plan

Annual training of applicators will incorporate appropriate application and safety training, and requires accredited continuing education courses.

For public education, CDC maintains an office on site that is staffed and available to answer questions regarding pesticide applications. The office will be responsible for public notification requirements included in the Permit.

Best Management Practices for each Application Mode

Applicators will be responsible for BMP implementation appropriate to the mode of application.

Best Management Practice for Product Type

Product labels will be consulted to ensure that application practices use BMPs to ensure that label instructions are followed.

Environmental Best Management Practices

The lake constitutes a single habitat type, and BMPs will ensure the minimal, efficient, and effective use of pesticides. Weather conditions will be evaluated prior to application events to ensure that high wind or potential rainfall events do not interfere with pesticide applications.

11. Identification of the Problem

Midges are the primary target of this vector control program. Densities of pests which are considered nuisance levels are preempted by the preventative nature of this program, since the primary biological agents target non-nuisance life stages for control. Target areas are focused on shallow marginal areas of the Lake which serve as breeding habitat, but extend into other areas of the Lake depending on conditions. Preventative treatment will rely on institutional knowledge from year to year considerations, and it is anticipated that monitoring data records will serve as a source of information for subsequent annual applications.

12. Examination of Alternatives

As discussed in earlier sections (e.g., Section 6), biological and physical controls are insufficient to control the nuisance condition without the use of pesticides. As discussed above, this program will include undertaking preventative steps to avoid the use of adulticides, track lake conditions to minimize use of pesticides, implement BMPs to ensure the safe application of pesticides at the Lake.

13. Correct Use of Pesticides Statement

CDC coverage under the States NPDES permit will undertake all reasonable precautions to minimize impacts caused by pesticide applications, including using the correct techniques, equipment, and procedures; taking into account weather conditions and the need to protect the environment.

14. Public Notices

CDC maintains an office at Lake San Marcos, and notices of application events and approximate schedules will be posted at that location at minimum. The posting will comply with provisions of Permit Section VIII.B.

15. References

- Citizens Development Corporation. 2012. Lake San Marcos Nutrient Impairments Investigation Workplan. June 2012.
- D. B. Stephens & Associates (DBSA), 2016. Remedial Investigation/Feasibility Study Report, Upper San Marcos Creek Watershed and Lake San Marcos. Prepared for Citizens Development Corporation and Public Agency Defendants. September 30.
- Regional Water Quality Control Board, San Diego Region. 2011. Investigative Order No. R9-2011-0033, For the Investigation of Nutrient Impairment in Lake San Marcos San Diego County. September 14.
- Regional Water Quality Control Board, San Diego Region. 2013a. Order No. R9-2013-0001 NPDES No. CAS0109266. National Pollutant Discharge Elimination System (NPDES) Permit And Waste Discharge Requirements For Discharges From The Municipal Separate Storm Sewer Systems (MS4s) Draining The Watersheds Within The San Diego Region. May 23.
- Regional Water Quality Control Board, San Diego Region. 2017. Resolution No. R9-2017-0038, A Resolution Supporting The Path Forward For Nutrient Load Reductions In Lake San Marcos And The San Marcos Creek Watershed. March 15.
- State Water Resources Control Board. 2016. Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Biological and Residual Pesticide Discharges to Waters of the United States for Vector Control Applications. Water Quality Order No. 2016-0039-DWQ General Permit No. CAG990004. Adopted March 1.
- U.S. Environmental Protection Agency 2001. June 2001 Update of the March 1991 Methoprene R.E.D. Fact Sheet. Pesticide Fact Sheet. June.

APPENDIX A:

**STATEWIDE GENERAL NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM (NPDES) PERMIT
FOR BIOLOGICAL AND RESIDUAL PESTICIDE DISCHARGES
TO WATERS OF THE UNITED STATES
FOR VECTOR CONTROL APPLICATIONS.**

**WATER QUALITY ORDER NO. 2016-0039-DWQ
GENERAL PERMIT NO. CAG990004.**

[PLACEHOLDER, TO BE INCLUDED IN PERMITTEE COPY]

APPENDIX B:
FIELD APPLICATION LOG

LAKE SAN MARCOS PESTICIDE APPLICATION PLAN

	YEAR:
<i>EVENT LOG / INFORMATION</i>	
<i>DATE of Application:</i>	
<i>Applicator NAME:</i>	
<i>Start time:</i>	<i>End Time:</i>
<i>APPLICATION INFORMATION</i>	
<i>Application Area (General)</i>	
<i>Application Product:</i>	
Describe dosage and method of application (include flow rate, target surface water area, and volume of water treated as applicable):	Include map showing vicinity of lake treated, the target treatment area, and the application area, with the date of application and the active ingredient applied
<i>Visual Monitoring Assessment (Lake Conditions):</i>	
<i>PAP CERTIFICATION:</i>	
I, _____ (print clearly) certify that the PAP has been followed.	
Signed:	