FINAL

MITIGATED NEGATIVE DECLARATION

THE INTEGRATED MOSQUITO MANAGEMENT PROGRAM

OF THE NAPA COUNTY MOSQUITO ABATEMENT DISTRICT

Napa County Mosquito Abatement District
P.O. Box 655
Napa, CA 94559
October 1999

INTEGRATED MOSQUITO MANAGEMENT PROGRAM

INTRODUCTION

This document is a Draft Mitigated Negative Declaration and Initial Study for the Integrated Mosquito Management Program of the Napa County Mosquito Abatement District (District), prepared by the District in accordance with Section 15162 of California Environmental Quality Act (CEQA) Guidelines. This document contains the following:

Draft Mitigated Negative Declaration. The Draft Mitigated Negative Declaration briefly summarizes and states the conclusions of the Initial Study (Part III), including potential impacts and mitigation measures to insure non-significance. Because the Project avoids significant impacts or includes measures that reduce potential impacts to levels of non-significance, the determination has been made that a Mitigated Negative Declaration is the appropriate document.

Initial Study. This portion of the document is organized with the following sections:

1. The Lead Agency's Determination, which is the statement of the overall significance of the Project's impacts and the identification of the appropriate environmental review document.

2. Environmental Checklist Form, which provides specific information about the Project's purpose and scope, the specific Project activities, actions taken by the District to keep potential environmental impacts of the Project at non-significant levels, and other required approvals.

3. Evaluation of Environmental Impacts, which contains the standard checklist where each environmental issue is defined, impacts are assessed, and determination is made of the level of significance of each potential impact. Explanations in support of the conclusions are also provided.

4. Detailed Technical Review of the Project, which contains narrative description of the Project Impact Area and Project activities, focusing on potential environmental impacts of Project activities and on the policies and practices adopted to ensure that impacts are not significant.

5. References cited or used in preparation of this Study.

6. Appendix. The District's Preliminary CEQA Review.

Comments regarding this report should be addressed to

Mr. Wesley A. Maffei
Manager
Napa County Mosquito Abatement District
P.O. Box 655
Napa, CA 94559

DRAFT MITIGATED NEGATIVE DECLARATION

Napa County Mosquito Abatement District
August 27, 1999

Project Title: **INTEGRATED MOSQUITO MANAGEMENT PROGRAM**

Project Proponent: **NAPA COUNTY MOSQUITO ABATEMENT DISTRICT**

Project Location: The whole of Napa County. In addition, the District periodically cooperates with adjoining Mosquito & Vector Control Districts and/or County and State Health Departments on activities that cross normal District boundaries; in these situations, the District or Department with jurisdiction over the locations where specific activities are performed has primary responsibility for these activities.

Project Description: The Integrated Mosquito Management Program of the Napa County Mosquito Abatement District is a long-standing, ongoing program of surveillance and control of mosquitoes. The program consists of six types of activities: 1) **Surveillance** for mosquito populations, mosquito habitats, disease pathogens, and public distress associated with mosquitoes; this includes trapping and laboratory analysis of mosquitoes to evaluate populations and disease threats, direct visual inspection of known or suspected mosquito habitats, the use of all-terrain vehicles, maintenance of paths, and public surveys; 2) Public **Education** to encourage and assist reduction or prevention of mosquito habitats on private and public property; 3) Management of mosquito habitat, especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities, etc. (**"Physical Control"**); 4) Applications of herbicides and other forms of **Vegetation Management** to improve surveillance or reduce mosquito populations; 5) Applications of the "mosquito fish" *Gambusia affinis*, the bacterium *Bacillus sphaericus*, the fungus *Lagenidium giganteum*, and possibly other predators and pathogens of mosquitoes (**"Biological Control"**); and 6) Application of non-persistent selective insecticides to reduce populations of larval or adult mosquitoes (**"Chemical Control"**).

General Plans: All Designations (Heavy Industry, Open Space, Parks, Residential, Commercial, Agricultural, etc.)

Zoning: All Zoning Districts

Potential Environmental Impacts and Mitigation: Because of the nature of the project activities, the District's Integrated Mosquito Management Program does not and could not cause significant impacts to aesthetics, agricultural resources, land use and planning, mineral resources, population and housing, public services, recreation, transportation and traffic, or utilities and service systems. In addition, district policies and the limited scale and frequency of project activities ensure that no significant impacts occur regarding air quality, cultural resources, geology and soil, hydrology and water quality, or noise.

The Project includes controls (District policies and practices) to minimize potential impacts to biological resources and hazards and hazardous materials, which could include:

1. Disturbance to natural communities or plants or animals, including special status species, associated with use of all-terrain vehicles, helicopters, and/or boats on and near wetlands;
2. Non-target pesticide impacts on plants or animals, including special status species;
3. Impacts to special status species by mosquito fish in the environment; and
4. Disturbance to and potential release of previously unknown sediment contaminants during physical control activities.

Established District policies require mosquito surveillance and the use of treatment criteria prior to chemical, biological, or physical control; monitoring and reporting of activities to appropriate agencies; and other measures to minimize potential environmental impacts. Additional mitigation measures to ensure that these potential impacts remain insignificant will include:

1. Maintenance of up-to-date maps and other information from the California Department of Fish and Game Natural Diversity Data Base and other reliable sources on the location of Special Status Species and designated Natural Communities in the Project Service Area;
2. Coordination of District activities with approved Habitat Conservation Plans and Endangered Species Recovery Plans;
3. Adoption of new policies as needed and provision of continuing training to field personnel to ensure minimization of specific mosquito control activities and/or the use of alternative mosquito control methods at times and in places where those specific mosquito control activities might otherwise significantly impact Special Status Species or designated Natural Communities; and
4. Review of agency lists for potential hazards (contaminated soils) prior to implementation of minor physical control projects in historically industrial zones; and additional, site-specific CEQA review prior to implementation of source reduction projects which might result in discharge of hazardous materials into the environment.

District Determination: In accordance with District policies regarding implementation of the California Environmental Quality Act (CEQA) and the CEQA Guidelines, the District conducted a Preliminary Review of its activities in early 1999 and concluded that all administrative, support, educational, and emergency activities were exempt from further CEQA review. Because some elements of the Integrated Mosquito Management Program are not clearly exempt from further CEQA review, the District has conducted an Initial Study to determine whether the District's Integrated Mosquito Management Program may have a significant effect on the environment. On the basis of that study the District hereby finds:

> *Although the on-going project could have a significant adverse effect on the environment, there is no significant adverse effect in this case because the mitigation measures described in the accompanying pages reduce impacts to insignificant levels or eliminate them. A Mitigated Negative Declaration is therefore the appropriate CEQA document for this Project.*

The environmental document that justifies the Mitigated Negative Declaration and provides the basis for this determination is the Initial Study, which is attached and hereby made part of this document.

PART III

CEQA INITIAL STUDY OF ENVIRONMENTAL IMPACTS

Napa County Mosquito Abatement District
August 30, 1999

Project Title: INTEGRATED MOSQUITO MANAGEMENT PROGRAM

SECTION 1. CEQA DETERMINATION

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

	Aesthetics		Agricultural Resources		Air Quality
	Biological Resources		Cultural Resources		Geology / Soils
	Hazards & Hazardous Materials		Hydrology / Water Quality		Land Use / Planning
	Mineral Resources		Noise		Population / Housing
	Public Services		Recreation		Transportation / Traffic
	Utilities / Service Systems		Mandatory Findings of Significance		

DETERMINATION. (To be completed by the Lead Agency.)

On the basis of this initial evaluation:

X **I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.**

Wesley A. Maffei
Signature

31 Aug 1999
Date

Wesley A. Maffei, Manager
Printed Name

Napa County Mosquito Abatement District
For

SECTION 2. ENVIRONMENTAL CHECKLIST FORM

This document is an Initial Study of the potential environmental impacts of the Integrated Mosquito Management (IMM) Program of the Napa County Mosquito Abatement District (District). This Initial Study was prepared pursuant to the California Environmental Quality Act (CEQA) of 1970, as amended, and in accordance with the CEQA Guidelines. The primary purpose of the Initial Study is to determine and document whether the ongoing activities have a significant or potentially significant effect on the environment.

2.1 PROJECT TITLE:

THE INTEGRATED MOSQUITO MANAGEMENT PROGRAM OF THE NAPA COUNTY MOSQUITO ABATEMENT DISTRICT

2.2 LEAD AGENCY NAME AND ADDRESS:

Napa County Mosquito Abatement District
P.O. Box 655
Napa, CA 94559

2.3 CONTACT PERSON AND PHONE NUMBER:

Wesley A. Maffei
Manager
(707) 258-6044

2.4 PROJECT LOCATION:

All areas contained within Napa County, California. In addition, the District can take action in bordering areas of Solano County, Sonoma County, Yolo County, or Lake County if needed to provide control of mosquitoes for residents of Napa County [Cal. Health & Safety Code Section 2270]. Areas actually or potentially impacted by the Project include:

1. The incorporated cities of American Canyon, Calistoga, Napa, St. Helena, and the Town of Yountville;
2. The unincorporated areas of Napa County; and
3. Other bordering areas in Solano, Sonoma, Yolo, or Lake Counties.

2.5 PROJECT SPONSOR'S NAME AND ADDRESS:

Napa County Mosquito Abatement District
P.O. Box 655
Concord, CA 95420

2.6 GENERAL PLAN DESIGNATION:

All general plan designations found within Napa County

2.7 ZONING:

All zoning designations found within Napa County

2.8 SURROUNDING LAND USES AND SETTING:

The Project Service Area, which is coterminous with Napa County, has a diverse set of land uses and environmental settings. The District divides the Service Area into six zones, corresponding roughly to the pattern of

mosquito production found in each (see map at end of Section 2). Zone 1 is the southern area of the District (south of Highway 121) and serves the southern portion of the City of Napa, all of American Canyon, and the adjacent unincorporated areas. Land uses also include inactive salt ponds, state wildlife refuges, light industrial, and extensive agricultural production. All of the District's coastal marshland and some of its seasonal wetlands are within this zone. Zones 2 and 3 include the City of Napa north of Highway 121, the Town of Yountville, and adjacent unincorporated areas. Zones 4 and 5 serve the Cities of St. Helena and Calistoga as well as the unincorporated communities of Angwin, Oakville, Pope Valley, and Rutherford. Zones 2 through 5 have a wide range of climatic conditions, land uses, and habitats, including riparian areas, dense oak woodland, coniferous forests, open grassland, extensive agricultural production, seasonal wetlands, numerous wastewater ponds, etc.. Zone 6 serves the unincorporated areas in and around Lake Berryessa and is much warmer and dryer than the rest of the County.

Mosquito production is associated with wet areas of all types and sizes. This includes marshes, ponds, creeks, seasonal wetlands, wastewater ponds, storm-water detention basins, irrigated pastures, duck clubs, etc, as well as individual homes or commercial buildings. Because of the diversity of mosquito habitat, almost all land use categories in the District Service Areas may be affected by the Project.

2.9 OTHER PUBLIC AGENCIES WHOSE REVIEW/APPROVAL IS REQUIRED:

The District's IMM Program as a whole, including the registration and continuing education of state-certified field personnel, is reviewed and approved by the **California Department of Health Services**, through a formal Cooperative Agreement that is renewed annually.

For work on state lands and riparian zones, wetlands or other sensitive habitats, the District coordinates and reviews activities with the **California Department of Fish & Game** and the **California State Lands Commission** as Trustee Agencies.

For minor physical control activities, the District obtains five-year regional permits from the **U.S. Army Corps of Engineers** (with review by the **San Francisco Regional Water Quality Control Board** and/or the **U.S. Fish & Wildlife Service**, as appropriate), and from the **San Francisco Bay Conservation & Development Commission**.

For chemical control activities, the District reports to and is periodically reviewed by the **Napa County Agricultural Commissioner**.

2.10 DESCRIPTION OF PROJECT:

The Integrated Mosquito Control Program of the Napa County Mosquito Abatement District (the Project) that is evaluated in this Initial Study is an ongoing program of surveillance and control of mosquito vectors[1] of human disease and discomfort. The Program/Project essentially consists of six types of activities:

- **Surveillance** for mosquito populations, mosquito habitats, disease pathogens, and public distress associated with mosquitoes; this includes trapping and laboratory analysis of mosquitoes to evaluate populations and disease threats, direct visual inspection of known or suspected mosquito habitats, the use of all-terrain vehicles, maintenance of paths, and public surveys;
- Public **Education** to encourage and assist reduction or prevention of mosquito habitats on private and public property;
- Management of mosquito habitat, especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities, etc. ("**Physical Control**");

[1]The California State Health and Safety Code defines a "vector" as "any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal" (Section 2200(f)).

- Applications of herbicides and other forms of **Vegetation Management** to improve surveillance or reduce mosquito populations;
- Applications of the "mosquito fish" *Gambusia affinis,* the bacterium *Bacillus sphaericus*, the fungus *Lagenidium giganteum*; and possibly use of other predators or pathogens of mosquitoes (**"Biological Control"**); and
- Application of non-persistent selective insecticides to reduce populations of larval or adult mosquitoes (**"Chemical Control"**).

Descriptions of these activities, including their typical annual frequency and intensity, and general District policies and procedures to ensure that they result in no significant environmental impact, are provided below. Detailed technical descriptions of these activities, including an extensive literature review and material-specific or site-specific District policies and procedures, including application criteria, are discussed in detail in Section 4 of this Initial Study.

A. Purpose and Need

The California Health and Safety Code defines a vector as "any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal" (Section 2200(f)). The District undertakes activities through its Integrated Mosquito Management Program to control mosquitoes as vectors of disease and/or discomfort in the Service Area.

Certain species of mosquitoes found in Napa County can transmit malaria, St. Louis encephalitis, western equine encephalomyelitis, and potentially other encephalitis viruses. A few species of mosquitoes are also capable of transmitting dog heartworm. Although some species of mosquitoes have not been shown to transmit disease, most species can cause human discomfort when the female mosquito bites to obtain blood. Reactions range from irritation in the area of the bite to severe allergic reactions or secondary infections resulting from scratching the irritated area. Additionally, an abundance of mosquitoes can cause economic losses, and loss of use or enjoyment of recreational, agricultural, or industrial areas.

Mosquitoes are extremely mobile and cause the greatest hazard or discomfort away from their breeding site. Each mosquito species has a unique life cycle and most of them occupy different habitats. In order to effectively control all types mosquitoes in the District Service Area, an integrated mosquito management program must be employed. District policy is to identify those mosquito species and sources in the Service Area, to recommend techniques for their prevention and control, and to anticipate and minimize any new interactions between mosquitoes and humans.

B. General Mosquito Management Strategy

As described in the Preliminary Review, the District's activities address mosquito management through a general strategy including identification of mosquito problems; responsive actions to control existing populations of mosquitoes, prevent new sources of mosquitoes from developing, and manage habitat to minimize mosquito production; education of land-owners and others on measures to minimize mosquito production or interaction with mosquitoes; and provision and administration of funding and institutional support necessary to accomplish these goals.

In order to accomplish effective and environmentally sound mosquito management, the manipulation and control of mosquitoes must be based on careful surveillance of their abundance, habitat (potential abundance), pathogen load, and/or potential contact with people; the establishment of treatment criteria (thresholds); and appropriate selection from a wide range of control methods. This dynamic combination of surveillance, treatment criteria, and selection between multiple control activities in coordinated program is generally known as Integrated Pest Management (IPM) (Glass 1975, Davis et al 1979, Borror et al 1981, Durso 1996, Robinson 1996).

The District's Mosquito Management Program, like any other IPM program, by definition involves procedures for minimizing potential environmental impacts. The District's Project employs IPM principles by first determining the species and abundance of mosquitoes through evaluation of public service requests and field surveys of immature and adult mosquito populations; and then, if the populations exceed predetermined criteria, using the most efficient,

effective, and environmentally sensitive means of control. For all mosquito species, public education is an important control strategy. In some situations, water management or other physical control activities (historically known as "source reduction", "permanent control", or "long-term control"[2]) can be instituted to reduce mosquito breeding sites. The District also uses biological control such as the planting of mosquitofish in some settings. When these approaches are not effective or are otherwise inappropriate, then pesticides are used to treat specific mosquito-producing or mosquito-harboring areas or mosquito populations.

In order to maximize familiarity by the operational staff with specific mosquito sources in the Project area, the District is divided into zones (currently six). Each zone is assigned a full-time Mosquito Control Technician, and sometimes an Aide, whose responsibilities include minor physical control, inspection and treatment of known mosquito sources, finding and controlling new sources, and responding to service requests from the public.

Mosquito control activities are conducted at a wide variety of sites throughout the District's Project area. These sites can be roughly divided into those where activities may have an effect on the natural environment either directly or indirectly (through drainage), and sites where the potential environmental impacts are negligible ("Non-Environmental Sites". Examples of "Environmental Sites" in the Project area include tidal marshes, duck clubs, other diked marshes, lakes and ponds, rivers and streams, vernal pools and other seasonal wetlands, stormwater detention basins, flood control channels, spreading grounds, street drains and gutters, wash drains, irrigated pastures, or agricultural ditches. Examples of "Non-Environmental Sites" include animal troughs, artificial containers, tire piles, fountains, ornamental fish ponds, swimming pools, liquid waste detention ponds, and non-natural harborage (such as wood piles, residential and commercial landscape, trash receptacles, etc.).

The intensity of chemical, biological, or physical control activities in the District Service Area in general, or in any particular mosquito source, varies seasonally and from year to year because of weather conditions, size and distribution of mosquito populations, disease patterns, known or potential pesticide resistance, and in response to other variables. Therefore, the scopes of work discussed in the sections below are illustrative of typical District activities levels, but they are expected to show continuing variation in the future.

C. CEQA-Exempt District Activities

All District activities were evaluated in the District's CEQA Preliminary Review (Appendix A1), which was developed in the Spring of 1999. In the Preliminary Review, the District concluded that most activities conducted by the District are statutorily or categorically exempt from further CEQA review. It was also determined that some specific activities within the District's Integrated Mosquito Management Program might exceed the scope of the exemptions to CEQA, or might trigger one or more of the exceptions to the exemptions, primarily because of their potential impacts on endangered species or in critical wetland habitats. Therefore the District has undertaken this Initial Study. To ensure that no potentially significant cumulative effects are missed, the entire IPM Program is evaluated here, with the exception of the Education activities that are clearly exempt from further CEQA review, as described in the Preliminary Review. In addition, all administrative support activities are exempt and are not discussed further in this document.

In the event of emergency conditions (actual or imminent disease outbreak), District actions are also exempt from CEQA (see Preliminary Review), and are therefore not covered by this document. It should be noted, however, that reasonably foreseeable actions in the event of emergencies vary from the routine operational actions of the District only in scope or intensity, and as such are not expected to result in any significant environmental impact.

D. SURVEILLANCE

The District's responsibility to protect public health and welfare involves monitoring the abundance of mosquitoes, mosquito habitat, mosquito-borne pathogens, and interactions between mosquitoes and people over time and

[2]In the 1940's to 60's, source reduction was sometimes called "permanent" or "long-term" control to contrast it with the clearly temporary ("short-term") results of chemical pesticides. Experience has showed that, while "long-term" may be an accurate description, the results of physical control are not permanent (see Section 4).

space. Collectively, these monitoring activities are termed Mosquito Surveillance. Mosquito surveillance provides the District with valuable information on what mosquito species are present or likely to occur, when they occur, where they occur, how many there are, and if they are carrying disease or otherwise affecting humans. Mosquito surveillance is critical to an Integrated Mosquito Management Program because the information it provides is evaluated against treatment criteria to decide when and where to institute mosquito control measures. Equally important is the use of mosquito surveillance in evaluating the efficacy, cost effectiveness, and environmental impacts of specific mosquito control actions.

The DISTRICT routinely uses a variety of traps for surveillance of adult mosquitoes, regular field investigation of known mosquito sources, flocks of sentinel chickens for arbovirus[3] testing, public service requests for adult mosquitoes; and low ground pressure all-terrain vehicles to access these sites.

The District's mosquito and disease surveillance activities are conducted in compliance with accepted Federal and State guidelines, and the reader is referred to the volumes by Moore et al. (1993), Durso (ed.). (1996), and Reisen et al. (1995) for further information on specific surveillance techniques. These guidelines recognize that local conditions vary, and are thus flexible in the selection and specific application of methods. Therefore, the District's specific activities and their potential environmental impacts are described below.

E. PHYSICAL CONTROL = HABITAT MODIFICATION

Dredging, placement of culverts or other engineering works, and other physical changes to the land can reduce mosquito production directly by improving water circulation or drainage, indirectly by improving habitat values for predators of larval mosquitoes, including fish and many invertebrates, or by otherwise reducing a site's habitat value for mosquito larvae. The DISTRICT performs these physical control activities in accord with all appropriate environmental regulations (wetland fill and dredge permits, endangered species review, water quality review, etc.), and in a manner that generally maintains or improves habitat values for desirable species. Major physical control activities or projects (beyond the scope of the District's five-year regional wetlands permits with the U.S. Army Corps of Engineers and the S.F. Bay Conservation and Development Commission) receive individual CEQA review. Minor physical control activities (covered by the regional wetlands permits) are covered under this document. These vary substantially from year to year, but typically consist of up to 2,000 feet of ditch maintenance. Under the regional permits, the District's work plans are reviewed annually by trustee and other responsible agencies prior to initiation of the planned work.

F. VEGETATION MANAGEMENT

The District periodically applies herbicides to reduce the mosquito habitat value of sites by improving water circulation or access by fish and other predators, or to allow access to standing water for inspections and treatment. Herbicides used by the District include Round Up and Rodeo, which are both based on the active ingredient Glyphosate, and Karmex, which is based on the active ingredient Diuron. Both Rodeo (labeled for aquatic applications) and Roundup (labeled for terrestrial applications) are used for spot control of actively growing vegetation. Karmex is used by the District in the fall as a preemergent herbicide. All herbicides are applied in strict conformance with label requirements.

Table 1 (page 9) shows the total amounts of herbicides used and the number of applications made by the District for the years 1995-1999.

G. BIOLOGICAL CONTROL

The DISTRICT uses the mosquitofish *Gambusia affinis* in some types of mosquito larval habitat to provide

[3]Arbovirus is a conventional term used to refer to ARthropod-BOrne Viruses (Reisen et al 1995).

biological control of mosquitoes through direct predation of larvae. Stocking by DISTRICT personnel complies with strict guidelines designed to ensure that no significant impacts can occur to native species. These guidelines are discussed in Section 4 of this Initial Study. On average, the District releases about 60-80 pounds of mosquitofish annually, and distributes an additional 20 pounds to the public.

Other biological control methods available to the District include the application of the fungus *Lagenidium giganteum*, and the biological insecticide *Bacillus sphaericus* (B sphaericus). *Lagenidium giganteum* and *B. sphaericus* are not used operationally by the District at this time, but might be adopted in the future for specific applications. Because the potential environmental impacts of applying the *Bacillus* relate to potential disturbance associated with the mode of application, and the potential for non-target toxicity, these materials will be discussed below under Chemical Control.

H. CHEMICAL CONTROL = PESTICIDE APPLICATION

When field inspections indicate the presence of mosquito populations which meet District criteria for chemical control (including abundance, density, species composition, proximity to human settlements, water temperature, presence of predators, and others), District staff apply pesticides to the site in strict accordance with the pesticide label instructions. The total number of applications and weight or volumes of pesticides applied by the District in 1995-1999 are shown in Table 1 (page 9).

a. Mosquito Larvicides: Depending on time of year, water temperature, organic content, mosquito species present, larval density, and other variables, pesticide applications may be repeated at any site at recurrence intervals ranging from annually to weekly.

Larvicides routinely used by the DISTRICT include Bti (*Bacillus thuringiensis israelensis*), Methoprene (Altosid), and Golden Bear 1111.

Bti (*Bacillus thuringiensis israelensis*) is a bacterium that is ingested by larval mosquitoes and disrupts their gut lining, leading to death before pupation. Bti is applied by the District as a liquid or bonded to an inert substrate (sand or corn cob granules) to assist penetration of vegetation. Persistence is low in the environment, and efficacy depends on careful timing of application relative to the larval instar. Therefore, use of Bti requires frequent inspections of larval sources during periods of larval production, and may require frequent applications of material. Application can be by hand, ATV, or aircraft. The District used about 163 gallons of aqueous Bti solution and 157 pounds of technical powder in 1998, and unusually wet year with high demands for mosquito control.

Methoprene, or Altosid, is a synthetic juvenile hormone designed to disrupt the transformation of a juvenile mosquito into an adult. It is applied either in response to observed high populations of mosquito larvae at a site, or as a sustained-release product that can persist for up to about four months. Application can be by hand, ATV, or aircraft. The District applied about 22 pounds of Altosid Pellets and 26.5 gallons of Altosid Liquid Larvicide in the entire Service Area during 1998.

Golden Bear Oil 1111 is a petroleum distillate with low phytotoxicity and fast environmental breakdown, that forms a thin film on water and kills larvae through suffocation and/or direct toxicity. It is typically applied by hand, ATV, or truck at application rates of 3-5 gallons per acre. The District applied about 1,645 gallons of GB 1111 to the entire Service Area during 1998, and has not applied over 2,000 gallons during any calendar year.

Agnique is the trade name for a recently reissued surface film larvicide, comprised of ethoxylated alcohol, that kills mosquito larvae and pupae in much the same manner as Golden Bear 1111. The District may use Agnique as an alternative to Golden Bear 1111 in the future although costs, limits of application, and effective duration are issues of concern. Because the application rate of Agnique is much lower than that of Golden Bear, this potential shift would not include an increase in volume of materials applied.

Finally, *Bacillus sphaericus* is a biological larvicide that the District may use in the future. The mode of action is similar to that of *Bti*, but *B. sphaericus* may be used more than *Bti* in some sites because of its higher effectiveness in water with higher organic content.

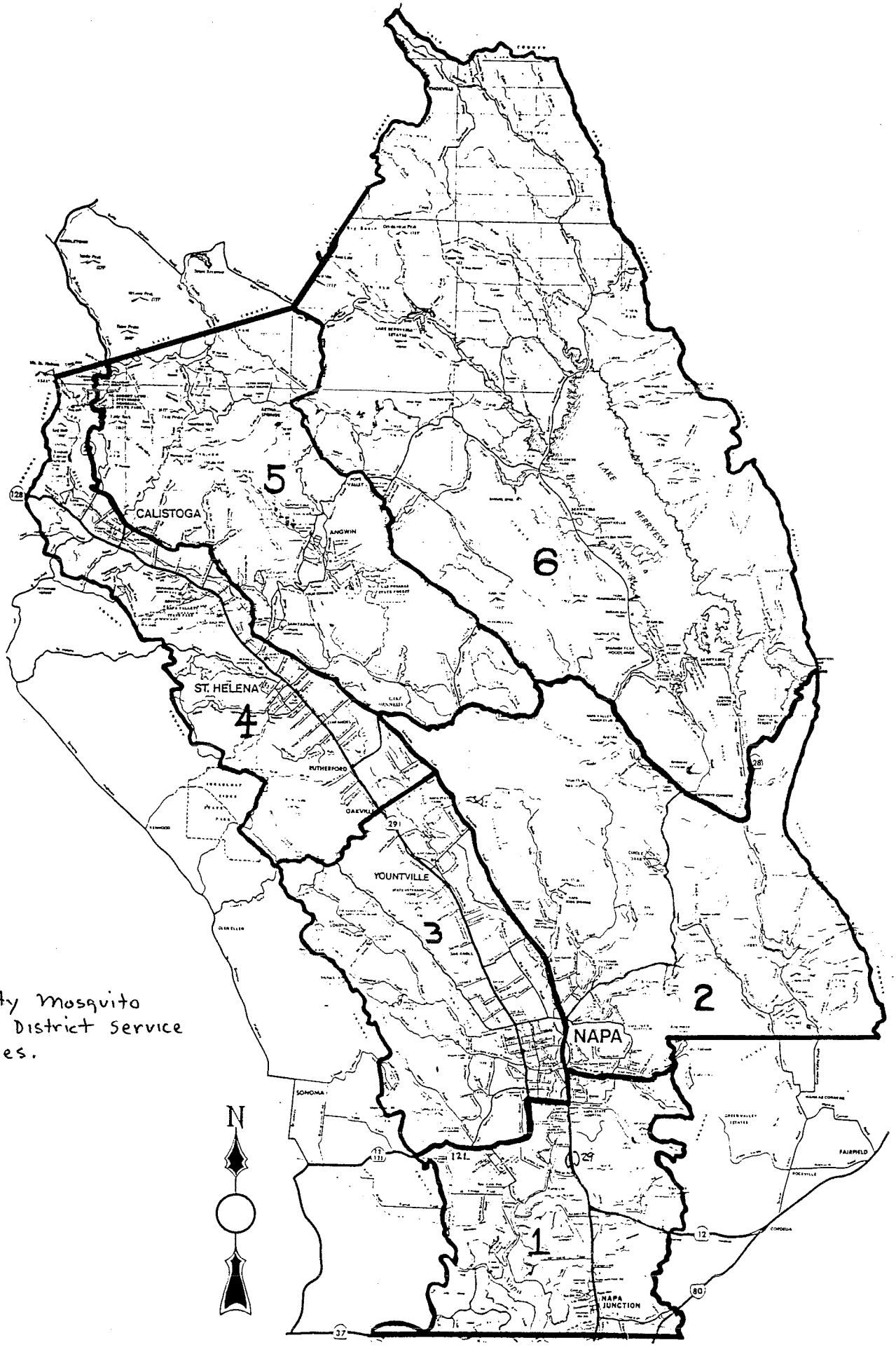
b. Mosquito Adulticides: In addition to chemical control of mosquito larvae, the DISTRICT also makes

aerosol applications of pesticides for control of adult mosquitoes if specific criteria are met, including species composition, population density (as measured by landing count or other quantitative method), proximity to human populations, and/or human disease risk (Section 4). As with larvicides, adulticides are applied in strict conformance with label requirements. Adulticides used by the District include Pyrethrins (Pyrocide® -- 23.8 gallons in 1998; Pyrenone Crop Spray® -- none applied in 1998) and the synthetic pyrethroids Resmethrin (Scourge® -- none in 1998) and Permethrin (none in 1998).

Table 1: Pesticide Use by Napa County Mosquito Abatement District, 1995-1999 (first value is number of applications of material by District staff during the year; second number is the total quantity of material applied by District staff during the year).

Pesticide (applications/units)	1995	1996	1997	1998*	1999*
Mosquito Larvicides					
Altosid					
Briquets (lbs)	0/0	0/0	0/0	0/0	0/0
Pellets (lbs)	2/8	2/8	2/12	12/21.95	18/5.44
Liquid (oz)	25/16.89	0/0	43/0.82	137/26.63	126/7.49
Bacillus thuringiensis H-14 (Bti)					
Teknar HPD (gal)	0/0	39/6.33	38/4.28	103/80.23	96/21.86
Vectobac 12AS (gal)	137/182.55	77/5.39	44/4.82	15/83.14	9/4.88
Vectobac Tech Powder (lbs)	417/223.9	380/219.88	377/172.43	310/157.71	154/99.67
Water Surface Films					
Golden Bear 1111 (gal)	340/571.25	282/647.75	230/714.5	407/1645.4	205/485
Agnique	0/0	0/0	0/0	0/0	0/0
Mosquito Adulticides					
Pyrethrins					
Pyrocide 7396 (gal)	105/18.68	127/17.73	93/15.32	131/23.81	135/21.92
Pyrenone (gal)	0/0	0/0	0/0	0/0	0/0
Resmethrin (Scourge) (gal)	0/0	0/0	0/0	0/0	0/0
Permethrin (Biomist) (gal)	0/0	0/0	0/0	0/0	0/0
Herbicides					
Glyphosate-based					
Rodeo (gal)	10/6	20/12	31/28.25	22/20.5	7/6.88
Roundup (gal)	49/34.2	44/30.38	70/44.88	27/22.63	44/37.56
Karmex DF (lbs)	82/1936	82/1588	94/1940	91/2200	0/0

Notes:
* 1998 was an exceptionally wet "El Niño" year
* 1999 data covers only January 1 – July 31



Napa County Mosquito Abatement District Service Area Zones.

SECTION 3. EVALUATION OF ENVIRONMENTAL IMPACTS

This section presents the detailed environmental checklist and a discussion of potential environmental impacts of the project and mitigation measures that have been incorporated into the project to reduce the impacts, if any, to a less-than-significant level. The checklist includes questions relating to 17 areas of concern, and following each subject category an explanation is provided to support the basis of the impact finding. In preparing this Section, the District has conformed with the CEQA Guidelines (Appendix G):

3.1 AESTHETICS.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?				X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?				X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?			X	
c) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?			X	

Explanation:

Setting

The Napa Valley has a very significant tourism industry, based on its attractive vineyards, riparian and other natural areas, hunting and fishing, and historic towns and structures. The aesthetic character of the area is critical to the economy and the quality of life, and protecting this character during government activities is a high priority for all government agencies, including the District.

Potential Environmental Impacts and Measures to Avoid Significance

Mosquito control activities will generally have no significant or long term effect on the appearance of wetlands or riparian zones. Inspection and control activities using wheeled vehicles on soft ground or in vegetated areas can temporarily knock down tall or stiff plants on the marshlands, but this is a short-term phenomena that is generally not visible except from a distance. In addition, the District typically uses ATV routes that minimize visual impacts. Physical control projects generally benefit the appearance of diked marshlands. With the changes in the hydrological regime, vegetation generally spreads into the barren areas. Overall, the cover and vigor of vegetation is expected to increase, and the area would appear greener. Bird use of source reduction sites should expand, especially during the dry season. These changes are expected to occur slowly over time, and are expected to enhance the views of the sites.

Adult mosquito traps contain light sources as an attractant to the mosquitoes. However, these lights are insignificant in relationship to existing light sources. Larger traps have a maximum light output of about 25 watts per trap, and are located in areas with 110v AC power and, thus, inevitably other lights. The smaller traps, which can be deployed at a distance from power lines, have batteries and bulbs equivalent to small flashlights.

3.2 AGRICULTURAL RESOURCES.

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				X
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?				X

Explanation:

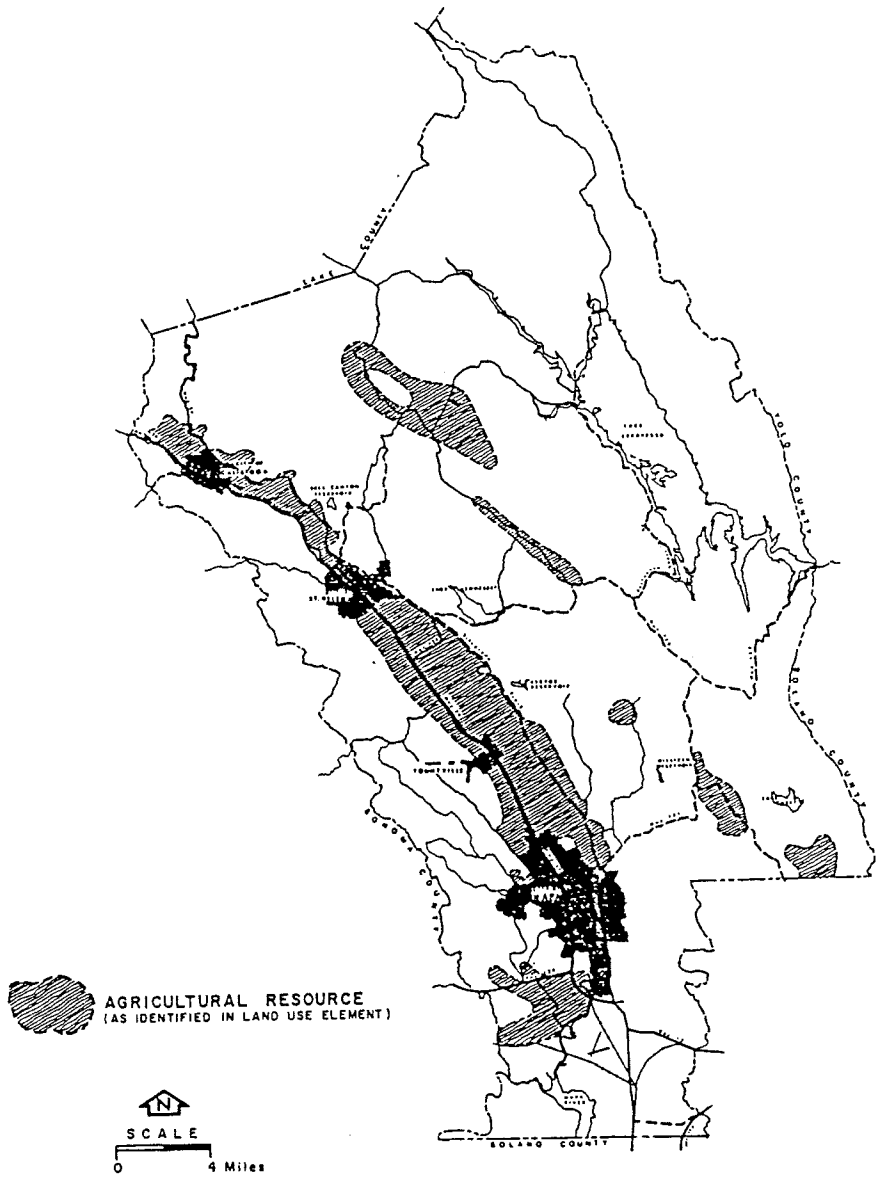
Setting

The District Service Area includes approximately 140,000 acres of agricultural lands, most of which is open range lands (see attached maps from Napa County General Plan). Of this total, about 36,000 acres are in cultivation each year, and about 500 acres are irrigated pastures (Napa County Ag. Commissioner, 8/27/99).

Potential Environmental Impacts and Measures to Avoid Significance

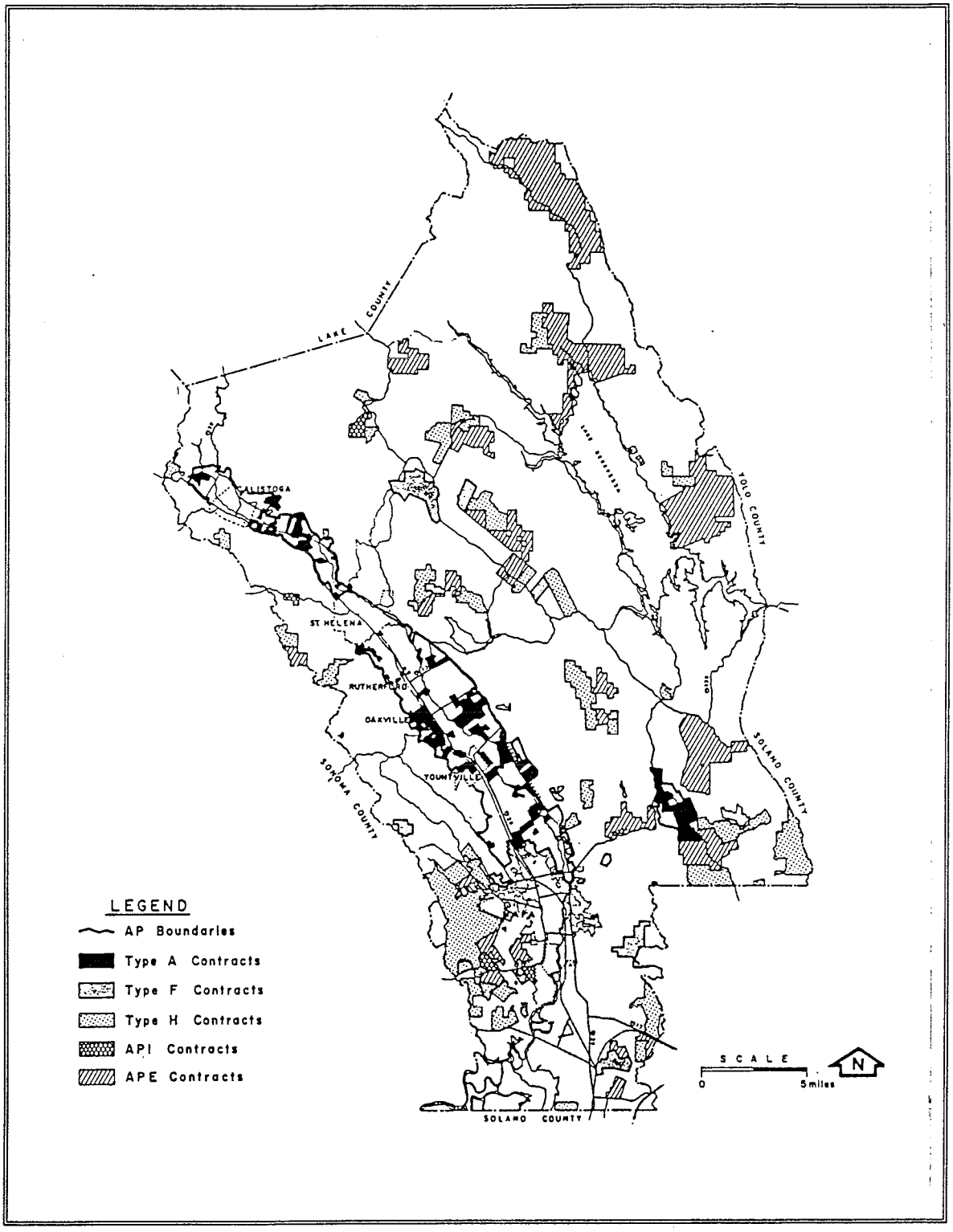
Mosquito control activities will not convert any agricultural lands to other uses, nor conflict with any Williamson Act contracts. Some District education or physical control activities could change the nature or timing of irrigation on crop lands or pastures, but these would not include conversions to non-agricultural uses. In some cases the District has consulted with land-owners who have converted agricultural or potential agricultural lands to duck clubs or other habitat conservation, but the District's role has been strictly to ensure that previously-planned conversion does not lead to increased mosquito production.

AGRICULTURAL LANDS



This map is a generalized representation of prime farmland; for more detailed information, consult the Napa County Soil Survey, published by U.S.D.A. Soil Conservation Service in 1978.

AGRICULTURAL PRESERVES



Source: Napa County Conservation, Development and Planning Department

3.3 AIR QUALITY.

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?			X	
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?			X	
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceedd quantitative thresholds for ozone precursors)?			X	
d) Expose sensitive receptors to substantial pollutant concentrations?			X	
e) Create objectionable odors affecting a substantial number of people?			X	

Explanation:

Setting

There are currently two pollutants for which the Air Basin that contains the Project Service Area has not attained both Federal and State criteria for ambient air quality: ozone (O_3), and particulate matter less than 10 micrometers in size (PM10) (BAAQMB, 6/25/99). Emissions of volatile organic compounds (VOC's), which are ozone precursors, are thus also considered an environmental problem in the Service Area.

In addition, it is recognized by the District that some individuals, institutions, and locations, including hospitals and schools, may be considered "sensitive receptors" with regards to air quality.

Potential Environmental Impacts and Measures to Avoid Significance - Chemical Control

Pesticide applications by the District do not significantly contribute to PM10, because most materials are applied directly to aquatic sources and aerosol applications use liquid droplets, not particulates, as carriers. Applications of GB-1111 and oil-based aerosols contribute insignificant quantities of VOC's. GB-1111, although an oil product, is listed as "non-volatile" on its Material Safety Data Sheet (MSDS -- see References). Aerosol pesticide applications in the District have not exceeded 25 gallons per year for all materials, which consist primarily of non-volatile ingredients. In addition, most of these materials are applied in rural or natural areas away from human settlement.

The District's Program/Project does not have a significant impact on sensitive receptors because of policies and practices to maintain a list of sensitive receptors and to minimize pesticide applications in their vicinity, to use the least toxic effective pesticide available in their vicinity, and to notify them prior to spraying.

Potential Environmental Impacts and Measures to Avoid Significance - Physical Control

Source reduction activities could generate small quantities of dust, which can add to PM10 loads. In practice, this is not a problem because of the saturated condition of the soils that are handled. In very dry diked marshes, ditching could cause dust problems if undertaken in late summer. However, the District's minor work regional permits require that work takes place from September through January, and allows only small projects. Therefore, net contribution to pollutant load is insignificant.

Increased emissions of odors by the source reduction activities following construction is very unlikely. Some wetland restoration projects in other areas have been accompanied by objectionable hydrogen sulfide odors. Based on a long history of variable flood regimes on the marshlands, with no odor complaints received by the District, it appears that the soils in this area are not prone to hydrogen sulfide production.

3.4 BIOLOGICAL RESOURCES.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?		X		
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?			X	
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) Through direct removal, filling, hydrological interruption, or other means?		X		
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?			X	
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				X
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?		X		

Explanation:

Setting

The Project impact area covers a wide range of natural habitats and highly developed areas, with an equally wide range of plant and animal communities from the heights of Atlas Peak and Mount Veeder to the extensive tidal marshlands associated with the Napa River and along the County's southern margin. Human activities in the Service Area, primarily during the last 150 years, have led to substantial changes in these habitats and in the populations of the organisms that inhabit them, so that many areas of the District Service Area exhibit some degree of human modification and impact.

Mosquito control activities are associated with wet areas of all types and sizes, and because of the diversity of mosquito habitat, mosquito control activities are conducted at a wide variety of different ecosystems and habitat types

throughout the District's Project area. These sites can be roughly divided into those where activities may have an effect on the natural environment either directly or through drainage from an upstream site, and sites where the potential environmental impacts are negligible. Examples of "Environmental Sites" in the Project area include tidal marshes, duck clubs, other diked marshes, lakes and ponds, rivers and streams, vernal pools and other seasonal wetlands, stormwater detention basins, flood control channels, spreading grounds, street drains and gutters, wash drains, irrigated pastures, or agricultural ditches. Examples of "Non-Environmental Sites" include animal troughs, artificial containers, tire piles, fountains, ornamental fish ponds, swimming pools, liquid waste detention ponds, and non-natural harborage (such as wood piles, residential and commercial landscape, trash receptacles, etc.).

A. Impacts and Mitigation - Endangered and other Special Status Species

The California Department of Fish and Game's Natural Diversity Database (NDDB) lists 65 special status species[1] in Napa County (April 5, 1999; see Section 4). In almost all cases, the primary explanation for their status is loss of habitat. Because the District's activities do not involve changes in land use, and because proposed physical control activities in non-agricultural sites are reviewed annually by Trustee and other Responsible agencies, the District's activities do not contribute to this process. In the areas where the District's routine activities do overlap with specific habitat, District policies and practices ensure that no significant impacts can occur.

Of the thirteen species and subspecies listed as "Endangered" under either the Federal or State Endangered Species Acts (ESA), only nine occur in habitats where the District has any routine operations (Table 4.2.1). These include the marsh plant Soft Bird's-Beak (*Cordylanthus mollis ssp mollis*); the vernal pool plants Contra Costa Goldfields (*Lasthenia conjugens*), Sebastapol Meadowfoam (*Limnanthes vinculans*), and Few Flowered Navarettia (*Navarettia leucocephala* var. *pauciflora*); the spring and meadow plants Calistoga Popcorn Flower (*Plagiobothrys strictus*) and Napa Bluegrass (*Poa napensis*); the perennial-stream inhabiting California Freshwater Shrimp (*Syncaris pacifica*); the tidal marsh bird California Clapper Rail (*Rallus longirostris obsoletus*); and the marsh-inhabiting mammal Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*). The District takes extreme care to avoid disturbance to listed endangered species, as detailed below. Habitat descriptions and current maps of distribution and potential habitat of all endangered species in the Service Area are maintained by the District and incorporated into the operational guidelines of field personnel.

In addition to endangered species, Table 4.2.2 shows an additional six taxa, including one plant, one beetle, one frog, and three birds, that are listed as "Threatened" or "Rare" under either the Federal or California ESA, but that are not listed "Endangered" under either ESA. This listing indicates that the species or subspecies is vulnerable to decline to endangered levels, and habitat loss is listed as the primary threat for each of these species. Of these, only Mason's Lilaeopsis (*Lilaeopsis masonii*), Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*), California Red-legged Frog (*Rana aurora draytonii*), and California Black Rail (*Laterallus jamaicensis coturniculus*) have habitat that might overlap with areas of routine District activity. The District takes care to avoid disturbance to listed threatened species, as detailed below, and is particularly careful to ensure no habitat loss for these taxa. Habitat descriptions and current maps of distribution of all threatened species in the Service Area are maintained by the District and incorporated into the operational guidelines of field personnel.

Table 4.2.3 lists an additional 17 vascular plants, 1 amphibian, 1 reptile, 3 birds, and 2 mammals that are considered "Species of Concern" under either the Federal or California ESA, but that are not listed as "Endangered" or "Threatened." Finally, the NDDB listing for Napa County (Table 4.2.4) notes 16 vascular plants and 6 birds that are not formally listed under the Federal or state ESA, but that are considered Special Status based either on a "species of concern" evaluation by the California Department of Fish & Game (CDFG) or by the California Native Plant Society (CNPS).

Although it has been suggested that other project elements (ATV use; Physical Control; Vegetation Management; Biological Control; and/or Chemical Control) may pose a threat to some endangered, threatened, rare,

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[1]Under the Federal and State Endangered Species Acts, the word "species" may also mean subspecies or other taxonomic groupings.

or other special status species in other areas, a thorough review of the IMM Program and the relevant scientific literature does not find substantial evidence to support these suggestions. Instead, the available credible information indicates that the Program/Project is very unlikely to have a significant impact on special status species or other biological resources within the Service Area. A detailed discussion and documentation to support these conclusions and the following observations is provided in the Project Technical Review (Section 4 of this Initial Study).

- The Project consists of a number of **ongoing activities**, each of which has been carried out by the District in the current Service Area for between 10 and 74 years without observed or demonstrated significant impacts on biological resources.
- Where adverse changes in biological resources have been observed in the Service Area or regionally, there is **no apparent relationship**, geographic or temporal, between District activities and these changes.
- There is **no substantial evidence of significant impacts** to biological resources caused by the specific project methods and materials, separately or cumulatively, at any level of application consistent with District policies and guidelines and Federal and State label requirements.
- The **scope** and **scale** of the District's activities are limited and insignificant in comparison to other similar activities in the Project Area, including agriculture and household pesticide use.
- The District **complies strictly with pesticide labels and wetlands permits** that are written to ensure that no significant impact to biological resources can occur.
- The District's activities are **highly selective in space and time**, based on a detailed list of potential mosquito sources, pre-control surveillance for mosquito abundance, and threshold criteria for control applications.
- The District's field technicians are **highly-trained** pesticide applicators, **certified by the California Department of Health Services** and required to complete frequent **continuing education** sessions sponsored by the District and by the Mosquito and Vector Control Association of California pursuant to State Regulations.
- The District's field activities are **routinely monitored** for safety, efficacy, and environmental impact by the District's Manager, by the Napa County Agricultural Commissioner, and by permit-issuing agencies.
- The District and the Mosquito & Vector Control Association of California routinely fund and collaborate with researchers from the University of California and other academic institutions on **research projects** to evaluate activities and to ensure that practices are used with the least potential impact on biological resources consistent with operational requirements.
- The District's activities are **consistent** with the Napa County General Plan Conservation Elements, and all known Habitat Conservation Plans, Endangered Species and Sensitive Habitat Recovery Plans, and City Plans in the Service Area.
- District staff routinely **coordinates and consults** with other responsible agencies, including the California Department of Health Services, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, the San Francisco Bay Conservation and Development Commission, the California State Lands Commission, the San Francisco Regional Water Quality Control Board, the U.S. Army Corps of Engineers, the Napa County Resource Conservation District, and the Napa County Flood Control District to ensure that Project activities do not result in significant impacts to biological resources.

In addition to these general conclusions, the District makes the following specific findings.

1. ATV's

The District uses All-Terrain Vehicles (ATV's) on wetlands to facilitate surveillance, to deliver and apply chemical pesticides, and to perform some physical control activities. In each case, the potential impacts of the ATV's are similar, and consist of noise and other disturbance to nearby wildlife, trampling of vegetation and/or nests, and compaction of soils. After an exhaustive review of the literature (Section 4), the District concludes that the use of ATV's by the District does not and will not have a significant effect on the environment. Specifically, the District finds that 1) the low frequency of usage at any particular site reduces the disturbance and noise impacts to less than significance; 2) most vegetation types rebound rapidly from single passes by District ATV's; 3) all vegetation types regrow completely following ATV use by the District, with no evidence of long-term impact; 4)

District training and policies prevent significant risk of trampling of nesting or other wildlife; and 5) the low ground pressure of District ATV's precludes significant soil compaction or erosion.

2. Physical Control

The District's Physical Control activities can be subdivided by habitat type into a) agricultural channel maintenance; b) other drainage ditch maintenance; c) minor riparian zone work; and d) marshland tidal enhancement. Maintenance activities in agricultural channels and other drainage ditches are similar in nature to work routinely performed by farmers, municipalities, and others for the same purpose, and are of low frequency and intensity. Based on this comparison, and the lack of contrary evidence, we find that these activities do not have the potential for significant environmental impact. Physical control activities in riparian areas are discussed in Section 3.4B below.

The primary aim of tidal enhancement projects on marshlands is to restore and enhance water flows and wetland values that have deteriorated due to human activity, while protecting or enhancing existing functions and values. Since the various taxa that use the marshes vary in their habitat requirements, there is no single hydraulic or management regime which will optimize all of the possible species. However, the elevational range of marsh sites, combined with the small scale of physical control activities covered by this document, ensure that hydraulic changes are limited and that no specific habitat for special status species is lost or significantly degraded. In addition, the District's minor physical control activities on tidal and historically-tidal areas are governed by five-year regional permits obtained by the District from the U.S. Army Corps of Engineers (USACE) and the San Francisco Bay Conservation and Development Commission (BCDC). One condition of each of these permits is the provision by the District of annual work plans for agency review prior to implementation of the planned work. This ensures that Trustee and other Responsible agencies are given timely opportunities to review specific planned activities and, if needed, to modify the District's proposals.

The most significant legally-protected species on marsh activity sites are the Salt Marsh Harvest Mouse and the California Clapper Rail, which are closely associated with Pickleweed (*Salicornia virginica*) and Cordgrass (*Spartina foliosa*). Our observations and the literature (Section 4) indicate that our physical control activities on marshes are generally beneficial to these species and their associated plants, although increased tidal flushing following reintroduction of tides to subsided sites adjacent to brackish water may temporarily depress *Salicornia* extent. The District's minor physical control activities are generally beneficial to channel-dependent listed species like the California Clapper Rail (Habitat Goals Project 1999). The District has an active research and monitoring program to ensure that physical control projects minimize the need for repetitive maintenance and the immediate disturbance associated with construction activities.

3. Vegetation Management

The District finds no substantial evidence that our vegetation management program could have a significant environmental impact. The EIR prepared for Caltrans' much more extensive vegetation management program [see Section 4.5 and citation in Section 3.18] found no potential significant impact associated with the materials used by the District, even at Caltran's much higher cumulative use.

4. Biological Control

Some challenges have been made against the use of mosquitofish (*Gambusia affinis*) for the control of mosquitoes, primarily on the supposition that their omnivorous feeding habit poses a threat to the juvenile forms of the federally-threatened California Reg-Legged Frog (*Rana aurora draytonii*). After an extensive review of the literature and our own field experience (Section 4), the District finds that there is no substantial evidence supporting this claim. Specifically, we find that 1) the District maintains spatial and temporal separation between mosquitofish

and immature Red-Legged Frogs, using the best available information on the location of the frogs; 2) the U.S. Fish and Wildlife Service acknowledges that they "cannot determine whether mosquitofish are harmful to California red-legged frogs." (USFWS 1996); 3) recent university research indicates that there is no direct (mortality) impacts of mosquitofish on Red-Legged Frogs in intense interactions in naturalistic settings, and that the only indirect impact seen in this research was a slight lowering of body weight at the transition from tadpole to adult, with no evidence that this had any biological significance (Lawlor 1999); 4) mosquitofish and red-legged frogs have been repetitively seen to coexist in natural settings outside of the District Service Area (USFWS 1996; Karl Malamud-Roam & Ron Keith, pers. comm. 1999); and 5) alternative and more plausible explanations exist to explain the observed historic decline in Red-legged frogs in the Service Area (USFWS 1996, Lawlor 1999).

5. Chemical Control

When mosquito numbers exceed District control thresholds and other control methods would be ineffective, contrary to permits or other environmental protections, or otherwise inappropriate, the District utilizes specific insecticides that are registered for use in California and that possess a current EPA label. As required by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), each pesticide used by the District has been tested for acute and chronic effects using Good Lab Practices on an array of nontarget species and under laboratory and field conditions. These tests, as well as studies conducted by qualified researchers at universities and other research institutions, have produced a wealth of literature showing no long-term adverse effect to non-target biological resources when applied selectively and consistently with the labels. A detailed technical summary of the literature on pesticides used or contemplated by the District is presented in the Program Technical Review (Section 4 of this Initial Study).

In addition to general District policies and practices noted earlier, to protect listed insects and crustaceans the District does not routinely apply insecticides other than Bti or Methoprene to areas with known populations of these organisms. As discussed in Section 4, these materials have no detectible effect on listed stream or vernal pool fauna. Because of the hydrology and habitat types in these specific areas, the District finds it highly unlikely that we would use other insecticides in these areas except under emergency conditions, and would do so only in consultation with the appropriate agencies.

Two specific assertions of links between chemical pesticides used by the District and special status species will be addressed briefly here because of recent associated publicity, despite the lack the any substantial evidence to support them:

First, it has recently been suggested that Altosid (S-methoprene) may be associated with deformities in frogs that have been observed in a number of States. The District has performed an exhaustive review of the literature (see Section 4) and concludes that there is no substantial evidence to support this suggestion. Specifically, we find that 1) there is no evidence of a spatial or temporal relationship between Altosid use and amphibian deformities; 2) in particular, there is no evidence of frog deformities at all in the District's Service Area, and no significant evidence of frog deformities anywhere in California where methoprene is used; 3) well-documented alternative explanations for frog deformities, that are more consistent with the epidemiological patterns observed, have been reported; 4) the observations discussed to support the assertion have not been duplicated by any other researchers; 5) severe deficiencies in methodology and/or interpretation exist in the few reports that make this assertion; 6) consultations with Dr. Mark Jennings, and other eminent herpetologists demonstrate no professional agreement with the claims; and 7) recent exhaustive reviews of this literature by independent analysts in Minnesota and New Zealand unconditionally agree with the District's findings on this question.

Second, questions have been raised for a number of years about whether insecticides used against mosquitoes could cause indirect impacts on higher organisms through impacts on food chains, and specifically if larvicides could reduce the populations of *Chironomid* or other midges to a degree significant to waterfowl or wading birds. The District has performed an exhaustive review of the literature (see Section 4) and concludes that there is no substantial evidence to support this suggestion. Specifically, we find that 1) there is no evidence of a

spatial or temporal relationship between larvicide use and population dynamics of waterfowl or wading birds; 2) Golden Bear 1111 has no effect on midge larvae (the species of concern in our area are primarily benthic); 3) Bti has no detectible effect on midge larvae when applied at label rates for mosquito control; 4) Methoprene, at label rates for mosquito control, can prevent adult emergence of midges but does not directly kill mosquito or midge larvae and therefore does not remove them from the food chain; 5) no bioaccumulation (food chain magnification) of larvicides in larva-eating animals has been demonstrated for larvicides used by the District; and 6) the District does not plan to use other larvicides in areas where midges might be a significant portion of the food chain, except under emergency conditions.

6. Mitigation Measures

Although the District does not find substantial evidence that the current Program could significantly impact special status species, the following additional mitigation measures will be adopted as a prudent action to ensure that impacts remain insignificant:

1. Maintenance of up-to-date maps and other information from the California Department of Fish and Game Natural Diversity Data Base and other reliable sources on the location of Special Status Species and designated Natural Communities in the Project Service Area;
2. Coordination of District activities with approved Habitat Conservation Plans and Species Recovery Plans; and
3. Adoption of new policies as needed and provision of continuing training to field personnel to ensure minimization of specific mosquito control activities and/or the use of alternative mosquito control methods at times and in places where those specific mosquito control activities might otherwise significantly impact Special Status Species or designated Natural Communities.

B. Impacts and Mitigation - Riparian and other Sensitive Habitats

District activities in sensitive habitats are essentially restricted to riparian corridors, which are addressed in this subsection, and to wetland areas, which are discussed in subsection 3.4(C) below. In riparian areas, the only District activities with any potential for environmental impacts are 1) minor physical control; 2) vegetation management for maintenance of access; 3) biological control (mosquitofish stocking); and 4) pesticide use. The only identified potential environmental impact of biological control in riparian zones is on sensitive species, which was discussed in A4 above (see also Section 4). Each of the other three is discussed individually below.

1. Physical Control & Vegetation Management

Physical control activities in riparian zones are regulated by Streambed Alteration Permits issued by the California Department of Fish and Game, as well as by Clean Water Act Section 404 permits issued by the U.S. Army Corps of Engineers, which are required for most activities in any jurisdictional wetlands. Vegetation Management activities in riparian zones consist essentially of brush clearing with hand tools to facilitate access for mosquito and mosquito habitat surveillance and control. In light of the precautionary measures imposed by the permit process and District policies and practices, the District does not find substantial evidence that either of these classes of activities could have a significant environmental impact.

2. Chemical Control

The potential environmental impacts associated with chemical control in riparian zones are discussed in A5.

C. Impacts and Mitigation - Wetland Habitats

District activities in non-riparian wetland habitats are addressed in this subsection. These primarily include tidal and diked marshlands (salt, brackish, and fresh), and vernal pools and other seasonal wetlands. In these areas, the only District activities with any potential environmental impacts are 1) ATV use; 2) minor physical control; 3) vegetation management for maintenance of access; 4) biological control (mosquitofish stocking); and 5) pesticide use. The only identified potential environmental impact of biological control in non-riparian zones is on sensitive species, which was discussed in A4 (see also Section 4). Each of the other four is discussed individually below.

1. ATV's

The District uses All-terrain vehicles (ATV's) on wetlands to facilitate surveillance, to deliver and apply chemical pesticides, and to perform some physical control activities. The general potential environmental impacts of ATV use were discussed in A1 above. In addition, vernal pools rarely reach District treatment criteria, and the District does not use ATV's or other vehicles in these areas except potentially under emergency conditions.

2. Physical Control and Vegetation Management

As is true in riparian zones (discussed in B1 above), physical control activities in wetlands require Clean Water Act Section 404 permits issued by the U.S. Army Corps of Engineers, and, in the coastal portions of the Service Area, a permit issued by the San Francisco Bay Conservation and Development Commission. Because of the stringent permit conditions imposed, we find no substantial evidence that significant environmental could result.

As in riparian zones, vegetation management in other wetlands is accomplished primarily to facilitate access for mosquito and mosquito habitat surveillance and control. In contrast to riparian areas, however, the District also makes use of chemical herbicides in agricultural drainage ditches and in some other settings to achieve this end.

3. Chemical Control

In addition to directly applying insecticides on wetlands for the control of larval mosquitoes, the District also sprays other pesticides for the control of adult mosquitoes in other areas, which might cause pesticide drift onto some wetlands. Based on the District's routine low application intensity, strict compliance with label criteria, and substantial research on non-target effects of the materials used operationally by the District, we find that no significant impact does or can generally result through this mechanism. District policies to ensure no significant environmental impacts will occur on the listed invertebrates in perennial streams and vernal pools are described in A5 above (see also Section 4).

D. Impacts and Mitigation - Migration Corridors and Nursery Sites

District activities have no known impact on any wildlife migration corridor, except as discussed in Section A.

E. Impacts and Mitigation - Local Policies and Ordinances

District activities have no apparent conflicts with any local environmental protection policies and ordinances.

Specifically, District activities are consistent with the Conservation Elements of the Napa County General Plan.

F. Impacts and Mitigation - Habitat Conservation Plans

A search of the USFWS website for "Habitat Conservation Plans/Incidental Take Permits" did not identify any federally-approved Habitat Conservation Plans in the District Service Area (6/3/99). A consultation with Dr. Peter Baye of the USFWS Division of Endangered Species indicated that there are currently no adopted Natural Community Conservation Plans for the Service Area (pers. comm. 8/30/99)

3.5 CULTURAL RESOURCES.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?			X	
b) Cause a substantial adverse change in the significance of an archaeological resource as defined in §15064.5?			X	
c) Directly of indirectly destroy a unique paleon-tological resource or site or unique geologic feature?				X
d) Disturb any human remains, including those interred outside of formal cemeteries?			X	

Explanation:

Setting

Napa County includes historical and archaeological resources, possibly including prehistoric human remains, in sites that date back thousands of years. Native American tribal groups that lived in the area prior to European contact were the Wappo, Lake Miwok, and Patwin (California Indian Library Collection 1999). Because the earliest human inhabitants of the area apparently spent much of their time near rivers and shores, most early sites have been buried as a result of extensive deposition of alluvium accompanied by a rise in sea level in the past 15,000 years (Atwater 1979, Moratto 1984), tectonic activity (Goman, 1996), and/or hydraulic mining debris (Gilbert, 1917). Thus, while a number of archaeological sites are known in the County (Pers. comm. Patricia Hornisher, Napa County Planning Dept, 8/31/99), it is possible that some of the coastal marshlands could cover archaeological resources.

During the Spanish and Mexican period of California history, much of the region was divided into ranchos, and many historical sites from this time remain (see attached list). Following integration into the United States socio-political sphere, the region experienced rapid growth and change, which has continued, at varying rates, until the present. Numerous historic resources from this time are also present (see attached list).

Potential Environmental Impacts and Measures to Ensure Insignificance

Mosquito control activities will not generally have any impact on historic resources, which are well known and routinely avoided. Minor physical control activities might involve modifications to older structures or inadvertent disturbance of archaeological sites, but this is very unlikely because these activities are essentially restricted to maintenance and minor modification of existing channels and water control structures.

The District will review potential minor physical control sites with the Napa County Planner prior to initiating these activities. In case of inadvertent disturbance of a potentially significant site, the District will promptly notify the State Historic Preservation Office and/or a qualified archaeologist and mitigation measures will be devised as appropriate. If human bones should be uncovered, work in the vicinity will stop and the Napa County Coroner will be called. If the coroner determines the remains to be human, he will contact the Native American Heritage Commission (NAHC). The NAHC will notify a local Native American descendent who will be allowed to inspect the find and provide recommendations for disposition.

Major physical control activities will have site-specific CEQA review prior to earthmoving. With the introduction of these measures, potential impacts are reduced to less than significant levels.

CERES

State Historical Landmarks
Napa County

California State Historical Landmarks in Napa County

Properties of historical importance in California are currently designated as significant resources in three state registration programs: State Historical Landmarks, Points of Historical Interest, and the California Register of Historic Places. Below is a list of the State Historical Landmarks for Napa County. This data is provided by the Office of Historic Preservation - California Department of Parks and Recreation and is also available in the California Historical Landmarks Book.

- **NO. 359 OLD BALE MILL** - This historic gristmill was erected by Dr. E. T. Bale, grantee of Carne Humana Rancho, in 1846. The mill, with surrounding land, was deeded to the Native Sons of the Golden West by Mrs. W. W. Lyman, and was restored through the efforts of the Native Son Parlors of Napa County.
Location: Bale Grist Mill State Historic Park, Hwy 29 (P.M. 32.1), 3369 N St. Helena Hwy, 3 mi NW of St. Helena
USGS Quadrangle Sheet Name: CALISTOGA

- **NO. 547 CHILES MILL** - Joseph Ballinger Chiles, who first came to California in 1841, erected the mill on Rancho Catacula 1845-56. The first American flour mill in Northern California, it was still in use in the 1880s. Chiles served as a vice president of the Society of California Pioneers, 1850-53.
Location: SW corner on hillside, Chiles and Pope Rd and Lower Chiles Valley Rd, 3.6 mi N on Hwy 128, Chiles Valley

- **NO. 562 LA CHRISTIANITA** - Near this spring, the first Christian baptism in Alta California was performed by Padre Francisco Gómez, a member of the Portolá Expedition, in 1769.
Location: Site and plaque in Camp Pendleton, Los Cristianitos Canyon, on Cristianitos Rd, 0.4 mi N. of intersection of San Mateo Rd, 3 mi E of I-5 at San Clemente, plaque in San Clemente Civic Center 100 Avenida Presidio, San Clemente
USGS Quadrangle Sheet Name: CALISTOGA

- **NO. 564 GEORGE YOUNT BLOCKHOUSE** - In this vicinity stood the log block-house constructed in 1836 by George Calvert Yount, pioneer settler in Napa County. Nearby was his adobe house, built in 1837, and across the bridge were his grist and saw mills, erected before 1845. Born in North Carolina in 1794, Yount was a trapper, rancher, and miller, he became grantee of the Rancho Caymus and La Jota. He died at Yountville in 1865.
Location: NE corner of Cook Rd and Yount Mill Rd, 1 mi N of Yountville

- **NO. 565 PETER LASSEN GRAVE** - In memory of Peter Lassen, the pioneer who was killed by

the Indians April 27, 1859, at 66 years of age.
Location: 2550 Wingfield Rd via Richmond Rd, 5 mi SE of Susanville

• **NO. 682 SITE OF YORK'S CABIN, CALISTOGA** - Among the first houses in this area was John York's log cabin, constructed in October 1845. Rebuilt as part of the home of the Kortum family, it was used as a residence until razed in 1930. Nearby was the cabin of David Hudson, also built in October 1845. Calistoga was named by Samuel Brannan.
Location: SW corner Hwy 29 (Foothill Blvd) and Lincoln Ave, Calistoga

• **NO. 683 SITE OF HUDSON CABIN, CALISTOGA** - David Hudson was one of the early pioneers who helped develop the upper portion of Napa Valley by purchasing land, clearing it, and planting crops and building homes. Hudson built his cabin in October 1845.
Location: NE corner of Hwy 29 (Foothill Blvd) and Lincoln Ave, Calistoga

• **NO. 684 SAM BRANNAN STORE, CALISTOGA** - Sam Brannan arrived in Napa Valley in the late 1850s and purchased a square mile of land at the foot of Mount St. Helena. This is the store he built, in which he made $50,000 in one year.
Location: NW corner of Wapoo Ave and Grant St, 203 Wapoo Ave, Calistoga

• **NO. 685 SAM BRANNAN COTTAGE, CALISTOGA** - Sam Brannan arrived in Napa Valley in the late 1850s with the dream of making it the 'Saratoga of California.' In 1866 cottages were built and palm trees planted in preparation for the grand opening of the resort. This is the only cottage still standing.
Location: 1311 Washington St, Calistoga

• **NO. 686 SITE OF KELSEY HOUSE, CALISTOGA** - Nancy Kelsey arrived in California in 1841 with the Bidwell-Bartleson party and settled with her family south of present-day Calistoga. Now the hearthstone is all that can be seen of the house. The property is owned by the Rockstrohs.
Location: 500 ft NW of intersection of State Hwy 29 and Diamond Mtn Rd, 1.1 mi S of Calistoga

• **NO. 687 NAPA VALLEY RAILROAD DEPOT, CALISTOGA** - The Napa Valley Railroad depot, now the Southern Pacific depot, was built in 1868. Its roundhouse across Lincoln Avenue is gone. On its first trip, this railroad brought people to Calistoga for the elaborate opening of Brannan's summer resort in October 1868.
Location: 1458 Lincoln Ave, Calistoga

• **NO. 693 GRAVE OF GEORGE C. YOUNT** - George Calvert Yount (1794-1865) was the first United States citizen to be ceded a Spanish land grant in Napa Valley (1836). Skilled hunter, frontiersman, craftsman, and farmer, he was the true embodiment of all the finest qualities of an advancing civilization blending with the existing primitive culture. Friend to all, this kindly host of Caymus Rancho encouraged sturdy American pioneers to establish ranches in this area, so it was well populated before the gold rush.
Location: George C. Yount Pioneer Cemetery, Lincoln and Jackson Sts, Yountville

• **NO. 710 ROBERT LOUIS STEVENSON STATE PARK** - In the spring of 1880, Robert Louis Stevenson brought his bride to Silverado. He and Fannie Osbourne Stevenson lived here from May 19 until July, while he gathered the notes for Silverado Squatters.
Location: Hwy 29 (P.M. 45.5), 75 mi NE of Calistoga

- **NO. 814 BERINGER BROTHERS WINERY** - Built by Frederick and Jacob Beringer, natives of Mainz, Germany, this winery has the unique distinction of never having ceased operations since its founding in 1876. Here, in the European tradition, were dug underground wine tunnels hundreds of feet in length. These maintain a constant temperature of 58 degrees, a factor considered necessary in the maturing and aging of fine wines.
Location: 2000 Main St, St. Helena

- **NO. 828 VETERANS HOME OF CALIFORNIA** - This home for California's aged and disabled veterans was established in 1884 by Mexican War veterans and members of the Grand Army of the Republic. In January 1897 the Veterans Home Association deeded the home and its 910 acres of land to the State, which has since maintained it.
Location: SW corner of California Dr and Hwy 29, Yountville

- **NO. 878 FIRST PRESBYTERIAN CHURCH BUILDING** - Designed by pioneer architects R. H. Daley and Theodore Eisen, this church is an outstanding example of late Victorian Gothic architectural styling. It is the best surviving example in this region of the early works associated with Eisen, who later became an important Southern California architect. The church has been in continuous use since its construction in 1874, longest pastorates were those of Richard Wylie and Erwin Bollinger.
Location: 1333-3rd St between Randolph and Franklin Sts, Napa

- **NO. 939 Twentieth Century Folk Art Environments (Thematic) -LITTO** - This is one of California's exceptional Twentieth Century Folk Art Environments. Over a period of 30 years, Emanuele 'Litto' Damonte (1896-1985), with the help of his neighbors, collected more than 2,000 hubcaps. All around Hubcap Ranch are constructions and arrangements of hubcaps, bottles, and pulltops which proclaim that 'Litto, the Pope Valley Hubcap King,' was here.
Location: 6654 Pope Valley Rd (P.M. 14.3), 2.1 mi NW of Pope Valley

See Also: Statewide Historical Landmarks listed by County

| CERES: Napa County | Counties | CERES Home | LUPIN | Webmaster |

3.6 GEOLOGY AND SOILS.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? *Refer to Division of Mines and Geology Special Publication 42.*			X	
ii) Strong seismic ground shaking?				X
iii) Seismic-rekated ground failure, including liquefaction?				X
iv) Landslides?				X
b) Result in substantial soil erosion or the loss of topsoill?			X	
c) Be located on a geologic unit that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?			X	
d) Be located on expansive soils, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?				X

Explanation:

Setting

The Project Service Area is located in the San Francisco Bay Area, which is one of the most seismically active regions in the United States. Some regions in the Service Area, including some unstable geological units, are likely to be subject to strong ground shaking, liquifaction, landslides, and possibly ground rupture in the event of a proximal moderate to severe earthquake on any of a number of faults that run through the County (see attached maps from Napa County General Plan). However, it is unlikely that these events would affect the District's facilities, which consist of a 30' x 60' metal Butler type building and a 10' x 12' portable metal pesticide storage building.

The soils underlying many mosquito-producing sites within the District's Service Area are moist and prone to compaction or erosion under substantial dewatering and/or operations of vehicles with high ground pressure (over about three pounds per square inch = psi). Both peat and mineral soils underlying wetlands in the areas are prone to wind erosion if dewatered for long periods.

Potential Environmental Impacts and Measures to Ensure Insignificance - ATV's

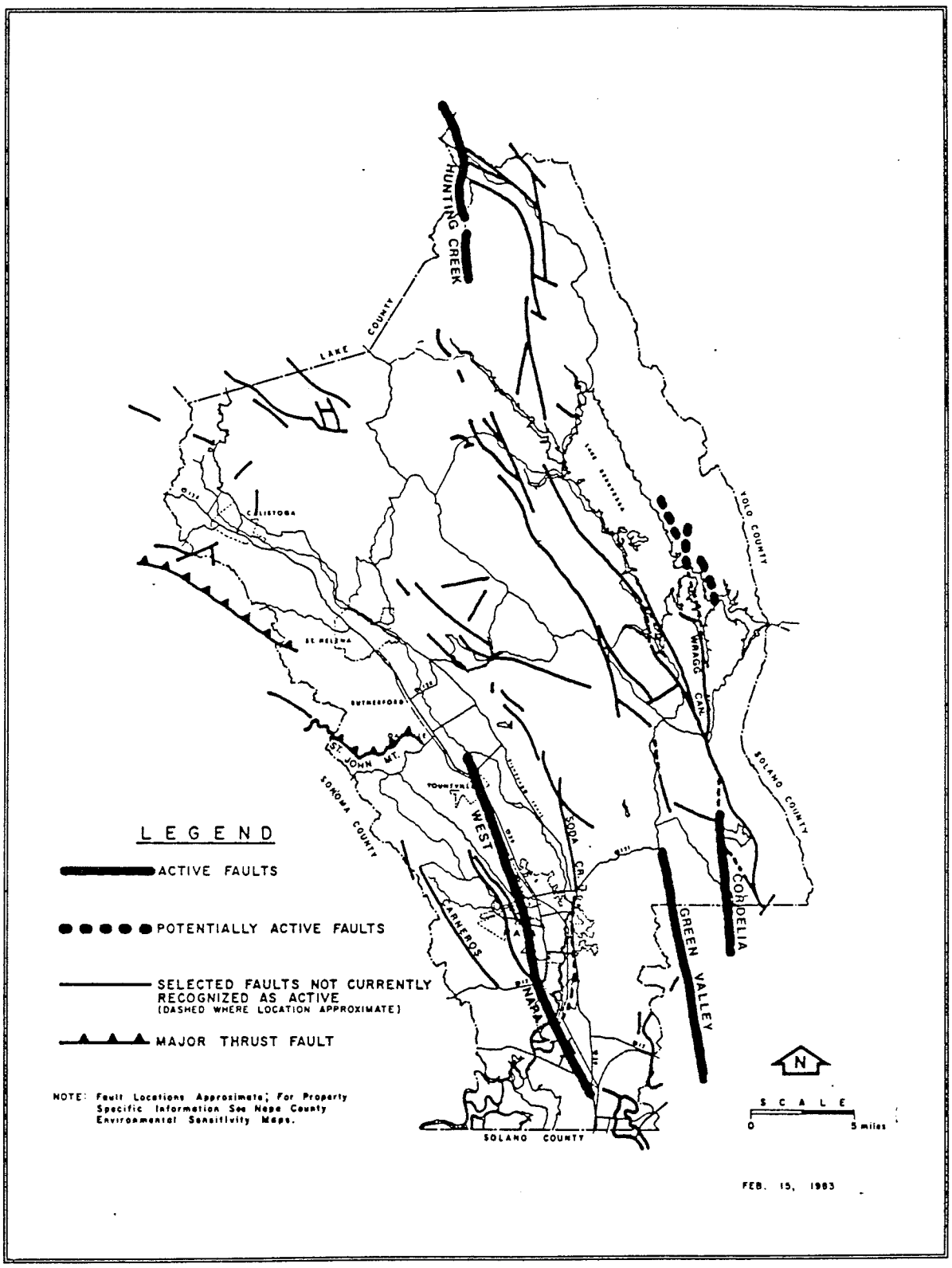
The use of all-terrain vehicles on marshes and other wetlands has been criticized on the grounds that they might compact soils or otherwise substantially alter the local geology. The District does not see substantial evidence that this could be a problem for our project for the following reasons: 1) the ATV's we use in natural settings have eight low pressure tires, wide soft treads, and a ground loading well under 2 psi; 2) the ATV's we use in agricultural settings have equivalent or lower total weight and ground loading than typical agricultural vehicles; 3) all of our field personnel that use ATV's are extensively trained on the use of ATV's; 4) over ten years experience with the same types of machinery have shown no evidence of long-term or significant impacts.

Potential Environmental Impacts and Measures to Ensure Insignificance - Physical Control

Artificial drainage of naturally-wet marshes can lead to warm weather drying, oxidation, wind erosion, and subsidence. Physical control activities by the District are designed to accelerate drainage only in built environments or in agricultural environments where soil irrigation and drainage is part of the ongoing agricultural practices. The District does not drain natural wetlands. On the contrary, physical control activities by the District are typically associated with improved soil water retention and reduced subsidence or erosion.

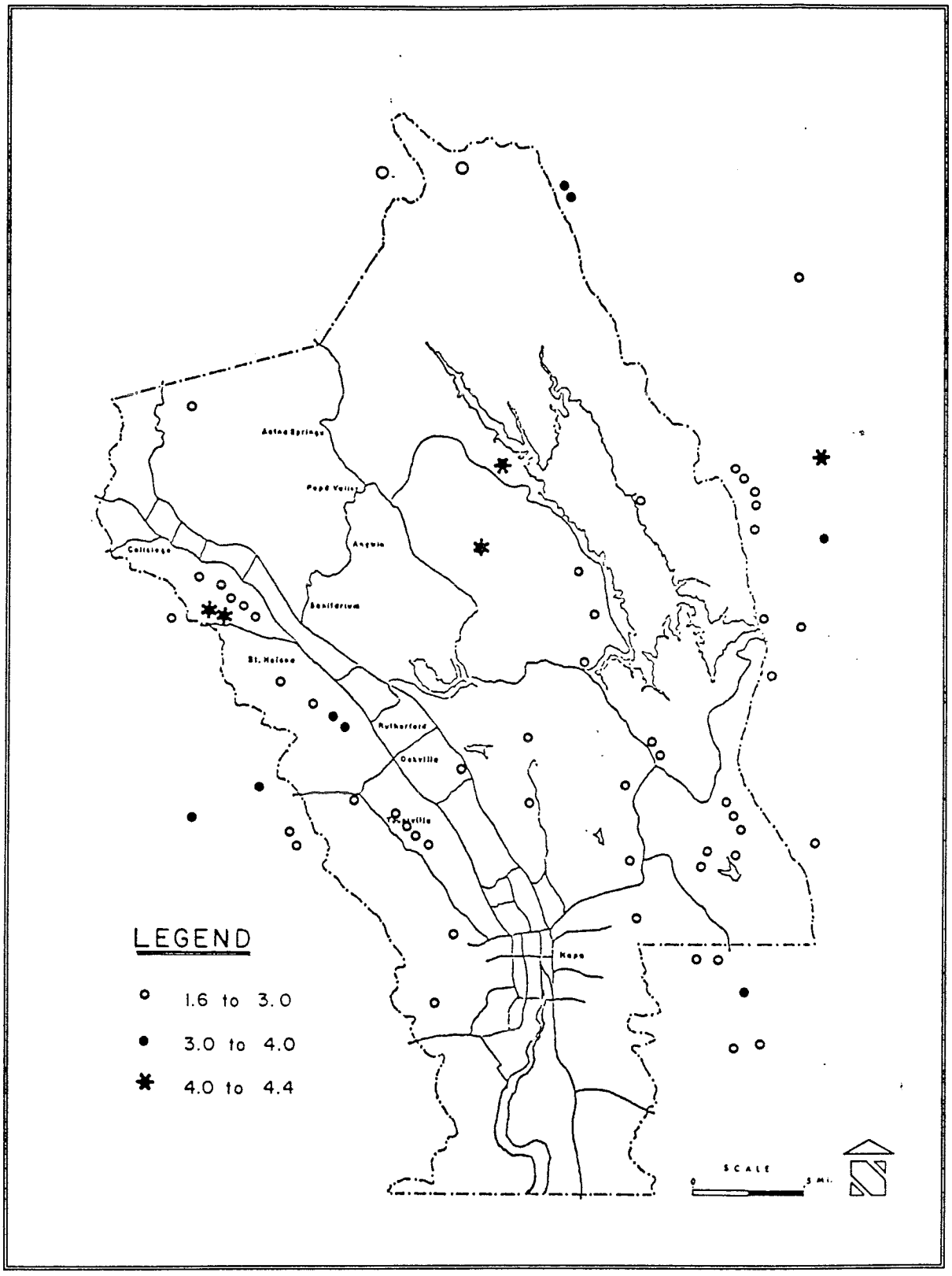
Other District activities have no impact on soils or geology.

FAULTS



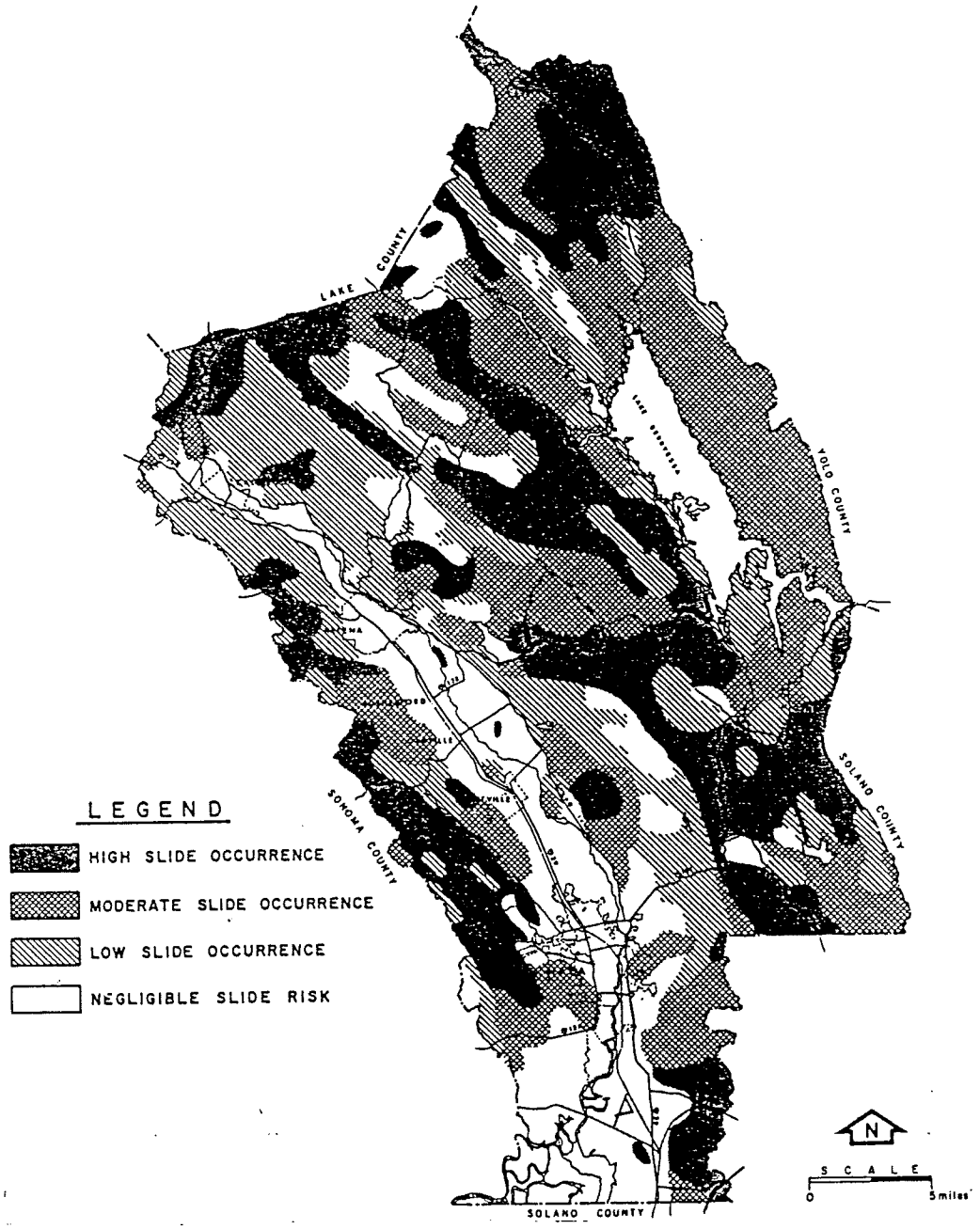
Source: C.D.M.G. Preliminary Special Studies Zone Maps, 1983;
U.S.G.S. Miscellaneous Field Studies Map MF-881, 1977;
U.S.G.S. Basic Data Contributions 54 and 56, 1973.

EARTHQUAKE MAGNITUDE (RICHTER SCALE) 1944-1965



Source: U.C. Berkeley Seismographic Station

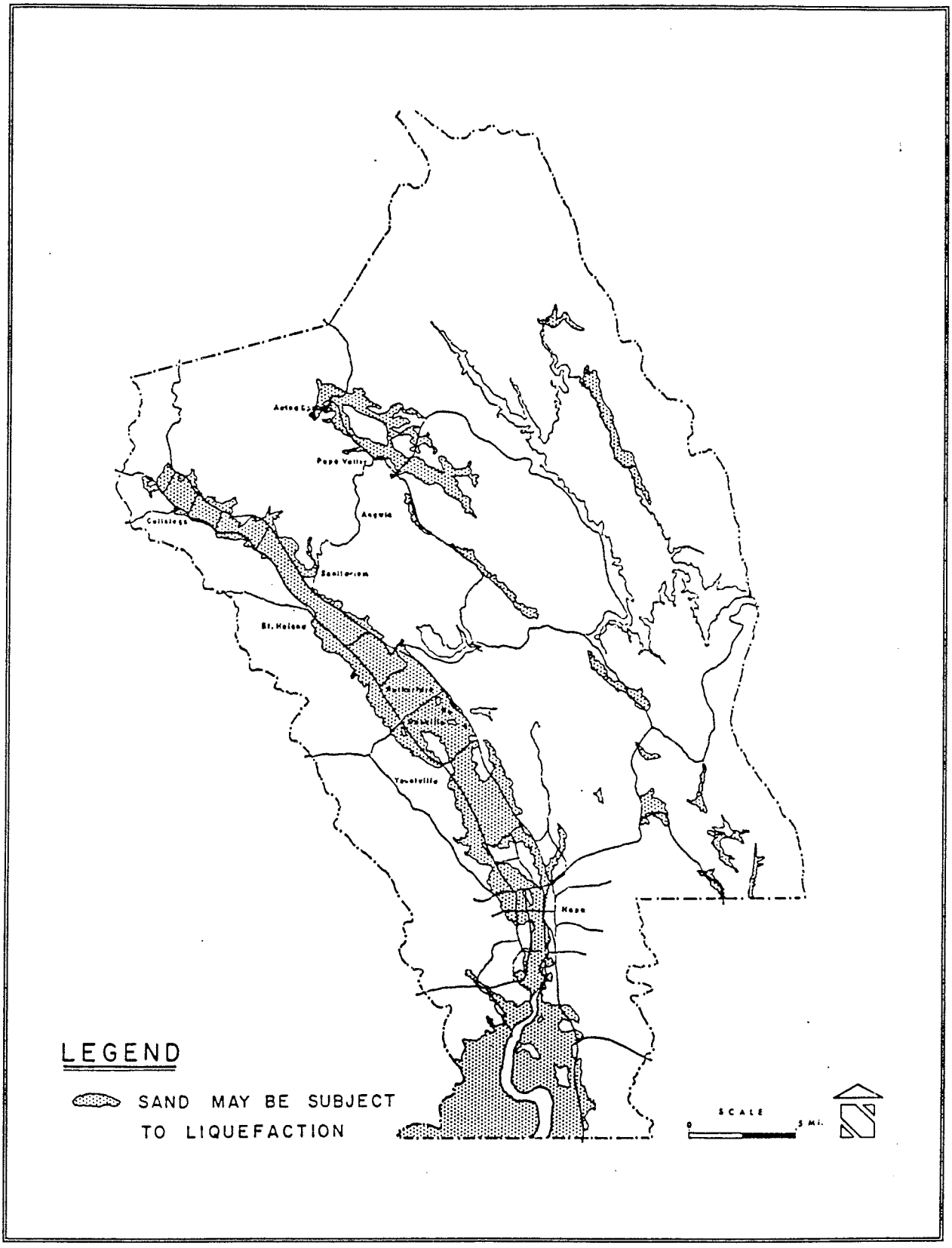
RELATIVE STABILITY OF UNDISTURBED SLOPES



NOTE: Map Generalized - Not Suitable For Evaluating Landslide Hazards On A Parcel Specific Basis; For The More Detailed Information Needed To Do This See Napa County Environmental Sensitivity maps.

SOURCE: Complied by Napa County Planning Department from maps prepared by the U.S. Geological Survey.

LIQUEFACTION POTENTIAL



Source: U.S.G.S. (1974) and C.D.M.G. (1963)

3.7 HAZARDS AND HAZARDOUS MATERIALS.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal or hazardous materials?			X	
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?			X	
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?			X	
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?		X		
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?			X	
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?				X
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				X
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildland are adjacent to urbanized areas or where residences are intermixed with wildlands?			X	

Explanation:

Setting

The Project Service Area includes a large number of winery waste and sewage treatment ponds. Furthermore, there are some historical minor industrial sites within close proximity to the Napa River and some of its associated seasonal or tidal wetlands. The hazard status of these areas is not fully known to the District. Physical control activities in any of these areas might pose a threat of release of hazardous materials if prudent pre-project site evaluations are not undertaken.

There is a public airport within the District Service Area. Although not a site for extensive routine mosquito surveillance or control, the District could undertake pesticide applications within and around this site, due to the proximity to marsh and seasonal wetland habitats and to human settlements.

Most of the Project Service Area is vulnerable to wildland fires (see attached map from Napa County General Plan), including areas where District activities involve routine use of motorized vehicles or pesticide application equipment, or the transportation and application of GB-1111 (larvicidal oil).

Potential Environmental Impacts and Measures to Avoid Significance - Chemical Control and Vegetation Management

Minimizing the hazards of mosquito-borne disease depends on effective mosquito control, which can include the use of chemical insecticides and herbicides. Application of pesticides within label guidelines do not constitute a significant hazard to the public (Cal. Dept. of Pesticide Registration). All pesticides are classified as "hazardous materials" by the state of California, regardless of their acute toxicity. Therefore, routine District activities do pose a risk of release of hazardous materials through accidental releases, and this can occur within one-quarter mile of existing or proposed school sites. District policies and practices, however, ensure that these risks and impacts are not significant.

First, the pesticides used by the District are safe. The District does not use Category 1 or Category 2 pesticides (see Section 4). The pesticides that are routinely used by the District have very low acute toxicities, and very low chronic toxicity at the concentrations and volumes transported and applied by the District.

Second, the volumes of pesticides transported or used by the District are small. Bulk deliveries of pesticides to the District are very infrequent, and are always handled by haulers certified by DOT for the materials they are transporting. The District does not transport large volumes of pesticides in its own vehicles. The highest load capacity for a District vehicle is 99 gallons of either GB-1111 (light oil) or 99 gallons of aqueous solutions.

Third, all District vehicles that transport or apply pesticides are equipped with all equipment and supplies needed to contain the largest possible spill from that vehicle. All District vehicles are maintained in good condition by a full-time mechanic working in a fully-equipped shop.

Fourth, all District personnel that handle pesticides are registered by the California Dept. of Health Services as Pesticide Applicators, and are required to complete annual pesticide safety training, including pesticide spill drills, offered by the District.

Fifth, the District and its personnel are routinely inspected by the Napa County Agricultural Commissioner's office to verify that all equipment is calibrated and functioning properly and to assure adequate staff training and knowledge concerning the proper use and handling of all pesticides used by the District.

In addition, all District vehicles carry fire extinguishers and two-way radios which can be used to summon assistance in the unlikely event that any District action initiates a fire. Although GB1111 is a petrochemical product, its chemical and physical characteristics make it extremely unlikely to ignite during foreseeable circumstances (MSDS), and if it does ignite, the low volumes used in District equipment and the nature of the application sites reduces the possibility of a wildfire to insignificance.

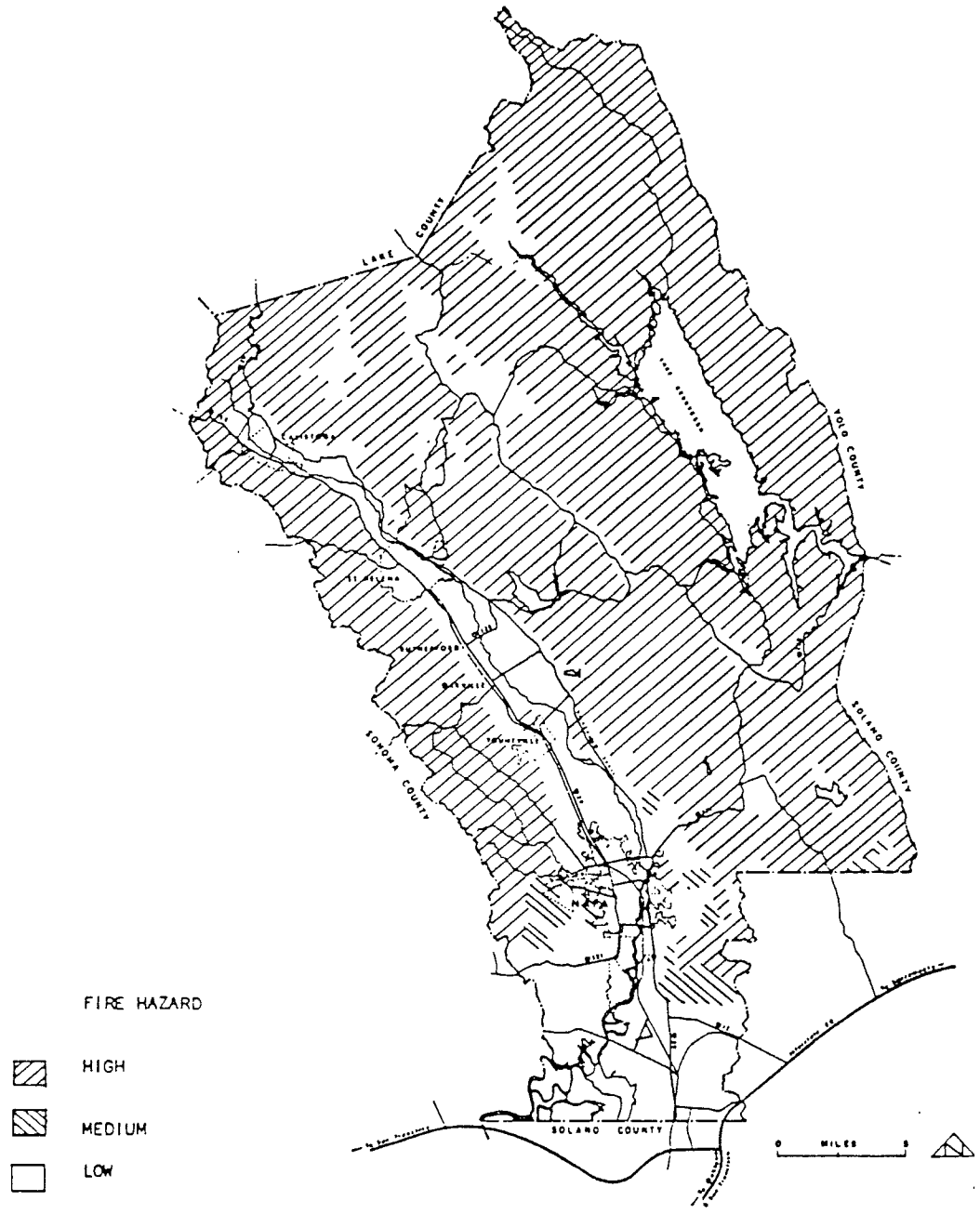
Potential Environmental Impacts and Mitigation - Physical Control

Excavation during minor physical control activities has the potential of uncovering previously-unknown buried hazardous materials. The risk of this is small because these activities typically take place in the footprint of existing levees, culverts, channels, or on sites that have never been an industrial site. However, in some circumstances, the land use history of an area where physical control is proposed is unclear. In addition, there is a possibility of exposure of contaminated soil from channel erosion after construction.

The USACE and BCDC regional permits that allow minor physical control work by the District require submission of annual work plans by the District and provide for wide agency review of these plans. As an additional prudent measure, the District will also conduct field visits, aerial photography evaluation, and agency record searches for evidence of contamination with hazardous materials, prior to initiating source reduction activities in any location where there is evidence of current or past industrial or heavy transportation activities in the area of influence of the proposed work.

WILDLAND FIRE HAZARD MAP

THIS MAP IS INTENDED TO PROVIDE A GENERALIZED PICTURE OF WILDLAND FIRE HAZARDS: FOR MORE DETAILED (PARCEL SPECIFIC) INFORMATION, THENAPA COUNTY ENVIRONMENTAL SENSITIVITY MAPS SHOULD BE CONSULTED.



Source: California Department of Forestry, Napa County Conservation, Development & Planning Department

3.8 HYDROLOGY AND WATER QUALITY.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge standards?			X	
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which a permit has been granted)?			X	
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?			X	
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?			X	
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?				X
f) Otherwise substantially degrade water quality?			X	
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?				X
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?			X	
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of a failure of a levee or dam?			X	
j) Inundation by seiche, tsunami, or mudflow?				X

Explanation:

Setting

The District's activities largely take place in wetlands, including riparian zones, as described in Section 3.4 (Biological Resources). As noted in 3.7 (Hazards and Hazardous Materials) above, all physical control activities in jurisdictional wetlands are subject to annual review by a wide range of state and federal agencies, which helps the District identify and avoid potential impacts associated with water quality or quantity.

Potential Environmental Impacts and Measures to Avoid Significance - Water Quality

The only potential effects of Project activities on water quality would be seen in impacts on fish and wildlife (discussed under Biological Resources) or through accidental release of pesticides (discussed under Hazards & Hazardous Materials).

Potential Environmental Impacts and Measures to Avoid Significance - Groundwater

The Project does not involve consumptive use of groundwater. Some physical control activities might involve maintenance of existing drainage works in agricultural or other highly impacted sites. Near-surface groundwater could be slightly lowered in these settings, but only in a direction and scope similar to standard agricultural drainage practices on the same parcels. In physical control projects in natural areas, the consequences of District activities are generally a restoration of hydraulic actions to pre-European conditions. This is generally considered a desirable situation (Habitat Goals Project 1999), and where the impacts could significantly alter current habitat values, the District will conduct a separate CEQA review of the proposed activities.

Potential Environmental Impacts and Measures to Avoid Significance - Erosion and Siltation

Of the Project activities, only physical control and vegetation management have any potential to cause erosion or siltation, and the small scale of these activities, combined with the permit requirements associated with physical control, preclude significant impacts.

Potential Environmental Impacts and Measures to Avoid Significance - Flooding

Of the Project activities, only physical control and vegetation management have any potential to result in flooding, and the small scale of these activities, combined with the permit requirements associated with physical control, preclude significant impacts. Specifically, while water control structures are often built within the 100-year floodplain, the intent and functioning of these structures is to reduce flood risk, rather than to impede or detrimentally redirect flows. As above, the District will conduct a separate CEQA review of any proposed major new work.

3.9 LAND USE AND PLANNING

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Physically divide an established community?				X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?			X	
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?			X	

Explanation:

Setting - Existing Environmental Practices, Plans, and Policies

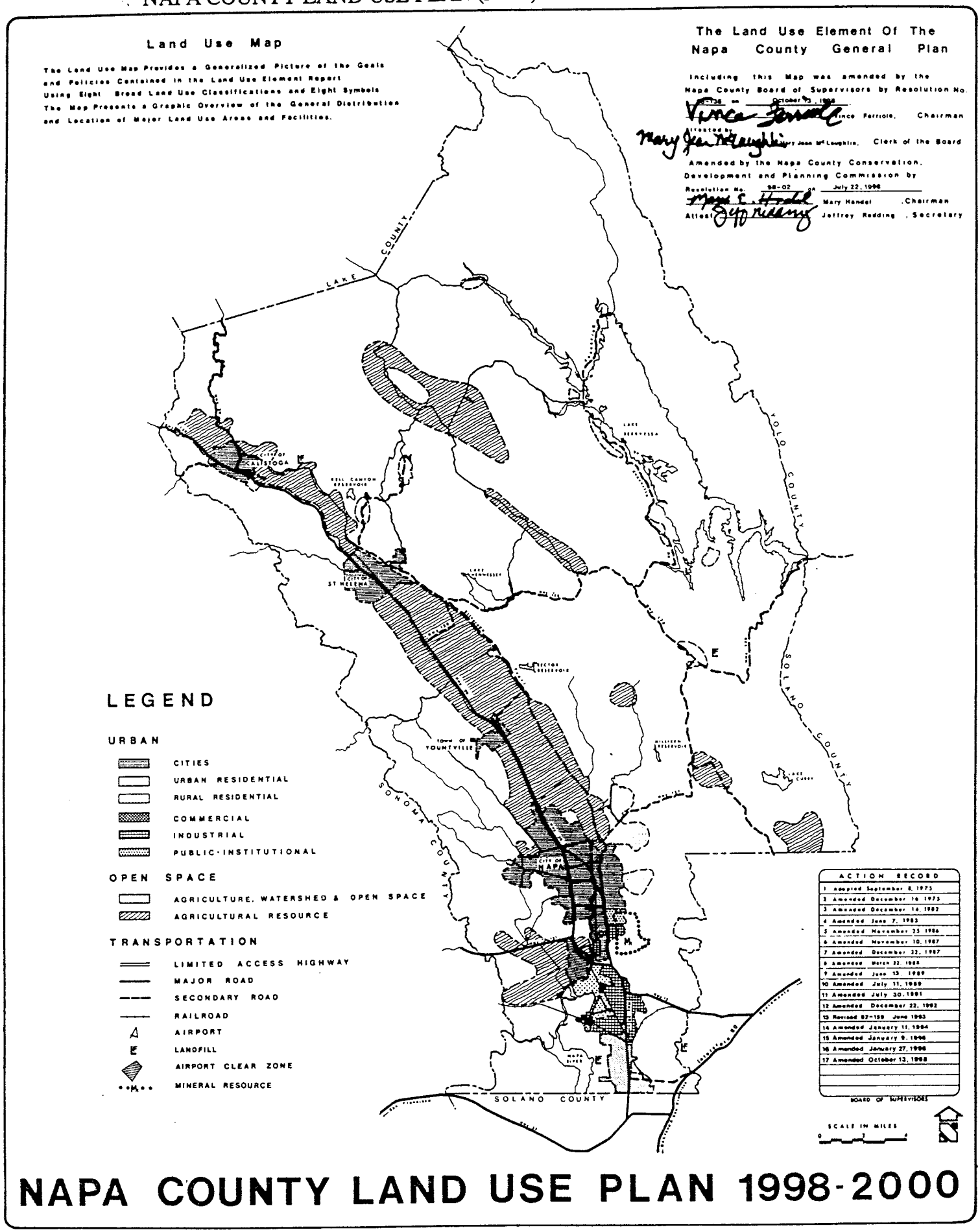
Because of the size and diversity of the District Service Area, there are a large number of existing environmental practices, plans, and policies, including those of Napa County (see attached map from Napa County General Plan) and the cities in the County. In addition, large institutional land-owners (e.g. the California Dept. of Fish & Game) have adopted land use plans and other environmental policies and practices.

Potential Environmental Impacts and Measures to Avoid Significance

All District activity types are compatible with the zoning, City and County general plan designations, and City and County general plan policies of the impact area. In addition, the County General Plan notes resource management, such as maintaining critical marsh and other endangered habitats, as one of the most appropriate uses in "Open Space" areas. Since the project involves maintenance and enhancement of wetlands, the project would be consistent with the policies contained in the County and City General Plans.

The activities proposed under the project do not directly result in any changes to land use on or off site. Implementation of the project activities is not expected to adversely affect adjacent uses or directly cause any changes to regional land use. Therefore, the project is compatible with existing land uses. The Project Elements, individually and collectively, appear to be consistent with all existing environmental policies and plans of relevance to the District's Service Area.

There are no approved Habitat Conservation Plans in the Service Area (USFWS 6/3/99; Peter Baye, pers. comm. 8/30/99).


Land Use Map
The Land Use Map Provides a Generalized Picture of the Goals and Policies Contained in the Land Use Element Report Using Eight Broad Land Use Classifications and Eight Symbols The Map Presents a Graphic Overview of the General Distribution and Location of Major Land Use Areas and Facilities.
The Land Use Element Of The Napa County General Plan
Including this Map was amended by the Napa County Board of Supervisors by Resolution No. 98-136 on October 13, 1998
Vince Ferriole, Chairman
Attested by Mary Jean McLaughlin, Clerk of the Board
Amended by the Napa County Conservation, Development and Planning Commission by Resolution No. 98-02 on July 22, 1998
Mary Handel, Chairman
Attest: Jeffrey Redding, Secretary
LAKE COUNTY
YOLO COUNTY
SOLANO COUNTY
SONOMA COUNTY
CITY OF CALISTOGA
CITY OF ST HELENA
TOWN OF YOUNTVILLE
CITY OF NAPA
LEGEND
URBAN
CITIES
URBAN RESIDENTIAL
RURAL RESIDENTIAL
COMMERCIAL
INDUSTRIAL
PUBLIC-INSTITUTIONAL
OPEN SPACE
AGRICULTURE, WATERSHED & OPEN SPACE
AGRICULTURAL RESOURCE
TRANSPORTATION
LIMITED ACCESS HIGHWAY
MAJOR ROAD
SECONDARY ROAD
RAILROAD
AIRPORT
LANDFILL
AIRPORT CLEAR ZONE
MINERAL RESOURCE
ACTION RECORD
1 Adopted September 8, 1975
2 Amended December 16, 1975
3 Amended December 14, 1982
4 Amended June 7, 1983
5 Amended November 25, 1986
6 Amended November 10, 1987
7 Amended December 22, 1987
8 Amended March 22, 1988
9 Amended June 13, 1989
10 Amended July 11, 1989
11 Amended July 30, 1991
12 Amended December 22, 1992
13 Revised 92-159 June 1993
14 Amended January 11, 1994
15 Amended January 9, 1996
16 Amended January 27, 1998
17 Amended October 13, 1998
BOARD OF SUPERVISORS
SCALE IN MILES
NAPA COUNTY LAND USE PLAN 1998-2000

3.10 MINERAL RESOURCES.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?				X
c) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?				X

Explanation:

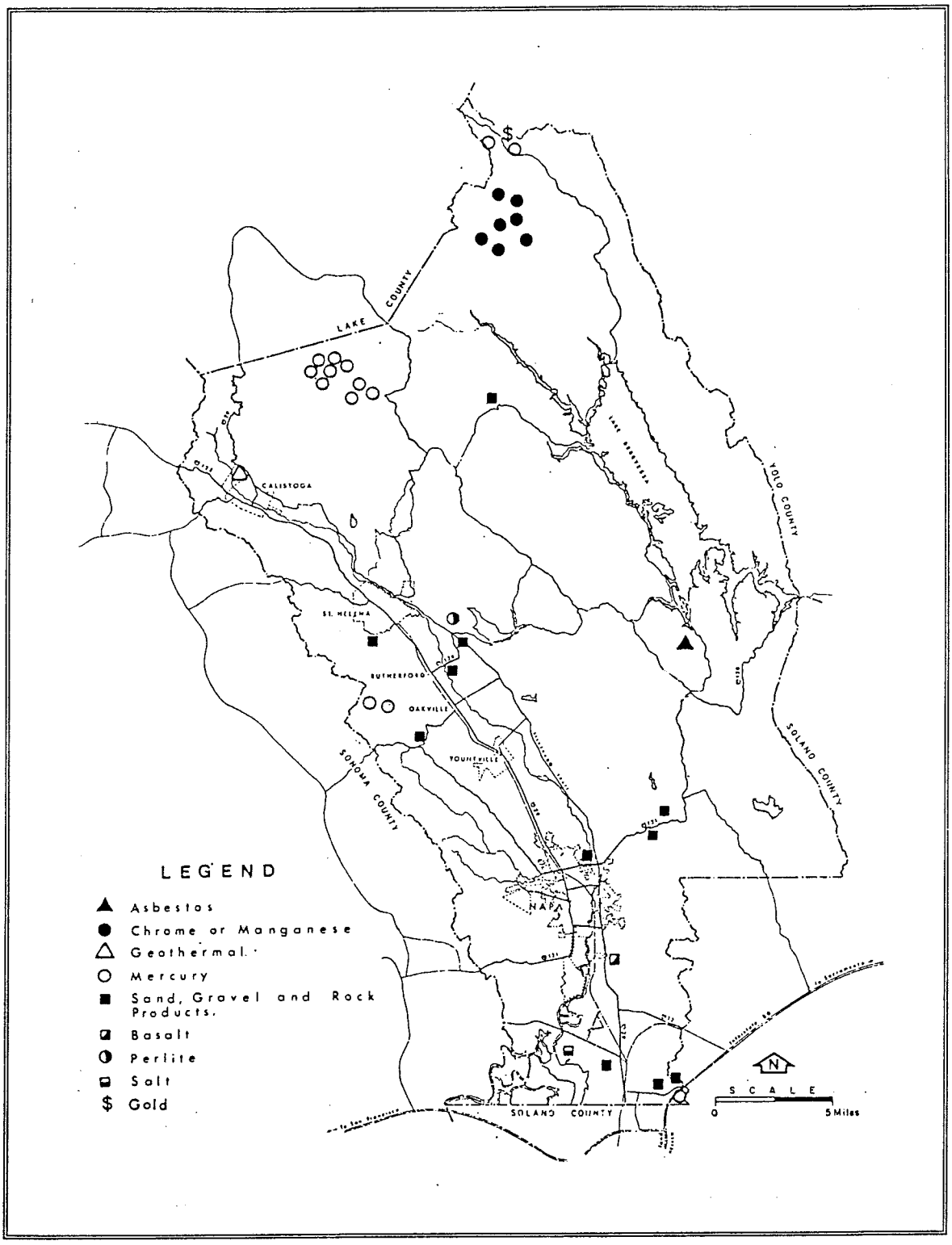
Setting

Mineral resources and mineral recovery operations are limited in Napa County (see attached map from Napa County General Plan). In the southern and central portions of the county, gravel and rock are extracted from river beds for general use. Other mineral resources include mercury, gold, chrome, and manganese (far northern reaches of the county), perlite (central region), asbestos (Lake Berryessa area), basalt (south county), salt (inactive; south county), and geothermal steam (Calistoga area).

Potential Environmental Impacts

Project operation does not involve any substantial mineral usage, nor does it interfere with any actual or proposed mineral extraction operations.

MINERAL DEPOSIT LANDS



3.11 NOISE.

Would the proposal result in:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?				X
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?				X
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?				X
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?			X	
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				X
f) For a project within the vicinity of a private airstrip, airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				X

Explanation:

Setting

The District uses ATV's, boats, and aircraft, and performs or directs physical control with heavy equipment, in marshlands surrounded by various land uses, including light industry, transportation, sewer treatment, agriculture, other open space, and single family residential. Primary noise sources in the Service Area include vehicular traffic, train traffic, and operational and construction activities at industrial facilities. The residential areas are generally located at some distance from the marshlands. Potential noise impacts on nesting birds and other wildlife are discussed under Biological Resources.

Potential Environmental Impacts and Measures to Avoid Significance - ATV's & Chemical Control

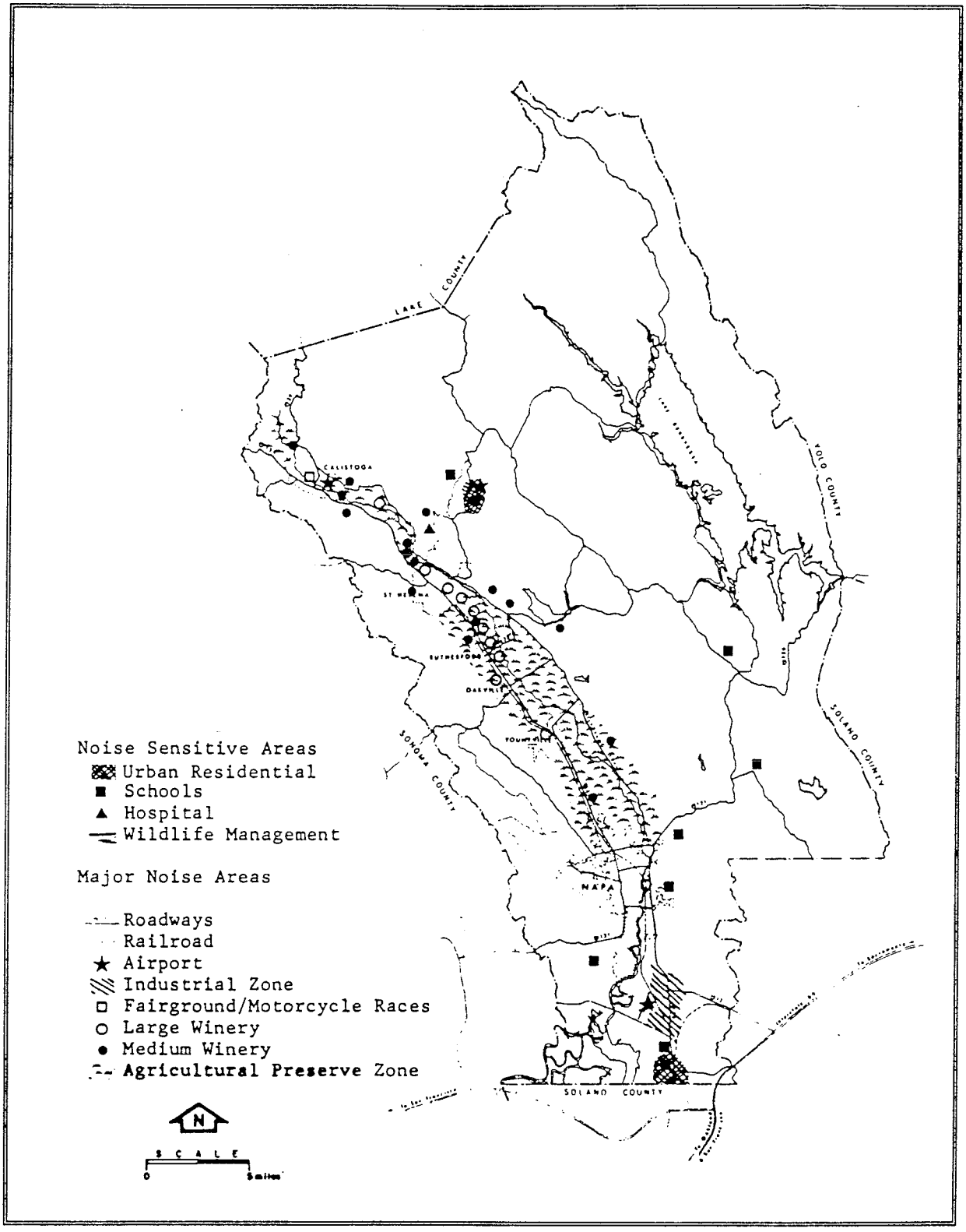
By Community Noise Equivalent Level criteria, there is no significant source of noise from the District's ATV's or other vehicles or ULV spray equipment to persons more than a few dozen feet from the vehicle. Because of the normal locations and times for operating these vehicles and equipment, and the very short time spent at any specific location, the risk of "unacceptable" noise is essentially nonexistent. Boat and aircraft use is infrequent and almost always near industrial areas, or open space at a distance from residential areas. Furthermore, aerial spray activities are coordinated with local and county emergency services, the county airport, and local communities (as

needed) to minimize concerns with respect to low-flying aircraft. In summary, the District has been conducting these activities for over fifty years without receiving noise complaints.

Potential Environmental Impacts and Measures to Avoid Significance - Physical Control

Any noise associated with source reduction projects would occur during construction of levees, tide gates, and culverts, or during dredging. Since the closest residential receptors are generally at some distance from the marsh areas where source reduction activities are concentrated, the noise from the dredging should not be discernible from the background noise from road and industry. No significant impacts from noise during construction are therefore expected.

NOISE SENSITIVE AREAS/MAJOR NOISE AREAS: NAPA COUNTY UNINCORPORATED AREA



3.12 POPULATION AND HOUSING.

Would the proposal:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads and other infrastructure)?			X	
b) Displace substantial numbers of existing housing [units], necessitating the construction of replacement housing elsewhere?				X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?				X

Explanation:

Setting

Single-family and other residential housing exists throughout Napa County, interspersed with industrial, commercial, and agricultural land uses. Prior to creation of the District, residential development in some areas of the County may have been slowed by high densities of mosquitoes. At this time, there are no areas in the District's Service Area where this is true.

Potential Environmental Impacts

No direct impacts on housing and population are anticipated from implementation of the Project. The Project does not create significant numbers of new jobs or directly induce any growth in the area; thus there would be no influx of workers. In addition, there would be no displacement of existing housing from the project, as Project implementation takes place on existing industrial, agricultural, and marsh lands.

While it could be argued that mosquito control activities by the District in the past removed a barrier to development, and therefore indirectly induced growth, the District now responds to the needs and desires of the existing population, and does not act anywhere within the Service Area with the intention of reducing mosquito populations to allow further development.

3.13 PUBLIC SERVICES.

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives of any of the public services:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
Fire protection?				X
Police protection?				X
Schools?				X
Parks?				X
Other public facilities?				X

Explanation:

Setting

Public services including fire protection and emergency medical care are located in cities throughout the Project area. Police agencies with jurisdiction over some or all of the Project area include local Police Departments, the Napa County Sheriff, and the California Highway Patrol.

Maintenance requirements of some roads are relatively high, due in part to the current flood regimes.

Costs to Caltrans and the County during road flooding include barriers, pumps, sandbags, vehicles, and personnel.

Potential Environmental Impacts and Measures to Ensure Insignificance

The Project places no significant demands on city or county public services. During the short construction period associated with source reduction projects, there could be a small chance for a need for emergency medical or fire protection services. The only long-term demands foreseen for government services will be for operation and maintenance of the facilities built in this Project. Since local governmental entities have largely performed these functions in the past, little additional demand for services is likely. In addition, road maintenance and flood-related costs should drop following permitted drainage improvement projects.

3.14 RECREATION.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				X
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?				X

Explanation:

Setting

The District Service Area includes significant recreational resources, including the Napa River and other areas adjacent to riparian zones or wetlands; and the wineries, historic cities, and other sites for outdoor tourism.

Potential Environmental Impacts

The project would not infringe on land upon which recreational uses could occur in the future. There would be no detrimental impact to recreational areas. By reducing mosquito abundance, the Program/Project substantially enhances outdoor recreational values and quality of life.

3.15 TRANSPORTATION / TRAFFIC.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections?			X	
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?				X
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?				X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				X
e) Result in inadequate emergency access?				X
f) Result in inadequate parking capacity?				X

Explanation:

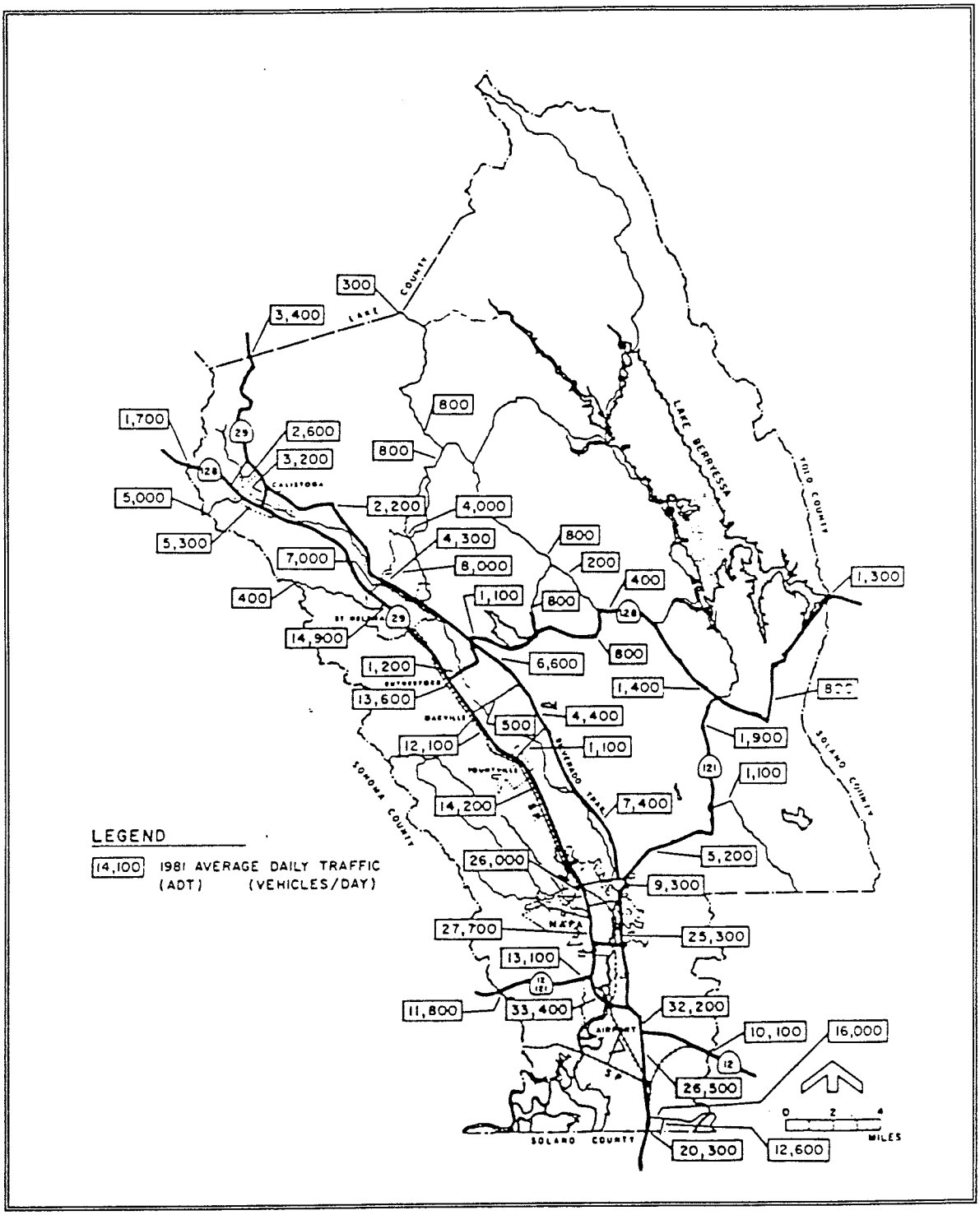
Setting

The Service Area includes a substantial commuting population and a very large tourism industry. Since 1994, 4.8 million tourists per year, many of them day visitors, have come to the Napa Valley area (Napa Valley Conference and Visitors Bureau 1998 Annual Report).

Potential Environmental Impacts and Measures to Avoid Significance

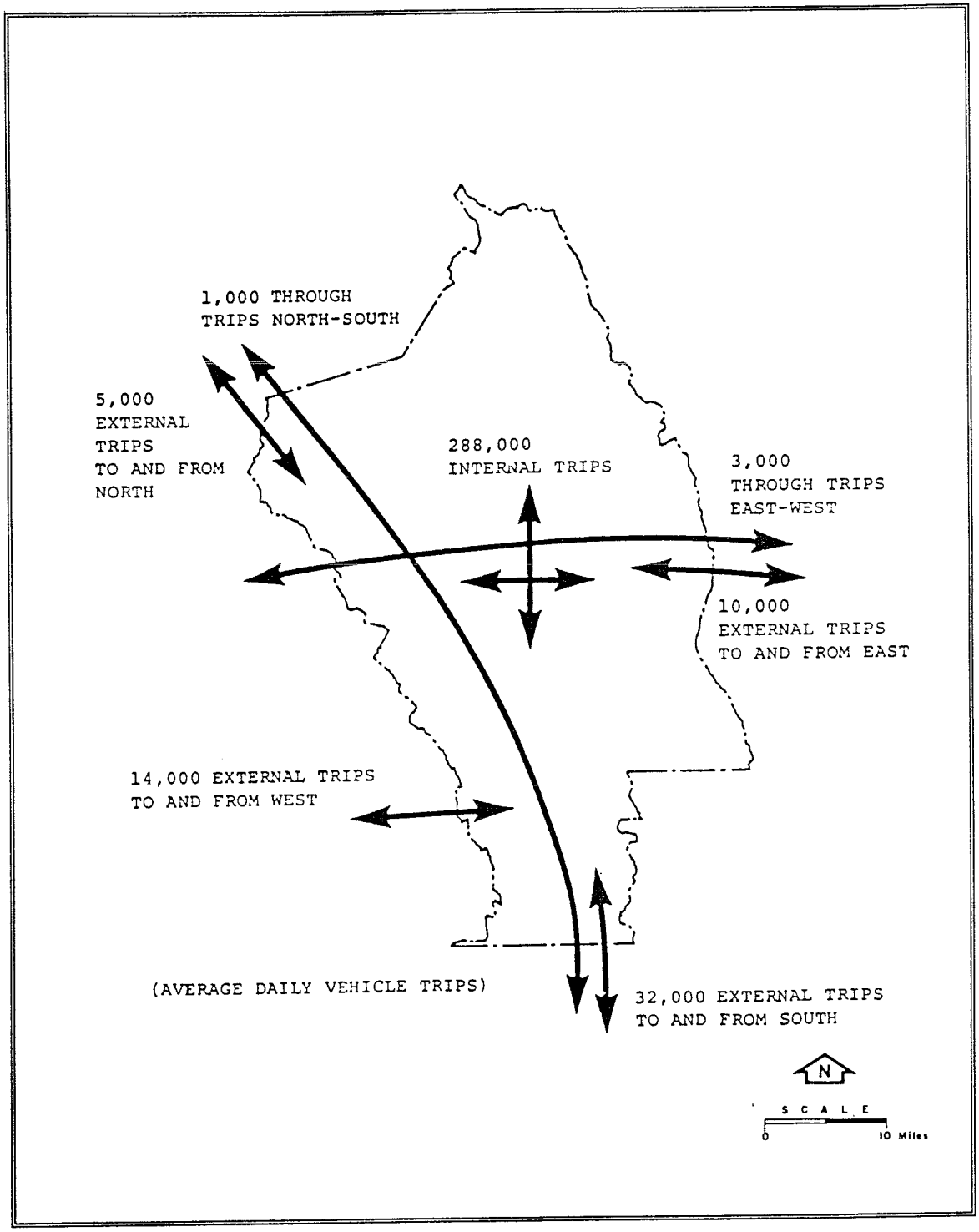
The small size of District staff and the small number of District vehicles (5) relative to the commuting, tourist, and business traffic in the Service Area (see attached maps from Napa County General Plan) means that District impacts to transportation and traffic are insignificant.

AVERAGE DAILY TRAFFIC, 1981



Source: CalTrans (1980 & 1981 Counts), Napa County Public Works Dept., Wilbur Smith & Associates, 1982

EXISTING VEHICLE TRIP DISTRIBUTION PATTERNS



Source: Wilbur Smith & Associates

3.16 UTILITIES AND SERVICE SYSTEMS.

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?				X
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?				X
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities the construction of which could cause significant environmental effects?				X
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?				X
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				X
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?				X
g) Comply with federal, state, and local statutes and regulations related to solid waste?				X

Explanation:
Potential Environmental Impacts and Measures to Avoid Significance

Mosquito control activities discussed in this report would not result in any substantial usage of utilities or service systems. Thus, there would be no demand-related impacts.

Coordination of source reduction activities with pipeline and electric line owners and operators, and routine notification to Underground Service Alert, are requirements in all construction contracts and will ensure no impacts to existing utilities.

Regional storm water drainage will often be improved by source reduction projects, and flood risk to local homes and roads may be reduced (see Water and Hazards sections).

3.17 MANDATORY FINDINGS OF SIGNIFICANCE.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?			X	
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?			X	
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?			X	

Explanation:

The District's Integrated Mosquito Management Program includes established policies and practices, together with new mitigation measures identified in other Sections, that will ensure that potential impacts to plant and wildlife species and historic or prehistoric resources remain at a less-than-significant level. Construction contract documents for District activities include measures to ensure that potential exposure of workers or others to hazards is less-than-significant. The project would not adversely affect any long-term environmental goals; in fact, many District activities function to restore the ecological quality of existing marsh areas while also improving the human environment through mosquito control and flood risk reduction.

The project would not result in significant cumulative impacts because potential for significant project impacts is eliminated by the policies, practices, and mitigation measures that have been included in the project. The project would not adversely affect human beings, either directly or indirectly.

3.18 EARLIER ANALYSES.

The District refers in this Initial Study to earlier CEQA documents. Copies of all of these documents are on file with the District, and will be made available for public review upon request. A copy fee will be required for extensive requests.

1. Preliminary Review of Activities of the Napa County Mosquito Abatement District (May 1999; updated August 1999; attached as an Appendix).

2. Final Environmental Impact Report on Napa County General Plan Revision (1991)

3. Final Environmental Impact Report on Caltrans' Vegetation Control Program. May 1992. Prepared by Jones & Stokes Associates, Inc., State Clearinghouse No. 89092515. *especially* Appendix I: Risk Assessment for Herbicides Used or Proposed for Use by the California Department of Transportation for Vegetation Management. July 1991. Prepared by K.S. Crump Division, Clement International Corporation.

SECTION 4. DETAILED TECHNICAL REVIEW OF PROGRAM/PROJECT

4.1 INTRODUCTION

The Napa County Mosquito Abatement District's Integrated Mosquito Management Program (IMMP) that is evaluated in this document is an ongoing program of surveillance and control of mosquitoes of human disease and discomfort. This Program consists of a coordinated set of activities which are described and discussed in detail below. An extensive body of knowledge exists, both in the District and in the published literature, on the reasons for these activities and the specific implementation, mode of action, efficacy, cost-effectiveness, safety, and potential environmental impacts of each. Therefore, the reader is directed to the extensive attached bibliography, and especially to the publications of the District, the American Mosquito Control Association (AMCA), and the Mosquito & Vector Control Association of California (MVCAC), for general discussions of mosquito control or for detailed information on the rationale, modes of action, and specific application of each mosquito surveillance and control technique. This Technical Review, on the other hand, only briefly summarizes general information on mosquito control methods, and primarily focuses on the potential environmental impacts of those mosquito surveillance and control activities currently or potentially used by the District, and those aspects of the District's environmental setting, program, and policies that ensure that these potential environmental impacts are insignificant.

In the interest of precision and clarity, both the common and scientific names are presented initially for organisms discussed in this report. In subsequent references to a species or subspecies, the more well-known name will be used consistently. Lists of common and scientific names are compiled for mosquitoes in a table after Section 4.1, and for Special Status Species in a set of tables after Section 4.2.

A. Project/Program Rationale

The California Health and Safety Code defines a vector as "any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal" (Section 2200(f)). The District undertakes activities through its Integrated Mosquito Management Program to control mosquitoes as vectors of disease and/or discomfort in the Service Area.

Twenty species of mosquitoes reside within the wet areas of Napa County. The table following page 3 lists these species known to occur within the District's Service Area. The reader is referred to the publications by Bohart and Washino (1978) and Meyer and Durso (1993) for detailed information concerning the biology, ecology, and diseases vectored by these mosquitoes.

Certain species of mosquitoes found in Napa County can transmit malaria, St. Louis encephalitis, western equine encephalomyelitis, and potentially other encephalitis viruses. A few species of mosquitoes are also capable of transmitting dog heartworm. Although some species of mosquitoes have not been shown to transmit disease, most species can cause human discomfort when the female mosquito bites to obtain blood. Reactions range from irritation in the area of the bite to severe allergic reactions or secondary infections resulting from scratching the irritated area. Additionally, an abundance of mosquitoes can cause economic losses, and loss of use or enjoyment of recreational, agricultural, or industrial areas.

Mosquitoes are extremely mobile and cause the greatest hazard or discomfort away from their breeding site. Each mosquito species has a unique life cycle and most of them occupy different habitats. In order to effectively control the range of mosquitoes inhabiting the District Service Area, an integrated mosquito management program must be employed. District policy is to identify mosquito species and mosquito sources in the Service Area, to recommend techniques for their prevention and control, and to anticipate and minimize any new interactions between mosquitoes and humans.

B. Project/Program Activities

The District's Integrated Mosquito Management Program consists of six general types of coordinated activities:

Surveillance for mosquito populations, mosquito habitats, disease pathogens, and public distress associated with mosquitoes. Mosquito surveillance activities include field counting, trapping, and laboratory analysis of mosquitoes, alternative hosts, and pathogens to evaluate populations and disease threats; field inspection of known or suspected mosquito habitats; maintenance of paths and the use of all-terrain vehicles to access mosquito habitat; analysis of public service requests and surveys; and other data collection methods.

Public Education to encourage and assist reduction and prevention of mosquito habitats on private and public property. While a critical element of our IMMP (see the attached Preliminary Review), public education activities are categorically exempt from CEQA review [CEQA Guidelines Sec. 15322] based on a finding by the State Secretary of Resources that these activities do not have a significant effect on the environment. Therefore, these activities will not be further reviewed in this document.

Physical Control. Management of mosquito habitat, especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities, etc., is known as "Physical Control". Activities designed to reduce mosquito populations through changes in the physical environment which reduce its habitat suitability for mosquitoes, or which improve habitat or mobility of natural predators of mosquitoes, are considered Physical Control; activities related to rearing or relocating these predators are discussed below as Biological Control. Activities which impact mosquito habitat through manipulation of vegetation is discussed below as Vegetation Management.

Vegetation Management. The District applies herbicides (chemical pesticides with specific toxicity to plants) and uses hand tools or other mechanical means of vegetation removal or thinning to improve surveillance or reduce mosquito habitats.

Biological Control. Application of the "mosquito fish" *Gambusia affinis*, the bacterium *Bacillus sphaericus* the fungus *Lagenidium giganteum*, or other predators or pathogens of mosquitoes is known as "Biological Control." *Gambusia affinis*, *Bacillus sphaericus*, and *Lagenidium giganteum* reproduce in natural settings, for at least some time, after release. *Bacillus thuringiensis israelensis* (Bti) materials applied by the District contain only spores made up of specific protein molecules produced by the Bti organism, and not live bacteria. Because the potential environmental impacts of *Bacillus sphaericus* or Bti application are generally similar to those of chemical pesticide applications, these materials are evaluated below under Chemical Control.

Chemical Control. In the context of the District's IMMP, "Chemical Control" is the application of non-persistent selective insecticides to directly reduce populations of larval or adult mosquitoes.

While these program/project elements together encompass the District's IMMP, it is important to note that the specific activities performed by District staff vary considerably from day to day, and from site to site, in response to mosquito species active, mosquito population size or density, mosquito population age structure, mosquito location, time of year, local climate and weather, potential for mosquito-borne disease, proximity to human populations, proximity to sensitive receptors, access by District staff to mosquito habitat, abundance of natural predators, availability and cost of control methods, effectiveness of previous control efforts at the site, potential for development of resistance in mosquito populations, land-owner policies or concerns, proximity to special status species, Endangered Species Recovery Plans, Habitat Conservation Plans, Natural Community Conservation Plans, and local community concerns. Therefore, the specific actions taken in response to current or potential mosquito activity in any specific place and time depends on factors of mosquito and pathogen biology, physical and biotic environment, human settlement patterns, local standards, available control methods, and institutional and legal constraints. While some consistent mosquito sources are exposed to repeated control activity, many areas with minor mosquito activity are not routinely treated, and most of the land within the District Service Area has never been directly treated for mosquitoes.

The District regularly reviews its IMMP to ensure that its practices are effective, economical, safe, environmentally sensitive, and responsive to the needs of the public. This means that new materials, methods, and treatment criteria are periodically incorporated by the District. Over the 74 year history of the District, these changes have generally reduced the potential environmental impacts of our activities through the introduction of more selective materials or through more subtle or sophisticated interactions with existing ecological and hydraulic processes. Therefore, although the District does not foresee adoption of any new general project elements beyond those listed above, it is likely that specific activities and policies discussed below will evolve, and it is certain that their intensity of application will continue to vary from site to site and from year to year. Where the modes of action and the intensity of proposed activities are similar to those in current use, the potential environmental impacts of the program as a whole should not increase as a result of these changes. Where substantially new materials, methods, or locations are proposed for routine operational use, the District will update this document.

C. General Mosquito Management Strategy

As described in the Preliminary Review, the District's activities address mosquito management through a general strategy including identification of mosquito problems; responsive actions to control existing populations of mosquitoes, prevent new sources of mosquitoes from developing, and manage habitat to minimize mosquito production; education of land-owners and others on measures to minimize mosquito production or interaction with mosquitoes; and provision and administration of funding and institutional support necessary to accomplish these goals.

In order to accomplish effective and environmentally sound mosquito management, the manipulation and control of mosquitoes must be based on careful surveillance of their abundance, habitat (potential abundance), pathogen load, and/or potential contact with people; the establishment of treatment criteria (thresholds); and appropriate selection from a wide range of control methods. This dynamic combination of surveillance, treatment criteria, and use of multiple control activities in a coordinated program is generally known as Integrated Pest Management (IPM) (Glass 1975, Davis et al 1979, Borror et al 1981, Durso 1996, Robinson 1996).

The District's Mosquito Management Program, like any other IPM program, by definition involves procedures for minimizing potential environmental impacts. The District's Project employs IPM principles by first determining the species and abundance of mosquitoes through evaluation of public service requests and field surveys of immature and adult mosquito populations; and then, if the populations exceed predetermined criteria, using the most efficient, effective, and environmentally sensitive means of control. For all mosquito species, public education is an important control strategy. In some situations, water management or other physical control activities can be instituted to reduce mosquito breeding sites. The District also uses biological control such as the planting of mosquitofish in some settings. When these approaches are not effective or are otherwise inappropriate, then pesticides are used to treat specific pest-producing or pest-harboring areas.

In order to maximize familiarity by the operational staff with specific mosquito sources in the Project area, the District is divided into zones (currently six). Each zone is assigned a full-time Mosquito Control Technician, and sometimes an Aide, whose responsibilities include minor physical control, inspection and treatment of known mosquito sources, finding and controlling new sources, and responding to service requests from the public.

Mosquito control activities are conducted at a wide variety of sites throughout the District's Project area. These sites can be roughly divided into those where activities may have an effect on the natural environment either directly or indirectly (through drainage), and sites where the potential environmental impacts are negligible ("Non-Environmental Sites"). Examples of "Environmental Sites" in the Project area include tidal marshes, duck clubs, other diked marshes, lakes and ponds, rivers and streams, vernal pools and other seasonal wetlands, stormwater detention basins, flood control channels, spreading grounds, street drains and gutters, wash drains, irrigated pastures, or agricultural ditches. Examples of "Non-Environmental Sites" include animal troughs, artificial containers, tire piles, fountains, ornamental fish ponds, swimming pools, liquid waste detention ponds, and non-natural harborage (such as covered wood piles, residential and commercial landscape, trash receptacles, etc.).

D. Emergency Activities

In the event of emergency conditions (actual or imminent disease outbreak), District actions temporarily vary from the routine operational actions of the District through increases in scope or intensity, and potentially through use of legal pesticides, in strict conformance with label requirements, that are not routinely used by the District. Because of their temporary nature and their essential similarity to routine activities, emergency activities are not expected to result in any significant environmental impact. In addition, the State has recognized that emergency conditions may require prompt action of a nature or intensity above typical levels as a means to protect public health, welfare, safety, or property, and has exempted these activities from requirements for further environmental review [CEQA Guidelines 15269, 15359].

Table 4.1.1: Mosquitoes of Napa County. The reader is referred to Bohart & Washino (1978) and Meyer & Durso (1993) for specific biological information on the mosquitoes listed in this table.

Scientific Name	Common Name
Genus *Aedes* ("*Ae.*")	
Aedes bicristatus	
Aedes dorsalis	Summer Salt Marsh Mosquito
Aedes nigromaculis	Irrigated Pasture Mosquito
Aedes sierrensis	Western Treehole Mosquito
Aedes squamiger	Winter Salt Marsh Mosquito
Aedes washinoi	Willow Pool Mosquito
Genus *Anopheles* ("*An.*")	
Anopheles franciscanus	
Anopheles freeborni	Western Malaria Mosquito
Anopheles occidentalis	
Anopheles punctipennis	Woodland Malaria Mosquito
Genus *Culex* ("*Cx.*")	
Culex apicalis	
Culex boharti	Bohart's Culex Mosquito
Culex erythrothorax	Tule or Cattail Mosquito
Culex pipiens	Little House Mosquito
Culex stigmatosoma	Banded Foul-Water Mosquito
Culex tarsalis	Encephalitis Mosquito
Culex thriambus	
Genus *Culiseta* ("*Cs.*")	
Culiseta incidens	Fish Pond Mosquito
Culiseta inornata	Winter Marsh Mosquito
Culiseta particeps	

Table 4.1.1.a: Supplemental Information on Mosquitoes of Napa County.

Scientific Name	Common Name	Habitat/Ecology	Hosts	Vector Potential/Diseases
Aedes bicristatus		One of the earliest appearing spring species. Larvae found in shallow margins of pools, ditches, etc. with heavy emergent vegetation.	Not very aggressive but will occasionally bite humans	Unknown
Aedes dorsalis	Summer Salt Marsh Mosquito	Larvae found in brackish and saline water (eg. intertidal marshes and margins of bays and lakes). Eight or more generations per year for tidal populations.	Bovine, equine and will readily bite humans	Calif. Encephalitis virus has been isolated from a Utah population.
Aedes nigromaculis	Irrigated Pasture Mosquito	Larvae form clumps along grassy margins. Associated with intermittently flooded pastures. Can have 10 or more generations per year.	Will readily bite humans and large domestic mammals.	Considered a potential threat for arbovirus transmission. Lab tests show this species can vector Western St. Louis and Japanese B encephalitis viruses.
Aedes sierrensis	Western Treehole Mosquito	Larvae found in treeholes and containers that have a lot of leafy sediment. Eggs hatch with initial fall rains and when dissolved oxygen is less than 0.25 ppm. Over winter as larvae with adults present from February – July.	Vicious biters of humans and other large mammals.	Primary vector of dog heartworm. Lab tests show this species capable of transmitting the Western equine encephalitis virus.
Aedes squamiger	Winter Salt Marsh Mosquito	Eggs hatch late fall and winter following high tides and heavy rains. Adults emerge end of February thru April and bite through early June. Univoltine.	Humans and ???	Unknown
Aedes washinoi	Washino's Willow Pool Mosquito	Larvae found in ditches, ponds, willow groves, berry vine filled depressions and densely shaded water sources.	Humans and ???	Unknown
Anopheles franciscanus		Larvae found in slow moving streams and pools of water containing rich growth of green algae and exposed to good sun. Over winter as adults.	Primarily mammals	Main Drain virus has been isolated from a San Diego population. Avian malaria was found in a Kern County population.
Anopheles freeborni	Western Malaria Mosquito	Larvae prefer clear, fresh seepage water in sunlit or partly shaded pools. Also found in rice fields and roadside ditches with grass. Over winter as adults.	Primarily mammals, will aggressively bite humans when encountered.	Most important vector of Vivax Malaria in California. Also a vector of Myxoma virus of rabbits. St. Louis encephalitis virus was isolated from a Sacramento population.
Anopheles occidentalis		Larvae found in ponds, creeks, streams, swamps, and seepages. Peak abundance in May and July. Over winter as both adults and larvae.	Rarely bites humans. Preference for bovine and equine blood.	
Anopheles punctipennis	Woodland Malaria Mosquito	Larvae mostly found in clear, shaded pools along creeks and streams in foothill areas.	Prefer large mammals	Has successfully transmitted Vivax Malaria. Has been reported as a vector of dog heartworm.

Supplemental Information on Mosquitoes of Napa County continued

Scientific Name	Common Name	Habitat/Ecology	Hosts	Vector Potential/Diseases
Culex apicalis		Larvae found in cut-off pools along woodland water courses and roadside ditches, Larvae present April thru December. Over winter as adults	Amphibians, reptiles and passerine birds.	Unknown – presumed none due to feeding preferences.
Culex boharti	Bohart's Culex Mosquito	Larvae found along the edges of slow moving streams or isolated pools of streams in open to partly shaded areas.	Amphibians	Unknown
Culex erythrothorax	Tule or Cattail Mosquito	Larvae found in tule swamps and ponds.	Primarily small mammals. Will bite humans if available	Western equine and St. louis encephalitis virus, and Turlock virus have been isolated from California populations. Calif. encephalitis virus has been isolated from Utah populations.
Culex pipiens	Little House Mosquito	Larvae prefer polluted or foul water high in organic content. Can occur in fresh water but not common. Found in artificial containers, storm drains, wastewater ponds, sumps, septic tanks, water under houses, etc.	Primarily birds. Will bite humans and pets if available.	Western equine and St. Louis encephalitis viruses are present in Calif. populations. Has also been known to vector Avian malaria.
Culex stigmatosoma	Banded Foul-Water Mosquito	Larvae found in both foul and slightly foul water from natural and artificial pools, storm drains, pastures, man-made containers, cess pools and wastewater ponds. Adults over winter in stumps and burrows.	Mammals and birds.	Western equine and St. Louis encephalitis viruses and Turlock virus have been isolated from Calif. populations. Is the primary vector of Avian malaria in Kern County.
Culex tarsalis	Encephalitis Mosquito	Larvae can be found in most fresh and brackish water sources. Can tolerate coastal marsh water with salinities up to 10 ppt. Not common in polluted water. Adults rest during the day in man-made shelters, animal burrows and treeholes.	Birds and mammals.	Primary vector of Western equine and St. Louis encephalitis viruses. Is also a vector of Avian malaria. Has been associated with Turlock, Hart Park and Lokern viruses.
Culex thriambus		Larvae are found in rock pools, isolated ponds and hoof prints along streams and creeks. Also in grassy roadside ditches.	Prefer passerine birds.	Unknown.
Culiseta incidens	Fish Pond Mosquito	Peak populations occur during the cooler months of the year. Larvae can be found in a wide range of fresh and brackish water habitats including isolated creek pools, artificial containers, fish ponds, abandoned swimming pools, water gardens, etc.	Domestic mammals and humans.	
Culiseta inorata	Winter Marsh Mosquito	Primarily a late fall through spring mosquito. Larvae found in a wide range of habitats including marshes, seepages, ditches, canals ponds, etc. Larvae can tolerate water with a salinity up to 26 ppt.	Prefer large domestic mammals. Will bite humans if available.	Have found Western equine enceph-alitis virus in Washington populations. Cache virus has been found in Utah and North Dakota populations.
Culiseta particeps		Larvae are found in small cut-off pools of streams and the shallow margins of *Typha* sp. Filled pools in wooded and semi-wooded habitats.	?	Unknown

4.2 PROGRAM/PROJECT SETTING

A. INTRODUCTION

The District's activities are conducted within a 797 square mile jurisdiction encompassing all areas contained within Napa County, California. Under Section 2270(a) of the Health and Safety Code, the District can also take limited action in bordering areas of Solano County, Sonoma County, Yolo County, or Lake County if needed to provide mosquito control for residents of Napa County. Therefore, areas actually or potentially impacted by District activities include

a. The incorporated cities of American Canyon, Calistoga, Napa, St. Helena, and the Town of Yountville;
b. The unincorporated areas of Napa County; and
c. Other bordering areas in Solano, Sonoma, Yolo, or Lake Counties.

The Project impact area covers a wide range of natural habitats and highly developed areas, with an equally wide range of plant and animal communities from the extensive tidal marshlands associated with the Napa River and along the County's south end to the heights of Atlas Peak and Mt. Veeder. Human activities in the Service Area, primarily during the last 150 years, have led to substantial changes in these habitats and in the populations of the organisms that inhabit them, so that many areas of the District Service Area exhibit some degree of human modification and impact (see County General Plan maps in Section 3).

Because of the diversity of mosquito habitat, mosquito control activities are conducted at a wide variety of different ecosystems and habitat types throughout the District's Project area. Mosquito control activities are associated with wet areas of all types and sizes. This includes marshes, ponds, creeks, seasonal wetlands, wastewater ponds, storm-water detention basins, irrigated pastures, duck clubs, etc, as well as individual homes or commercial buildings.

Mosquito control sites can be roughly divided into those where activities may have an effect on the natural environment either directly through on-site activities or indirectly through drainage to off-site areas, and sites where the potential environmental impacts are negligible. Examples of "Environmental Sites" in the Project area include Tidal Marshes, Duck Clubs, Other Diked Marshes, Lakes and Ponds, Rivers and Streams, Vernal Pools and other Seasonal Wetlands, Storm water Detention Basins, Flood Control Channels, Spreading Grounds, Street Drains and Gutters, Wash Drains, Irrigated Pastures, or Agricultural Ditches. Examples of "Non-Environmental Sites" include Animal Troughs, Artificial Containers, Tire Piles, Fountains, Ornamental Fish Ponds, Swimming Pools, Waste Detention Ponds, and Non-Natural Harborage (such as wood piles, residential and commercial landscape, trash receptacles, etc.).

B. WETLANDS AND OTHER SENSITIVE HABITATS

The District's Service Area includes extensive areas of wetlands and riparian corridors, and most of the District's mosquito control activities take place in these habitat types. The District maintains detailed maps and data bases of all areas where mosquito production takes place in the Service Areas (the "Source List"), and the location ("Source Number") is recorded for all chemical, biological, or physical control activities. Therefore, the District has a detailed long-term data base which allows evaluation of the intensity of control efforts, and their relationship to specific wetland or riparian sites. We have not observed degradation of these sites associated with our activities.

A number of specific habitat types that may be considered "sensitive" are found within the District Service Area. These include tidal marshes, extensive seasonal wetlands and grassland/meadow seeps, vernal pools, and numerous riparian corridors. These areas are well-known to District staff, and specific mosquito surveillance and control methods used in these areas are consistent with published management plans and District policies, defined throughout this report, to ensure their protection.

C. ENDANGERED AND OTHER SPECIAL STATUS SPECIES

The California Department of Fish and Game's Natural Diversity Database (NDDB) lists 65 special status species[1] in Napa County (April 5, 1999; see Section 3.4 and tables at the end of this Section). In almost all cases, the primary explanation for their status is loss of habitat. Because the District's activities do not involve changes in land use, and because proposed physical control activities in non-agricultural sites are reviewed annually by Trustee and other appropriate agencies, the District's activities do not contribute to this process. In those areas where the District's routine activities do overlap with specific habitat, District policies and practices ensure that no significant impacts can occur.

Of the thirteen species and subspecies listed as "Endangered" under either the Federal or State Endangered Species Acts (ESA), only nine occur in habitats where the District has any routine operations (Table 4.2.1). These include the marsh plant Soft Bird's-Beak (*Cordylanthus mollis ssp mollis*); the vernal pool plants Contra Costa Goldfields (*Lasthenia conjugens*), Sebastapol Meadowfoam (*Limnanthes vinculans*), and Few Flowered Navarettia (*Navarettia leucocephala* var. *pauciflora*); the spring and meadow plants Calistoga Popcorn Flower (*Plagiobothrys strictus*) and Napa Bluegrass (*Poa napensis*); the perennial-stream inhabiting California Freshwater Shrimp (*Syncaris pacifica*); the tidal marsh bird California Clapper Rail (*Rallus longirostris obsoletus*); and the marsh-inhabiting mammal Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*). The District takes extreme care to avoid disturbance to listed endangered species, as detailed below. Habitat descriptions and current maps of distribution and potential habitat of all endangered species in the Service Area are maintained by the District and incorporated into the operational guidelines of field personnel.

In addition to endangered species, Table 4.2.2 shows an additional six taxa, including one plant, one beetle, one frog, and three birds, that are listed as "Threatened" or "Rare" under either the Federal or California ESA, but that are not listed "Endangered" under either ESA. This listing indicates that the species or subspecies is vulnerable to decline to endangered levels, and habitat loss is listed as the primary threat for each of these species. Of these, only Mason's Lilaeopsis (*Lilaeopsis masonii*), Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*), California Red-legged Frog (*Rana aurora draytonii*), and California Black Rail (*Laterallus jamaicensis coturniculus*) have habitat that might overlap with areas of routine District activity. The District takes care to avoid disturbance to listed threatened species, as detailed below, and is particularly careful to ensure no habitat loss for these taxa. Habitat descriptions and current maps of distribution of all threatened species in the Service Area are maintained by the District and incorporated into the operational guidelines of field personnel.

Table 4.2.3 lists an additional 17 vascular plants, 1 amphibian, 1 reptile, 3 birds, and 2 mammals that are considered "Species of Concern" under either the Federal or California ESA, but that are not listed as "Endangered" or "Threatened." Finally, the NDDB listing for Napa County (Table 4.2.4) notes 16 vascular plants and 6 birds that are not formally listed under the Federal or state ESA, but that are considered Special Status based either on a "species of concern" evaluation by the California Department of Fish & Game (CDFG) or by the California Native Plant Society (CNPS).

The listed species that are most likely to intersect with District activities are those in one of the following three habitat types: Tidal or Historically-Tidal Marshlands, Vernal Pools, or Riparian Zones and Springs.

A. Tidal & Historically-Tidal Marshlands

Special Status Species in the District's tidal and historically-tidal marshlands are the endangered Soft Bird's-Beak, California Clapper Rail, and Salt-Marsh Harvest Mouse; the threatened or rare California Black Rail and Mason's Lilaeopsis; and the unlisted Suisun Marsh Aster (*Aster lentus*), Delta Tule Pea (*Lathyrus jepsonii jepsonii*), and Marin Knotweed (*Polygonum marinense*). The District has extensive information on the distribution of these species and subspecies in the District Service Area.

B. Vernal Pools

Special Status Species in vernal pools in the District Service Area are the endangered Contra Costa Goldfields, Sebastopol Meadowfoam, and Few-Flowered Navarretia; and the unlisted Legenere (*Legenere limosa*), Dwarf

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[1]Under the Federal and California Endangered Species Acts, the word "species" may also mean subspecies or other taxonomic groupings.

Downingia (*Downingia pusilla*), Woolly Meadowfoam (*Limnanthes floccosa ssp. floccosa*), and Baker's Navarretia (*Navarettia leucocephala ssp. bakeri*). Additionally, District staff have located and identified a population of the fairy shrimp *Linderiella occidentalis* heretofore unknown in Napa County. The nature and location of vernal pools are well known to District personnel, and surveillance and control activities in these areas are infrequent and designed to prevent any damage to the hydrology, flora, or fauna of these sensitive areas.

C. Riparian Zones & Springs

Special Status Species in riparian zones (along streams) in the District Service Area are the endangered California Freshwater Shrimp); the threatened Valley Elderberry Longhorn Beetle and California Red Legged Frog; and the unlisted Marsh Checkerbloom (*Sidalcea oregona hydrophila*), Foothill Yellow-Legged Frog (*Rana boylii*), and Northwestern Pond Turtle (*Clemmy marmorata marmorata*). In addition, the endangered Calistoga Popcorn Flower and Napa Blue Grass are associated with springs in the Service Area. District activities in riparian areas or near streams are conducted almost exclusively on foot using hand tools or small volumes of highly-selective pesticides to minimize potential environmental impacts.

Table 4.2.1: Listed Endangered Species in Napa County

Compiled by Wes Maffei, NCMAD
from NDDB, April 5, 1999 Revision

Scientific Name	Common Name	Federal	California	Other	Notes
Vascular Plants					
Astragalus clarianus	Clara Hunt's Milk-Vetch	Endangered	Threatened	CNPS 1B	Valley grassland & foothill woodland
Castilleja affinis ssp neglecta	Tiburon Indian Paintbrush	Endangered	Threatened	CNPS 1B	Valley grassland; Serpentine substrate
Cordylanthus mollis ssp mollis	Soft Bird's-Beak	Endangered	Rare	CNPS 1B	**Brackish marshlands**
Lasthenia conjugens	Contra Costa Goldfields	Endangered		CNPS 1B	Valley grassland & **Vernal Pools**
Limnanthes vinculans	Sebastopol Meadowfoam	Endangered	Endangered	CNPS 1B	**Vernal Pools**, meadows, & **seeps**
Navarretia leucocephala ssp pauciflora	Few-Flowered Navarretia	Endangered	Threatened	CNPS 1B	**Vernal Pools**
Plagiobothrys strictus	Calistoga Popcorn-Flower	Endangered	Threatened	CNPS 1B	**Springs** & Meadows; Alkaline substrate
Poa napensis	Napa Blue Grass	Endangered	Endangered	CNPS 1B	**Springs** & Meadows; Alkaline substrate
Trifolium amoenum	Showy Indian Clover	Endangered		CNPS 1B	Valley grassland; Serpentine substrate
Invertebrates					
Syncaris pacifica	California Freshwater Shrimp	Endangered	Endangered		**Lowland perennial streams; Huichica Ck.**
Birds					
Haliaeetus leucocephalus	Bald Eagle	Threatened	Endangered		Nesting & wintering
Rallus longirostris obsoletus	California Clapper Rail	Endangered	Endangered		**Salty to brackish tidal marshes**
Mammals					
Reithrodontomys raviventris	Salt-Marsh Harvest Mouse	Endangered	Endangered		**Salty to brackish marshes; associated with pickleweed (*Salicornia virginica*)**

Table 4.2.2: Listed Threatened and Rare Species in Napa County

Compiled by Wes Maffei, NCMAD
from NDDB, April 5, 1999 Revision

Scientific Name	Common Name	Federal	California	Other	Notes
Vascular Plants					
Lilaeopsis masonii	Mason's Lilaeopsis	SC	Rare	CNPS 1B	**Open-water edge of brackish marshes**
Invertebrates					
Desmocerus californicus dimorphus	Valley Elderberry Longhorn Beetle	Threatened			Closely associated with Elderberry trees in **riparian areas**
Amphibians & Reptiles					
Rana aurora draytonii	California Red-Legged Frog	Threatened		CDFG SC	**Riparian & other wetlands.**
Birds					
Charadrius alexandrinus nivosus	Western Snowy Plover	Threatened		CDFG SC	Nesting habitat
Laterallus jamaicensis coturniculus	California Black Rail	SC	Threatened		**Marshes**
Strix occidentalis caurina	Northern Spotted Owl	Threatened		CDFG SC	Forests

Table 4.2.3: Other Listed Species of Concern in Napa County
Compiled by Wes Maffei, NCMAD
from NDDB, April 5, 1999 Revision

Scientific Name	Common Name	Federal	California	Other	Notes
Vascular Plants					
Aster lentus	Suisun Marsh Aster	SC		CNPS 1B	**Fresh water & brackish marshes**
Atriplex joaquiniana	San Joaquin Saltbush	SC		CNPS 1B	Shadscale scrub, valley grassland, meadows, & **seeps**; Alkaline soils
Calystegia collina ssp oxyphylla	Mt. St. Helena Morning Glory	SC		CNPS 4	Open grassy or rocky places or oak pine woods; Often serpentine
Ceanothus confusus	Rincon Ridge Ceanothus	SC		CNPS 1B	Dry, shrubby slopes
Ceanothus divergens	Calistoga Ceanothus	SC		CNPS 1B	Dry, shrubby, rocky, volcanic slopes
Ceanothus sonomensis	Sonoma Ceanothus	SC		CNPS 1B	Chaparral; Sand, serpentine, volcanic soils
Fritillaria pluriflora	Adobe Lily	SC		CNPS 1B	Adobe soils of interior foothills
Hesperolinon bicarpellatum	Two-Carpellate Western Flax	SC		CNPS 1B	Serpentine; Chaparral
Hesperolinon breweri	Brewer's Western Flax	SC		CNPS 1B	Chaparral or grassland; Sometimes serpentine
Hesperolinon drymarioides	Drymaria-Like Western Flax	SC		CNPS 1B	Serpentine; Chaparral or woodland
Juglans hindsii	N. California Black Walnut	SC		CNPS 1B	Canyons & valleys
Lathyrus jepsonii var jepsonii	Delta Tule Pea	SC		CNPS 1B	**Freshwater and brackish marshes**
Legenere limosa	Legenere	SC		CNPS 1B	**Wet areas; Vernal Pools**
Madia hallii	Hall's Madia	SC		CNPS 1B	Serpentine barrens in open chaparral
Polygonum marinenese	Marin Knotweed	SC		CNPS 3	**Coastal salt marshes**

Sidalcea hickmanii ssp viridis	Marin Checkerbloom	SC		CNPS 1B	Chaparral & open conifer forest; Sometimes on serpentine
Streptanthus brachiatus ssp brachiatus	Socrates Mine Jewel-Flower	SC		CNPS 1B	Serpentine barrens, open chaparral, or woodland
Reptiles and Amphibians					
Rana boylii	Foothill Yellow-Legged Frog	SC		CDFG SC	
Clemmys marmorata marmorata	Northwestern Pond Turtle	SC		CDFG SC	
Birds					
Agelaius tricolor	Tricolored Blackbird	SC		CDFG SC	**Marshes; Nesting colony**
Athene cunicularia	Burrowing Owl	SC		CDFG SC	Burrows
Gleothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	SC		CDFG SC	**Salt marshes**
Mammals					
Corynorhinus townsendii townsendii	Townsend's Western Big-Eared Bat	SC		CDFG SC	
Sorex ornatus sinuosus	Suisun Shrew	SC		CDFG SC	**Salt to brackish marshes**

Table 4.2.4: Other Special Status Species in Napa County

Compiled by Wes Maffei, NCMAD
from NDDB, April 5, 1999 Revision

Scientific Name	Common Name	Federal	California	Other	Notes
Vascular Plants					
Astragalus rattanii var jepsonianus	Jepson's Milk-Vetch			CNPS 1B	Open grassy or gravelly areas; Often serpentine
Astragalus tener var tener	Alkali Milk-Vetch			CNPS 1B	Alkaline flats; Vernally moist meadows
Balsamorhiza macrolepis var macrolepis	Big-Scale Balsamroot			CNPS 1B	Open grassy slopes & valleys
Cryptantha clevelandii var dissita	Serpentine Cryptantha			CNPS 1B	Chaparral; Sometimes serpentine; Sandy/rocky soil
Downingia pusilla	Dwarf Downingia			CNPS 2	**Vernal Pools** & Roadside ditches
Erigeron angustatus	Narrow-Leaved Daisy			CNPS 1B	Serpentine areas
Hesperolinon sp nov "serpentinum"	Napa Western Flax			CNPS 1B	Serpentine; Chaparral
Layia septentriaonalis	Colusa Layia			CNPS 1B	Serpentine or sandy soils
Limnanthes floccosa ssp floccosa	Woolly Meadowfoam			CNPS 2	**Moist meadows & Vernal Pools**
Linanthus jepsonii	Jepson's Linanthus				
Lupinus sericatus	Cobb Mountain Lupine			CNPS 1B	Open wooded slopes
Navarretia leucocephala ssp bakeri	Baker's Navarretia			CNPS 1B	**Vernal Pools**
Navarretia rosulata	Marin County Navarretia			CNPS 1B	Rocky serpentine areas
Penstemon newberryi var sonomensis	Sonoma Beardtongue			CNPS 1B	Outcrops & peak areas

Sidalcea oregona ssp hydrophila	Marsh Checkerbloom			CNPS 1B	Wet soil of stream banks, meadows
Streptanthus morrisonii	Morrison's Jewelflower				Serpentine barrens; Chaparral
Birds					
Accipiter striatus	Sharp-Shinned Hawk		CDFG-SC		Nesting
Aquila chrysaetos	Golden Eagle		CDFG-SC		Nesting & Wintering
Cypseloides niger	Black Swift		CDFG-SC		Nesting
Elanus leucurus	White-Tailed Kite				Nesting
Falco mexicanus	Prairie Falcon		CDFG-SC		Nesting
Progne subis	Purple Martin		CDFG-SC		Nesting

California Department of Fish and Game
Natural Diversity Database

For information about these species or natural communities, or other species or natural communities, or for staff contacts, please see the NDDB website at http://www.dfg.ca.gov/whdab/cnddb.htm

IMPORTANT NOTICE:

This list of species was produced from data presently included in the California Natural Diversity Database (CNDDB). The CNDDB is a positive sighting data base, and our data sets can not be considered to be complete for every species in every county. Therefore, this list must not be considered to be a comprehensive list of all special status species in the county.

Special Status Plants, Animals and Natural Communities of

NAPA COUNTY

Scientific Name	Common Name	STATUS*: (see footnotes) Federal	California	CDFG	CNPS
Vascular Plants					
Aster lentus	SUISUN MARSH ASTER	Species of concern	None		1B
Astragalus clarianus	CLARA HUNT'S MILK-VETCH	Endangered	Threatened		1B
Astragalus rattanii var jepsonianus	JEPSON'S MILK-VETCH	None	None		1B
Astragalus tener var tener	ALKALI MILK-VETCH	None	None		1B
Atriplex joaquiniana	SAN JOAQUIN SALTBUSH	Species of concern	None		1B
Balsamorhiza macrolepis var macrolepis	BIG-SCALE BALSAMROOT	None	None		1B
Calystegia collina ssp oxyphylla	MT. SAINT HELENA MORNING-GLORY	Species of concern	None		4
Castilleja affinis ssp neglecta	TIBURON INDIAN PAINTBRUSH	Endangered	Threatened		1B
Ceanothus confusus	RINCON RIDGE CEANOTHUS	Species of concern	None		1B
Ceanothus divergens	CALISTOGA CEANOTHUS	Species of concern	None		1B
Ceanothus sonomensis	SONOMA CEANOTHUS	Species of concern	None		1B
Cordylanthus mollis ssp mollis	SOFT BIRD'S-BEAK	Endangered	Rare		1B
Cryptantha clevelandii var dissita	SERPENTINE CRYPTANTHA	None	None		1B
Downingia pusilla	DWARF DOWNINGIA	None	None		2
Erigeron angustatus	NARROW-LEAVED DAISY	None	None		1B
Fritillaria pluriflora	ADOBE-LILY	Species of concern	None		1B
Hesperolinon bicarpellatum	TWO-CARPELLATE WESTERN FLAX	Species of concern	None		1B
Hesperolinon breweri	BREWER'S WESTERN FLAX	Species of concern	None		1B
Hesperolinon drymarioides	DRYMARIA-LIKE WESTERN FLAX	Species of concern	None		1B
Hesperolinon sp nov "serpentinum"	NAPA WESTERN FLAX	None	None		1B
Juglans hindsii	NORTHERN CALIFORNIA BLACK WALNUT	Species of concern	None		1B
Lasthenia conjugens	CONTRA COSTA GOLDFIELDS	Endangered	None		1B
Lathyrus jepsonii var jepsonii	DELTA TULE PEA	Species of concern	None		1B
Layia septentrionalis	COLUSA LAYIA	None	None		1B
Legenere limosa	LEGENERE	Species of concern	None		1B
Lilaeopsis masonii	MASON'S LILAEOPSIS	Species of concern	Rare		1B
Limnanthes floccosa ssp floccosa	WOOLLY MEADOWFOAM	None	None		2
Limnanthes vinculans	SEBASTOPOL MEADOWFOAM	Endangered	Endangered		1B
Linanthus jepsonii	JEPSON'S LINANTHUS	None	None		
Lupinus sericatus	COBB MOUNTAIN LUPINE	None	None		1B
Madia hallii	HALL'S MADIA	Species of concern	None		1B
Navarretia leucocephala ssp bakeri	BAKER'S NAVARRETIA	None	None		1B
Navarretia leucocephala ssp pauciflora	FEW-FLOWERED NAVARRETIA	Endangered	Threatened		1B
Navarretia rosulata	MARIN COUNTY NAVARRETIA	None	None		1B
Penstemon newberryi var sonomensis	SONOMA BEARDTONGUE	None	None		1B
Plagiobothrys strictus	CALISTOGA POPCORN-FLOWER	Endangered	Threatened		1B
Poa napensis	NAPA BLUE GRASS	Endangered	Endangered		1B
Polygonum marinense	MARIN KNOTWEED	Species of concern	None		3
Sidalcea hickmanii ssp viridis	MARIN CHECKERBLOOM	Species of concern	None		1B
Sidalcea oregana ssp hydrophila	MARSH CHECKERBLOOM	None	None		1B
Streptanthus brachiatus ssp brachiatus	SOCRATES MINE JEWEL-FLOWER	Species of concern	None		1B

Special Status Plants, Animals and Natural Communities of

NAPA COUNTY

Scientific Name	Common Name	STATUS*: (see footnotes) Federal	California	CDFG	CNPS
Vascular Plants					
Streptanthus morrisonii	SEE INDIVIDUAL SUBSPECIES!	None	None		
Trifolium amoenum	SHOWY INDIAN CLOVER	Endangered	None		1B
Crustaceans					
Syncaris pacifica	CALIFORNIA FRESHWATER SHRIMP	Endangered	Endangered		
Beetles					
Desmocerus californicus dimorphus	VALLEY ELDERBERRY LONGHORN BEETLE	Threatened	None		
Amphibians					
Rana aurora draytonii	CALIFORNIA RED-LEGGED FROG	Threatened	None	SC	
Rana boylii	FOOTHILL YELLOW-LEGGED FROG	Species of concern	None	SC	
Reptiles					
Clemmys marmorata marmorata	NORTHWESTERN POND TURTLE	Species of concern	None	SC	
Birds					
Accipiter striatus (nesting)	SHARP-SHINNED HAWK	None	None	SC	
Agelaius tricolor (nesting colony)	TRICOLORED BLACKBIRD	Species of concern	None	SC	
Aquila chrysaetos (nesting and wintering)	GOLDEN EAGLE	None	None	SC	
Athene cunicularia (burrow sites)	BURROWING OWL	Species of concern	None	SC	
Charadrius alexandrinus nivosus (nesting)	WESTERN SNOWY PLOVER	Threatened	None	SC	
Cypseloides niger (nesting)	BLACK SWIFT	None	None	SC	
Elanus leucurus (nesting)	WHITE-TAILED KITE	None	None		
Falco mexicanus (nesting)	PRAIRIE FALCON	None	None	SC	
Geothlypis trichas sinuosa	SALTMARSH COMMON YELLOWTHROAT	Species of concern	None	SC	
Haliaeetus leucocephalus (nesting & wintering)	BALD EAGLE	Threatened	Endangered		
Laterallus jamaicensis coturniculus	CALIFORNIA BLACK RAIL	Species of concern	Threatened		
Progne subis (nesting)	PURPLE MARTIN	None	None	SC	
Rallus longirostris obsoletus	CALIFORNIA CLAPPER RAIL	Endangered	Endangered		
Strix occidentalis caurina	NORTHERN SPOTTED OWL	Threatened	None	SC	
Mammals					
Corynorhinus townsendii townsendii	TOWNSEND'S WESTERN BIG-EARED BAT	Species of concern	None	SC	
Reithrodontomys raviventris	SALT-MARSH HARVEST MOUSE	Endangered	Endangered		
Sorex ornatus sinuosus	SUISUN SHREW	Species of concern	None	SC	
Natural Communities					
Coastal and valley freshwater marsh	N.A.	None	None		
Coastal brackish marsh	N.A.	None	None		
Northern coastal salt marsh	N.A.	None	None		
Northern interior cypress forest	N.A.	None	None		
Northern vernal pool	N.A.	None	None		
Serpentine bunchgrass	N.A.	None	None		
Wildflower field	N.A.	None	None		

4.3 MOSQUITO AND DISEASE SURVEILLANCE ACTIVITIES

A. INTRODUCTION

The District's responsibility to protect public health and welfare involves monitoring the abundance of mosquitoes, mosquito habitat, mosquito-borne pathogens, and interactions between mosquitoes and people over time and space. Collectively, these monitoring activities are termed Mosquito Surveillance. Mosquito surveillance provides the District with valuable information on what mosquito species are present or likely to occur, when they occur, where they occur, how many there are, and if they are carrying disease or otherwise affecting humans. Mosquito surveillance is critical to an Integrated Mosquito Management Program because the information it provides is evaluated against treatment criteria to decide when and where to institute mosquito control measures. Equally important is the use of mosquito surveillance in evaluating the efficacy, cost effectiveness, and environmental impacts of specific mosquito control actions.

The District's mosquito and disease surveillance activities are conducted in compliance with accepted Federal and State guidelines, and the reader is referred to the volumes by the U.S. Public Health Service (Moore et al 1993), the Mosquito and Vector Control Association of California (Reisen et al 1995, Durso 1996), and by Service (1993) for further information on specific surveillance techniques. These guidelines recognize that local conditions vary, and are thus flexible in the selection and specific application of methods. Therefore, the District's specific activities and their potential environmental impacts are described below.

B. MOSQUITO SURVEILLANCE

Mosquitoes in nature are distributed within their environment in a pattern that maximizes their survival to guarantee reproductive success. Simply stated, this means that mosquitoes occur where they are likely to survive, mate, and produce young. One interesting aspect of mosquito biology is the fact that immature stages develop in water and later mature to a winged adult that is capable of both long and short range dispersal. This duality of their life history presents mosquito control agencies with unique circumstances that require separate surveillance strategies for the aquatic versus terrestrial life stages. Detailed descriptions of mosquito surveillance activities performed by the District can be found in the publications by Service (1993) and Durso (1996).

A. IMMATURE MOSQUITOES

Immature mosquito stages include eggs, four larval stages, and pupae. Mosquito control agencies routinely target the larval and pupal stages to preclude an emergence of adults. Operational evaluation of the presence and abundance of immature mosquitoes is limited to the larval and pupal stages, although the District may sample eggs for research reasons. Operationally, the abundance of the immatures in any identifiable "breeding" source is measured through direct sampling with a 250ml dipper, which provides relative local abundance as number of immatures per unit volume or area of the source. This method requires access by field personnel to within about three feet of larval sites at least every two weeks. The spatial patchiness of larvae requires access to multiple locations within each source, rather than to single "bell-weather" stations .

B. ADULT MOSQUITOES

Mosquito adults, primarily females, are sampled to determine the direct threat posed by their distribution, abundance, species mix, and pathogen status. Direct surveillance is typically accomplished using a variety of traps that are configured to attract mosquitoes to the trap where they are captured by suction and sequestered in an escape-proof net or glass enclosure. Other direct surveillance strategies, less commonly used by the District, include landing counts, and artificial resting units (Service 1993, Durso 1996).

Another important measure of adult mosquito abundance is the number and distribution of service requests from the public. While this number is obviously dependent on other factors beyond absolute mosquito abundance, including recent publicity about the district or about mosquito problems, it is an important indication of where and when

the public desires action. In combination with identification of the species causing the disturbance, this can also be a powerful technique in identifying previously unknown mosquito sources, or known sources with resurgent mosquito production.

Host-seeking traps: Traps for host-seeking female mosquitoes include standard and modified (e.g. Fay; EVS = "Encephalitis Virus Surveillance") CDC-type portable light traps, which release carbon dioxide (dry ice and/or compressed gas) at a low rate (typically two pounds/night/trap) to attract female mosquitoes seeking blood meals. Essential trap components include a battery power source, a low ampere motor with suction-type fan housed in a durable plastic cylinder, carbon dioxide and light sources (typically 3-6 volts), and a collection container for holding captured adults. The number of females collected during each night of trap operation is expressed numerically as the number of females per trap night. Use of these traps requires direct access to the trap site by field personnel on two consecutive days, typically once per week.

Light traps: Light traps use a source of photo-attraction (typically a 25 watt incandescent bulb) to lure mosquitoes to the trap where they are pulled in by the suction provided by an electric motor/fan combination. Mosquitoes picked up by the suction are directed through a cone to a collection jar where they are killed by a household insecticide[2]. The standard trap of this type used by most mosquito control agencies is the New Jersey Light Trap. This trap is considerably larger and less portable than the host-seeking trap and requires a source of 110v AC to operate. Like the host-seeking trap, the number of females collected during each night of trap operation is expressed as the number of females per trap night. This surveillance methods requires one field visit per trap per week, and the District typically maintains about eighteen traps.

C. SURVEILLANCE FOR MOSQUITO-BORNE DISEASES

A. ARBOVIRAL DISEASES

The primary mosquito-borne human diseases for which routine surveillance occurs in the service area are known as "arboviruses" (ARthropod-BOrne viruses). The primary reservoir for the pathogens that cause these diseases are wild birds, and humans only become exposed as a consequence of an accidental exposure to the bite of infective mosquitoes. The two arboviruses of greatest public health concern in California are western equine encephalomyelitis virus (WEE) and St. Louis encephalitis virus (SLE). Clinical illness caused by WEE is predominately seen in young children while SLE tends to affect the elderly.

Detecting the presence of these mosquito-borne viruses in nature requires the application of a number of sophisticated methodologies, which are discussed in detail in the recent technical report by Reisen, et al. (1995). Two methods of encephalitis virus surveillance commonly used by mosquito control agencies in California involve 1) capturing and testing female mosquito mosquitoes for the presence of mosquito-borne encephalitis viruses and 2) periodically testing for the presence of encephalitis virus specific antibodies in the blood serum of either sentinel chickens or wild birds that are potentially exposed to infective mosquito bites.

Virus isolations from mosquito mosquitoes: Female mosquitoes to be tested for the presence of encephalitis viruses are usually captured by host-seeking traps. Collections are sorted by species and pooled in lots of 50. Pools are later tested to determine if virus is present and to what extent virus is disseminated (minimum infection rate) throughout the vector mosquito population.

Antibody conversion rates in sentinel birds: In addition to isolating viruses from mosquitoes captured in the wild, the presence of virus in the environment can also be detected by exposing animals that are not affected by infection, but develop neutralizing antibodies to the specific viral pathogen. A number of sentinel systems have been developed, and among those evaluated are domestic chickens in caged flocks consisting of 10-20 animals. Birds used as sentinels are treated humanely, and provided with ample shelter, water and feed. Wild birds can also be tested, and

[2]A 1 inch piece of Shell No-Pest Strip© (Vapona) per trap, which is properly disposed of when no longer effective.

are banded and released into the wild after a small blood sample is taken. The collected blood samples (sera) are subsequently tested for the presence of virus specific antibody.

B. OTHER DISEASES

The presence and abundance of other diseases, including malaria and dog heartworm, are periodically monitored by the District.

More specifically, the District has in place a program to track both endemic (contracted from local mosquitoes) and imported malaria cases. Information received from County and State health departments alert the District of people diagnosed with malaria. The District then follows up with the patients to identify the source of infection (local or imported) and to ensure that treatment regimes are followed correctly and completely. Known breeding sites of the Woodland Malaria Mosquito (*Anopheles punctipennis*) within two miles of the patient's residence are resurveyed and, if needed, treated. This malaria surveillance program was established to prevent the malaria pathogen *Plasmodium vivax* from becoming established in Napa County *Anopeheles* populations. California's early history with extensive malaria morbidity and mortality, the presence of large populations of *An. punctipennis*, and the large and increasing human population in the County together justify this program.

In addition, dog heartworm is monitored through case reports submitted by veterinarians and by occasional testing of adult Western Treehole Mosquitoes (*Ae. sierrensis*) for the presence of the filarial worm *Dirofilaria immitis*.

D. CONCLUSIONS: POTENTIAL ENVIRONMENTAL IMPACTS OF SURVEILLANCE

The District's surveillance activities require access to mosquito habitat sites; the placement of mosquito traps, and sentinel birds in the field; the collection of mosquitoes in the field; and the direct or instrumental collection of physical data. Each of these activities poses a small potential for disturbance to natural or artificial environments.

The potential environmental impacts associated with the District's surveillance activities are insignificant. The State Secretary of Resources has determined that information collection and inspection activities do not generally have a significant impact on the environment [CEQA Guidelines Sections 15306 & 15309], and the available information on the District's surveillance activities are in agreement with this principle.

Surveillance Policy: District policy is to perform essential surveillance activities with the least negative impact on the environment. Technical staff use, whenever possible, pre-existing accesses such as roadways, open areas, walkways, and trails in a an effort to minimize off road travel. At times, vegetation management (e.g., pruning trees, clearing brush and weed removal) may become necessary where overgrowth impedes freedom of vehicle travel and staff movement on foot. All of these actions only result in a temporary/localized physical change to the environment with regeneration/regrowth occurring within a span of about one year.

District staff involved with performing surveillance duties are instructed to be respectful of the environment and associated wildlife and to limit their impact to only what is necessary to perform their assigned tasks. Wanton disregard and attendant abuses of the environment are not tolerated in the District's mosquito control surveillance operations. When off-road travel is necessary, District staff are instructed to avoid threatened and endangered plants and sensitive habitat areas and to minimize any environmental damage caused by off-road travel.

Non-invasive Sampling: Non-invasive sampling is considered a type of sampling that does not impact the environment directly. Low impact methods include the placement of host-seeking mosquito traps, light traps, artificial resting units (ARUs), and sentinel chicken flocks. In this situation, existing roads, trails, and clearings are usually utilized to accommodate this type of surveillance activity. Clearings are sometimes necessary for the placement of sentinel chicken coops and potentially Australian Crow traps and/or mist nets to sample resident and migratory wild birds.

Invasive Sampling: Invasive sampling is considered a type of sampling that may impact the environment directly. Where roads, trails, and clearings have to be created to gain access to facilitate surveillance, the consequences may require removal of vegetation and minor grading to establish roads, trails, and minimal clearings. These actions are necessary to establish sites where routine surveillance actions are necessary based upon established environmental risk factors associated with mosquito breeding and previous history of disease transmission. In any clearing or grading

work, the District avoids threatened and endangered plants and habitat areas and minimizes the scope of the work to the smallest area feasible.

Obtaining samples of immature mosquitoes involves removal of some negligible quantities of water. This water may also include non-target organisms associated with the mosquito immatures. Technicians will either make a count of the immatures present or remove a small number for identification at the agency office laboratory, returning the contents of the dipper back into the source once the quantification and identification process is completed. Taking dipper samples also requires the technician to wade into the source and repetitively sample/dip along transects to assess the extent and magnitude of immature mosquito populations. Trampling of some vegetation can occur, but most sampling actions involve either walking the shore line or wading through open water gaps that border emergent vegetation (grasses, tules, cattails, etc.) where mosquito immatures are most likely to be sampled. Technicians are advised not to penetrate dense vegetation for reasons of safety and unnecessary environmental impact.

Special Use of Birds to Support EVS Activities: Placement of sentinel chickens is a necessary component of encephalitis virus surveillance (EVS). Therefore, their physical presence is required at sites where virus activity is to be monitored on a routine basis. Sentinel chickens are sequestered in a coop structure (usually 4'x4'x6' or larger) covered with 1" welded wire to exclude access by resident wildlife with perhaps the exception of mice and other small rodents. Feed and water is housed within the coop enclosure. Manure is removed as needed to reduce fly production. A wire skirting is placed around the base of the coop to prevent wildlife from directly contacting the feces and foraging on the residual feed (various commercially available chicken feeds).

Transportation and Access Requirements: Normal surveillance necessitates the use of access roads, trails, and clearings to facilitate sampling. Roads allow vehicles to transport needed staff and equipment to specific sites deemed critical. As indicated above, this action may necessitate the periodic removal of some marginal vegetation and weed control on the median between the wheel ruts of established dirt/gravel roads. Access trails (2-3 feet in width) to the margins of wetlands, ponds, streams, and rivers are maintained by periodic vegetation removal via simple pruning or trimming if necessary. Weeds/grasses choking trails also can be removed by spot application of herbicides. These vegetation control methods are discussed in more detail in sub-section 4.5 below.

All Terrain Vehicles (ATVs): The District sometimes relies upon the use of all terrain vehicles to facilitate access into areas that are not otherwise accessible by conventional transportation means or by foot. Some situations where flooding and wetlands preclude access by 4-wheel drive vehicles or reasonable walking distance in waders/boots do require the use of an approved ATV. District staff do not use ATV's where environmental conditions (e.g., impenetrable vegetation/terrain, endangered/threatened plants) can result in causing an accident, personal injury or significant environmental damage.

4.4 PHYSICAL CONTROL = MOSQUITO HABITAT MANAGEMENT

A. INTRODUCTION

The population of any mosquito species in an area, and hence its potential ability to spread human disease and discomfort, is limited by the capacity of the environment to produce, feed, harbor, and allow dispersal of the species. As for any animal, the "carrying capacity" and "immigration potential" of an area for mosquito species are complex variables which are often summarized with the phrase "habitat" (Collins & Resh 1989).

Managing mosquito habitat to reduce mosquito production or migration, either directly or through public education, is often the most cost-effective and environmentally-benign element of an integrated mosquito management program. This approach to the control of mosquitoes and other pests is often called "physical control" to distinguish it from those mosquito management activities that directly rely on application of chemical pesticides (chemical control) or the introduction or relocation of living agents (biological control). Other terms that have been used for mosquito habitat management include "source reduction", which emphasizes the significance of reducing the habitat value of an area for mosquitoes, or "permanent control", to contrast with the temporary effectiveness of pesticide applications[3]. Mosquito habitat management is important because its use can virtually eliminate the need for pesticide use in and adjacent to the affected habitat, and in some situations can virtually eliminate mosquito production from specific areas for long periods of time, freeing staff for other work and reducing the potential disturbances associated with frequent biological or chemical control activities. It is important to note that, regardless of the terminology, the intent is to reduce the abundance of mosquitoes produced or sheltered by an area while protecting or enhancing the habitat values of the area for desirable species. In many cases, physical control activities involve restoration and enhancement of natural ecological functioning, including production and dispersal of special status species and/or predators of mosquitoes.

Dredging, placement of culverts or other engineering works, and other physical changes to the land can reduce mosquito production by improving water movement or the District's capacity for active management of water. In natural settings, these activities are generally used to enhance water circulation, which directly reduces mosquito production while at the same time improving habitat values for many predators or parasites of larval mosquitoes, such as fish and many invertebrates. The biology of mosquito predators, parasites, and predators is discussed in the Section on Biological Control. In artificial or highly managed settings, physical control can include improved drainage as well, to reduce the duration of standing water below the time needed for the development of immature mosquitoes. The District performs these physical control activities in accord with all appropriate environmental regulations (wetland fill and dredge permits, endangered species review, water quality review, etc.), and in a manner that generally maintains or improves habitat values for desirable species.

Physical control of mosquitoes can be as simple as properly discarding old containers that hold water capable of producing mosquitoes such as the *Ae. sierrensis* or the Fish Pond Mosquito *(Cs. incidens)* or as complex as implementing Open Marsh Water Management (OMWM) or Rotational Impoundment Management (RIM) in historically-tidal marshlands. OMWM and RIM are source reduction strategies that control salt marsh mosquitoes (e.g. the Winter Salt Marsh Mosquito *(Ae. squamiger)* or the Summer Salt Marsh Mosquito *(Ae. dorsalis)*) at the same time that significant habitat restoration is occurring.

B. MOSQUITO HABITATS CONDUCIVE TO PHYSICAL CONTROL

Mosquitoes grow in a wide range of habitat types in the District's Service Area, and environmentally-beneficial or benign physical control methods have been developed for most of these habitat types, including both natural and artificial or highly-modified settings. However, each habitat type also includes some specific examples in which their site characteristics may preclude effective or acceptable physical control. Therefore, the descriptions below are generic, and site-specific evaluation is important before initiating source reduction.

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[3]In the 1940's to 60's, source reduction was sometimes called "permanent" or "long-term" control to contrast it with the clearly temporary ("short-term") results of chemical pesticides. Experience has showed that, while "long-term" may be an accurate description, the results of physical control are not permanent.

Freshwater Lakes, Ponds And Retention Areas: The District Service Area includes a number of areas, generally man-made, that are permanently ponded with fresh water. Examples include the margins of reservoirs with shallow water and emergent vegetation, artificial ponds for holding drinking water for livestock and retention ponds created for holding of rainwater. Some retention ponds have been constructed within freeway interchanges and others have been built in cities and towns to provide wildlife habitat and flood protection. Natural lakes are usually not a mosquito problem because most of the water is deep, and there may be little emergent vegetation.

There are a number of species of mosquitoes that exploit these types of habitat. In the District Service Area, the Encephalitis Mosquito (*Cx. tarsalis),* the Banded Foul-Water Mosquito *(Cx. stigmatosoma),* the Winter Marsh Mosquito *(Cs inornata), Cs. incidens*, and the Willow Pool Mosquito (*Ae. washinoi*) are found in ponded freshwater.

Seasonal (Rainwater) Wetlands and Vernal Pools: The Service Area's Mediterranean climate results in large numbers of seasonally-flooded areas which may produce large numbers of mosquitoes during part of the year. Vernal pools are a specific type of seasonally-flooded wetland, distinguished by a subsurface hardpan and often an assemblage of protected plants and invertebrates. Mosquitoes produced in these types of rainwater sources include *Cx. tarsalis*, *Cs. inornata*, and *Ae. washinoii.*

Peripheral areas of tidal and historically tidal marshes can produce mosquitoes in response to seasonal rains, as well as following unusually high tides. Depending on the salinity and timing of flooding, mosquitoes found in these settings can include the *Culiseta* and *Culex* species mentioned above as well as *Ae. squamiger* or *Ae. dorsalis.*

Salt and Brackish Marshes: The tidal marshlands of the District Service Area vary in their salinity, their tidal regimes, and their engineering history, and the mosquito fauna they support is consequently varied. Prior to the creation of dikes and levees, the upper sections of some marshes produced enormous *Aedes* broods following the higher high tides associated with full or new moons ("spring tides"), because natural predators of mosquitoes could not survive the dry periods between these high tides. Extensive diking and drainage exacerbated this situation in many areas by prolonging the duration and intensity of the dry periods, while still allowing periodic inundation. The high mosquito populations made human habitation difficult in many areas, and the District was originally founded to address mosquitoes from the marshlands along the lower Napa River. In the District Service Area, several past physical control efforts greatly reduced salt-marsh mosquito production in these marshes through enhancing the frequency and duration of tidal inundation, or through other water management strategies.

In the District's Service Area, *Ae. squamiger* and *Ae. dorsalis* are the primary salt marsh mosquitoes. *Ae. squamiger* is a winter breeder and has a single generation per year. *Ae. dorsalis* adults occur in the spring and summer, and may have several generations per year. Adults of both species of mosquito frequently travel long distances from their larval habitats to find a blood meal.

Marshes and Duck Clubs: A number of marshes of varying salinity are managed to provide aquatic habitats for wildlife, especially water fowl, in Napa County. Some of these marshes are drained and re-filled periodically to enhance the primary productivity of the habitat, and under certain circumstances, this can result in large populations of mosquitoes.

The major waterfowl management areas in the District Service Area include private duck clubs (Detjen, Zanders, Giovannoni) and the California Department of Fish & Game's Huichica Creek Unit, Napa River Unit, Coon Island Unit, American Canyon Unit, and Fagen Marsh Ecological Reserve.

Ae. dorsalis, Ae. squamiger, Cx. tarsalis, and *Cs. inornata* are the most common species found in these habitats. Depending upon the management practices for the marsh or swamp, floodwater *Aedes* such as *Ae. dorsalis* can become a serious problem, especially in those cases where marshes are periodically drained and re-flooded.

Riparian Zones: Riparian zones, consisting primarily of riparian forests and willow groves associated with intermittent creeks, are those areas that border the edges of seasonal and year round streams and rivers. The variability of light, moisture and the amounts and types of lush vegetation result in a complex, biologically diverse habitat that has many microhabitats and species. This complex biological system also supports a number of mosquito species, five of which are pests or vectors of the diseases malaria or dog heartworm. These mosquitoes include *An. punctipennis*, *Ae. sierrensis*, *Ae. washinoi*, *Cs. incidens*, and *Cs. particeps* (this species has no common name).

Tree holes: Tree holes are rot cavities formed in the bases of branches or in those parts of trees where branches have broken off or have been improperly trimmed. Some species of trees, such as oaks, sycamores, elms, cottonwoods

and eucalyptus are prone to having one or more tree holes. *Ae. sierrensis* is the mosquito species frequently breeding in this habitat and is the primary vector of dog heartworm disease.

Wastewater treatment facilities: Aquatic sites in this category include a wide variety of ponds, ditches and other structures designed to handle wastewater of some kind. Included are sewage treatment ponds, ponds managed for denitrification, dairy drains and storm sewers.

Mosquito species usually found in these types of sources are the Little House Mosquito (*Cx. pipiens*), *Cx. stigmatosoma*, and to a lesser degree, *Cx. tarsalis*, the Tule (or Cattail) Mosquito *(Cx. erythrothorax)*, and flood-water *Aedes* species. Human activities are responsible for establishing the vast majority of the aquatic habitats used by *Cx. pipiens*. A much wider range of larval habitats, including both artificial and natural aquatic systems, is used by *Cx. tarsalis*. In large wastewater ponds, immature *Cx. pipiens* and *Cx. stigmatosoma* are generally most abundant near the inflow area where the nutrient loads are normally the highest.

Cx. tarsalis is like *Cx. stigmatosoma* in terms of its range of larval habitats, but its seasonal pattern of abundance is similar to that found in *Cx. pipiens*. *Cx. tarsalis* inhabits not only semipermanent ponds but also more ephemeral habitats, such as temporary pools in spray-irrigation fields. *Cx. erythrothorax* is the most pestiferous wastewater *Culex* species because it feeds mainly on mammals, while females of the other species are either general or primarily avian feeders. However, *Cx. tarsalis* is the species with the greatest impact because it is the dominant *Culex* in California during the summer and fall, occurs in wastewater systems that vary over a wide range of nutrient loads, and is the primary vector of St. Louis encephalitis (SLE) and western equine encephalomyelitis (WEE) viruses.

Aedes. - Unlike *Culex,* whose eggs hatch within a few days after being laid in rafts on the water surface, *Aedes* lay their eggs individually on moist substrate with hatching occurring only after the eggs have been flooded. Consequently, *Aedes* are seldom found in wastewater systems where there is little or no variation in surface water levels. However, poorly designed, improperly operated, or inadequately maintained systems often lead to conditions that are ideal for an invasion by floodwater mosquitoes. Poorly drained spray-irrigation fields often become water logged, especially during the rainy season. Land application of wastewater may also increase the salt content of the soils. Under these conditions, inland sites may become suitable aquatic habitats for the salt marsh mosquito *Ae. dorsalis*.

Irrigated Agriculture: There are several species of mosquitoes that can breed in water that stands only 1 to 2 weeks. Such habitats include irrigation tail water as well as standing water in irrigated pastures. Many mosquito species are found in these sources. Pastures and other agricultural lands are enormous mosquito producers, frequently generating huge broods of *Aedes*, *Culex* and *Culiseta* mosquitoes.

Cx. tarsalis, Cx. pipiens, Cx. stigmatosoma, the Irrigated Pasture Mosquito *(Ae. nigromaculis)*, and *Cs. inornata* are just some of the species that may breed in irrigated agricultural areas.

Artificial Containers: Containers such as flowerpots, cans, barrels, buckets, fountains, cemetery urns, and tires are excellent habitats for several species of mosquitoes. Abandoned or poorly maintained swimming pools, hot tubs, and spas also fall into this category. Typically problems with container-breeding mosquitoes occurs during and just after the wetter parts of the year.

The container-inhabiting mosquito of particular concern in California is *Cs. incidens*. Other mosquito species found in containers include *Cx. pipiens, Cx. stigmatosoma, Cx. tarsalis, Cs. inornata* and *Ae. sierrensis*. Artificial containers also have the potential to serve as a breeding source or means for introducing exotic mosquitoes such as *Ae. aegypti* and *Ae. albopictus*. These exotic species, important vectors of yellow fever and Dengue fever, have become well established in the southeastern United States and have been difficult to control because of their propensity for common use of artificial containers.

C. METHODS FOR PHYSICAL CONTROL OF MOSQUITOES IN NON-TIDAL HABITATS

Physical control of mosquitoes requires modifying the environment so that it provides less habitat value for mosquitoes while maintaining or improving habitat for desirable species. Generally, this involves improving the circulation of water in areas where temporary expanses of shallow standing water allow mosquitoes to flourish, and where thick vegetation, periodic drying, or poor water quality preclude significant predator pressure. While physical control of mosquitoes can represent a "win-win" strategy in many sites, it is not appropriate everywhere, and is seen as one element of the District's IMM Program. In this subsection, physical control of mosquitoes in non-tidal

environments is discussed briefly. For a more thorough review, please see *Guidelines for the Ecological Control of Mosquitoes in Non-tidal Wetlands of the San Francisco Bay Area* (Collins & Resh 1989). Physical control of mosquitoes in tidal and historically tidal marshlands is discussed in Sub-Section 4.4D, but much of the following discussion is also relevant for duck clubs on historically-tidal marshlands.

Physical control of mosquitoes in nontidal habitats typically involves improving the habitat value or dispersal potential of the site for mosquito predators; reducing the habitat value for mosquitoes through vegetation management, increased circulation, steepening banks, or changes in water quality; or by reducing the duration of standing water in areas that produce mosquitoes by filling small areas or improving drainage.

Filling or draining artificially ponded areas (low spots in flood-irrigated fields, etc.) can be cost-effective and environmentally-acceptable, but are not appropriate strategies in natural areas (however small), large permanent water bodies, or in areas set aside for storm water or wastewater retention. In such situations, the other options are more appropriate. At this time, the District is rarely involved in new drainage projects. However, the District does maintain or assist with the maintenance of some existing drainage systems. This maintenance can include upkeep of gates and other water control structures, excavating accumulated spoil materials, and vegetation management such as cutting, mowing, clearing debris, and/or herbiciding overgrown vegetation (see Section 4.5).

Ditches are a traditional technique for mosquito control, and they function in a number of ways. In addition to providing drainage if they lead from high to low ground, ditches can serve as a larvivorous fish reservoir. As rainfall increases, larvivorous fish move outward to adjacent areas to prey on immature mosquitoes, and as water levels decrease, larvivorous fish retreat to water in the ditches. Also, sills or weirs constructed in ditches can intentionally decrease water flow, decrease emergent aquatic weeds, prevent depletion of the water table, and allow larvivorous fish year-round refuge.

Over the past several decades, urban development has occurred in areas where mosquito control drainage ditches have existed as the primary drainage systems. In many cases, maintenance responsibility for mosquito control projects has been taken over by city and county public works departments and integrated into their comprehensive storm water management programs.

Aquatic Plant Management And The Effects On Mosquito Populations: Certain mosquito species use various aquatic plants such as bulrush or cattails as a primary habitat for egg deposition and larval development. Because aquatic plants can, at times, produce heavily vegetated stands, the use of conventional mosquito management techniques, such as biological and chemical control, may be ineffective. Therefore, management of the vegetation (mosquito habitat) may be the only means of reducing populations of mosquitoes that rely on aquatic plants. At times, this is accomplished directly through the use of herbicides or mechanical removal; these methods and their environmental consequences will be discussed later and in Section 4.5. At other times, vegetation change is accomplished indirectly through water management; these consequences of physical control will be discussed in this Section (4.4).

Freshwater Swamps and Marshes: Environmental laws greatly restrict habitat manipulations in these areas (which can produce *Aedes*, *Anopheles, Culex*, and *Culiseta* species) without extensive site-specific review by permit agencies. Where maintenance of existing ditches and other channels is allowed under Nation-wide and Regional permits from the U. S. Army Corps of Engineers (USACE) and/or Stream-bed Alteration Permits from the California Department of Fish and Game, these activities could be conducted by the District under this Review. Otherwise, the District would undertake separate CEQA assessment on a case by case basis.

Riparian Zones: Control measures will vary depending on the density of the human population, proximity of sensitive species, the vector potential of the mosquito causing the complaint, and access to the larval breeding or adult resting habitat. Minor physical control activities with insignificant environmental impacts can be accomplished using hand tools to connect small ponded areas to the channel along the edge of streams with highly variable flows. Generally, thick brush and complex micro-topography preclude extensive physical control in these areas, and biological or chemical control is generally more effective.

Tree holes: Control measures are very limited here due to the large numbers of tree holes in most impacted areas, difficulties in access, concerns for staff safety, and in some cases the age and size of the tree (heritage trees). The control methods utilized are also dependant on the location and numbers of people and pets affected by the mosquitoes produced from this habitat. Current control measures include public education, filling of some holes with sand or other inert materials to displace larval habitat, or chemical control (larvicides or aerosols).

Irrigated Agricultural Fields: Proper water management, land preparation, and adequate drainage are the most effective means of physically controlling mosquitoes in these types of sources. The District provides technical assistance to landowners that are interested in reducing mosquitoes by developing drainage systems on certain lands. Additionally, several state and federal programs provide both financial and technical assistance in developing efficient irrigation and drainage facilities for private land. These programs not only improve the value of the property, but assist in controlling mosquito development.

Wastewater Treatment Facilities: In many parts of California, clean freshwater for domestic, agricultural, or industrial uses is becoming a critical resource. Wastewater recycling and reuse help to conserve and replenish freshwater supplies. Concern for water quality conditions in lakes, rivers, and marine areas has resulted in the enactment of new state laws that will greatly limit future disposal of wastewater into these aquatic systems. To adjust to these changing conditions, many communities must implement wastewater reuse and recycling programs. Mosquito problems are frequently associated with some of the conventional wastewater treatment operations, and the expanded use of wastewater recycling and reuse may inadvertently create even more mosquito habitats.

Pond management options which are effective in controlling mosquitoes include timed periodic draining, providing deep water sanctuary for larvivorous fish, minimizing emergent and standing vegetation, and maintaining steep banks. The District routinely advises property owners on the best management practices for ponds to reduce mosquito development. In addition, the District provides localized vegetation management on most ponds to discourage mosquito oviposition sites.

Septic Systems: Many households in California, especially in rural areas, use on-site treatment systems, such as septic tanks and associated drain fields. With proper soil porosity, sufficient lateral fields, and low human congestion, these systems are safe and efficient. The wastewater in a properly located and maintained septic tank system will percolate into the subsoil without causing surface water accumulation that may induce mosquito production. Yet, when these systems are placed in locations with inappropriate soil conditions, wastewater will flow laterally, often into nearby swales and ditches. Physical control measures include repair and rebuilding of systems, and ditch maintenance in areas where lateral flow occurs.

Municipal Treatment Facilities: In California, municipal treatment facilities may be associated with mosquito problems. These can stem from operation of both small (package plants) and large facilities. Package plants may result in mosquito production in holding ponds because they are poorly maintained or operated beyond their capacity. Larger plants may use various methods to improve water quality conditions beyond the levels obtained in secondary treatment process. These methods include spray irrigation, rapid-dry ponds, aquatic plant/wastewater systems, and the use of natural or modified wetlands. Physical control methods include vegetation management, pond maintenance, structure repair, and improvement of pond substrates.

Spray-Irrigation Systems: Secondarily treated wastewater is used to irrigate golf courses, road medians, pastures, sod fields, citrus groves, and other types of crops. During the rainy season, these spray fields may become waterlogged, particularly those in low-lying areas with high water tables or in poorly drained soils. Under these conditions, the continued application of spray irrigation will result in the accumulation of surface water, thus providing aquatic habitats for a variety of mosquito species. Physical control methods are employed by landowners, and include proper grading of irrigated lands, and better water management.

Wastewater/Aquatic Plant Systems: At some sewage treatment facilities in California, certain species of aquatic plants (e.g., water hyacinths) have been added to human-made ponds containing secondarily treated wastewater for nutrient removal and biomass production. Mosquito problems can be produced in this type of system if the inflow has received inadequate secondary treatment. Effective nutrient removal requires periodic harvesting of a portion of the standing crop.

Storm Water and Wastewater Management: The management of Storm water and wastewater is very important, and when done without sound engineering, poor construction or improper maintenance, can result in considerable mosquito problems. Because of recent restrictions on the flow of storm waters into natural waterways, the question of design of Storm water retention facilities has become a critical issue. Physical control measures may be required, but proper design of facilities will be the most important factor.

Currently there is a wide range of mosquitoes produced in these facilities including floodwater *Aedes* species in intermittently wet facilities and *Culex* and *Anopheles* species associated with permanent or semi-permanent wet facilities. The *Aedes* species are the most pestiferous, and may serve as vectors of viruses that infect humans.

Mosquito production can be engineered out of Storm water and wastewater facilities but not always easily. Permanent water ponds can be kept clean of weeds with a water quality that is also sufficient to support mosquito-eating fish. Dry facilities can be designed to dry down in three days to prevent floodwater mosquito production, but some standing water beyond the three-day period may occur due to intermittent rainfall common during the rainy season.

Agricultural and Industrial Wastewater: Many commercial operations have on-site treatment facilities for decreasing nutrient loads from their wastewater, and generally, they use techniques similar to those applied to domestic wastewater. The quantity of wastewater produced at some commercial locations, such as those associated with wine making, may be highly variable during the year. Therefore, the amount of surface water in the holding ponds or spray fields used in the wastewater treatment may fluctuate considerably, thereby contributing to the production of mosquitoes. Wastewater from feed lots and dairy barns is often placed in holding or settling ponds without any prior treatment. Several mosquito species of the genus *Culex* can become extremely abundant in these ponds, especially in the absence of aquatic plant control.

Artificial Container Habitats: A container-breeding mosquito problem can be solved by properly disposing of such materials, covering them or tipping them over to ensure that they do not collect water. The District has an extensive program that addresses urban container breeding mosquito problems through house-to-house surveillance and formalized education programs.

Tires: Waste tires have been legally and illegally accumulating in California for the past several decades. The legal accumulations usually take the shape of a somewhat organized pile containing up to several million tires. Illegally dumped tires may be scattered about singly or exist in piles containing up to 40 to 50 thousand tires. Unfortunately, most of the problem tires are not in large piles, but scattered about, making removal difficult and, at best, labor intensive.

The design of tires makes them ideal breeding sites for several species of mosquitoes, of which, some are very important vectors of disease. Until the mid-1980s, waste tires were considered more of a nuisance and environmental threat than the possible foci of mosquito-borne disease epidemics. This changed in 1985 when a substantial breeding population of *Ae. albopictus* was discovered in Houston, Texas. It is probable that this population arrived from Japan as eggs deposited inside used tires.

Thus far, *Ae. albopictus* has not become established in California, and the dry summers here appear not to be favorable to their establishment. However, their introduction poses a serious threat, and California mosquitoes such as *Cx. pipiens* and Cs. *incidens* do breed in tires. It should be noted that in 1987, *Ae. albopictus* was found in imported used tires in Oakland, California. Early detection and an aggressive, long-term surveillance and control program prevented this mosquito from becoming established.

For management of used tires, the California Integrated Waste Management Board oversees storage sites with more than 500 tires. That agency also has developed regulations regarding the storage of waste tires with regards to mosquito control. These regulations include the provision of the local mosquito control agency being involved with the permit process required to store used tires.

D. METHODS FOR PHYSICAL CONTROL OF MOSQUITOES IN TIDAL HABITATS

Physical control of mosquitoes on tidal or historically-tidal marshlands has been a major activity of the District since its inception in 1925. While marsh filling or diking for mosquito control were common in other areas, the District relied primarily on ditching, either for improved drainage on sites diked by others, or for enhanced tidal circulation on undiked sites. Today, both of these activities are still permissible, but the great majority of District activity in these areas focuses on increasing tidal circulation as a means of directly reducing habitat suitability for mosquitoes and as a means of improving production or access for predators of mosquitoes.

Extensive evaluation of the physical control methods described below indicates that they have no significant detrimental impact of the environment when performed under District and permitting agency guidelines, and on the contrary are generally beneficial to a wide range of desirable species including special status species (Balling et al 1979,

Resh and Balling 1979, Balling et al 1980, Barnby and Resh 1980, Resh et al 1980, Rosenberg et al 1981, Balling and Resh 1982, Balling and Resh 1983, Resh and Balling 1983, Barnby et al 1985, Collins and Resh 1985; Collins et al 1986, Balling and Resh 1991, Batzer and Resh 1992, Kramer et al 1992, Batzer et al 1993, Kramer et al 1995, Batzer et al 1997). The District has funded or participated in some of this research and has incorporated the significant findings into its source reduction policies.

Circulation Ditches and Open Marsh Water Management: Ditching can be used in both salt marsh or freshwater locations to control mosquitoes by: 1) enhancing drainage thus eliminating mosquito-producing sites, or, 2) allowing larvivorous fish access to mosquito breeding locations (this can be enhanced through the creation of permanent water bodies which act as predatory fish reservoirs). A ditching network frequently connects shallow ditches to permanent water habitats, whether they be ponds or canals. Where it is impossible or impractical to connect to major waterways, a permanent pond is constructed deep enough to hold water throughout the year to harbor fish, and radial ditches connect the mosquito-producing locations to the ponds.

Speed Scavel: Many marshes in the San Francisco Estuary have small ditches that are, or have been, created with a small plow known as a speed scavel. This device is usually pulled by a small tractor or a vehicle known as a Thiokol or snow cat. The ditches formed by the speed scavel are up to 18 inches wide and 18 inches deep and are another means by which water circulation can be enhanced within a tidal or muted tidal system. Small dredge spoils are created along the sides of the ditch which requires District staff to then broadcast these materials by hand to minimize the potential for creating areas where unwanted, exotic vegetation can grow within the marsh. This technique has been used successfully for many years by the District and other mosquito and vector control districts throughout the state.

Rotary Ditching: Over the past 20 years, rotary ditching has been implemented on both the east and west coasts of the U.S. Rotary ditching involves the construction of shallow ditches usually 4 feet wide and 2-3 feet deep, using high-speed rotary equipment which broadcasts spoil evenly over the marsh surface. Rotary ditching generally is considered more environmentally acceptable than deep ditching because spoil material from these shallow ditches is evenly distributed in a very thin layer over the marsh surface. Consequently, the problem of the accumulation of overburden, with the subsequent invasion of exotic vegetation, is eliminated. Impacts to vegetation are usually limited to the ditch itself, as the tractor will climb over the vegetation allowing it to spring back, causing little damage. Marsh ditching seems to affect the vegetation as only a top-dressing of dirt might affect a lawn. Experience repeatedly has demonstrated that a properly designed rotary ditching system can greatly decrease the need for larvicide applications on the affected marsh. Rotary ditching can be cost effective and of lower management intensity when used in areas where it can be physically installed.

Rotary ditchers broadcast the spoil indiscriminately and can throw debris great distances. Therefore, great care is necessary when working in congested areas. In loose soils, the size and shape of the finished ditch will not be maintained due to erosion from water movement through the ditch. Because of the fixed geometry of the ditcher side slopes, the chosen depth at any point along a channel determines the width at that point; therefore, a shallow ditch is also relatively narrow.

As with other ditching programs, some concerns have been raised about the possible marsh hydrological changes (i.e., dewatering of marsh ponds or pans) that may occur from the installation of rotary ditches. This dewatering concern has been typically addressed through the installation of ditch sills, the tops of which are usually set at mean high water. The installation of sills can result in water being retained in the ditch and on the marsh surface; however, this is not always the case with some dewatering of the marsh still occurring. Also, more frequent flooding of the marsh can alter soil salinity, with possible impacts to the benthic invertebrate or plant communities. Because these marshes typically evolved with high channel densities and high flood frequencies, this represents a relatively minor transition between natural successional stages at the site.

Basic limitations on the use of rotary ditching revolve around the size of the ditch needed, soil types, access, adjacent terrain, vegetation present, and the potential for buried contaminants or historic or archaeological sites. Areas with sandy loose soil are not good ditching candidates. Ditch cleaning or new construction is possible in areas of limited woody vegetation if planned carefully. Experience has shown that poorly engineered ditches can produce more mosquitoes than preconstruction areas, as is true for any physical control project. Because they distribute material evenly over the marsh surface, rotary ditches do not result in the formation of spoil piles. Therefore, rotary ditching receives serious consideration for any mosquito control ditch-construction project. Environmental regulatory agencies

generally will consider rotary ditching of impoundments because it usually will reduce pesticide use and will allow the maintenance of an impoundment in a free tidally exchanging condition for a longer period of the year. In some cases, it allows the impoundment to be opened permanently. Rotary ditching projects are usually undertaken by mosquito control offices and require permits from the USACE along with other local and regional approval.

Impoundments: The principle of impounding water for mosquito control is simple; keeping a sheet of water across a salt-marsh substrate prevents *Aedes* mosquitoes from ovipositing on these otherwise attractive soils. On impounded marsh, mosquito and biting midge control is effectively achieved with a minimum of pesticide use. While common in Florida, impounding water specifically for mosquito or biting midge control has not been used extensively along the California coast. However, impounding water for other purposes, including waterfowl habitat and salt production, is very common in the San Francisco Bay Area, and can have the same results, depending on the timing, depth, duration, and frequency of flooding, as well as the characteristics of the soil and vegetation.

Duck Ponds and Mosquito Production: For close to 100 years, duck clubs have existed around the San Francisco Estuary to provide enhanced habitat for waterfowl and to allow hunting by club members. Cooperative management of these areas to limit mosquito production while enhancing waterfowl production has been a goal of Mosquito and Vector Control Districts for many years, and there is an extensive body of theoretical and practical knowledge on how to achieve this end.

Most of the duck clubs are in Solano County, and while mosquitoes produced in them can affect people in Napa County, mosquito control on Solano County clubs is outside the jurisdiction of this District.

Rotational Impoundment Management: RIM is a formal strategy of impoundment management that achieves multipurpose management by allowing the impoundment to: 1) control salt-marsh mosquito production from the marsh through means other than insecticides; 2) promote survival and re-vegetation by maintaining open periods and sufficiently low water levels during the summer flooding period, and 3) allow marine life to use the previously unavailable impounded high marsh.

E. CONCLUSIONS: POTENTIAL ENVIRONMENTAL IMPACTS

The District makes a distinction between "Minor" and "Major" physical control activities, based on the 5-year regional wetlands permits issued to the District by the USACE and the San Francisco Bay Conservation and Development Commission (BCDC). Those mosquito source reduction activities which require individual permits from the Corps and BCDC because of their scope or nature are considered "Major" and all activities that do not require individual permits are considered "Minor".

The potential environmental impacts of the District's Minor physical control activities are not significant. The State Secretary of Resources has determined that most of these activities do not generally cause significant environmental impact [CEQA Guidelines Sections 15301 & 15304]. Section 15301 uses this determination to exempt from CEQA review the operation, maintenance and minor alteration of existing drainage or other facilities involving negligible or no expansion of use. Examples cited in the Guidelines include the maintenance of stream channels and debris clearing to protect fish. Section 15304 exempts the minor alteration of land, water and vegetation that do not involve the removal of mature, scenic trees. Examples cited in the Guidelines include minor trenching where the surface is restored and maintenance dredging where the spoil is deposited in an authorized spoil area.

Consistent with the scope of the exemptions, and as applied to mosquito control activities, minor trenching and ditching means the following: digging, excavating and expanding ditches, drains and trenches in situations where all of the following conditions are satisfied: the capacity of the new or expanded facility is only negligible or insignificant; the surface area is restored; the spoil, if any, is deposited in an authorized area; and the work does not impact any mature trees, threatened or endangered plant or animal species, or sensitive habitat areas.

More extensive ditching may still fall under the regional USACE and BCDC permits, and based on the literature cited above and the protections (including annual review of plans) built into these permit processes, we do not find that our work can have a significant environmental impact. Projects too extensive to fall under the regional permits, as noted above, will need to be analyzed on a case-by-case basis with project-specific initial studies or other required environmental documents. Major physical control projects potentially involve substantial environmental change, and are subject to individual review under CEQA by the District.

4.5 VEGETATION MANAGEMENT

A. INTRODUCTION

Species composition and density of vegetation are basic elements of the habitat value of any area for mosquitoes, for predators of these mosquitoes, and for protected flora and fauna. District staff periodically undertakes vegetation management activities, or encourages and teaches others how to do so on their property, as a tool to reduce the habitat value of sites for mosquitoes or to aid production or dispersal of mosquito predators, as well as to allow access by District staff to mosquito habitat for surveillance and other control activities. These activities can include physical manipulation using small hand tools such as machetes and pruners, weed removal with mechanized equipment, water management (e.g. periodically drying and then reflooding ponded areas), and/or chemical control (herbicides). Care and timing are critical with water management so as to not encourage unnecessary mosquito breeding due to fluctuating water levels. Chemical control of vegetation uses the herbicides Round Up and Rodeo, which are both based on the active ingredient Glyphosate, and Karmex, a preemergent herbicide based on the active ingredient diuron. All herbicides are applied in strict conformance with label requirements and District policies.

B. PHYSICAL CONTROL OF VEGETATION

Tools ranging from shovels, pruners, chain saws, and "weed-whackers" on up to heavy equipment, can all be used at times to clear plant matter that either prevent access to mosquito breeding sites or that prevent good water management practices which would minimize mosquito populations. Generally, however, District "brushing" activities rely almost entirely on hand tools. Surveys for special status plants, coordination with the landowner, and acquisition of necessary permits are completed before any work is undertaken. Trimmed vegetation is either removed and disposed of properly from the site or broadcast in such a way as to minimize visual degradation of the habitat. Trimming is also kept to a minimum to reduce the possibility of the invasion of exotic species of plants and animals. Follow up surveys are also conducted to verify that the work undertaken was effective and that the physical manipulation of the vegetation did not result in any unintended overall habitat degradation. To date, no complaints have been received and no habitat degradation has been noted following physical manipulation of vegetation within a mosquito breeding habitat.

In addition, the use of water management to control vegetation is in some ways an extension of physical control, in that water control structures created as part of a physical control project may be used to directly manipulate hydroperiod (flood frequency, duration, and depth) as a tool for vegetation management. In addition, where potential evapotranspiration rates are high, this water management can also become a mechanism for salinity management, and indirectly, vegetation management through another path.

C. HERBICIDES

The District's restricted use of herbicides to principally man-made sites precludes the risk of damage to, or loss of, sensitive wetland habitats or special status organisms. Surveys are conducted to ensure that risk from application of these chemicals will not impact any sensitive habitats, special status species or food crops. Furthermore, care is taken to make sure that potential drift is eliminated by using these chemicals only during periods when there is no wind. Application is also timed to maximize effectiveness and reduce the need for additional applications. The following information on toxicity and environmental effects is taken from Caltrans' EIR for herbicide use (1991).

D. GLYPHOSATE-BASED HERBICIDES

The herbicides Roundup and Rodeo are both based on the active ingredient Glyphosate. These are selective materials with very low animal toxicity (see Table after this Section), and they are applied in strict conformance with label requirements. The District applied 22.63 gallons of Round Up, which is labeled for terrestrial application, and 26.5 gallons of Rodeo, which is chemically similar to Round Up but labeled for aquatic application, in 1998.

1. IDENTIFICATION AND USE

Glyphosate, N-(phosphonomethyl)glycine, is a nonselective, nonresidual, postemergence herbicide used for the control of weeds and brush (Shipp et al., 1986; USDA, 1984). Glyphosate is effective against deep-rooted perennial species and against annual and biennial species of grasses, sedges and broadleaf weeds (EPA, 1986). It acts in plants by inhibiting amino acid synthesis. Its physical form is colorless crystals. The two most widely used formulations are Roundup (41% of the isopropylamine salt of glyphosate with surfactants) and Rodeo (53% of the isopropylamine salt of glyphosate without surfactants). Roundup and Rodeo are occasionally used to control growth of poison oak and black berry vines that would otherwise prevent access to mosquito breeding habitats, and to control weed growth on the levees and access roads associated with winery waste and wastewater treatment ponds.

2. FATE AND TRANSPORT IN THE ENVIRONMENT

The persistence of glyphosate in the environment is very low and in soil is dependent on absorption to soil particles, runoff, and microbial transformation. Complete microbial transformation does occur rapidly in soil and water (hydrolysis half-life 35 days). Depending on soil type, a half-life of 3-130 days has been calculated. The lower number is for silty, clay loam and the upper for a sandy loam with little organic matter (USDA, 1984) Glyphosate in soil is resistant to chemical degradation and phototransformation (Shipp et al., 1986). The vapor pressure of glyphosate is negligible, indicating that glyphosate would not volatilize (Hartley and Kidd, 1987).

In aquatic systems, glyphosate absorbs strongly to organic and mineral matter where it is degraded primarily by microorganisms (Shipp et al., 1986). Its estimated half-life in natural waters is 7-10 weeks (Ghassemi et al, 1981). Glyphosate is relatively nonmobile in the environment due to its rapid and strong absorption to soil particles. The extent of absorption onto soil appears to be related to the clay content of soil and the cation-exchange capacity of the soil (Glass, 1987). Absorption is greater in soils saturated with aluminum and iron compared with soils saturated with sodium and calcium. At low application rates, pH does not affect glyphosate binding to soil, while at high application rates glyphosate binding decreases with increasing soil pH (Shipp et al., 1986). The K_{oc} for glyphosate is calculated to be 25.4 ml/gm (Lyman et al, 1982), indicating that glyphosate would be expected to migrate with infiltrating groundwater. However, studies of glyphosate in the environment indicate that is not the case. Glyphosate was not detected in groundwater in California (CDFA, 1989). Data indicate that it is relatively nonleachable and has a low tendency for transport in runoff (Shipp et al., 1986).

Glyphosate has virtually no tendency to bioaccumulate in animals (Ghassemi et al., 1981). The Unites States Department of Agriculture (1984) reports a default BCF of 1 as a conservative indicator of bioconcentration and suggests glyphosate has a low tendency for bioaccumulation.

3. POTENTIAL FOR HUMAN AND OTHER MAMMALIAN TOXICITY

Ingestion of Roundup by humans has been reported to result in irritation of the mouth, nausea, intestinal discomfort, vomiting and diarrhea. Ingestion of large quantities has been reported to result in hypotension and pulmonary edema (Monsanto, 1989). Dose levels at which these effects were observed were not reported nor is it clear to what extent the surfactant component contributed to these effects. Dermal exposure to a 6.4% aqueous solution of roundup by volume on human skin did not result in primary irritation or in dermal sensitization.

The acute oral, inhalation and dermal toxicity of glyphosate is low. The acute oral LD_{50} of glyphosate and Roundup in rats ranged from 4,300 - 5,600 mg/kg and in rabbits has been reported at 3,800 mg/kg. A four hour LC_{50} of 25 mg Roundup/l of air has been reported in rats. In another inhalation study, no evidence of toxicity was observed in rats exposed to 4.89 mg Roundup/l of air. Percutaneous absorption studies indicate that glyphosate is not readily absorbed through the skin. No signs of toxicity have been observed in rabbits following dermal exposure to 5,000 mg/kg of glyphosate or Roundup. Therefore, the acute dermal LD_{50} in rabbits is greater than 5,000 mg/kg for both chemicals. The LD_{50} for dermal exposure to Roundup in rats exceeds 17,600 mg/kg. Glyphosate is nonirritating to the skin, but moderate skin irritation, attributed to the presence of surfactants, has been reported in laboratory animals after exposure to Roundup. The transient ocular irritation has been reported in rabbits exposed to glyphosate and Roundup in standard eye irritation tests (Shipp et al., 1986). No signs of allergic contact dermatitis or dermal sensitization has been reported in guinea pigs exposed to glyphosate.

No treatment-related alterations in clinical chemistry parameters or pathological changes in organs have been observed in rats or mice exposed orally to glyphosate either subchronically or chronically. Adverse effects have been limited to depressed body weight or altered organ weights. In male rats, no toxicity occurred at 135 mg glyphosate/kg/day, but an increase in the absolute and relative lung weight was reported at 340 mg glyphosate/kg/day. In mice, there were no signs of toxicity reported at 2,305 mg glyphosate/kg/day, but a reduction in body weight gain did occur at 12,225 mg glyphosate/kg/day. Minor nasal irritation has been the only effect observed following subchronic inhalation exposure of rats to 0.36 mg of an aqueous solution of Roundup (41% glyphosate/l of air) (Shipp et al., 1986).

No treatment-related toxicity has been observed following chronic exposure to glyphosate at doses up to 5,874 mg/kg/day in mice or 31 mg/kg.day in rats (Shipp et al., 1986). An apparent decrease in the absolute and relative pituitary weight has been observed in dogs administered 100 mg glyphosate/kg/day for one year (EPA, 1986).

No adverse effects on reproductive capability have been observed in rats fed 30 mg glyphosate/kg/day in a three generation reproduction study. Focal renal tubular dilation was reported in third generation male rats exposed to 30 mg glyphosate/kg/day in this study with no effects observed in 10 mg glyphosate/kg/day. There was no evidence of a teratogenic effect in rats or rabbits exposed to 3,500 or 350 mg glyphosate/kg/day, respectively (Shipp et al., 1986).

Glyphosate has been evaluated for genotoxic activity in a variety of in vivo and in vitro systems. No evidence of genotoxicity has been reported (Shipp et al., 1986).

No significant differences in the total number of tumor-bearing animals or the total number of animals with malignant tumors were found in a 26-month feeding study in rats at doses up to 31 mg glyphosate/kg/day. In a 24-month study in mice at a dose of 3,900 mg glyphosate/kg/day, an increase in the incidence of renal tubular adenomas compared to historical controls was reported in male mice; however, they were not considered to be treatment-related (Shipp et al., 1986). An independent panel reviewed the pathology and concurred that the tumors were not treatment-related and EPA revised the cancer classification from C to D.

The Table at the end of this Section lists the known organismal toxicity studies for glyphosate.

E. DIURON (KARMEX)

1. IDENTIFICATION AND USE

The herbicide 3-(3,4-dichlorophenyl)1,1-dimethylurea, a substituted urea commonly known as Diuron, Trade name Karmex, is a systemic herbicide which inhibits photosynthesis. Its physical form is colorless crystals and it is used for a variety of annual and perennial broadleaf and grassy weeds on both crop and non-crop sites (EPA, 1983, WSSA, 1983). Diuron is applied by this District in the fall and winter for weed control on waste water pond levees and access roads for sewage treatment facilities and wineries.

2. FATE AND TRANSPORT IN THE ENVIRONMENT

Diuron is relatively stable and does not readily undergo phototransformation or volatilization (soil half-life 150-200 days). Therefore, losses by these two mechanisms is probably insignificant. Loss of Diuron from surface soil is minimal (Newton and Dost, 1984) unless diuron is exposed on the soil surface for several days or weeks under hot, dry conditions (WSSA, 1983). Transformation of Diuron in soil is through progressive demethylation followed by hydrolysis (EPA, 1982). This process appears to occur via microbes and is subject to the metabolic rates induced by the soil environment. Microbial transformation is faster with moderate temperatures, higher organic content in soil, and adequate moisture (EPA, 1982).

Diuron is expected to tightly bind to soil resulting in relatively low mobility, and penetration of diuron into surface soil would be very shallow (Newton and Dost, 1984). The K_{oc} for Diuron was calculated to be 560 ml/gm, indicating that diuron would have a moderate tendency to absorb to soil and not migrate to ground water (Lyman et al., 1982). However, diuron has been detected in ground water in California at concentrations ranging from 0.10 to 3 /l (CDFA, 1989).

In surface water, diuron is relatively immobile due to limited solubility (42 mg/l at 25°C) and absorption to sediment. Because of this low mobility, surface deposits of diuron are not an important source of water contamination due to runoff (Newton and Dost, 1984). In aqueous solutions, diuron is relatively stable to hydrolysis at pH values commonly found in natural surface waters (EPA, 1982).

Diuron may have a slight potential for bioaccumulation in animals; however, the extent of bioaccumulation has not been established (EPA, 1982). No measured steady-state bioconcentration factor (BCF) is available for Diuron. An empirical regression equation may be used to estimate the BCF for aquatic species. Based on the solubility of diuron, the BCF is estimated to be 75 (Kenaga and Goring, 1978), indicating a low tendency for bioconcentration.

3. POTENTIAL FOR HUMAN AND OTHER MAMMALIAN TOXICITY

No studies on human toxicity following diuron exposure have been found.

The acute toxicity of diuron in laboratory animals by the oral, dermal, or inhalation routes is low. The acute oral LD_{50} in rats ranges from 3,400 to >10,000 mg diuron/kg. In rabbits, the acute dermal LD_{50} is greater than 2,500 mg/kg, and the 1-hour LC_{50} is less than 200 mg/l in rats. Diuron is nonirritating or produced only slight irritation to the skin and eyes in rabbits and skin sensitization tests in guinea pigs were negative.

No data on neurotoxicty was located in the literature.

Diuron is not teratogenic in laboratory animals, but can produce fetotoxicity at high dosages. In a developmental study in rats given diuron during gestation, no teratogenic effects were observed at doses up to 500 mg/kg, however, fetotoxicity, manifested by wavy ribs and other bone variants, occurred at 125 mg/kg, the lowest dose tested. No adverse reproductive effects, fetotoxicity, or teratogenicity were reported in a three-generation reproduction study in rats administered 6.25 mg/kg/day.

Diuron has not been shown to be genotoxic. Results were negative for diuron tested in forward gene mutation assays, *Salmonella typhimurium* assays (with and without metabolic activation), and in tests for unscheduled DNA synthesis. However, the principle metabolite of diuron, 3,4-dichloroaniline, was mutagenic in the fungus, *Aspergillus nidulans* (EPA, 1982).

Results of a two year study in which rats were fed diuron were negative for carcinogenic effects.

A lifetime Health Advisory for exposure to diuron in drinking water of 14 g/l has been proposed by the EPA (Hileman, 1990).

The Table at the end of this Section lists the known organismal toxicity studies for diuron.

F. CONCLUSIONS: POTENTIAL ENVIRONMENTAL IMPACTS

The low inherent toxicity of glyposate- and diuron-based herbicides, the low volumes of these materials applied by the District, and the District's policies of avoiding natural sites with these materials together ensure that no significant environmental impacts results from the District's use of Diuron.

Toxicity of Glyphosate to Selected Test Organisms

Organism	Effect	Dose (mg/kg)	Comments	Source
Bobwhite Quail	LD_{50}	>2,000		USDA, 1988
Bobwhite Quail	8-day LD_{50}	>928	Dose estimated from concentration in food (4,460 ppm)	USDA, 1984
Japanese Quail	5-day LD_{50}	625	Dose estimated from 5,000 ppm in food; no fatalities	USDI, 1986
Mallard	8-day LD_{50}	>928	Dose estimated from concemtrations in food (4,460 ppm)	USDA, 1984
Chicken	NOEL	15,000	Adult hen; dosed twice daily with 1,250 mg/kg, 3 consecutive days; no effects observed	USDA, 1984
Goat	LD_{50}	4,860	Roundup	USDA, 1988

Organism	Effect	Conc. (mg/l)	Comments	Source
Rainbow Trout	96-hr LC_{50}	10-97	Static tests; range of hardness of 5.3-86 mg/l $CaCO_3$, and pH 6.3 to 8.2, respectively; technical	Wan et al, 1989
fingerling (0.5 g) Rainbow Trout	96-hr LC_{50}	48	Roundup	USDA, 1984
fingerling (0.5 g)	96-hr LC_{50}	14-33	Static tests; range of hardness of 5.3-86 mg/l $CaCO_3$, and pH 6.3 to 8.2, respectively; Roundup	Wan et al, 1989
fingerling (1 g)	96-hr LC_{50}	1.3	Roundup	USDA, 1988
fingerling (2 g)	96-hr LC_{50}	8.3	Static test; Roundup	USDA, 1984 &1988
Trout	96-hr LC_{50}	>1,000	Rodeo	USDA, 1988
	96-hr LC_{50}	680-1,000	Combined with surfactant; Rodeo	USDA, 1988
Bluegill	96-hr LC_{50}	140	Technical	USDA, 1988
	96-hr LC_{50}	24	Flow through test; technical	USDA, 1988
	96-hr LC_{50}	78	Flow through test; technical	USDA, 1988
	96-hr LC_{50}	5	Static test; Roundup	USDA, 1984
	96-hr LC_{50}	14	Roundup	USDA, 1984
	96-hr LC_{50}	>1,000	Rodeo	USDA, 1988
Fathead Minnow	96-hr LC_{50}	97	Static Test; technical	USDA 1984 & 1988
	MATC	>25.7	No adverse effects on survival, growth, or reproduction; 255 days exposure; technical	USDA, 1988
	96-hr LC_{50}	2.3	Static test; Roundup	USDA, 1984 & 1988
Channel Catfish	96-hr LC_{50}	130	Technical	USDA, 1988
fingerling (2.2 g)	96-hr LC_{50}	13	Static test; Roundup	USDA, 1984 & 1988
Swim-up Fry	96-hr LC_{50}	3.3	Roundup	USDA, 1988

Toxicity of Glyphosate to Selected Test Organisms (cont'd)

Organism	Effect	Conc. (mg/l)	Comments	Source
Carp	96-hr LC_{50}	115	Technical	USDA, 1988
	96-hr LC_{50}	>10,000	Rodeo	USDA, 1988
Grass Carp	96-hr LC_{50}	15	Roundup	USDA, 1988
Chinook Salmon	96-hr LC_{50}	20	Roundup	USDA, 1988
	96-hr LC_{50}	750-1,440	Rodeo	USDA, 1988
Coho Salmon	96-hr LC_{50}	22	Roundup	USDA, 1988
	96-hr LC_{50}	600-1,000	Rodeo	USDA, 1988
Cladoceran (*Daphnia* sp.)	48-hr LC_{50}	780	Technical	USDA, 1988
Cladoceran (*Daphnia magna*)	48-he EC_{50}	3	First instar; Roundup	USDA, 1988; USDI, 1986
	48-hr LC_{50}	930	Rodeo	USDA, 1988
	NOEL	50	21-day exposure; reduced reproduction at 96 mg/l; technical	USDA, 1988
Grass Shrimp	96-hr LC_{50}	281	Technical	USDA, 1984
Fiddler Crab	96-hr LC_{50}	934	Technical	USDA, 1984
Midge Larvae (*Chironomus plumosus*)	48-hr EC_{50}	55	Third instar; static test; technical	USDA, 1984; USDI, 1986
	48-hr EC_{50}	18	Static test; Roundup	USDA, 1984 & 1988
	------	2	Significant increase in stream drift; Roundup	USDA, 1984 & 1988
Amphipod (*Gammarus pseudolimnaeus*)	96-hr LC_{50}	43	Roundup	USDA, 1988
Crayfish	96-hr LC_{50}	>1,000	Roundup	USDA, 1988
Copepod (*Nitocera spinipes*)	96-hr LC_{50}	22	Roundup	USDA, 1984 & 1988

Note: LC_{50} = concentration lethal to 50% of the test organisms
EC_{50} = concentration resulting in a specific effect in 50% of the test organisms
MATC = maximum acceptable toxicant concentration derived from chronic study
NOEL = no observed effect level

Toxicity of Diuron to Selected Test Organisms

Organism	Effect	Dose (mg/kg)	Comments	Source
Mallard	LD_{50}	>2,000	Single dose	USDA, 1986
Mallard	8-day LD_{50}	>200	Ducklings; dose estimated from >1,000 ppm in food	USDA, 1986
Bobwhite Quail	8-day LD_{50}	>346	Dose estimated from 1,730 ppm in food	USDA, 1986
Japanese Quail	8-day LD_{50}	>625	Dose estimated from 5,000 ppm in food	USDA, 1986
Pheasant	8-day LD_{50}	>625	Dose estimated from 5,000 ppm in food	USDA, 1986
Chicken	10-day LOEL	10	Decreased weight gain resulted after 10 daily doses; all chickens died after 9 doses of 250 mg/kg	USDA, 1986

Organism	Effect	Conc. (mg/l)	Comments	Source
Rainbow Trout	96-hr LC_{50}	5.3	Static test	Mayer & Ellersieck, 1986
Bluegill Sunfish	96-hr LC_{50}	2.8	Static test	Mayer & Ellersieck, 1986
Guppy	96-hr LC_{50}	25		Hartley & Kidd, 1987
Lake Trout	96-hr LC_{50}	1.1	Static test	Mayer & Ellersieck, 1986
Cutthroat Trout	96-hr LC_{50}	0.71	Static test	Mayer & Ellersieck, 1986
Coho Salmon	LC_{50}	<2.4	Static test	Mayer & Ellersieck, 1986
Striped Mullet	LC_{50}	6.3		Kenaga, 1979
Amphipod (*Gammarus fasciatus*)	96-hr LC_{50}	0.16	Mature; static test	Mayer & Ellersieck, 1986
Cladoceran (*Daphnia magna*)	LC_{50}	47		Kenaga, 1979
Cladoceran (*Daphnia pulex*)	48-hr EC_{50}	1.4	First intar; static test	Mayer & Ellersieck, 1986
Cladoceran (*Simocephalus serrulatus*)	48-hr EC_{50}	2	First instar; static test	Mayer & Ellersieck, 1986
Brown Shrimp	EC_{50}	>1		Kenaga, 1979
Sowbug (*Asellus brevicaudus*)	96-hr LC_{50}	15.5	Mature; static test	Mayer & Ellersieck, 1986
Stonefly (*Pteronarcys californica*)	96-hr LC_{50}	1.2	Second year class; static test	Mayer & Ellersieck, 1986
Eastern Oyster	96-hr LOEL	1.8	50% decrease in shell growth	USDA, 1986

Note: LC_{50} = concentration lethal to 50% of the test organisms.
EC_{50} = concentration resulting in a specific effect in 50% of the test organisms (usually immobilization in cladocerans)
LOEL = lowest observed effect level

4.6 BIOLOGICAL CONTROL OF MOSQUITOES.

A. INTRODUCTION

Biological control of mosquitoes and other pests is the intentional introduction or redistribution of pathogens, parasites or predators to reduce the size of target mosquito populations. In this report, and generally in the literature, it is distinguished from habitat manipulations that do not involve direct movement of living organisms, even though these "physical control" activities may ultimately depend on the action of parasites or predators for their success. Biological control of mosquito larvae is one of the principal components of the District's Integrated Mosquito Management program. The District does not use biological control against adult mosquitoes at this time.

Intentional biological control of mosquitoes is a relatively recent development and can largely be traced to observations and ecological studies of fish predation on mosquito larvae beginning early in this century (Smith 1904). Early investigations studied the potential effects of indigenous, and later introduced, fish on mosquito larvae. Results of such studies have been adopted in developing strategies to use mosquito predators in providing economical and sustained levels of control. As resistance to pesticides and environmental concerns associated with their use became more prevalent after the mid-1960's, biological control of larval mosquitoes became used more often as a method of protecting the public from mosquitoes and the diseases they transmit. However, reliable biological control of adult mosquitoes has not been demonstrated, and is not currently pursued by the District. It should also be noted that biological control methods also have potential environmental impacts, and their proper use is as one component of an integrated management program based on surveillance, treatment criteria, and selection of the most appropriate control method at the time and place that mosquito control is required.

Predation of mosquito larvae by the mosquitofish *Gambusia affinis* is significant in many types of mosquito habitat in the District Service Area, and the District intentionally releases mosquitofish into some of these sites. Stocking by DISTRICT personnel complies with strict guidelines designed to ensure that no significant impacts can occur to native species. These guidelines are discussed below. In 1998, District staff stocked about 60 pounds of mosquitofish and distributed about an additional 20 pounds of fish to the public.

Other biological control methods available to the District include the application of the fungus *Lagenidium giganteum* ("*Lagenidium*"), and the "biological insecticide" *Bacillus sphaericus* ("*B. sphaericus*"). Although neither *Lagenidium* and *B. sphaericus* are routinely used by the District at this time, either might be adopted in the future for specific applications. In addition, protein spores from the bacteria *Bacillus thuringiensis israelensis* (Bti) are used by the District as a "biological insecticide," but because no live organisms are used, the District does not consider this Biological Control. Because the potential environmental impacts of applying either type of *Bacillus* are associated with the potential disturbance associated with the mode of application and the potential for non-target toxicity, these materials will also be discussed in the Chemical Control section of this document.

B. BIOLOGICAL CONTROL AGENTS

Biological control agents of mosquitoes include a wide variety of pathogens, parasites and predators. As a rule, mosquito pathogens and parasites are usually highly specific to their mosquito host, whereas predators are more general in their feeding habits and opportunistically feed on mosquitoes.

Mosquito Pathogens: Mosquito pathogens include an assortment of viruses and bacteria. They are highly host-specific and usually infect mosquito larvae when they are ingested. Upon entering the host, these pathogens multiply rapidly, destroying internal organs and consuming nutrients. The pathogen can be spread to other mosquito larvae in some cases when larval tissue disintegrates and the pathogens are released into the water to be ingested by uninfected larvae.

Examples of viruses that can infect mosquitoes are mosquito iridoviruses, densonucleosis viruses, nuclear polyhedrosis viruses, cytoplasmic polyhedrosis viruses and entomopoxviruses. Examples of bacteria pathogenic to mosquitoes are *Bacillus sphaericus* and several strains of *Bacillus thuringiensis israelensis*. These two bacteria produce proteins that are toxic to mosquito larvae. Both are produced commercially as mosquito larvicides.

Mosquito Parasites: The life cycles of mosquito parasites are biologically more complex than those of mosquito pathogens and involve intermediate hosts or organisms other than mosquitoes. Mosquito parasites are ingested by the feeding larva or actively penetrate the larval cuticle to gain access to the host interior. Once inside the host, parasites consume the internal organs and food reserves until the parasite's developmental process is complete. The host is killed when the parasite reaches maturity and leaves the host (*Romanomermis culicivorax)* or reproduces (*Lagenidium giganteum).* Once free of the host, the parasite can remain dormant in the environment until it can begin its developmental cycle in another suitable host.

Examples of mosquito parasites are the fungi *Coelomomyces spp., Lagenidium giganteum, Culicinomyces clavosporus* and *Metarhizium anisopliae*; the protozoa *Nosema algerae, Hazardia milleri, Vavraia culicis, Helicosporidium spp., Amblyospora californica, Lambornella clarki* and *Tetrahymena spp.*; and the nematode *Romanomermis culicivorax.*

Mosquito Predators: Mosquito predators are represented by highly complex organisms, such as insects, fish, birds and bats, that consume larval or adult mosquitoes as prey. Predators are opportunistic in their feeding habits and typically forage on a variety of prey types. This allows the predators to build and maintain populations at levels sufficient to control mosquitoes, even when mosquitoes are scarce.

Examples of mosquito predators include representatives from a wide variety of taxa: coelenterates (*Hydra* spp.); platyhelminths (*Dugesia dorotocephala, Mesostoma lingua*, and *Planaria* spp.); insects (Anisoptera, Zygoptera, Belostomidae, Geridae, Notonectidae, Veliidae, Dytiscidae and Hydrophilidae); arachnids (*Pardosa* spp.); fish (*Gambusia affinis, Gasterosteus aculeatus, Poecillia reticula*); bats; and birds (anseriformes, apodiformes, charadriiformes and passeriformes). Because of their abundance and easy identification, Notonectids and Dytiscids are routinely monitored by District staff. Where these invertebrate predators of mosquito larvae are abundant, chemical control is rarely used (see Treatment Criteria in Section 4.7).

Environmental Relationships in Biological Control: The effectiveness of a mosquito biological control agent lies in its ability to reduce mosquito numbers as quickly as possible. An ideal biological agent 1) feeds preferentially on mosquitoes, 2) exhibits an extremely efficient hunting or parasitizing strategy, and 3) reproduces quickly. These traits determine suitability for practical application. New mosquito sources initially have few predators and other competing aquatic organisms. Mosquito control personnel use this knowledge to develop a control strategy that involves integrated pest management techniques.

Since mosquitoes are capable of colonizing sources within days of flooding, initial control efforts attempt to suppress the first generations of mosquitoes until natural predators or competitors can control them. Initial treatment includes the selective use of pesticides and appropriate environmental manipulation, such as vegetation and water quality management. Once biological control is established in a "managed" source, periodic inspections at timely intervals are adequate to monitor changes in larval abundance. Periodically, the source may require treatments with pesticides when 1) predators are not effective, 2) aquatic and shoreline vegetation provides too much shelter, 3) the water level changes, or 4) water quality does not support predators.

Conservation and Application of Predators: The ability of predators to control mosquitoes, is related to four factors: 1) whether mosquitoes are preferred prey, 2) whether the hunting strategy of the predator maximizes contact with mosquitoes, 3) whether the predator consumes large numbers of mosquitoes, and 4) whether the predator is present in sufficient numbers to control mosquitoes. Predator effectiveness is enhanced when proper conditions are present.

Within a typical aquatic environment that produces mosquitoes, predators are distributed among different substrates. For example the surface of the pond supports water striders, planaria and spiders. Below the water surface, backswimmers, predaceous diving beetles and water scavenger beetles live and feed. If the pond contains vegetation, then the plant surfaces (periphyton) will support *Hydra*, damselfly and dragonfly nymphs, and giant water bug nymphs and adults. The benthos supports dragonfly and damselfly nymphs that feed on organisms associated with silts and organic detritus. Together, the different predators form a spatial network that accounts for predation throughout the pond. Ideally an adequate variety of vegetation should be present to maintain sufficient levels of predator diversity. Greater potential for an acceptable level of mosquito control exists when more predators are present. Care should be taken so that mosquitoes do not have an advantage when too much or too little vegetation is removed.

Most of the currently registered mosquito larvicides minimally impact predators. Making applications at the lower end of the label rate can further minimize any undesirable impacts from these larvicides. The overall objective

of using predators is to reduce the frequency of pesticide applications. This minimizes environmental impact and delays the development of mosquito resistance to pesticides.

Predation on mosquitoes is a natural process that will occur without human intervention. However, the level of mosquito control by natural predators can be increased by the conservation of predators in the environment and by augmentation of the predator population through stocking and habitat enhancement.

C. PRACTICAL APPLICATIONS OF BIOLOGICAL CONTROL AGENTS

A wide range of organisms have been evaluated for their effectiveness as biological control agents against mosquito larvae, but only a relatively small number are currently in use in California. There have been a number of reasons for this, including 1) difficulties in mass production, 2) failure to produce a consistent level of larval control, 3) expense, and 4) restricted application because of environmental concerns. Most agents, particularly predators and parasites, have only demonstrated acceptable control in conjunction with mosquitofish and larvicides. Currently, the only biological control agents in use or consideration by the District are *Bacillus thuringiensis israelensis, Bacillus sphaericus, Lagenidium giganteum* and the mosquitofish *Gambusia affinis*. Mosquitofish will be discussed in the next subsection.

Microbial Agents and Mosquito Control: Commercial formulations of *Bacillus sphaericus* and *Bacillus thuringiensis israelensis* are extensively used as mosquito larvicides. Both are highly selective for mosquitoes and are innocuous to associated non-target organisms and predators. *Bacillus thuringiensis israelensis* is also toxic to black flies, a pest and disease vector.

Bacillus thuringiensis israelensis and *Bacillus sphaericus* are often considered chemical control measures because they are available in commercial formulations that consist of granular, powdered or liquid concentrates. The use of these two microbials is discussed further under Chemical Control (Section 4.7).

Lagenidium giganteum and Mosquito Control: *Lagenidium giganteum* is a fungal parasite of mosquito larvae. Motile zoospores enter mosquito larvae either when ingested or by penetrating the cuticle. The fungus grows rapidly throughout the host body cavity and once the host dies, zoospores are released that can infect other larvae.

Lagenidium giganteum is a highly specific parasite of mosquito larvae. Other organisms are not susceptible and there is no mammalian toxicity. However, use of *L. giganteum* is limited because of environmental requirements for growth and development of the fungus.

Lagenidium giganteum is available commercially as an aqueous suspension. It contains 40% (wt./wt.) *L. giganteum* (California strain) mycelium (10^{10} CFU or Colony Forming Units, a concentration measure by cell counts per liter) and 60% inert ingredients. *Lagenidium giganteum* may be applied from ground or air. Label rates range from 9 to 180 fluid ounces per acre. Most treatments will require 20 to 80 fl. oz./acre, a common rate is 25 fl. oz./acre. Zoospores form within 16 hours after application and mortality occurs within 24 to 48 hours.

D. MOSQUITOFISH AND MOSQUITO CONTROL

Gambusia affinis is the most commonly used biological control agent for mosquitoes in the world. Careful use of this fish can provide safe, effective, and persistent suppression of a variety of mosquito species in many types of mosquito sources. As with all safe and effective control agents, the use of mosquitofish requires a good knowledge of operational techniques and ecological implications, careful evaluation of stocking sites, use of appropriate stocking methods, and regular monitoring of stocked fish. For general information on the biology of mosquitofish and their application in mosquito control programs, the reader is referred to Downs (1991) and Swanson et al (1996).

Aquatic Habitats: Mosquitofish have been used to control mosquitoes in a wide variety of mosquito sources. These sources include both artificial and natural water bodies: dairy, industrial and municipal wastewater ponds; flood control basins and underground storm drains; neglected swimming pools, ornamental ponds and water troughs; irrigation and roadside ditches; seasonally flooded agricultural lands, rice fields, duck clubs and wildlife refuges; and such wetlands areas as marshes, sloughs, swamps and river seepage.

The number and density of mosquitofish needed to achieve acceptable control of larval mosquitoes varies considerably with the mosquito species, water temperature, etc.. In situations where large populations of mosquitoes are hatching in a short amount of time, a relatively high density of mosquitofish is required. In general, suitable habitats promote reproduction and growth rather than just sustaining the stocked mosquitofish population. Sources where conditions do not favor population growth may not be suitable for mosquitofish use, or may require stocking at substantially higher rates.

The principal habitat characteristic that affects the successful use of mosquitofish is its relative stability. Mosquitofish usually are not effective in intermittently flooded areas unless a refuge impoundment is provided. Because of this, mosquitofish are more effective against mosquitoes breeding in permanent and semi-permanent water (e.g. *Culex* spp., *Anopheles* spp., and *Culesita* spp.) than against floodwater mosquitoes (primarily *Aedes* spp.).

Mosquitofish are best suited for use in shallow, standing water and are particularly useful in large sources where the repeated use of chemical control is expensive, prohibited, or impractical.

Availability of food, other than mosquito larvae, and shelter are also important factors affecting the suitability of a site. Mosquitofish survival, growth, and reproduction are highly dependent on diet and feeding rates. Shelter to protect the young from cannibalistic adults is essential for population growth. Vegetation, or other shelter, may also reduce predation on adult mosquitofish by birds, larger fishes, and other predators.

Habitats in which the water quality conditions, particularly temperature, dissolved oxygen, pH, and pollutants, exceed the tolerance limits of mosquitofish are not suitable sites for biocontrol. In sources with poor but sublethal water quality, feeding, reproductive activity and consequently mosquito control, may be adversely affected. Use of mosquitofish is sometimes possible in suboptimal environments that inhibit reproduction, but special stocking and monitoring methods may be required.

The presence of piscivorous fishes or other predators in the source habitat may rule out stocking with mosquitofish. High densities of invertebrate and vertebrate predators, such as notonectids and young game fish, which prey on small mosquitofish can prevent mosquitofish population growth.

Stocking Methods: Stocking methods can have significant effects on the degree of mosquito control achieved. In most cases, the objective is to release the minimum number of fish at the time when conditions within the source promote rapid population growth and at locations which facilitate dispersal throughout the source. The most appropriate methods depend on the type and location of the mosquito source, season, and the degree and duration of control desired.

Stocking Rate: Mosquitofish generally are released at densities lower than those necessary for mosquito control with the expectation that reproduction and recruitment will greatly increase the fish population within a few weeks. The best stocking rate depends primarily on the type of mosquito source, season, and mosquito control objective, for example immediate control vs. control later in the season. Understocking can result in inadequate mosquito control whereas overstocking may result in excellent control, but is wasteful of the usually limited fish supply.

In general, for early season stocking of mosquito sources that contain healthy populations of food organisms and adequate vegetation to provide shelter for the small mosquitofish, 0.2-0.5 lb./acre is appropriate. Higher stocking rates are necessary in a variety of circumstances, including 1) late season stocking and/or short flooded season, for example, wild rice fields or duck club ponds. In these situations, mosquitofish population growth is reduced as a result of a shorter breeding season and declining thermal and photoperiodic stimuli for breeding; 2) poor quality environments which depress or inhibit reproduction and/or feeding, for example, habitats characterized by low temperature, low light, or high levels of chemical or organic pollution; 3) sources in which immediate mosquito control is desired; and 4) sources which harbor high densities of mosquito larvae, for example, agricultural drainage ditches.

Stocking Date: Date of release of mosquitofish into a mosquito source affects biocontrol efficacy primarily through its influence on mosquitofish population growth. The age of the source can also affect population growth since both food and shelter may be sparse in new habitats. In mosquito sources stocked late in the season, population growth is reduced because of the shortened breeding season and declining reproductive stimuli. Stocking date necessarily varies with type of mosquito source but, in general, mosquitofish are released one to three weeks post-flooding. Mosquito sources that require late season stocking, such as duck club ponds are usually stocked with higher numbers of fish or treated with supplemental larvicides.

Stocking Location: A sufficient number of mosquitofish must be stocked where mosquito larvae are present. Although mosquitofish can swim through dense vegetation, dispersal throughout a large habitat takes time and is slowed by the presence of additional barriers such as dikes or complicated shorelines.

The size and complexity of a source are important considerations when determining the number and locations of release sites. In large, complicated habitats, such as rice fields or wetlands, mosquitofish are typically be released at several locations. For small area sources, all fish may be released at a single site.

Water flow may also be a consideration. In general, mosquitofish are stocked at the upstream end of the source since fish tend to move downstream from the release site.

Handling, Release and Monitoring: Most mosquitofish are released by hand; however, mosquitofish can also be dropped from airplanes and helicopters, when stocking large area sources such as rice fields. Regardless of the release method, care is taken to minimize stress. Abrupt changes in water temperature are avoided, and fish are usually transported in water at a temperature similar to that at the end source. Mosquitofish are not stocked during extremely hot weather or when water temperatures approach the upper tolerance limits of the fish (>35°C or 95°F).

After stocking, mosquitofish populations are monitored regularly to assess fish density, population growth, and biocontrol efficacy. A low number of fish may necessitate restocking or alternative mosquito control efforts.

The minnow trap is the most commonly used tool for assessing mosquitofish populations and, when used properly, it is effective and reliable. A minnow trap consists of a fine mesh cage with one or two inset funnel-shaped openings oriented with the narrow ends pointed into the cage. Fish enter the trap easily; the outer opening is wide and directs the fish into the cage. Once inside, the only exit is the narrow opening and few fish escape. Minnow traps are set so that a portion of the trap is above the anticipated maximum water level. This insures that surface feeding mosquitofish are captured and allows captured fish access to the surface for survival during episodes of low dissolved oxygen (e.g., pre-dawn hours). Minnow traps can be constructed using readily available material or purchased from many commercial aquaculture suppliers.

The number of fish captured in a trap provides a good estimate of the total number of fish in the habitat. Frequency of monitoring is optional but, for reliability between samples, minnow traps are usually deployed for equal amounts of time. The District generally leaves traps in place for 24 hours.

Use of Mosquitofish by the Public: Mosquitofish are made available to the public for backyard water gardens and ornamental fish ponds. Fish can be picked up Monday through Friday during normal office hours. All citizens that pick up fish are informed of the restrictions for use of mosquitofish and of the California Fish and Game regulations pertaining to the placement of non-native fishes into creeks, lakes or other natural water bodies of the state. The public is also informed on how to properly care for and maintain the mosquitofish that they are given.

E. Environmental Considerations of Mosquitofish Use

Many species of larvivorous fish have been evaluated as agents to control mosquitoes, including various species of atherinids, centrarchids, cichlids, cyprinids, cyprinodontids, gasterosteids, and other poeciliids. However, mosquitofish are considered best suited from both biological and operational perspectives.

Advantages of Mosquitofish for Biological Control: Mosquitofish possess characteristics which make them efficient predators of mosquito larvae. They thrive in shallow, calm, vegetated waters, which is the same environment where many mosquitoes prefer to lay eggs, and can tolerate wide ranges of water temperature and quality. Mosquitofish are surface-oriented predators where mosquito larvae are an accessible prey. The small size of the fish enable them to penetrate moderately vegetated and shallow areas within the mosquito source. Mosquitofish are live-bearers that grow rapidly, mature at a young age, and reproduce quickly. This allows the fish to establish a high population in the source shortly after stocking. In many sources, seasonal peaks in mosquitofish activity and population growth coincide with mosquito reproduction times. Because of their omnivorous feeding habits, mosquitofish can thrive in habitats where mosquitoes occur intermittently.

Mosquitofish are hardy and easy to handle, transport, and stock. As a result of extensive research and practical experimentation in California, mosquitofish can be reliably cultured in large numbers. Problems still exist in some areas with winter survival rates and inadequate supplies of fish in the spring. Because the fish reproduce where they are stocked, long-term control can be achieved by stocking relatively few fish, often in a single application. Compared to

pesticides, which require repeated applications, mosquitofish can provide inexpensive and safe long-term control, sometimes within days after application. Although not all introductions are successful, mosquitofish are an effective biological control component of an integrated mosquito management program.

Limitations to Use of Mosquitofish for Biological Control: Not all types of mosquito sources are suitable for stocking with mosquitofish and mosquitofish are not effective in all situations. Since mosquitofish usually are not stocked in numbers sufficient to cause an immediate effect, they do not control mosquitoes as quickly as pesticides do. In some areas, federal, state, or local agency permission is required to stock mosquitofish.

Mosquitofish and Non-mosquito Prey: Mosquitofish, despite their name, cannot survive solely on a diet of mosquito larvae (Reddy & Pandian 1972). Laboratory and field research have shown that mosquitofish also will eat a wide variety of food, including zooplankton, copepods, cladocerans, and immature stages of many insects, including midges, water beetles, damselflies, and mayflies (Washino & Hokama 1967, Ahmed et al 1970, Reed & Hoy 1970, Miura et al 1979, Farley 1980, Walters & Legner 1980, Bence 1988, Walton & Mulla 1991, Lawlor et al 1999). Hess & Tarzwell (1942) concluded that mosquitofish were true opportunistic feeders, so that the simple availability of prey was the key criteria in prey selection by mosquitofish. As such, the selection of food items by mosquitofish apparently shifts away from specific prey as its abundance drops. The District has been unable to find any substantial evidence of extirpation of any taxa by mosquitofish in creeks or other open or complex natural sites.

Within their generally wide diet, mosquitofish do have some clear feeding preferences, including food at the water surface, prey size ranging from large zooplankton to very small fish or invertebrates, and prey that is not highly mobile (Swanson et al 1996). While mosquitofish can modify food chains in small experimental pools, and can have significant impacts on endemic fish in these settings (Swanson et al 1996, USFWS 1996), there has been no published information on significant effects on reducing food resources for higher predators, reducing other mosquito predators, or reducing Special Status Species in the District Service Area. Because questions have been raised on this last point with regards to the California Red-legged Frog, this species is discussed in additional depth below.

Mosquitofish and Red-Legged Frogs: Some challenges have been made against the use of mosquitofish for the control of mosquitoes, based on the concern that the omnivorous feeding habit of mosquitofish poses a threat to the juvenile forms of the federally-threatened California Red-legged Frog. The District does not find substantial evidence to support this claim, either in the literature or from our own field experience. Specifically, the U.S. Fish and Wildlife Service (USFWS), after originally issuing statements asserting that mosquitofish have played a role in the historic reduction of red-legged frogs, acknowledged in their final Listing document for the species that they have no evidence for a link between mosquitofish and the decline of Red-Legged Frogs:

> "The Service is aware of several sites where mosquitofish and California red-legged frogs are currently coexisting. This evidence suggests that the relationship between mosquitofish and California red-legged frogs is complex. Additional research clearly is needed to more fully understand how these two species interact. The final rule has been revised to reflect current knowledge on this issue. The Service cannot determine whether mosquitofish are harmful to California red-legged frogs." (USFWS Federal Register 5/23/96)

Subsequently, research at the University of California at Davis, partially funded by the USFWS, showed no direct (mortality) impacts of mosquitofish on Red-Legged Frogs in intense interactions in naturalistic settings; the only indirect impact seen in this research was a slight lowering of body weight at the transition from tadpole to adult, with no evidence that this has any biological significance (Lawlor et al, 1999). In addition, as noted by the USFWS, mosquitofish and red-legged frogs have been frequently observed by qualified researchers to coexist in natural settings, similar to those in the District Service Area (field notes by Karl Malamud-Roam, Terry Strange, Chris Miller, Wes Maffei, Ron Keith, and others). Finally, alternative and more plausible explanations, including hunting, habitat destruction, and the introduced Bullfrog (*Rana catesbeiana*), apparently explain the observed historic decline in Red-legged frogs in the Service Area (USFWS 1996, Lawlor et al 1999).

Project Controls to Limit Environmental Impacts to Non-Significance: District activities are undertaken in coordination with other agencies involved in management of natural resources and the environment, and are carried out pursuant to a framework of federal and state regulation. The following specific observations support our conclusion that existing District controls are effective to avoid significant environmental impact:

- The District has used mosquitofish in the current Service Area for over fifty years without any apparent relationship, geographic or temporal, between our activities and observed environmental changes;
- The District's use of mosquitofish is highly selective in space and time, based on a detailed list of potential mosquito sources, pre-control surveillance for mosquito abundance, and threshold criteria for control applications;
- In particular, District policies explicitly prohibit release of mosquitofish into known Red-legged Frog sites, as mapped by the California Department of Fish and Game's Natural Diversity Database, Habitat Conservation Plans, and other reliable sources;
- The District's field technicians are highly-trained, certified by the California Department of Health Services, and are required to complete frequent continuing education sessions sponsored by the State, the District, or the Mosquito & Vector Control Association of California;
- The District's field activities are routinely monitored for safety, efficacy, and environmental impact by the District's Manager, by the Napa County Agricultural Commissioner, and by permit-issuing agencies;
- The District's activities are consistent with the Conservation Policies of the Napa County General Plan and identified Habitat Conservation Plans, Endangered Species and Sensitive Habitat Recovery Plans, and City Plans in the Service Area; and
- District staff routinely coordinates and consults with other responsible agencies, including the California Department of Health Services, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, BCDC, the California State Lands Commission, the San Francisco Regional Water Quality Control Board, USACE, the Napa County Resource Conservation District, and the Napa County Flood Control District to ensure that Project activities do not result in significant impacts to biological resources.

F. CONCLUSIONS

The District has found biological control in the form of mosquitofish release and redistribution to be an environmentally-acceptable mosquito control technique in many settings. Particularly in altered or artificial aquatic habitats, the use of mosquitofish as a component of an integrated mosquito management program may be environmentally preferable to no action, the exclusive use of pesticides, or drainage (World Health Organization, 1982). In addition, the increasingly limited availability of registered pesticides and increasing insect resistance to pesticides increases the need for alternatives including biological control. As agents for biological control of mosquitoes, mosquitofish deserve consideration, and, in many specific situations, are the best choice.

Though mosquitofish are not native to California, they are now ubiquitous throughout most of the state's waterways and tributaries. In much of the state's wetland areas, mosquitofish are now part of the natural ecosystem. Also, much of the aquatic habitat that is highly productive for mosquitoes is disrupted habitat, with flora and fauna that are predominately non-native species. In these areas, stocking of mosquitofish will have minimal impact on non-target species.

Many precautions are taken to minimize the environmental impact in habitats where mosquitofish are introduced. Mosquitofish are introduced into wetland communities that are biologically complex. The impact on habitats that contain native fishes are especially considered and weighed prior to introduction. Mosquitofish are stocked only in careful compliance with federal and state endangered species acts, so as to avoid the potential to harass and impact threatened and endangered fish, amphibians, insects and other wildlife. The considered use of mosquitofish by the District ensures the protection of the environment by augmenting the natural process of predation on mosquito larvae through the use of a natural predator, the mosquitofish.

While the District has not yet adopted other biological control agents for operational use, tests with *Bacillus sphaericus* and *Lagenidium giganteum* indicate that they may be appropriate and environmentally-acceptable mosquito control agents in the District Service Area in the near future.

Mosquitofish Stocking Guide Chart

CONDITION	SOURCE†								
	Lake or Pond	Creek	Horse Trough or Wine Barrel	Swimming Pool or Ornamental Pond	Irrigation Ditch*	Marsh	Catchment Basins	Flood Control Canal	Duck Club Ponds
Threatened or Endangered Species Present	DS	DS	NA	NA	DS	DS	DS	DS	DS
Threatened or Endangered Species Absent	S	S	S	S	S	S	S	S	S
Water Temperature Below 55°F	DS	DS	DS	DS	DS	DS	DS	DS	DS
Water Temperature Above 55°F	S	S	S	S	S	S	S	S	S
Salinity Below 15ppt	S	S	S	S	S	S	S	S	S
Salinity Above 15ppt	NA	NA	NA	NA	NA	DS	NA	NA	DS
Distance to Populated Area Less Than 10 miles	S	S	S	S	S	S	S	S	S
Distance to Populated Area Greater Than 10 miles	DS	DS	DS	DS	DS	DS	DS	DS	DS
Water Velocity High	NA	DS	NA	NA	DS	NA	DS	DS	NA
Water Velocity Low	S	S	S	S	S	S	S	S	S

† Consult staff if status of threatened or endangered species is unknown or if there is the potential for fish migrate to other sources.

* Usually have mosquitofish.

‡Sources with predatory fish may need to be stocked yearly.

DS= Don't Stock Mosquitofish **S=Stock Mosquitofish** **NA= Not Applicable**

Home/cem/wp/MFSChart

4.7 CHEMICAL CONTROL

A. INTRODUCTION

Control of mosquitoes with pesticides ("Chemical Control") is an essential portion of the District's Integrated Mosquito Management Program. When mosquito abundance exceeds District thresholds, and physical or biological control would be ineffective, inefficient, or otherwise inappropriate, selective pesticides to control larval mosquitoes (larvicides) and/or adult mosquitoes (adulticides) are used.

District staff have discretion to select from and apply a range of pesticides when field inspections indicate the presence of mosquito populations which meet District chemical control criteria and guidelines. Depending on the mosquito, these criteria and guidelines evaluate mosquito species composition, density, extent, and age (larval instar) structure; proximity to human settlements, including sensitive receptors; weather (water temperature, wind, evaporation rate, air temperature inversion); abundance of predators of mosquitoes; regional or local pathogen (disease organism) activity; vegetation; previous control efficacy history at the specific site; and/or potential for development of resistance (see District Guidelines following this Section; also Durso 1996, Lawlor 1997, etc.). Pesticide use by the District thus varies spatially and temporally in response to a large number of variables. The total number of applications and quantities of pesticides applied by the District from 1995 through July 1999 are shown in the following table.

Table 4.7.1: Pesticide Use by Napa County Mosquito Abatement District, 1995-1999 (first value is number of applications of material by District staff during the year; second number is the total quantity of material applied by District staff during the year). 1999 data are through July 31. Note that 1998 was an extraordinarily wet year, with very high mosquito production.

Pesticide (applications/units)	1995	1996	1997	1998	1999
Mosquito Larvicides					
Altosid					
Briquets (lbs)	0/0	0/0	0/0	0/0	0/0
Pellets (lbs)	2/8	2/8	2/12	12/21.95	18/5.44
Liquid ~~(oz)~~ (gal)	25/16.89	0/0	43/0.82	137/26.63	126/7.49
Bacillus thuringiensis H-14 (Bti)					
Teknar HPD (gal)	0/0	39/6.33	38/4.28	103/80.23	96/21.86
Vectobac 12AS (gal)	137/182.55	71/5.39	44/4.87	15/83.14	9/4.88
Vectobac Tech Powder (lbs)	417/223.9	380/219.88	377/172.43	310/157.71	154/99.67
Water Surface Films					
Golden Bear 1111 (gal)	340/571.25	282/647.75	230/714.5	407/1645.4	205/485
Agnique	0/0	0/0	0/0	0/0	0/0
Mosquito Adulticides					
Pyrethrins					
Pyrocide 7396 (gal)	105/18.68	127/17.73	93/15.32	131/23.81	135/21.92
Pyrenone (gal)	0/0	0/0	0/0	0/0	0/0
Resmethrin (Scourge) (gal)	0/0	0/0	0/0	0/0	0/0
Permethrin (Biomist) (gal)	0/0	0/0	0/0	0/0	0/0

Herbicides					
Glyphosate-based Rodeo (gal) Roundup (gal)	10/6 49/34.2	20/12 44/30.38	31/28.25 70/44.88	22/20.5 27/22.63	7/6.88 44/37.56
Karmex DF (lbs)	82/1936	82/1588	94/1940	91/2200	0/0

In addition to the pesticides used routinely by the District, which are all discussed in detail in this Section, there are a large number of other materials, especially organophosphate (OP) larvicides (see below), labeled and registered for use against mosquitoes in California. The District does not use, nor does it plan to use, organophosphate pesticides. Therefore, although these materials are available for use, they will not be discussed in this report. Further information on any California registered pesticide is available from the California Department of Pesticide Registration (DPR 1999).

B. POTENTIAL ENVIRONMENTAL IMPACTS OF CHEMICAL CONTROL

Any chemical control of mosquitoes or any other pests presents a number of potential environmental impacts, the significance of which can vary substantially. These potential environmental impacts can be conveniently divided into those associated with the pesticide itself, including its inert ingredients and breakdown products, and those associated with its mode of application (noise and other disturbance effects). In addition, potential pesticide impacts are often divided into those which might affect people directly (safety, residue, chronic toxicity), and those affecting other non-target organisms (especially Endangered and other Special Status Species). This sub-section will present generic issues and information on the potential environmental impacts associated with the mosquito control pesticides and pesticide application methods used or under consideration by the District, and the general policies and practices of the District to ensure that these impacts are not significant. Further information, specific to each material or application method, follows in the next sub-sections.

The pesticides used by the District are selective, non-persistent, and safe to the operator and other persons. Only pesticides registered by the United States Environmental Protection Agency and California Environmental Protection Agency are used by the District. Pesticide application is always done in strict accordance with the pesticide label instructions (labels and Material Safety Data Sheets = MSDS for all pesticides used by the District are available from the District or from the California Department of Pesticide Registration). The District's strict compliance with pesticide labels and MSDS's, together with other measures described below, ensure that the pesticides available for mosquito control, when applied in accordance with legal requirements, are safe and cause little or no environmental impact.

1. SAFETY

Pesticides, by their nature, are toxic to some organisms. Their toxicity, however, varies considerably between different species, and to a lesser extent between individuals of the same species, when exposed to identical dosages. The safety of pesticides to humans is primarily assessed through measurements of acute (single-dose) toxicity in other animals, which is summarized using "signal words" on the pesticide label or the "LD-50" values on the MSDS (high values indicate low toxicity; see Durso 1996). The following is an explanation of these signal words. Please note that the District does not use pesticides with a "Warning" or "Danger" label except under emergency conditions.

CAUTION. This word signals that the product is slightly toxic ("Category 3 or 4"). An ounce to more than a pint taken by mouth could kill the average adult. Any product which is slightly toxic orally, dermally, or through inhalation or causes slight eye and skin irritation will be labeled "CAUTION".

WARNING. This word signals that the product is moderately toxic ("Category 2"). As little as a teaspoonful to a tablespoonful by mouth could kill the average sized adult. Any product which is moderately toxic orally, dermally, or through inhalation or causes moderate eye and skin irritation will be labeled "warning".

DANGER. This word signals that the pesticide is highly toxic ("Category 1"). A taste to a teaspoonful taken by mouth could kill an average sized adult. Any product which is highly toxic orally, dermally, or through inhalation or causes severe eye and skin burning will be labeled "DANGER".

Pesticide safety is also evaluated in terms of Chronic Toxicity, or the response of organisms to repeated exposures to the material being tested. The California Department of Pesticide Registration (DPR) requires extensive testing for toxicity as a condition for allowing registration of pesticides in California, and as of July 1999 did not report any studies showing evidence of chronic toxicity associated with any of the pesticides used by the District when used at or near label rates (DPR 1999). DPR has reported "possible adverse" effects associated with repeated exposures at extremely high dosages (exceeding legally allowed label rates and District operations by a factor of 100 or more) of Permethrin, Pyrethrins, Resmethrin, Piperonyl Butoxide, Glyphosate, and Diuron (DPR 1999). District policies and practices, which are discussed in more detail below, ensure that the conditions encountered during these tests cannot occur during District operations.

Finally, standard toxicology measurements show average risk to the population as a whole. Therefore, a substantial margin of safety is incorporated in label instructions and District application policies and practices to protect children, persons with compromised health, and other "sensitive receptors."

Protection of public health and safety and other environmental values is ensured during pesticide applications by rigorous measures, including applicator registration and testing by the California Department of Health Services, ongoing training provided by the District and the Mosquito & Vector Control Association of California, routine equipment calibration, and regular inspections by the Napa County Agricultural Commissioner.

2. NON-TARGET EFFECTS

In addition to potential toxicity to humans, pesticides are evaluated for their potential effects on other non-target organisms. The District uses selective materials with little or no impact on other mammals, birds, and most other vertebrates. Some labeled mosquito control pesticides can have non-target effects on other invertebrates or fish, amphibians, and other aquatic organisms. The Environmental Hazards section on labels of pesticides used for mosquito control instruct applicators about how to avoid and minimize these non-target impacts, and the District rigorously follows these instructions. For example, some adulticide labels instruct the applicator to avoid direct application over water or drift into sensitive areas (i.e., wetlands) due to a potential toxicity of these compounds to fish and invertebrates. Although there is some variation in the habitats to be avoided, they usually include lakes, streams and marshes. The District strictly follows label instructions and carefully monitors environmental and meteorological conditions to maximize effectiveness while avoiding and minimizing non-target exposure and environmental effects.

An additional type of non-target effect that has been reported in the past is the disruption of food chains through the loss of wide ranges of insects or other prey organisms. With the pesticides currently used by the District, their selective toxicity and lack of bioaccumulation generally protect food chains from significant impact. However, some recent questions have been raised about the potential impacts of these more selective materials on midges, which are physiologically similar to mosquitoes and important in the food supply for some waterfowl and wading birds. The District has performed an exhaustive review of the scientific literature and concludes that there is no substantial evidence to support this suggestion. Specifically, 1) there is no evidence of a spatial or temporal relationship between larvicide use and population dynamics of waterfowl or wading birds (Scientific Peer Review Panel 1996); 2) Golden Bear 1111 has no effect on benthic midge larvae, which do not breath at the water surface; 3) Bti has no detectible effect on midge larvae when applied at the maximum allowable label rates for mosquito control; 4) Methoprene, at label rates for mosquito control, can prevent adult emergence of some species of midges but does not directly kill mosquito or midge larvae and therefore does not remove them from the food chain; 5) no bioaccumulation (food chain magnification) of larvicides in larva-eating animals has been demonstrated for larvicides used by the District; and 6) the District does not use, and does not plan to use, other larvicides in areas where midges might be a significant portion of the food chain, except under emergency conditions.

3. INERT INGREDIENTS, SYNERGISM, AND ENVIRONMENTAL FATE

Ideally, the safety and environmental effects of pesticides are evaluated not only in terms of the active ingredient(s) of the pesticide, but also with relation to their inert ingredients and the chemicals that are produced as the pesticide is broken down in the environment (environmental fate), and with all possible combinations of other environmental compounds (synergisms). In the past, some persistent mosquito control pesticides (eg.DDT) both accumulated in animal tissues and were concentrated up food chains (bioaccumulation), and also created breakdown products that themselves posed environmental risks (eg. DDE from DDT). As a practical matter, it has been impossible for DPR or any other institution to test every possible chemical interaction and breakdown product. However, pesticides

are tested as mixtures, together with their inert compounds, prior to their registration by USEPA or DPR, and extensive information has been collected on their total toxicity, bioaccumulation, and environmental fate. Neither EPA, DPR, nor other researchers have found significant environmental effects associated with the inert ingredients, synergisms, or breakdown products associated with materials used by the District. In addition, these materials do not bioaccumulate (see specific material descriptions later in this Section).

4. RESISTANCE AND LOSS OF EFFECTIVENESS

A number of examples of pesticide resistance have been published over the years, and one of the concerns with the development of resistance is the observed tendency of applicators to increase application frequency and/or intensity as pesticide effectiveness drops. The District has not experienced control failures due to resistance while using the current array of pesticides. However, to help guard against the development of resistance, and the monetary or environmental costs that can result, the District makes use of a number of pesticides with different modes of action, closely monitors research on resistance, and is committed to revising application practices if needed to avoid resistance.

5. DISTURBANCE ASSOCIATED WITH APPLICATION METHODS

In order to minimize potential non-target effects, modern pesticides are not only selective, but are also labeled for application directly to the mosquito population or habitat. Therefore, a means of applying the pesticide to the environment is needed and, for remote or large sites, a means of transportation. While small mosquito sources are routinely treated by hand with a backpack tank or other small container/sprayer, the District also uses trucks, hose reels, ATV's, and/or aircraft as needed for pesticide application. The noise and physical disturbance associated with these vehicles can cause disturbance to wildlife or nearby people, and the District plans its applications to minimize application frequency and disturbance intensity. At times, the desire for pesticides with low environmental persistence must be balanced with the desire to minimize application frequency, and some specific materials (eg. Altosid pellets, see below) are specifically designed for a long-term slow release of non-persistent pesticides.

6. DISTRICT POLICIES AND PRACTICES TO PROTECT THE ENVIRONMENT

In addition to the environmental protection measures and procedures inherent in the District's IMM program as discussed earlier (especially application thresholds and other criteria), there are other practices inherent in the District's chemical control program that protect the environment:

1. There are numerous federal and state laws and regulations that strictly control and regulate the storage, transport, handling, use and disposal of the pesticides in order to protect against surface and groundwater contamination and other impacts to the environment and public health. (E.g., Federal Insecticide, Fungicide and Rodenticide Act; Cal. Food & Agric. Code divisions 6 & 7; Cal. Code of Regs., title 3, division 6.) The District and its staff consistently comply with these laws and regulations and are routinely inspected by the county agricultural department for compliance.
2. The District only uses pesticides registered by the U.S. Environmental Protection Agency and California Department of Pesticide Regulation. The District then strictly complies with the pesticide label restrictions and requirements concerning the storage, transport, handling, use and disposal of the pesticides.
3. Consistent with the District's integrated mosquito management principles, when using pesticides, the District selects the least hazardous material that will meet its goals. The District does not use Category 1 pesticides, and only uses Category 2 pesticides in emergency conditions.
4. The District regularly calibrates the output of all of its pesticide application equipment.
5. The District and its employees are regulated by the State Department of Health Services (DHS). Mosquito control activities are coordinated with DHS pursuant to an annual Cooperative Agreement, under which the District commits to comply with certain standards concerning mosquito control and pesticide use. State law and the Cooperative Agreement require District mosquito control employees to be certified by DHS as a mosquito control technician. This certification helps to ensure that the employees are adequately trained regarding safe and proper mosquito control techniques, including the handling and use of pesticides and compliance with laws and regulations relating to mosquito control and environmental protection. The District also works in close coordination with the county agricultural commissioner, including periodic reporting of its activities.

C. CHEMICAL CONTROL OF MOSQUITO LARVAE

1. INTRODUCTION

Larviciding is a general term for the application of non-living natural materials or synthetic chemical products to aquatic habitats to kill mosquito larvae or pupae or to otherwise prevent emergence of adult mosquitoes. Materials designed to function in this way are known as larvicides, and they can be applied in a wide variety of formulations using a broad range of application technologies. Larviciding was developed early this century for the control of malaria and yellow fever mosquitoes, and still represents the most extensive set of District chemical control activities.

The District uses larvicides to treat a wide variety of aquatic habitats and communities, ranging from small domestic containers to larger agricultural and marshland areas. Frequently, the aquatic habitats targeted for larviciding are temporary or semi-permanent, since permanent aquatic sources usually contain natural mosquito predators such as fish and do not require further treatment, unless vegetation is so dense that it prevents natural predation. Temporary sites such as tidal marshes, flooded agricultural areas, or the margins of creeks produce prolific numbers of flood-water mosquitoes. While flood water mosquitoes develop during the first weeks after flooding, it often takes at least two to three weeks for the first macro invertebrate predators of mosquitoes to become established, and therefore biological or chemical control can be needed.

Where chemical control is appropriate, the major advantage of larviciding is the very small amount of larval habitat compared to adult mosquito habitat, and consequently the small acreage requiring treatment. Typically, the District applies larvicides to about one percent of the total District Service Area in any year.

There are times when larviciding is inappropriate (Durso 1996). Effective larviciding results are not always easy to achieve, and is critically dependent on timing when using nonpersistent pesticides. The size, location, or topography of the mosquito source area may make timely larviciding impossible. Spatial accuracy of the larvicide application is also extremely important. Congregated larvae may be easy targets, but missing a relatively small area containing them is also easy and leads to the emergence of many adults. Finally, larvicide labels allow a range of legal application dose rates; the selected rate must be sufficiently high to control the targeted mosquito species and sufficiently low to avoid or minimize non-target effects, especially where Special Status Species are present.

Natural fauna inhabiting larvicide application sites in addition to mosquitoes may include amphibians, fish, other vertebrates, and invertebrates, particularly insects and crustaceans, but larviciding causes little impact to these species. Temporarily flooded sites that meet District criteria to larvicide are generally very low in diversity of non-mosquito animal species at those times, due to the time needed for most non-mosquito species to locate and colonize these sites after flooding (Collins & Resh 1989). Also, because the District applies larvicides in limited areas at any time, most of the non-target species that do exploit temporary aquatic habitats are capable of quickly recovering from localized population declines via re-colonization from untreated proximal areas (Lawlor et al 1997).

Impacts of larviciding on flora are insignificant because the materials have no toxicity to plants, because the application methods involve very little disturbance to plants or soil, and because there are a small number of Special Status plants within potential District treatment areas, and District staff is trained to avoid them.

Larvicides routinely used by the DISTRICT include Golden Bear Oil 1111, Methoprene (Altosid), and Bti (*Bacillus thuringiensis israelensis*). Depending on water temperature, organic content, mosquito larval density, and other variables, pesticide applications may be repeated at any site at frequencies ranging from annually (synchronous cold water species) to weekly (irrigated pastures in hot weather, etc.).

Commercially available and experimental larvicides used by the District are discussed below. The presentation begins with the Insect Growth Regulator S-Methoprene, and then follows with Water Surface Films (GB1111 and Agnique), and concludes with Ingested Bacterial Larvicides (Bti and *Bacillus sphaericus*). A discussion of application methods, which are essentially common to all these materials, follows.

2. INSECT ENDOCRINE AGENTS = INSECT GROWTH REGULATORS (IGR's)

S-METHOPRENE. s-Methoprene (known simply as Methoprene or as its trade name, Altosid) is a synthetic analogue (mimic) of a naturally occurring insect hormone called Juvenile Hormone (JH). JH is found during aquatic life stages of the mosquito and in other insects, but is most prevalent during the early instars. As mosquito larvae mature, the level of JH steadily declines until the 4th instar molt, when levels are very low. This is considered to be a sensitive period when all the physical features of the adult begin to develop. s-Methoprene in the aquatic habitat can

be absorbed on contact and the insect's hormone system then becomes unbalanced. When this happens during the sensitive period, the imbalance interferes with 4th instar larval development. One effect is to prevent adults from emerging. Since pupae do not eat, they eventually deplete body stores of essential nutrients and then starve to death. Based on its mode of action, s-Methoprene is considered an insect growth regulator (IGR). This material has no effect on mosquito pupae and must be contacted by larvae to be effective.

Methoprene is applied either in response to observed high populations of mosquito larvae at a site, or as a sustained-release product that can persist for four months or longer. Application can be by hand, ATV, or aircraft. The District applied about 22 pounds of Altosid Pellets and 26.6 gallons of Altosid Liquid Larvicide in the entire Service Area during 1998.

FORMULATIONS AND DOSAGES. s-Methoprene is a very short lived material in nature, with a half-life of about two days in water, two days in plants, and ten days in soil (Wright 1976 in Glare & O'Callaghan 1999, La Clair et al 1998). The manufacturer has developed a number of formulations to maintain an effective level of the active material in the mosquito habitat (0.5-3.0 parts per **billion** = ppb[4]; (Scientific Peer Review Panel 1996)) for a practical duration, thus minimizing the cost and potential impacts associated with high-frequency repeat applications. Currently, five s-methoprene formulations are sold under the trade name of Altosid. These include Altosid Liquid Larvicide (A.L.L.) and Altosid Liquid Larvicide Concentrate, Altosid Briquets, Altosid XR Briquets, and Altosid Pellets. Altosid labels contain the signal word "CAUTION".

ALTOSID LIQUID LARVICIDE (A.L.L.) & A.L.L. CONCENTRATE. These two micro-encapsulated liquid formulations have identical components and only differ in their concentrations of active ingredients (AI). A.L.L. contains 5% (wt./wt.) s-Methoprene while A.L.L. Concentrate contains 20% (wt./wt.) s-Methoprene. The balance consists of inert ingredients that encapsulate the s-Methoprene, causing its slow release and retarding its ultraviolet light degradation. Maximum labeled use rates are 4 ounces of A.L.L. and 1 ounce of A.L.L. Concentrate (both equivalent to 0.0125 lb. AI) per acre, mixed in water as a carrier and dispensed by spraying with conventional ground and aerial equipment. In sites which average a foot deep, these application rates are equivalent to a maximum active ingredient concentrations of 4.8 ppb, although the actual concentration is substantially lower because the encapsulation does not allow instantaneous dissolution of all of the active ingredient into the water.

Because the specific gravity of Altosid Liquid is about that of water, it tends to stay near the target surface. Therefore, no adjustment to the application rate is necessary in varying water depths when treating species that breathe air at the surface. 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 BRIQUETS. Altosid Briquets were the first solid methoprene product marketed for mosquito control, beginning in 1978. Briquets consist of 4.125% s-methoprene (.000458 lb. AI/briquet), 4.125% (wt./wt.) r-methoprene (an inactive isomer), and plaster (calcium sulfate) and charcoal to retard ultra violet light degradation. Altosid Briquets release methoprene for about 30 days under normal weather conditions and, as noted earlier, this means that the concentration of AI in the environment at any time is much lower than the value calculated from the weight of material applied.

Applications are usually made at the beginning of the mosquito season, and under normal weather conditions, repeat treatments occur at approximately 30 day intervals. The recommended application rate is 1 Briquet per 100 sq. ft. in non-flowing or low-flowing water up to 2 feet deep. Small sites with any mosquito genera may be treated with this formulation. Typical treatment sites include storm drains, catch basins, roadside ditches, ornamental ponds and fountains, cesspools and septic tanks, waste treatment and settlement ponds, transformer vaults, abandoned swimming pools, and construction and other man-made depressions.

ALTOSID XR BRIQUETS. This formulation consists of 2.1% (wt./wt.) s-methoprene (.00145 lb. AI/briquet) embedded in hard dental plaster (calcium sulfate) and charcoal. Despite containing only 3 times the AI as the "30-day briquet", the comparatively harder plaster and larger size of the XR Briquet change the erosion rate allowing sustained s-methoprene release for up to 150 days in normal weather. The recommended application rate is 1 to 2

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[4]Note that this concentration is measured in parts per **billion**, and is equivalent to 0.0005 to 0.003 ppm (parts per **million**) when comparing application rates and toxicity studies.

briquets per 200 sq. ft. in no-flow or low-flow water conditions, depending on the target species. Many applications are similar to those with the smaller briquets, although the longer duration of material release can also make this formulation economical in small cattail swamps and marshes, water hyacinth beds, small pastures, meadows, freshwater swamps and marshes, woodland pools, flood plains and dredge spoil sites.

ALTOSID PELLETS. Altosid Pellets were approved for use in April 1990. They contain 4.25% (wt./wt.) s-methoprene (0.04 lb. AI/lb.), dental plaster (calcium sulfate), and charcoal in a small, hard pellet. Like the Briquets discussed above, Altosid Pellets are designed to slowly release s-methoprene as they erode. Under normal weather conditions, control can be achieved for up to 30 days of constant submersion or much longer in episodically flooded sites (Kramer 1993). Label application rates range from 2.5 lbs. to 10.0 lbs. per acre (0.1 to 0.4 lb. AI/acre), depending on the target species and/or habitat. At maximum label application rates, as with the Briquets, the slow release of material means that the actual concentration of active ingredient in the water never exceeds a few parts per billion.

The target species are the same as those listed for the briquet and liquid formulations. Listed 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. Altosid XR-G was approved for use in 1997. This product contains 1.5% (wt./wt.) s-methoprene. Granules are designed to slowly release s-methoprene as they erode. Under normal weather conditions, control can be achieved for up to 21 days. Label application rates range from 5 lbs. to 20.0 lbs. per acre, depending on the target species and/or habitat. The species are the same as listed for the briquet 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.

ENVIRONMENTAL IMPACTS: Methoprene is a material with very high specificity in its mode of action. Exhaustive reviews of the published literature on this material attest to its lack of adverse environmental impact (Mian & Mulla 1982, Scientific Peer Review Panel 1996, Glare & O'Callaghan 1999, Office of the Minnesota Legislative Auditor 1999). The table following the Methoprene discussion is a list of organisms impacted by S-Methoprene in studies reviewed by Glare & O'Callaghan (1999).

Wright (1976) reviewed the toxicology data collected for Methoprene registration and found no clinical signs of toxicosis in swine, sheep, hamsters, rats, dogs, rabbits, guinea pigs and cattle. Additionally, teratological (birth defect) studies in swine, sheep, hamsters, rats and rabbits showed no observable effects. Hester et al. (1980) found non-target organisms did not exhibit any adverse effects when exposed to treatments of sand granule and liquid formulations of methoprene up to a maximum of three and seven weeks, respectively. The acute, short-term toxicity of ZR-515 (methoprene) was also tested on 35 aquatic organisms including Protozoa, Platyhelminths, Rotatoria, Annelida, Arthropoda, Mollusca, Chordata and Thallophyta, and LC50 values of 0.9 to 5.0 ppm were calculated (250 to 1000 times label rates) (Miura and Takahashi 1973). Dosages used for larval mosquito control produced no adverse effect on the organisms tested, except for some sensitivity in larvae of some aquatic Diptera (Chironomidae, Ephydridae, and Psychodidae).

Bircher and Ruber (1988) assessed the toxicity of methoprene to all life cycle stages of the salt marsh copepod (*Apocyclops spartinus*) at concentrations ranging from 0.1 to 10.0 ppm. In general the copepods were resistant to concentrations of methoprene used to control mosquitoes, but early nauplii did show some mortalities to methoprene concentrations near the lower margins of mosquito susceptibility. Christiansen et al. (1977) showed a reduction in survival of larvae of the mud-crab *Rhithropanopeus harrisii* (Gould) under a range of salinity and temperature conditions, when exposed to 0.01, 0.1 and 1.0 ppm methoprene. McKenney and Mathews (1988) reported that larval survival, growth and energy metabolism of an estuarine shrimp *Palaemonetes pugio* were altered by exposure to low ug/l concentrations of an insect growth regulator (the juvenile hormone analogue, methoprene).

Finally, an extensive early study of technical (powdered) methoprene on a Louisiana coastal marsh (Breaud et al 1977) showed reductions in populations of adult and young scud (*Hyalella azteca*), adult and young opossum shrimp (*Taphromysis louisianae*), adult and young freshwater prawns (*Palaemonetes paludosus*), immature mayflies

(*Callibaetis* sp.), larval dance flies (*Notophila* sp.), larval midges *(Chironomidae*), adult and young fresh water snails (*Physa* sp.), immature damselflies and dragonflies (*Enallagma, Anax*, and *Belonia* spp.), adult burrowing water beetles (*Suphisellus* sp. and *Hydrocanthus* sp.), adult water scavenger beetles (*Berosus infuscatus*), and immature water scavenger beetles (*Berosus* spp.). On the other hand, populations **increased** for immature water boatmen (*Trichocorixa louisianae*), larval moth flies (*Psychoda* sp.), adult and young crawfish (*Procambarus clarki* and *Cambarellus* sp.), and adult predaceous diving beetles (*Liodessus affinis*) after the methoprene applications. Finally, no statistically significant ($P>0.05$) difference was seen between the test and control populations of 28 other aquatic organisms. Interpretation of this study is difficult in part because of the mixed nature of the results, which largely indicate the complexity of ecosystem dynamics in marshlands. Also, the application rate (28gm AI/ha technical powder) was at least twice the highest label rate allowed today, and was effectively much higher when the encapsulation and other coatings on modern formulations is considered.

After examining these and other studies, District staff and the recent reviewers listed above have concluded that 1) applications of methoprene (especially technical powder) at rates significantly higher than allowed by the label can adversely impact a number of aquatic animals; 2) animal species are not extirpated (locally eliminated) by repeated methoprene use except at application rates far higher than District practices; 3) emergence of adults of some fly species (specifically, some types of midges) can be temporarily reduced at application rates similar to District practices; 4) larval flies affected by methoprene are not killed at label application rates, but are prevented from becoming adults; 5) for species that are affected by methoprene, recolonization and reestablishment of populations from neighboring sites is fast once intense control was relaxed, 6) the patchy distribution of mosquito larvaes leads to maintenance of untreated refugia for non-targets, speeding recolonization, and 7) no bioaccumulation of methoprene has been seen in animals that have eaten mosquito or midge larvae treated with methoprene.

Finally, it has recently been suggested that methoprene may be associated with deformities in frogs that have been observed in a number of States (Frognet 1999). The District finds no substantial evidence to support this suggestion, and recent exhaustive reviews of this literature by independent analysts in Minnesota and New Zealand also find no evidence to support this claim (Glare & O'Callaghan, 1999; Minnesota State Auditor's Office, 1999). First, there is no evidence of a spatial or temporal relationship between Altosid use and amphibian deformities and, in particular, there is no evidence of frog deformities at all in the District's Service Area, and no significant evidence of frog deformities anywhere in California where methoprene use occurs (Fenn 1999). Second, well-documented alternative explanations for frog deformities, including infection with Trematodes, that are more consistent with the epidemiological patterns observed, have been reported (Sessions 1999). Third, the observations discussed to support the assertion have not been duplicated by any other researchers (Ankley et al 1998, Glare & O'Callaghan 1999). Fourth, consultations with Dr. Mark Jennings (May 1999) and other eminent herpetologists find no professional agreement with the claims of methoprene and frog deformities. Finally, severe deficiencies in methodology and/or interpretation exist in the few reports that make this assertion, including La Clair's failure to compensate for natural degradation of methoprene in the environment (La Clair 1998) and Sparling's failure to evaluate parasitism (Sparling 1998).

Published reports of concentrations of methoprene (ppm) required to inhibit 50% of adult emergence (IC_{50}) or cause 50% mortality (LC_{50}).

Target	Stage[1]	Mortality measure (ppm) LC_{50}	Mortality measure (ppm) $IC/EI/EC_{50}$[2]	Formulation	Reference
Diptera: Culicidae					
Aedes aegypti		0.0221		Altosid	Zebitz 1986
Ae. aegypti		0.000077			Spencer and Olson 1979
Ae. aegypti	4th	0.0008-0.015			Pridantseva *et al.* 1978
Ae. aegypti	4th	0.013		Altosid SR-10	Pridantseva and Volkova 1976
Ae. aegypti	4th		0.00038		Buei *et al.* 1975
Ae. aegypti	3rd	0.000397		Altosid ALL	Ritchie *et al.* 1997
Ae. albopictus		0.0009			Baruah and Das 1996
Ae. albopictus	4th		0.00062		Buei *et al.* 1975
Ae. albopictus	1st		0.0120	Altosid 10F	Toma *et al.* 1990
	4th		0.0009		
Ae. albopictus	4th		0.0017	Poultex 5E	Farghal *et al.* 1988
Ae. daitensis	1st		0.0743	Altosid 10F	Toma *et al.* 1990
Ae. detritus		0.0009		Altosid SR-10	Majori *et al.* 1977
Ae. epactius		0.000002			Spencer and Olson 1979
Ae. funereus	3rd	0.000072		Altosid ALL	Ritchie *et al.* 1997
Ae. notoscriptus	3rd	0.000359		Altosid ALL	Ritchie *et al.* 1997
Ae. riversi	1st		0.0176	Altosid 10F	Toma *et al.* 1990
Ae. iriomotensis	1st		0.0017	Altosid 10F	Toma *et al.* 1990
	4th		0.00006		
Ae. sollicitans	4th	0.000005		95.4% a.i	Khoo and Sutherland 1985
Ae. sollicitans		0.00015			Spencer and Olson 1979
Ae. togoi		0.0024		Altosid	Zebitz 1986
Ae. togoi	4th		0.00085		Buei *et al.* 1975
Ae. triseriatus	4th	0.000135		Altosid SR-10	Wells *et al.* 1975
		0.000093		Altosid 10-F	
Ae. triseriatus	4th	0.000176		technical 95.4% a.i	Khoo and Sutherland 1985
Ae. vigilax		0.000022		Altosid ALL	Ritchie *et al.* 1997
Armigeres subalbatus	4th		0.15		Buei *et al.* 1975
Ar. subalbatus	1st		14.9352	Altosid 10F	Toma *et al.* 1990
Ar. subalbatus	4th		1.2819		
Anopheles dirus	4th	0.00010-0.00017		Altosid sustained-release	Sithiprasasna *et al.* 1996
An. farauti	3rd	0.000057		Altosid ALL	Ritchie *et al.* 1997
An. sundaicus	4th	0.00009			Imai *et al.* 1987
Culex annulirostris	3rd	0.000089		Altosid ALL	Ritchie *et al.* 1997
Cx. fuscanus	1st		0.0976	Altosid 10F	Toma *et al.* 1990
	4th		0.0009		
Cx. infantulus	4th		0.00073		Buei *et al.* 1975
Cx. orientalis	4th		0.0010		Buei *et al* 1975
Cx. pipiens pallens	3rd		0.03		Noguchi and Ohtaki 1974
	4th		0.02		
	pharate pup.		0.0006		
	pupae		1.0		
Cx. pipiens pallens	3rd		0.028		Buei *et al.* 1975
	4th		0.00037		
Cx. quinquefasciatus		0.0011			Baruah and Das 1996
Cx. quinquefasciatus	1st		0.0374	Altosid 10F	Toma *et al.* 1990

	4th		0.0013		
Cx. quinquefasciatus (Cuba)	4th	0.005			Navarro-Ortega *et al.* 1991
Cx. quinquefasciatus (France)		0.0006			
Cx. quinquefasciatus	4th		0.00076	Poultex 5E	Farghal *et al.* 1988
Cx. sitiens	3rd	0.001124		Altosid ALL	Ritchie *et al.* 1997
Cx. tritaeniorhynchus	1st		0.0466	Altosid 10F	Toma *et al.* 1990
Cx. tritaeniorhynchus	4th		0.0012	Altosid 10F	Toma *et al.* 1990
Cx. tritaeniorhynchus summorosus	4th		0.00065		Buei *et al.* 1975
Cx. univittatus	eggs	1.1276		Altosid	Abdel-Aal 1995
Psorophora columbiae		0.000052			Spencer and Olson 1979
Diptera: Ceratopogonidae					
Culicoides circumscriptus			0.0094	slow release	Takahashi *et al.* 1985
Diptera: Chironomidae					
Chironomus yoshimatsui	last instar		0.0025	Altosid 10 F/	Kamei *et al.* 1982
			0.00065	slow release	
C. yoshimatsui[3]	field		0.0044	Altosid 10 F	Kamei *et al.* 1982
Diptera: Muscidae					
Musca domestica			50.3		Das and Vasuki 1992
			0.4 -15		Danish Pest Infestation Laboratory 1974
Diptera: Psychodidae					
Psychoda alternata			0.0014	Altosid 10F/	Kamei *et al.* 1993
			0.0023	slow release	
Diptera: Tephritidae					
Ceratitis capitata	eggs		1028	Altosid SR10	Farghal *et al.* 1983
	larvae		350		
	prepupae		0.63		
	pupae		1.80		
Coleoptera: Chrysomelidae					
Dicladispa armigera	larvae	1.26			Hazarika and Baishya 1997
	pupae	1.13			
D armigera	eggs	0.92			Hazarika and Baishya 1996
	adults				
Coleoptera: Coccinellidae					
Epilachna chrysomelina	eggs	6.4	1.6		Kinawy and Hussein 1987
Coleoptera: Tenebrionidae					
Tenebrio molitor			0.026	Altosid	Solomon and Metcalf 1974
Hemiptera: Lygaeidae					
Oncopeltus fasciatus			5.0	Altosid	Solomon and Metcalf 1974
Lepidoptera: Nocutidae					
Spodoptera litura	last-instar		68.077		Mane and Subrahmanyam 1996
Lepidoptera: Tortricidae					
Cydia molesta	eggs	0.000055			MacFarlane and Jameson 1974
Siphonaptera: Pulicidae					
Xenopsylla cheopis		0.00011			Chamberlain *et al.* 1988
Ctenocephalides felis	cocoon formation:		0.014		Kobayashi *et al.* 1994
	larval-adult:		0.00032		
Acari: Pyroglyphidae					
Dermatophagoides farinae	tritonymphs		0.0028		Saleh *et al.* 1976

[1] No. of instar

[2] IC_{50}, EI_{50} and EC_{50} = 50% inhibition of emergence

[3] In the field, 2 h exposure.

Toxicological properties of methoprene (from Wright 1976).

Property	Dose for effect
Acute oral toxicity - rat	34,600 mg/kg
Acute oral toxicity - dog	LD_{50}=5000-10000 mg/kg
Subacute oral studies (90 days, rate and dog)	No effects with 5000 ppm
Primary skin and eye irritation	Non irritating
Acute dermal toxicity (rabbit)	Dermal LD_{50}=3000-10000 mg/kg
Acute aerosol inhalation (rat)	No effects at 2000 ppm
Three generation reproduction study (rat)	No effects at 2500 ppm
Teratology studies (rat, rabbit)	No effects at 1000 mg/kg
Dominant lethal mutagenicity	No effects at 2000 mg/kg
Static fish toxicity studies	
Bluegill	LD_{50} =4.62 ppm
Channel catfish	LD_{50} >100 ppm
Coho salmon	LD_{50} =32 ppm
Trout	LD_{50} =106 ppm
Crustacean toxicity studies	
Crayfish	LD_{50} =100 ppm
Fresh water shrimp	LD_{50} =100 ppm
White shrimp	LD_{50} =100 ppm
Pink shrimp	LD_{50} =100 ppm
Subacute oral feeding studies	
Mallard duck	LD_{50} >10,000 ppm
Bobwaite quail	LD_{50} >10,000 ppm
Chickens	LD_{50} >4640 ppm
Reproduction studies (bobwhite quail and mallard duck)	No effects at 30 ppm
Mammalian hormone bioassay (mouse and rat)	No estrogenic, androgenic, anabolic or glucocorticoid activity

Environmental properties of methoprene (From Wright 1976)

Property	
Persistence in soil (1 lb/acre, 1.12 kg/ha)	Halflife < 10 days
Movement in soil	Remains in top few inches of soil
Persistence in water in field	Halflife < 2 days
Persistence in plants (1 lb/acre, 1.12 kg/ha)	
Alfalfa	Halflife < 2 days
Rice	Halflife < 1 day
Uptake by plants	Wheat did not take up residues from treated soil
Fate in food chain	Does not accumulate in food chain
Fate in animals (mice, rats, guinea pigs, steers or cows)	Rapidly metabolised and eliminated
Fate in fish (natural field conditions)	No accumulation
Effects on non-target insects	No deleterious effects on non-target species

3. WATER SURFACE FILMS

INTRODUCTION. Water Surface Film larvicides spread across water surfaces and disrupt larval respiration, killing mosquitoes and some other classes of air-breathing aquatic insects. Water surface film larvicides used by the District include specially refined petroleum distillates (Golden Bear 1111) and ethoxylated Isostearyl Alcohols (Agnique). In addition to being safe and selective agents effective for the control of younger larval instars, these are the only currently registered larvicides used by the District that are effective against mosquito pupae. Therefore, when timely larval control is not possible or not successful, pupal control can usually be achieved using these products.

MOSQUITO LARVICIDE GB-1111 (GOLDEN BEAR 1111). This product, generally referred to as Golden Bear 1111 or simply GB-1111, is a highly-refined petroleum based "napthenic oil" with very low phytotoxicity and no detectible residual products within days after application. Volatility is very low ("non-volatile" according to the MSDS), and environmental breakdown presumably results primarily from natural microbial degradation into simple organic compounds. The label for GB-1111 contains the signal word "CAUTION". GB-1111 contains 99% (wt./wt.) oil and 1% (wt./wt.) inert ingredients including an emulsifier. The nominal dosage rate is 3 gallons per acre or less. Under special circumstances, such as when treating areas with high organic content, up to 5 gallons per acre may be used.

GB-1111 provides effective control on a wide range of mosquito species. Applied to breeding areas, GB-1111 is an effective material against any mosquito larvae and pupae obtaining atmospheric oxygen at the water surface. It can even be effective in treating adult mosquitoes as they emerge. Where pupal density is high, or where warm water indicates that this will occur soon, GB-1111 is used unless other materials are required by site-specific protocols or other application criteria. Low dosages (1 gallon per acre) of oil work slowly, especially in cold water, and can take 4 to 7 days to give a complete kill. Higher dosage rates are sometimes used (up to 5 gallons per acre) to lower the kill time. It is typically applied by hand, ATV, or truck and aerial application is possible for large areas, but is not routine. The District applied about 1,645 gallons of GB 1111 to the entire Service Area during 1998, and has not applied over 2,000 gallons during any calendar year.

POTENTIAL ENVIRONMENTAL IMPACTS OF GB-1111. Little information has been published on the potential environmental impacts of this pesticide. GB-1111 was reregistered as a mosquito larvicide by the California Department of Pesticide Registration on April 20, 1999 (DPR 1999), and subsequent consultations with the Registration Specialist for this material at DPR indicate that the Department did not find evidence that GB-1111 has any potential significant environmental impacts when applied under label requirements and District application protocols (Duane Schnabel, DPR, pers. comm. May, 1999).

Four studies by Tietze et al (1991, 1992, 1993, 1994) tested three species of fish (Inland Silversides, Mosquitofish, and Sheepshead Minnows) and a range of microorganisms and concluded that this larvicide is not toxic to the tested organisms at label application rates. Mulla and Darwazeh (1981) experimented with GB-1111 in small experimental ponds and found that benthic invertebrates were unaffected while populations of surface breathing insects were temporarily reduced following application of this larvicide. Lawlor (UC Davis, in prep., pers. comm 8/25/99) has recently completed a significant independent study of non-target effects of GB-1111, with financial assistance from USFWS, on the tidal marshes of Newark, CA, and observed the following effects: 1) surface breathing insect populations were reduced at the time of treatment; 2) this effect did not persist beyond a few days (= no residual pesticide effects); 3) those potentially affected animals with high mobility left the site, while some of those that could not leave died (especially water boatmen (Corixidae)); 4) overall populations of invertebrate species were not affected, apparently because of recolonization from neighboring untreated sites.

AGNIQUE: Agnique is the trade name for a recently reissued surface film larvicide, comprised of ethoxylated alcohol. To date, the District has not used Agnique, but may do so in the future. According to the label, Agnique 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 Golden Bear 1111, especially in sites where the moderate temporary sheen associated with GB-1111 might be objectionable. Because the application rate of Agnique is much lower than that of Golden Bear, this potential shift would not include an increase in volume of materials applied.

POTENTIAL ENVIRONMENTAL IMPACTS OF AGNIQUE. A number of efficacy and nontarget studies had been conducted on this material when it was registered under the name Aerosurf. The pesticide was reregistered in California in July 1999 and consultations with DPR indicate that the Department did not find evidence that Agnique has any potential significant environmental impacts when applied under label requirements and District application protocols (Duane Schnabel, DPR, pers. comm. May, 1999). Minor proprietary changes in preparation did not apparently change any of the material's potential environmental impacts, and therefore the earlier literature is referenced.

Most published studies conducted with this larvicide tested application rates of 3 to 100 times the maximum label rate. At these rates, no observable effect on mortality or development was noted in tests on green tree frogs, seven species of fresh and salt water fish, two species of shrimp, five species of water beetle, or one species each of fairy shrimp, crayfish, snail, polychaete worm, mayfly naiad, copepod, ostracod, or midge. In addition, no effect was seen on five species of plants. As with GB-1111, air (surface) breathing insects were temporarily adversely impacted. Waterboatmen, backswimmers, and one species of water beetle exhibited increased mortality at application rates above label limits. In addition, a clam shrimp, a crab, an amphipod, and one species of isopod exhibited minor to significant increases in mortality at levels several times the highest application rate allowed by the label. For more information, please see the accompanying table. It should be noted that the greater persistence of this material (up to two weeks) relative to GB-1111 can reduce the need for repeated applications, but might also increase the duration of suppression of other air-breathing insects. Because District larvicide protocols require application of larvicides only in areas with mosquito larvae, and because larval distribution is highly patchy (Service 1993), recolonization of impacted non-targets from unsprayed areas should still occur promptly.

Isostearyl Alcohol Ethoxylate
Monomolecular Surface Film
Non-target Effects

Species		Effects	Reference
Hyla cinerea (Hylidae)	Fresh-water green tree frog	6 month study; >10 x application rate: normal progression from tadpole to adult	Webber & Cochran
Hypostomus plecostomus Loricaariidae	Fresh water fish	6 month study; >10 x application rate: normal development	Webber & Cochran
Gambusia affinis Baird and Girard (Poeciliidae)	Fresh water mosquito fish	6 month study, >10 x application rate: normal development	Webber & Cochran
Fundulus confluentus Goode and Bean	Salt water fish	7 day study, >10 x application rate: normal development	Webber & Cochran
Fundulus grandis Baird and Girard	Salt water fish	7 day study, >10 x application rate: normal development	Webber & Cochran
Cyprinodon variegatus Lacepede (Cyprindodontidae)	Salt water fish	7 day study, >10 x application rate: normal development	Webber & Cochran
Poecilia latipinna Lesveur (Poeciliidae)	Salt water fish	7 day study, >10 x application rate: normal development	Webber & Cochran
Dormitator maculatus Bloch (Eleotridae)	Salt water fish	7 day study, >10 x application rate: normal development	Webber & Cochran
Fundulus similus (Baird and Girard)	Longnose killifish	96 hour static acute toxicity testing, 100x application rate: 0% mortality	Hester, Olson & Dukes
Palaemonetes pugio Holthius	Grass shrimp	96 hour static acute toxicity testing, 100x application rate: 0% mortality	Hester, Olson & Dukes
Palaemonetes paludosus (Gibbs)	Freshwater shrimp	96 hour static acute toxicity testing, 100x application rate: 0% mortality	Hester, Olson & Dukes
Uca spp.	Fiddler crab	96 hour static acute toxicity testing, 100x application rate: 3.3% mortality	Hester, Olson & Dukes
Procambarus spp.	Crayfish	96 hour static acute toxicity testing, 100x application rate: 0% mortality	Hester, Olson & Dukes
Gammarus spp.	Freshwaater amphipod	96 hour static acute toxicity testing, 100x application rate: 1.9% mortality	Hester, Olson & Dukes
Asellus spp.	Freshwater isopod	96 hour static acute toxicity testing, 100x application rate: 0.5% mortality	Hester, Olson & Dukes
Streptocephalus seali Ryder	Fairy shrimp	96 hour static acute toxicity testing, 100x application rate: 0% mortality	Hester, Olson & Dukes
Physa spp.	Snail	96 hour static acute toxicity testing, 100x application rate: 0% mortality	Hester, Olson & Dukes
Laeonereis culveri (Webster)	Polychaete	96 hour static acute toxicity testing, 100x application rate: 0% mortality	Hester, Olson & Dukes

Isostearyl Alcohol Ethoxylate
Monomolecular Surface Film
Non-target Effects

Callibaetis pacificus (Seeman)	Mayfly naiads	Field testing, 0.5 – 1.0 gallon/acre: no effects	Mulla, Darwazeh, Luna, 1983
Berosus metalliceps Sharp (Dytiscidae)	Diving beetle adults	Field testing, 0.5 – 1.0 gallon/acre: no effects	Mulla, Darwazeh, Luna, 1983
Copepods, Ostracods		Field testing, 0.5 – 1.0 gallon/acre: no effects	Mulla, Darwazeh, Luna, 1983
Chironomids	Midges, adults	Field testing, 0.5 – 1.0 gallon/acre: dead adults on water surface	Mulla, Darwazeh, Luna, 1983
Eulimnadia sp. Conchostraca: Limnadiidae	Clam shrimp	Field testing, 3 – 10x application rate: high mortality rates on day one post-treatment; complete recovery of population by day 3	Takahashi, Wilder, Miura, 1984
Corisella spp. Hemiptera: Corixidae	Corixids	Field testing, 3 – 10x application rate: high mortality rates on day one post-treatment; complete recovery of population by day 3	Takahashi, Wilder, Miura, 1984
Notonecta unifasciata	Nonectids	Field testing, 3 – 10x application rate: Low to moderate mortality rate on day one post-treatment; complete recovery of population by day 3	Takahashi, Wilder, Miura, 1984
Tropisternus spp.	Beetle adults	Field testing, 3 – 10x application rate: 36% mortality observed on day one post-treatment only at 10x application rate; complete recovery of population by day 3	Takahashi, Wilder, Miura, 1984
Tropisternus spp.	Beetle larvae	Field testing, 3 – 10x application rate: no effect observed	Takahashi, Wilder, Miura, 1984
Enorchrus sp.		Field testing, 3 – 10x application rate: no effect observed	Takahashi, Wilder, Miura, 1984
Laccophilus spp.		Field testing, 3 – 10x application rate: no effect observed	Takahashi, Wilder, Miura, 1984
Hygrotus sp.		Field testing, 3 – 10x application rate: no effect observed	Takahashi, Wilder, Miura, 1984

Isostearyl Alcohol Ethoxylate
Monomolecular Surface Film
Non-target Effects

Chironomids	Midges, larvae	Field testing, 3 – 10x application rate: no effect observed	Takahashi, Wilder, Miura, 1984
Avicenna germinan (Linn.)	Black mangrove	Field testing, 1 gallon/acre application rate: no effect observed	Hester, Dukes, Levy, Ruff, Hallmon, Olson, Shaffer
Batis maritima (Linn.)	Saltwort	Field testing, 1 gallon/acre application rate: no effect observed	Hester, Dukes, Levy, Ruff, Hallmon, Olson, Shaffer
Spartina laterniflora Loisel	Cordgrass	Field testing, 1 gallon/acre application rate: no effect observed	Hester, Dukes, Levy, Ruff, Hallmon, Olson, Shaffer
Sagittaria sp.	Arrowhead	Field testing, 1 gallon/acre application rate: no effect observed	Hester, Dukes, Levy, Ruff, Hallmon, Olson, Shaffer
Oryza sativa Linn. Var. mars	Rice	Field testing, 1 gallon/acre application rate: no effect observed	Hester, Dukes, Levy, Ruff, Hallmon, Olson, Shaffer

4. BACTERIAL (INGESTION) LARVICIDES

INTRODUCTION. The District uses two types of ingested toxins whose active ingredients are manufactured by bacteria. These control agents are often designated as Bacterial Larvicides. Their mode of action requires that they be ingested to be effective, which can make them more difficult to use than the contact toxins and water surface films. Bacteria are single-celled parasitic or saprophytic micro-organisms that exhibit both plant and animal properties, and range from harmless and beneficial to intensely virulent and lethal. A beneficial form, *Bacillus thuringiensis* (Bt), is the most widely used (especially in agriculture) microbial pesticide in the world. It was originally isolated from natural Lepidopteran (butterfly and moth) die-offs in Germany and Japan. Various Bt products have been available since the 1950's, and in 1976, Dr. Joel Margalit and Mr. Leonard Goldberg isolated from a stagnant riverbed pool in Israel, a subspecies of *B. thuringiensis* that had excellent mosquito larvicide activities. It was named *B.t.* variety *israelensis* (B.t.i.) and later designated *Bacillus thuringiensis* Serotype H-14. Either of these two designations may be found on the labels of many bacterial mosquito larvicide formulations used today. Another species of bacteria, *B. sphaericus*, also exhibits mosquito larvicidal properties.

BTI (*Bacillus thuringiensis* var. *israelensis*). B.t.i. organisms produce, when environmental conditions are favorable, five different microscopic protein pro-toxins packaged inside one larger protein container or crystal. The crystal is commonly referred to as delta (d-) endotoxin. If the d-endotoxin is ingested by a mosquito larva, these five proteins are released in the alkaline environment of the insect larval gut. The five proteins are converted into five different toxins if specific enzymes also are present in the gut. Once converted, these toxins destroy the gut wall, which leads to paralysis and death of the larvae. B.t.i. is toxic to larval stages of all genera of mosquitoes and to black flies (Simuliidae).

B.t.i. is grown commercially in large fermentation vats using sophisticated techniques to control environmental variables such as temperature, moisture, oxygen, pH and nutrients. The process is similar to the production of beer, except that B.t.i. bacteria are grown on high protein substrates such as fish meal or soy flour and the spore and delta endotoxin are the end products. At the end of the fermentation process, B.t.i. bacteria exhaust the nutrients in the fermentation machine, producing spores before they lyse and break apart. Coincidental with sporulation, the delta endotoxin is produced. The spores and delta endotoxins are then concentrated via centrifugation and microfiltration of the slurry. It can then be dried for processing and packaging as a solid formulation or further processed as a liquid formulation. Since some fermentation medium (e.g. fish meal) is always present in liquid formulations, they generally smell somewhat like the medium.

There are five basic B.t.i. formulations available for use: liquids, powders, granules, pellets, and briquets. Liquids, produced directly from a concentrated fermentation slurry, tend to have uniformly small (2-10 micron) particle sizes which are suitable for ingestion by mosquito larvae. Powders, in contrast to liquids, may not always have a uniformly small particle size. Clumping, resulting in larger sizes and heavier weights, can cause particles to settle out of the feeding zone of some target mosquito larvae, preventing their ingestion as a food item. Powders must be mixed with an inert carrier before application to the larval habitat, and it may be necessary to mix them thoroughly to achieve a uniformly small consistency. B.t.i. granules, pellets, and briquets are formulated from B.t.i. primary powders and an inert carrier. B.t.i. labels contain the signal word "CAUTION".

The amount of toxins contained within B.t.i. products are reported indirectly as the result of at least two different bioassays and are difficult to equate to one another. Prepared volumes of toxins are applied to living mosquito larvae and the resulting mortality produces through formulae numerical measures known as International Toxic Units (ITU's) and *Ae. aegypti* International Toxic Units (AA-ITU's). These measures are only roughly related to observed efficacy in the field, and are therefore inappropriate to consolidate and report on like other toxicants (active ingredients).

Bti is applied by the District as a liquid or sometimes bonded to an inert substrate (sand or corn cob granules) to assist penetration of vegetation. Application can be by hand, ATV, or aircraft. Persistence is low in the environment, usually lasting three to five days due to sensitivity to UV light. Kills are usually observed within 48 hours of toxin ingestion. As a practical matter, apparent failures are usually followed with oil treatments.

Timing of application is extremely important in operational use of bacterial toxins. Optimal benefits are obtained when treating 2nd or 3rd instar larvae. Treatments at other development stages may provide poor control. Since fourth instar mosquito larvae quit feeding prior to becoming pupae, it is necessary to apply B.t.i. prior to this point in their development. Although the details are poorly understood, evidence suggests that larvae also undergo a period of reduced feeding or inactivity prior to molting from 1ST to 2ND, 2ND to 3RD, and 3RD to 4TH instars. If we apply B.t.i at these points in their development, the toxic crystals may settle out of the water column before the larvae resume feeding, and

with synchronous broods of mosquitoes, complete control failures may result. With asynchronous broods, efficacy may also be reduced. Therefore a disadvantage of using B.t.i. is the limited application window available.

BTI LIQUIDS. Currently, three commercial brands of B.t.i. liquids are available: Aquabac XT, Teknar HP-D, and Vectobac 12AS. Labels for all three products recommend using 4 to 16 liquid oz/acre in unpolluted, low organic water with low populations of early instar larvae (collectively referred to below as clean water situations). The Aquabac XT and Vectobac 12 AS (but not Teknar HP-D) labels also recommend increasing the range from 16 to 32 liquid oz/acre 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 (collectively referred to below as dirty water situations) also is seen in various combinations on the labels for all other B.t.i. formulations discussed below.

B.t.i. liquid may also be combined with the Altosid Liquid Larvicide discussed earlier. This mixture is known as Duplex. Because B.t.i. is a stomach toxin and lethal dosages are somewhat proportional to a mosquito larvae's body size, earlier instars need to eat fewer toxic crystals to be adversely affected. Combining B.t.i. with methoprene (which is most effective when larvae are the oldest and largest or when you have various, asynchronous stages of one or more species) allows a District to use less of each product than they normally would if they would use one or the other. Financially, most savings are realized for treatments of mosquitoes with long larval development periods, asynchronous broods or areas with multiple species of mosquitoes.

BTI POWDERS. Aquabac Primary Powder, Vectobac TP and Bactimos WP brands of B.t.i. powders are available. The Vectobac TP label recommends using a calculated 3.2 to 6.4 oz (by weight)/acre in clean water, and up to 12.8 oz/acre in dirty water situations. The Bactimos WP label correspondingly recommends using 2 to 6 oz/acre and up to 12 oz/acre. Aquabac Primary Powder currently is labeled for manufacturing use only. However, the label is currently being amended by the EPA to allow end user applications in quantities similar to those of the other powder formulations. The District used approximately 158 pounds of Vectobac TP in 1998.

BTI SAND GRANULES. Labeling is available for both Vectobac and Bactimos B.t.i. powders to guide end users in making their own "On Site Sand Granules", and commercial formulations are also available. Sand formulations require coating the particles with an oil, such as GB-1111, and then applying dry B.t.i. powder which will stick to the oil. Because most target mosquito species graze at the water surface or within the water column, and not at the bottom, it is desirable to stick the powder to the sand in a way that B.t.i. is released upon contact with the water, and is thus available for the larvae. The District prepares its own Bti sand granules, in accordance with the label instructions, using Vectobac Technical Powder and GB1111. This is the primary Bti formulation used by the District, and the Bti used to prepare sand granules was included in the District's use of Bti Powders described in the previous paragraph.

BTI CORNCOB GRANULES. There are currently two popular corncob granule sizes used in commercial formulations. Aquabac 200G, Bactimos G, and Vectobac G are made with 5/8 grit crushed cob, while 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 of all B.t.i. granules recommend using 2.5 to 10 lb./acre in clean water and 10 to 20 lb./acre in dirty water situations.

ENVIRONMENTAL IMPACTS OF BTI. Products containing Bti are ideally suited for use in integrated mosquito management programs because the active ingredient has a highly specific mode of action and is therefore extremely selective. Bti does not interrupt activities of most beneficial insects and predators. Bti controls all larval instars provided they have not quit feeding, and can be used in almost any aquatic habitat with no restrictions. It may be applied to irrigation water and any other water sites except treated finished drinking water. Bti is fast acting and its efficacy can be evaluated almost immediately. It can kill larvae within 1 hour after ingestion, and since each instar must eat in order for the larvae to grow, that means Bti usually kills mosquito larvae within 48 hours of application. Bti leaves no residues, and it is quickly biodegraded. Resistance is unlikely to develop simultaneously to the five different toxins derived from the Bti delta-endotoxin since they have five different modes of action. This suggests that this mosquito larvicide will continue to be effective for many years.

Bti labels carry the CAUTION signal word, suggesting the material may be harmful if inhaled or absorbed through the skin. However, the 4-hr Inhalation LC 50 in rats is calculated to be greater than 2.1 mg/liter (actual) of air, the maximum attainable concentration. The acute Dermal LD 50 in rabbits is greater than 2,000 mg/kg body weight and is considered to be non-irritating to the eye or skin. That is equivalent to a 220 lb. individual spilling more than a half gallon of Bti liquid directly onto his/her skin or eyes and not washing it off. Toxicology profiles also suggest that the inert ingredients (not the Bti) in liquid formulations, may cause minor eye irritation in humans. The acute Oral LD 50 in rats is greater than 5,000 mg/kg body weight (similar to an individual drinking over 5 quarts) suggesting the material is practically non-toxic in single doses. Common table salt has an LD 50 of 4,000 mg/kg of body weight.

Bti applied at label rates has virtually no adverse effects on applicators, livestock, or wildlife including beneficial insects, annelid worms, flatworms, crustaceans, mollusks, fish, amphibians, reptiles, birds or mammals (deBarjac et al 1980, Garcia et al 1981, Gharib and Hilsenhoff 1988, Holck and Meek 1987, Knepper and Walker 1989, Leclair et al 1988, Marten et al 1993, Merritt et al 1989, Molloy et al 1992, Miura et al 1980, Mulla et al 1983, Mulla et al 1982, Purcell 1981, Reish et al 1985, Shadduck 1980, Siegel et al 1987, Tietze et al 1993,1992,1991, Tozer and Garcia 1990). However, non-target activity on larvae of insect species normally associated with mosquito larvae in aquatic habitats has been observed. There have been reported impacts in larvae belonging to the midge families Chironomidae, Ceratopogonidae, and Dixidae (Anderson et al 1996, Molloy 1992, Mulla et al 1990, Rodcharoen et al 1991, Tozer and Garcia 1990). These non-target insect species, taxonomically closely related to mosquitoes and black flies, apparently contain the necessary gut pH and enzymes to activate delta-endotoxins. However, the concentration of Bti required to cause these effects is 10 to 1,000 times higher than maximum allowed label rates.

Bacterial spores of Bti are uniquely toxic to nematoceran Diptera (mosquitoes, midges, blackflies, psychodids and ceratopogonids) (Lacey and Mulla 1990). That result was reported after reviewing Bti studies conducted using a variety of Bti formulations and under a variety of test conditions. Lacey and Mulla (1990) concluded that Bti was a highly selective larvicide that produced minimal adverse impact on the environment. Garcia et al. (1981) tested a total of 23 species of aquatic organisms other than mosquito larvae using various formulations of Bti in his laboratory. No mortality was observed for these species with the exception of *Chironomus maturus* which showed a degree of susceptibility similar to that of mosquito larvae. Miura et al. (1980) found Bti at rates used for mosquito control to be very safe to organisms associated with mosquito breeding habitats. A total of 28 species or species groups were treated with the bacterium under simulated or field conditions, with no adverse effects observed, except for chironomid larvae, which were slightly affected. However, the effect was so light that the population in the field continuously increased after the treatment. Miura et al. (1981) found Bti and *Bacillus sphaericus*, when applied at rates used for mosquito control, very safe to organisms associated with mosquito breeding habitats, including natural enemies of mosquito larvae. When various aquatic organisms were exposed to the bacteria under laboratory, simulated or field conditions, no adverse effect was noted on the organisms with the exceptions of chironomid and psychodid larvae. Chironomid larvae were slightly affected by Bti treatment at a rate used for mosquito control but pyschodid larvae were only affected at the higher concentration (50ppm).

After testing mice, rats and rabbits, Siegal et al. (1987) concluded that Bti was not a virulent mammalian pathogen and that it could be used safely in environments where human exposure was likely to occur. Key and Scott (1992) conducted laboratory studies with Bti and *Bacillus sphaericus* against the grass shrimp *Palaemonetes pugio* and the mummichog *Fundulus heteroclitus*. Their study indicated that both Bti and *B. sphaericus* larvicides have large margins of safety. In a study by Aly and Mulla (1987), aquatic mosquito predators were fed with *Cx. quinquefasciatus* Say fourth-instar larvae intoxicated with either Bti or *Bacillus sphaericus* preparations. Although the mosquito larvae contained large amounts of the bacterial preparations in their gut, no effect upon longevity or ability to molt was observed in the backswimmer *Notonecta undulata*, in naiads of the dragonfly *Tarnetrum corruptum*, or in naiads of the damselfly *Enallagma civile*. Equally, the reproduction of *N. undulata* and the predation rate and ability to emerge normally in *T. corruptum* and *E. civile* were not affected by ingestion of large amounts of bacterial toxins.

At extremely high doses, negative effects of Bti were obtained when solubilized parasporal crystalline proteins were injected into the intra-abdominal space of Japanese quail (Kallapur et al., 1992). Exposure of brook trout *Salvelinus fontinalis* fry to 4500 and 6000 mg/liter Teknar for 45 min resulted in 20 and 86.4% mortality, respectively (Fortin et al., 1986). Again, it should be noted that the rates tested were more than 50X the allowed label rate for mosquito control.

Organisms not susceptible to *Bacillus thuringiensis israelensis*

Higher order	Genus and species	Common name	Reference
ACARI	*Hydrachnella* sp.		Becker and Margalit 1993
	Hydracarina sp.	mite	Beck 1982
	Hydrachna sp.	mite	
AMPHIBIANS	*Hylo regilla*	tree frog tadpole	Abbott Laboratories; Garcia *et al.* 1980
	Bufo sp.	toad tadpole	
	Bufo bufo		Becker and Margalit 1993
	Bufo viridis		
	Bufo calamita		
	Taricha torosa	California newt	Abbott Laboratories; Garcia *et al.* 1980
	Rana temporaria		Paulov 1985a & b
	Triturus alpestris		Becker and Margalit 1993
	Triturus vulgaris		
	Triturus cristatus		
	Bombina variegata		
	Rana esculenta		
FISH	*Gambusia affinis*	mosquito fish	Abbott Laboratories; Garcia *et al.* 1980
	Lucania parva	rainwater killifish	
	Gasterosteus wheatlandi	twospine stickleback	
	Lepomis macrochirus	bluegill	Christensen 1990a
	Salvelinus fontinalis	brook trout	Wipfli *et al.* 1994
	Salmo trutta	brown trout	
	Oncorhynchus mykiss	rainbow trout	Wipfli *et al.* 1994; Christensen 1990b
	Pseudomugil signifer	Pacific blue-eye fish	Brown *et al.* 1998
	Poecilia reticulata	larvivorous fish	Mittal *et al.* 1994
	Tilapia nilotica		Lebrun and Vlayen 1981
	Esox lucius		Becker and Margalit 1993
	Cyprinus carpio		
	Perca fluviatilis		
	Ambloplites rupestris	rock bass	Merritt *et al.* 1989
	Epiplatys sp.	killifish	Beck 1982
	Cyprinoidei	goldfish	
	Cyprinodon variegatus	sheephead minnow	Christensen 1990c
CRUSTACEANS	*Orconectes limosus*	crayfish	Becker and Margalit 1993
	Amphipoda		
	Gammaridae sp.	scuds	Abbott Laboratories; Garcia *et al.* 1980
	Hyalella azetaca	sideswimmer	Abbott Laboratories; Garcia *et al.* 1980
	Gammarus duebeni	Salt-marsh	Roberts 1995
	Gammarus pulex	crustaceans	Becker and Margalit 1993
	Hyallela azteca		Gharib and Hilsenhoff 1988
	Palaemonidae		
	Leander tenuicornis		Brown *et al.* 1996
	Palaemonetes varians		Roberts 1995
	Decapoda		
	Hemigrapsus sp.	purple shore crab	Abbott Laboratories; Garcia *et al.* 1980
	Anostraca		
	Artemia salina	fairy shrimp	Abbott Laboratories; Garcia *et al.* 1980
	Conchostracans		
	Eulimnadia texana	clam shrimp	Mulla 1990
	Cladocera		
	Simocephalus vetulus	water flea	Abbott Laboratories; Garcia *et al.* 1980
	Daphnia		Ali 1981
	Daphnia magna		Lebrun and Vlayen 1981
	Daphnia pulex		Becker and Margalit 1993
	Moina rectirostris		Mulla 1990

	Moina macrocopa		Beck 1982
	Chirocephalus grubei	anostacan snail	Becker and Margalit 1993
	Ostracoda		
	Ostracoda		Becker and Margalit 1993; Ali 1981
	Cypridae sp.	seed shrimp	Abbott Laboratories; Garcia *et al.* 1980
	Copepoda		
	Macrocyclops sp.	copepods	Abbott Laboratories; Garcia *et al.* 1980
	Macrocyclops albidus	Larvivorous	Marten *et al.* 1993
	Mesocyclops longisetus	copepods	
	M. ruttneri		
	Acanthocyclops vernalis		
	Cyclops spp.		Ali 1981; Beck 1982
	Cyclops strenuus		Becker and Margalit 1993
	Isopoda	marine sow bug	Abbott Laboratories; Garcia *et al.* 1980; Knepper and Walker 1989
	Asellus aquaticus		Becker and Margalit 1993
INSECTS	**Ephemeroptera**		
	Baetis sp.		Ali 1981
	Callibaetis sp.	mayfly nymphs	Abbott Laboratories; Garcia *et al.* 1980
	Callibaetis pacificus		Mulla 1990
	Stenonema		Merrit *et al.* 1989
	Cloeon dipterum		Becker and Margalit 1993
	Leptoplebia sp.		Beck 1982
	Caenis lactea		
	Ephemera danica		
	Odonata		
	Ischnura sp.	damselfly nymphs	Abbott Laboratories; Garcia *et al.* 1980
	Anax sp.		
	Erythemis simplicicollis		Painter *et al.* 1996
	Tarnetrum corruptum		Aly and Mulla 1987
	Enallagma civile		
	Ischnura elegans		Becker and Margalit 1993
	Symetrium striolatum		
	Orthetrum brunneum		
	Cordulia sp.	dragonfly nymph	Beck 1982
	Hemiptera		
	Trichocorixa reticulata	water boatmen	Abbott Laboratories; Garcia *et al.*, 1980
	Hesperocorixa leavigata		
	Trichocorixa		
	Corixidae		
	Bueona scimitra	backswimmer	Abbott Laboratories; Garcia *et al.* 1980
	Notonecta kirby	backswimmer	Abbott Laboratories; Garcia *et al.* 1980
	Notonecta undulata	backswimmers	Aly and Mulla 1987
	Notonecta glauca		Beck 1982; Olejnicek and Maryskova 1986
	Buenoa antigone		Quiroz-Martinez *et al.* 1996
	Pleidae	pygmy backswimmer	Abbott Laboratories; Garcia *et al.* 1980
	Micronecta meridionalis		Becker and Margalit 1993
	Sigara striata	water bug	Beck 1982; Becker and Margalit 1993
	Sigara lateralis		
	Ranatra sp.		Beck 1982
	Ilyocoris cimicoides		Becker and Margalit 1993
	Anisops varia		
	Heteroptera		
	Plea leachi		Becker and Margalit 1993

Coleoptera		
Tropisternus salsamentus	scavenger and predaceous water beetle	Abbott Laboratories; Garcia *et al.* 1980
Peltodytes edentulus,		Gharib and Hilsenhoff 1988
Haliplus immaculicollis		
Hydroporus undulatus		
Laccophilus maculosus		
Tropisternus sp.		Abbott Laboratories; Garcia *et al.* 1980
Dytiscidae		Abbott Laboratories; Garcia *et al.* 1980
Hyphydrus ovatus		Becker and Margalit 1993
Guignotus pusillus		
Coelambus impressopunctatus		
Hygrotus inaequalis		
Hydroporus palustris		
Ilybius fuliginosus		
Rhantus pulverosus		
Rhantus consputus		
Hydrobius fuscipes		
Anacaena globulus		
Hydrophilus caraboides		
Berosus signaticollis		
Bombyx mori		Nataraju *et al.* 1993
Baeosus sp.	beetles	Beck 1982
Coelambus sp.		
Gyrinidae sp.		
Laccophilus sp.		
Trichoptera		
Mystacides alafunbriata	caddisfly larvae	Abbott Laboratories; Garcia *et al.* 1980
Several species	caddisfly nymphs	Abbott Laboratories; Garcia *et al.* 1980
Limnephilus flavicornis (F.),	caddisfly	Lebrun and Vlayen 1981
Limnophilus sp.		Becker and Margalit 1993
Phryganea sp.		
Diptera		
Ephydra riparia complex	brinefly larvae	Abbott Laboratories; Garcia *et al.* 1980
Dicraneta sp.	cranefly larvae	
Chelifera sp.	dancefly larvae	
Musca domestica	housefly	Vankova 1981; Larget *et al.* 1981
Procladius freemani	tanypodine midges	Mulla *et al.* 1990
P. sublettei		
Tanypus sp.		
Chanoborus sp.	gnat	Beck 1982
Drosophila melanogaster	fruit fly	
Erioischia brassicae	cabbage maggot	
Toxorhynchites splendens	predatory mosquito	
Culicoides sp.	predatory midge	
Chironomus plumosus	midge	
Chironomid larvae		
Lucilia cuprina		Akhurst *et al.* 1997
Plecoptera		
Several species	stonefly nymphs	Garcia *et al.* 1980; Kreig *et al.* 1980
Hymenoptera		
Apis mellifera	honey bee	Abbott Laboratories; Garcia *et al.* 1980
Trichogramma evanescens	egg parasite	Beck 1982

FLATWORMS	**Tubellaria**		
	Dugesia dorotocephala	flatworm	Abbott Laboratories; Garcia *et al.* 1980
	Dugesia tigrina		Becker and Margalit 1993
	Bothromesostoma personatum		
	Platyhelminthes		
	Dugesia tigrina	planarian flatworm	Beck 1982
EARTHWORMS	**Nadididae**	earthworms	Abbott Laboratories; Garcia *et al.* 1980
	Lumbricidae		
	Tubifex sp.		Becker and Margalit 1993
	Helobdella stagnalis	Leech	
	Oligochaeta	roundworm	Beck 1982
NEMATODA	*Neoaplectana carpocapsae*	entomopathogenic	Poinar *et al.* 1990
	Heterorhabditis heliothidis	nematodes	
MOLLUSCS	Gastropoda		Abbott Laboratories; Garcia *et al.* 1980
	Physa sp.	freshwater snail	
	Pelecypoda sp.	mussels	
	Taphius glabratus	snail	Larget *et al.* 1981
	Physa acuta		Becker and Margalit 1993
	Anisus leucostomus		
	Bathyomphalus contortus		
	Hippeutis complanatus		
	Pisidium sp.		
	Aplexa hypnorum	moss bladder snail	Beck 1982; Becker and Margalit 1993
	Galba palustris	marsh snail	
	Bithynia tentaculata	snail	Beck 1982
	Planorbis planorbis	snail	
	Radix sp.	ear pond snail	Beck 1982
	Vivparus contectus	snail	
	Ostrea edulis	oyster	
	Mytilus edulis	blue mussel	
Cnidaria			
	Hydra sp.		Becker and Margalit 1993
Rotatoria			
	Brachionus calyciflorus	zooplankton	Becker and Margalit 1993

Abbott Laboratories: from 1993 publicity on VectoBac®.

BACILLUS SPHAERICUS. *Bacillus sphaericus* is a commonly occurring spore-forming bacterium found throughout the world in soil and aquatic environments. This bacterium is also grown in fermentation vats and formulated for application using processes similar to that of Bti. Some strains produce a protein endotoxin at the time of sporulation. This endotoxin destroys the insect's gut in a way similar to Bti and the toxin is only active against the feeding larval stages and must be partially digested before it becomes activated. The District does not use *Bacillus sphaericus* presently, but may apply it in some circumstances in the future.

At present, the molecular action of *B. sphaericus* is now well understood. Isolation and identification of the primary toxin responsible for larval activity has demonstrated that it is a protein with a molecular weight of 43 to 55 kD. A standard bioassay similar to that used for Bti has been developed to determine preparation potencies. The bioassay utilizes *Culex quinquefasciatus* 3rd to 4th instar larvae.

B. sphaericus adversely affects larval mosquitoes but, in contrast to Bti, is virtually non-toxic to Black Flies (Simulidae). *Culex* species are the most sensitive to *Bacillus sphaericus*, followed by *Anopheles* and some *Aedes* species. In California, *Culex* spp. and *Anopheles* spp. may be effectively controlled. Several species of *Aedes* have shown little or no susceptibility, and salt marsh *Aedes* species are not susceptible. *B. sphaericus* differs from Bti in being able to control mosquito larvae in highly organic aquatic environments, including sewage waste lagoons, animal waste ponds, and septic ditches. Also in contrast to Bti, field evaluations of VectoLex-CG (a commercial formulation of *B. sphaericus*) have shown environmental persistence for 2-4 weeks, and the ability to recycle (grow and reproduce). Persistence varies with a number of environmental parameters, and is low in saline or highly-organic environments.

VECTOLEX CG. VectoLex-CG is the trade name for Abbott Laboratories' granular formulation of *B. sphaericus* (strain 2362). The product has a potency of 50 BSITU/mg (*Bacillus sphaericus* International Units/mg) and is formulated on a 10/14 mesh ground corn cob carrier. The VectoLex-CG label carries the "CAUTION" hazard classification. VectoLex-CG is intended for use in mosquito breading sites that are polluted or highly organic in nature, such as dairy waste lagoons, sewage lagoons, septic ditches, tires, and storm sewer catch basins. VectoLex-CG is designed to be applied by ground (by hand or truck-mounted blower) or aerially at rates of 5-10 lb./acre. Best results are obtained when applications are made to larvae in the 1st to 3rd instars. Use of the highest rate is recommended for dense larval populations. Larval mortality may be observed as soon as a few hours after ingestion but typically takes as long as 2-3 days, depending upon dosage and ambient temperature.

ENVIRONMENTAL IMPACTS OF BACILLUS SPHAERICUS. *B. sphaericus* has been extensively tested and has had no adverse effects on mammals or other non-target organisms. *B. sphaericus* technical material was not infective or pathogenic when administered as a single oral, intravenous or intratracheal dose to rats (Shadduck et al, 1980; Siegel and Shadduck, 1990). No mortalities or treatment-related evidence of toxicological effects were observed. The acute oral and dermal LD 50 values are greater than 5000 mg/kg and greater than 2000 mg/kg, respectively. The technical material is only moderately irritating to the skin and eye. Oral exposure of *B. sphaericus* is practically nontoxic to mallard ducks. No mortalities or signs of toxicity occurred following a 9000 mg/kg oral treatment. Birds fed diets containing 20% w/w of the technical material experienced no apparent pathogenic or toxic effects during a 30-day treatment period. Mallards given an intraperitoneal injection of *B. sphaericus* demonstrated toxicologic effects including hypoactivity, tremors, ataxia and emaciation. The LD 50 value was greater than 1.5 mg/kg.

Acute aquatic fresh water organism toxicity tests were conducted on bluegill sunfish, rainbow trout and daphnids. The 96 hour LC 50 and NOEC (No Observable Effect Concentration) value for bluegill sunfish and rainbow trout was greater than 15.5 mg/liter; the 48 hour EC 50 and NOEC value for daphnids was greater than 15.5 mg/liter. Acute aquatic saltwater organism toxicity tests were conducted on sheepshead minnows, shrimp and oysters. The 96 hour LC 50 value for both sheepshead minnows and shrimp was 71 mg/liter, while the NOEC value was 22 mg/liter for sheepshead minnows and 50 mg/liter for shrimp. The 96-hour EC 50 value for oysters was 42 mg/liter with a NOEC of 15 mg/liter. The LC 50 and NOEC value for immature mayflies was 15.5 mg/liter. Honeybees exposed to l0E4-10E8 spores/ml for up to 28 days demonstrated no significant decrease in survival when compared to controls. Additional studies on various microorganisms and invertebrates, specifically cladocerans, copepods, ostracods, mayflies, chironomid midges, water beetles, backswimmers, water boatmen, giant water bugs, and crawfish, have shown no adverse effects or negative impacts (Holck and Meek 1987, Miura et al 1981, Mulla et al 1984, Rodcharoen et al 1991, Walton and Mulla 1991, Key and Scott 1992, Tietze et al 1993). Furthermore, Ali (1991) states that although *B. sphaericus* is known to be highly toxic to mosquito larvae, *B. sphaericus* does not offer any potential for midge control. Acute toxicity of *B. sphaericus* to non-target plants was also evaluated in green algae. The 120-hour EC 50 and NOEC values exceed 212 mg/liter.

5. LARVICIDING TECHNIQUES AND EQUIPMENT

Because of the wide range of mosquito sources in the Service Area, and the variety of pesticide formulations described above, the District uses a variety of techniques and equipment to apply larvicides, including hand held sprayers and spreaders, truck- or ATV-mounted spray rigs, and helicopters or other aircraft. For a brief description of these application methods, see Durso (1996). District criteria for selecting application methods are attached.

Ground Application Equipment. The District uses conventional pick-up trucks, ARGO and Polaris All Terrain Vehicle's (ATV's) as larvicide vehicles. A chemical container tank, high pressure, low volume electric or gas pump, and spray nozzle are mounted in the back of the truck bed, with a switch and extension hose allowing the driver to operate the equipment and apply the larvicide from the truck's cab. The ATV's have a chemical container mounted on the vehicle, a 12 volt electric pump supplying high pressure low volume flow, and booms and/or hoses and spray tips allowing for application while steering the vehicle. ATV's are ideal for treating areas such as agricultural fields, pastures, and other off-road sites. Additional training in ATV safety and handling is provided to employees before operating these machines.

Additional equipment used in ground applications include hand held sprayers and backpack blowers. Hand held sprayers (hand cans) are standard one or two gallon garden style pump-up sprayers used to treat small isolated areas. Backpack sprayers are gas powered blowers with a chemical tank and calibrated proportioning slot. Generally a pellet or small granular material is applied with a backpack sprayer or "belly grinder" machine designed to distribute pellets or granules.

There are several advantages of using ground application equipment, both when on foot and when conveyed by vehicles. Ground larviciding allows applications while in close proximity to the actual treatment area, and consequently treatments to only those micro habitats where larvae are actually present. This also reduces both the unnecessary pesticide load on the environment and the financial cost of the amount of material used and its application. Both the initial and the maintenance costs of ground equipment is generally less than those for aerial equipment. Ground larviciding applications are less affected by weather conditions than are aerial applications.

However, ground larviciding is impractical for large or densely wooded areas. There is also a greater risk of chemical exposure to applicators than there is during aerial larviciding operations. Damage may occur from the use of a ground vehicle in some areas. Ruts and vegetation damage may occur, although both these conditions are reversible and generally short-lived. Technicians are trained to recognize sensitive areas and to use good judgement to avoid significant impacts.

Aerial Application Equipment. When large areas are simultaneously producing mosquito larvae at densities exceeding District treatment thresholds, then the District may use helicopters or other aircraft to apply any of the larvicides discussed above. The District contracts with independent flying services to perform aerial applications, with guidance to the target site provided by District staff. Aerial application of larvicides is a relatively infrequent activity for the District, typically occurring only a few times each year, with each application covering up to a few hundred acres. However, larval production can vary substantially and the District is capable of undertaking more frequent or extensive operations.

There are three advantages to using fixed or rotary wing (helicopter) aerial larvicide application equipment compared to ground application. First, it can be more economical for large target areas with extensive mosquito production. Second, by covering large areas quickly, it can free District staff to conduct other needed surveillance or control. Third, it can be more practical for remote or inaccessible areas, such as islands and large marshes, than ground larviciding. However, there is a greater risk of drift with aerial applications, especially with liquid or ULV (Ultra Low Volume) aerial larviciding, and consequently there is more potential risk of non-target exposure. In addition, accuracy in hitting the target area temporarily requires additional manpower for flagging or expensive electronic guidance systems, which can increase costs. Finally, in addition to the timing constraints inherent in most larvicide use, the potential application window can be very narrow for aerial activities due to weather conditions.

6. MANAGING LARVICIDE RESISTANCE.

Selecting the proper class of larvicide and the formulation are both important in pesticide resistance management. For example, use of sub-lethal dosages (below the lower end of the label recommended application rates)

may encourage resistance. Insects with inherent tolerances for weakly applied pesticides may survive to produce tolerant offspring. Also, use of extended-release formulations beyond their recommended use period may encourage resistance by exposing mosquitoes to sub-lethal concentrations of active ingredients.

7. LARVICIDES AND OTHER CONTROL OPTIONS.

Currently used mosquito larvicides, when applied properly, are efficacious and environmentally safe. These agents have been successfully integrated into the District's programs. Historically, Mosquito and Vector Control Districts have usually viewed larviciding as less effective or less economical than physical control, water management, or biological control; and as more effective than adulticiding. However, this view developed long ago when the values of wetlands were not as widely recognized as they are today, and when relative control costs were different. To some extent, this philosophy has been evolving in recent decades as more selectivelarvicides have become available, and as physical and biological control have become more constrained by regulatory requirements. While it can be hard to compare the relative environmental impacts of different control strategies, it is now increasingly common to primarily use selective larvicides in relatively undisturbed sites, and to emphasize physical control and biological control primarily in man-made or disturbed areas.

Compared to adulticides, larvicides are generally more selective and pose less risk for drift. Larvicides are usually applied directly into natural and man-made aquatic habitats as liquid or solid formulations, and aerial drift is negligible. Drift in water can result from flushing or rainwater runoff, but under these conditions, rapid environmental breakdown and dilution reduce pesticide concentration and consequently minimizes exposure to non-target organisms.

D. CHEMICAL CONTROL OF ADULT MOSQUITOES

1. INTRODUCTION

When physical, biological, and chemical control of larval mosquitoes fails or is otherwise insufficient, the District periodically uses insecticides to directly reduce populations of adult mosquitoes (adulticiding). When adult mosquito populations exceed District thresholds (see flow chart at the end of this Section), District staff use ULV (Ultra Low Volume) sprayers to generate aerosol mists of very small insecticide droplets, which are allowed to intentionally drift into and across areas harboring the target species. Insecticides for control of adult mosquitoes are known as adulticides, and the District can select from a variety of materials registered for this purpose. District staff can also choose from a variety of adulticide application equipment, ranging from hand-held to vehicle-mounted to aerial spray rigs. Please note the distinction between "aerosol" pesticide applications, which describe all District adulticiding activity, and "aerial" pesticide applications, which refer to any application of pesticides from aircraft, regardless of the target.

The effectiveness and efficiency of adulticiding depends on a number of related factors. First, the mosquito species to be treated must be susceptible to the insecticide applied. Some California mosquitoes are resistant or more tolerant to some adulticides thus affecting the selection of chemical. Second, insecticide applications must be made during periods of adult mosquito activity, which varies between species. Some species of mosquitoes are diurnal (biting in the daytime), others are crepuscular (biting at dawn or dusk), and still others are nocturnal (biting at night). Aerosol applications should be made when the target mosquitoes are flying and are maximally exposed to the aerosol mist. District criteria emphasize adulticiding as a technique to reduce populations of *Cx. tarsalis* (the primary vector of encephalitis) and *Ae. sierrensis* (the primary vector of dog heartworm), which are primarily crepuscular species. Therefore, District adulticiding activity primarily takes place at dawn and dusk.

In addition, technical considerations can influence adulticide effectiveness. First, the application must generate a pesticide concentration in the air that is lethal to the target insect. Second, since the aerosol mist must move from the sprayer to the target mosquitoes; the size of the pesticide droplets is critical to ensure proper movement without rapid evaporation, settling to the ground, or drift away from the target site. Studies have shown that droplets within the 8-15 micron diameter range are most effective in controlling adult mosquitoes (Mount 1998). Third, whether the treatment is ground or aerially applied, sufficient insecticide must be distributed to cover the target site with an effective dose. Densely vegetated habitats may require a higher application rate than open areas to allow the wind to sufficiently carry droplets through the foliage.

Finally, environmental conditions may also affect the results of adulticiding. Wind determines how the ULV droplets will be moved from the sprayer to and within the treatment area. Conditions of no wind will result in the material not moving from the application point. High wind can inhibit mosquito activity and will quickly disperse the

insecticide too widely to be effective. Light wind conditions (1-10 mph) are the most desirable both because mosquitoes are most likely to be active and because the aerosol is most likely to maintain the proper concentration as it moves through the target area. Also, ULV applications are generally avoided during hot daylight hours because thermal conditions will cause small droplets to rise, moving them away from mosquito habitats and flight zones. Preferred conditions include the presence of a thermal inversion near the ground, which can trap the aerosol in a mist in the lower ten or twenty feet of the atmosphere, maintaining the proper control dose with minimal material use. Ideal conditions of wind and temperature are generally found around sunrise or sunset, andadulticiding is usually conducted during these times. This practice minimizes exposure of non-target diurnal species such as bees or butterflies. Control of adults of some mosquito species may require modifications of this schedule to accommodate the species flight activity pattern.

District criteria on the use of ULV treatments are attached, and address mosquito species composition and abundance, pathogen (disease organism) presence, proximity of mosquitoes to human populations, presence of an open (no people) target area, and weather conditions (see attached pages). As with larvicides, adulticides are applied in strict conformance with label requirements.

The adulticide routinely used by the District is Pyrethrum (= Pyrethrins; MGK Pyrocide® -- about 23.8 gallons applied in 1998). The synthetic pyrethroids Resmethrin and Permethrin have not been used by the District in the last five years, but might be used under some circumstances.

2. PYRETHRINS AND PYRETHROIDS

INTRODUCTION Pyrethrin (pyrethrum) is a natural insecticide extracted from certain varieties of the flower *Chrysanthemum cinerariaefolium* and consists of six active ingredients collectively known as pyrethrins (Worthing & Hance 1991). This material provides effective control of adult mosquitoes and other insect pests at very low dosage and has little residual activity (persistence) due to its sensitivity to sunlight. The flowers are grown commercially in parts of Africa and Asia. Synthetic analogues of the natural pyrethrins reached commercial success in the 1950's. Like the natural pyrethrins, 'first generation' synthetic pyrethroids such as phenothrin and tetramethrin, are relatively unstable when exposed to light. During the 1960's-1970's, great progress was made in synthetic light-stable pyrethroids. These photostable pyrethroids represent the 'second generation' of these compounds. However, the low persistence of natural pyrethrum means that it is often required in agricultural areas, despite its significantly higher cost.

Pyrethrins and pyrethroids exhibit rapid knockdown and kill of adult mosquitoes, characteristics that are considered a major benefit of their use. The mode of action of these compounds relates to their ability to affect sodium channel function in the insects' neural membranes. Their toxicity in insects is markedly increased by the addition of synergists (primarily piperonyl butoxide) which inhibit detoxification of thepyrethrins in insects. There is no evidence that these synergists increase toxicity in mammals.

Pyrethrins and synthetic pyrethroids are not cholinesterase inhibitors, are non-corrosive and will not damage painted surfaces. They are less irritating than other mosquito adulticides and have a less offensive odor. In comparison to other adulticides, pyrethroids may be effectively applied at much lower rates of active ingredient per acre.

NATURAL PYRETHRINS: MGK Pyrocide and Pyrenone Crop Spray are California-registered natural pyrethrin formulations, with labels containing a CAUTION statement. MGK Pyrocide contains 5% pyrethrin and 25% piperonyl butoxide, while Pyrenone Crop Spray contains 6% pyrethrins and 60% piperonyl butoxide. MGK Pyrocide is applied as a ULV spray with a dosage per acre of typically 0.87 oz/acre (equivalent to 0.0027lbs of pyrethrins and 0.0135 pounds of piperonyl butoxide per acre). The Pyrenone label is less restrictive, but District protocols result in similar doses of active ingredient and synergist.

RESMETHRIN. Resmethrin is a 1st generation synthetic pyrethroid and is the active ingredient in Scourge. Resmethrin provides rapid knockdown and quick kill of all species of adult mosquitoes, and is also effective against many other flying or crawling insects, although it is slower acting than naturalpyrethrins. Resmethrin exhibits very low mammalian toxicity, degrades very rapidly in sunlight and provides little or no residual activity. Resmethrin products are available in several concentrations that range from 1.5% to 40% and may or may notcontain piperonyl butoxide.

Scourge contains 4.14% Resmethrin, 12.54% piperonyl butoxide, 5% aromatic petroleum solvent (a mixture of hydrocarbons) and other inert ingredients. Scourge is labeled with the signal word "Caution", and has a maximum rate of application of 0.007 lbs per acre of the active ingredient.

PERMETHRIN. Permethrin is a second-generation synthetic pyrethroid with a broad spectrum of activity against all mosquito species. It exhibits fast action, low volatility, good photostability, low solubility in water, no odor, and low mammalian toxicity. Its photostability means that permethrin provides some residual activity when applied directly to surfaces. It is formulated as the active ingredient in products such as Permanone and Biomist. Permethrin is a general use pesticide with labels that may contain either the signal word WARNING (Category 2) or CAUTION (Category 3) depending on the particular product. The District does not use Category 2 pesticides except in emergency circumstances. Permethrin products are available in various concentrations, from 1.5% to 57% and may or may not be synergized with piperonyl butoxide. Synergized permethrin products may contain piperonyl butoxide in various ratios by weight but the maximum rate of application is 0.007 lbs. per acre of the active ingredient.

3. ADULTICIDING TECHNIQUES AND EQUIPMENT

The District applies adulticides, when needed, primarily from truck mounted ULV aerosol equipment, and occasionally from hand-held or ATV-mounted ULV equipment. Adulticide application from the air is possible, but would be used by the District only in emergency conditions. Therefore, aerial aerosol applications are not evaluated in this review.

ULV aerosol machines ("cold foggers") use a forced air blower to generate a fine mist of technical (pure) or highly concentrated insecticide. ULV machines come in a wide variety of sizes, and 8-12 horsepower blowers are most common. Unlike earlier "thermal foggers", ULV sprayers use no oil diluent, and their name is derived from the very low volumes of total material sprayed per acre treated. In mosquito control ground adulticiding operations, application rates rarely exceed 1 oz./acre of particles, each with diameters from 8-15 microns.

The sprayers today use several techniques to meet these requirements. Air blast sprayers, which use either high volume/low pressure vortical nozzles or high pressure air-shear nozzles to break the liquid into very small droplets, are most common. Other forms of atomization equipment include centrifugal energy nozzles (rotary atomizers) which form droplets when the liquid is thrown from the surface of a high speed spinning porous sleeve or disc, ultrasonic equipment which vibrates and throws the droplets off, and electrostatic systems which repel the droplets.

The insecticide metering equipment available on these machines ranges from a simple glass flow-meter and a pressurized tank or electric pump on fixed flow machines to computer controlled, speed correlated, event recording and programmable flow management systems. The fixed flow units are designed to be operated with the vehicle traveling at a constant speed. Most of these use 12 volt laboratory type pumps which are quite accurate.

Ground adulticiding equipment is normally mounted on some type of vehicle, but the District also has smaller units that can be carried by hand or on a person's back for small area treatments. Pickup trucks are the most common conveyance for ULV sprayers, but the District also can use ATV's. With the 8-12 hp midsize sprayers described above, a vehicle speed of about 10mph typically generates an acceptable dose rate.

4. POTENTIAL ENVIRONMENTAL IMPACTS OF ADULTICIDING

Adulticiding poses a number of potential environmental impacts associated with non-target toxicity, pesticide drift, and with disturbance associated with the applications. The mode of action of pyrethrins and pyrethroids means that these pesticides have a wider spectrum of potential non-target toxicity than the larvicides discussed before (Worthing & Hance 1991). In addition, the need for the aerosol mist to drift through the mosquito harborage (target area) generates some risk that materials will spread beyond the intended target area. However, selective use of these materials, based on the District's rigorous criteria for selecting and applying these materials and strict adherence to label requirements, limits their potential environmental impacts to insignificant levels.

Pyrethrins and pyrethroids are highly toxic to most insects, moderately toxic to many fish and some birds, and much less toxic to other organisms (Mallis 1990, Worthing & Hance 1991). Worthing & Hance (1991) report acute oral LD50 values of pyrethrin of about 150 ug/bee in honey bees, 584-9000 mg/kg for rats, and >10,000 mg/kg for mallard

ducks[5]. Percutaneous LD50 values for pyrethrin include >1,500 mg/kg for rats and >5,000 mg/kg for rabbits. Toxicity values for Resmethrin in rats include oral LD50 >2,500 mg/kg and percutaneous LD50 >3,000 mg/kg. For Permethrin, typical oral LD50 values are 430-4,000 mg/kg in rats, 40-2690 mg/kg in mice, >3,000 mg/kg in chickens, and >13,500 mg/kg in Japanese quail. In addition, DPR has reported "possible adverse" chronic toxicity effects associated with repeated exposures at extremely high dosages (exceeding legally allowed label rates and District operations by a factor of 100 or more) of Permethrin, Pyrethrins, Resmethrin, and Piperonyl Butoxide (DPR 1999).

Translating these values to a risk assessment of field applications can be difficult because of the complex distributions of both target and non-target species in natural settings. While it is clear that these materials can cause significant immediate mortality in some desired insects, recent studies by UC Davis and USFWS researchers have demonstrated rapid (24 - 48 hour)rebound of impacted insect populations following ULV activities with pyrethroids and malathion in the Central Valley (Lawlor et al, 1997). In general, mosquito distribution is patchy, so adulticide application is discontinuous; this allows non-target organisms both to migrate to untreated areas to escape toxins and/or to recolonize the treated area from nearby untreated areas.

Toxicity in fish is measured as LC50, or the concentration of toxicant in the water that is fatal to 50% of the sample by the end of a fixed time period (often 96 hours). Worthing & Hance (1991) report 96 hour LC50 values for coho salmon and channel catfish exposed to pyrethrum of 39 mg/L and 114 mg/L respectively. It is not easy to relate these values to the volumes of active ingredient that might drift from a treatment area and settle on water, but the risk has been judged high enough that the pesticide labels for these materials warn not to apply them to lakes, streams, or ponds, or when drift from the application might settle on these areas. However, direct deleterious effects have not been documented for non-targets in aquatic habitats as a result of deposition of currently employed adulticides, probably due to a small mass depositing per unit area and dilution factors such as tidal flushing and water depth (Lawlor et al, 1997).

In addition to label restrictions over drift onto sensitive environmental sites, there are operational limitations on these materials based on the need to minimize potential impacts on some classes of sensitive agricultural resources -- in particular, organic farms and honey bees and bee hives. Excessive drift onto organic farms can disrupt agricultural activities and/or lead to loss of organic registration for the farmer. Drift onto honey bees or hives with active bees can kill the bees and destroy the hive. In either case, inadvertent non-target impacts can lead to significant public outcry or financial claims against the District. For all these reasons, these types of impacts are not acceptable to the District.

5. MEASURES TO MINIMIZE ENVIRONMENTAL IMPACTS OF ADULTICIDING

The most important measure to minimize the potential environmental impacts of adulticiding is spatial and temporal separation of aerosol applications from sensitive species or habitats. In general, this is accomplished by strict compliance with label requirements and District criteria. For example, the Environmental Hazards section on labels of pesticides used as mosquito adulticides instruct applicators to avoid direct application over water or drift into sensitive areas due to a potentially high toxicity of these compounds to fish and invertebrates. Although there is some variation in the habitats to be avoided, they usually include lakes, streams and marshes. Also, District staff always evaluate the wind speed and direction and the potential for a thermal inversion prior to initiating aerosol activities.

Specific measures include the District's emphasis on *Cx. tarsalis* in its adulticide criteria. The District typically applies aerosol adulticides at dawn or dusk because that is when this target species is active. Fortuitously, this is also when temperature inversions and light wind generally make drift easiest to predict and manage, and also when many non-target insects (bees, butterflys) are not active. In addition, District policies and protocols do not allow non-emergency adulticiding in residential areas without proper notification and consent of the affected residents, or over open water.

The District takes measures to avoid impacts to organic farmers, bee keepers, and other sensitive receptors. Organic farmlands are located and plotted by the district. Adulticiding operations are performed in a manner that avoids drift over organic farms. The District strives to identify and communicate with bee keepers, to avoid exposing their colonies to adulticiding activities undertaken by District staff. Avoiding bee hives has been a primary concern of District operations. Location of hives are identified on maps and technicians are instructed to avoid applying pesticide in a manner that would drift over these areas.

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[5]When an LD50 is reported as greater than a large number, it means that fewer than half of the test animals died at the highest concentration tested.

In addition, the District maintains a list of sensitive receptors, and has established a policy to notify these receptors prior to aerosol applications and/or to avoid aerosol applications which might drift onto them, except under emergency conditions. Finally, conducting ULV operations in the early morning and late evenings, increases the efficacy of the control operation and minimizes exposure to people and their pets.

As described for larviciding, spray equipment is calibrated regularly, and at least once a year. Measurements for output and droplet sizes of the pesticides being used are confirmed to maximize efficiency and minimize potential adverse impacts.

All personnel who apply pesticides receive retraining at least once a year. This training consists of an annual review concerning all aspects of the pesticides the applicator will be handling that year. All applicators are certified by the Department of Health Services on the safe and proper use of pesticides. Applicators must also undergo a minimum of 20 hours of formal continuing education every two years to maintain their state certification.

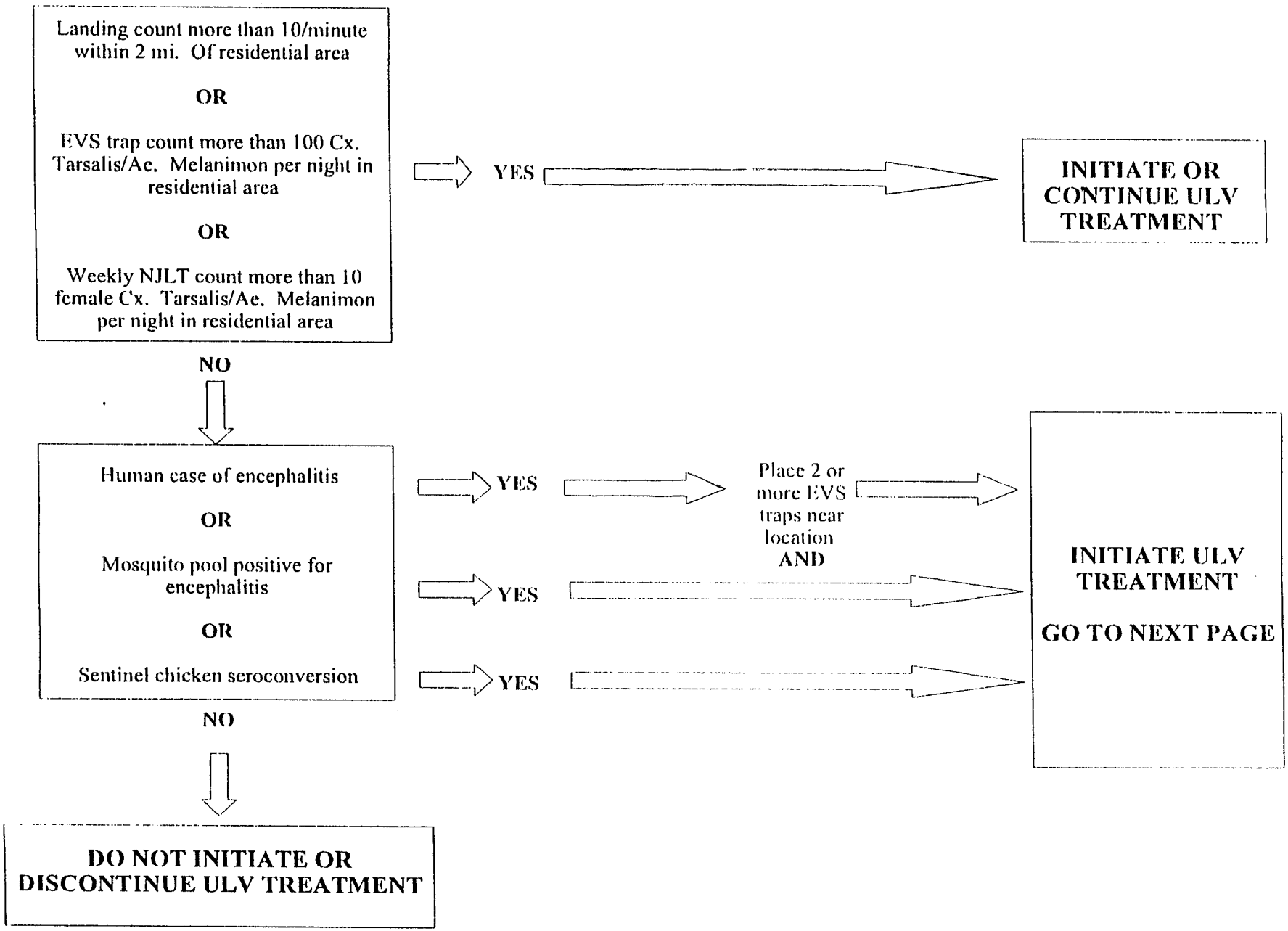
E. CONCLUSIONS: APPROPRIATE USE OF CHEMICAL CONTROL

The use of pesticides is an effective and environmentally sensitive part of the District's Program to manage mosquito populations in the District. The use of larvicides limits the proliferation of mosquito larvae in aquatic sources, while adulticiding reduces harmful levels of adult mosquitoes. In concert with public education and physical and biological control, this combination of control methods maintains and protects the human environment so that it is safer, healthier and more comfortable, while recognizing and protecting habitat values for other desired species.

The District's use of IPM principles ensures that pesticides are not used more frequently or more extensively than needed. For example, in 1998 the District treated only 5,405 acres directly for mosquitoes and an additional 294 acres with herbicides to reduce mosquito production. The total District Service Area is over 509,440 acres, with mosquito production and adult mosquito harborage found in discrete areas throughout this acreage. Thus, less than 0.06% of the total Service Area was treated with herbicides and less than 1.1% was treated with mosquito larvicides and adulticides during this time.

The District contains many sources that produce significant mosquito populations near populated areas. Without ongoing and effective mosquito control, the resulting mosquito activity would significantly and adversely effect the human environment. The District's program will never eradicate all mosquitoes. Rather, it is a resource maintenance program aimed at striking a balance to allow comfortable and healthful human existence within the natural environment, while protecting and maintaining the environment.

ULV TREATMENT CRITERIA p.1



ULV TREATMENT CRITERIA p.2

Encephalitis detected (from p.1)
ULV initiated

Landing count more than 10/minute

OR

Any EVS trap count more than 100 Cx. Tarsalis/Ae. Melanimon per night

OR

Any weekly NJLT count more than 10 female Cx. Tarsalis/Ae. Melanimon per night

Yes → **CONTINUE ULV TREATMENT**

NO

DISCONTINUE ULV TREATMENT

SECTION 5. REFERENCES

notes: 1) CEQA Environmental Documents are described under subsection 3.18 of this Initial Study

2) Each of the General References listed immediately below has an extensive bibliography justifying the general conclusions. To avoid unnecessary repetition, we refer the reader to them for additional literature on mosquito control and its potential environmental impacts.

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APPENDIX

CEQA PRELIMINARY REVIEW OF DISTRICT ACTIVITIES

NAPA COUNTY MOSQUITO ABATEMENT DISTRICT

CEQA PRELIMINARY REVIEW OF THE ONGOING INTEGRATED MOSQUITO MANAGEMENT PROGRAM

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CEQA PRELIMINARY REVIEW OF THE ONGOING
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May 31, 1999

EXECUTIVE SUMMARY

The California Environmental Quality Act (CEQA) was adopted by the California Legislature in 1970. It requires state and local agencies to estimate and evaluate the environmental implications of their actions, and to avoid or reduce the significant environmental impacts of their decisions when feasible.

CEQA generally requires state and local agencies to prepare an environmental document (either an Environmental Impact Report (EIR) or a Negative Declaration) assessing the potential environmental impacts of discretionary projects that may affect the environment, and to adopt mitigation measures for "potentially significant impacts". CEQA exempts from these requirements certain activities that are not considered "Projects", projects declared exempt from CEQA by the Legislature, and other classes of projects that the State Secretary for Resources has determined do not have a significant effect on the environment.

However, the Act also specifies that the categorical exemptions may not be used where activities "may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies", where "the cumulative impact of successive projects of the same type in the same place, over time, is significant", or "where there is a reasonable possibility that the activity will have a significant effect on the environment due to unusual circumstances."

Napa County Mosquito Abatement District's (District) Mosquito Control Program/Project employs IPM (Integrated Pest Management) principles to effectively protect the public from mosquitoes and mosquito-borne disease while protecting the environment. The District first determines the species and abundance of mosquitoes through evaluation of public service requests and field surveys of immature and adult mosquito populations; and then, if the populations exceed predetermined criteria, uses the most efficient, effective,, and environmentally sensitive means of control. For all mosquito species, public education is an important control strategy. In some situations, water management or other physical control activities are instituted to reduce mosquito production. The District uses biological control such as the planting of mosquito fish in some settings. When these approaches are not effective or are otherwise inappropriate, then pesticides are used to treat specific mosquito-producing or mosquito-harboring areas.

The District previously concluded that its mosquito control activities were exempt from CEQA, and declared a policy of issuing CEQA environmental documents in those cases where specific activities were not exempt.

Based upon the currently available evidence, as demonstrated in this document and in the cited

references, the District now concludes that most District activities are still exempt from CEQA. However, some specific activities within the District's Project might exceed the scope of these exemptions to CEQA, or might trigger one or more of the exceptions to the exemptions, primarily because of regulatory questions about our potential impacts on endangered species or on critical wetland habitats. Therefore, The District will undertake an Initial Study, as described in the CEQA Guidelines, of our Mosquito Surveillance and Control Project.

Major physical control projects, and other activities as required, will continue to be assessed under individual CEQA documents.

I. PURPOSE OF PRELIMINARY REVIEW

The purpose of this preliminary review is to evaluate whether Napa County Mosquito Abatement District's ("District") mosquito control activities require environmental evaluation and/or mitigation under the California Environmental Quality Act ("CEQA"). This review is prepared under CEQA Guidelines sections 15060 and 15061 to evaluate the application of CEQA and the CEQA exemptions to the District's Mosquito Surveillance and Control Program/Project.

The District was formed in 1925 to control mosquitoes throughout Napa County. The District's Program/Project to control mosquitoes consists of continual surveillance and monitoring of mosquito populations and of human contact with mosquitoes to ascertain the threat of disease transmission and public nuisance; and the use of safe, environmentally sensitive, integrated mosquito management and control methods (discussed in more detail within this document) to protect the public from this threat. Control of mosquitoes has thus been an ongoing and longstanding Project of the District.

The purpose of this report is to evaluate whether the District's Integrated Mosquito Management Program is in accord with the California Legislature's current policy for environmental quality. Specifically, this report will:

1. Summarize the District's powers and the current and potential activities that together comprise the District's Program/Project;

2. Determine whether activities within the District's Project fall within one or more of the statutory or categorical exemptions to CEQA;

3. If an activity is categorically exempt, determine if one of the exceptions to the use of categorical exemptions set forth in State CEQA Guidelines section 15300.2 applies to the exemption; and

4. Identify the manner in which the District will comply with CEQA for its Project.

A. The California Environmental Quality Act (CEQA)

The California Environmental Quality Act was adopted by the California Legislature in 1970. According to the CEQA Deskbook, "The California Environmental Quality Act is California's most important environmental law. It requires state and local agencies to estimate and evaluate the environmental implications of their actions. Furthermore, it aims to prevent environmental effects an agencies actions by requiring them, when feasible, to avoid or reduce the significant environmental impacts of their decisions." (Bass, et al., 1996). Specifically, in the introduction to CEQA (California Public Resources Code section 21000), the Legislature finds and declares as follows (emphasis added):

(a) The maintenance of a quality environment for the people of this state now and in

the future is a matter of statewide concern.

(b) It is necessary to provide a high-quality environment that at all times is healthful and pleasing to the senses and intellect of man.

(c) There is a need to understand the relationship between the maintenance of high-quality ecological systems and the general welfare of the people of the state, **including their enjoyment of the natural resources of the state.**

(d) The capacity of the environment is limited, and it is the intent of the Legislature that the government of the state take immediate steps **to identify any critical thresholds for the health and safety of the people of the state and take all coordinated actions necessary to prevent such thresholds being reached.**

(e) Every citizen has a responsibility to contribute to the preservation and enhancement of the environment.

(f) The interrelationship of policies and practices in the management of natural resources and waste disposal requires systematic and concerted efforts by public and private interests to enhance environmental quality and to control environmental pollution.

(g) It is the intent of the Legislature that all agencies of the state government which regulate activities of private individuals, corporations, and public agencies which are found to affect the quality of the environment, shall regulate such activities so that major consideration is given to preventing environmental damage, while **providing a decent home and satisfying living environment for every Californian.**

Therefore, in Section 21001 (CEQA), the Legislature further finds and declares that it is the policy of the state to:

(a) Develop and maintain a high-quality environment now and in the future, and take all action necessary to protect, rehabilitate, and enhance the environmental quality of the state.

(b) Take all action necessary to provide the people of this state with clean air and water, enjoyment of aesthetic, natural, scenic, and historic environmental qualities, and freedom from excessive noise.

(c) Prevent the elimination of fish or wildlife species due to man's activities, insure that fish and wildlife populations do not drop below self perpetuating levels, and preserve for future generations representations of all plant and animal communities and examples of the major periods of California history.

(d) Ensure that the long-term protection of the environment, consistent with the provision of a decent home and suitable living environment for every Californian, shall be the guiding criterion in public decisions.

(e) Create and maintain conditions under which man and nature can exist in productive harmony to fulfill the social and economic requirements of present and future generations.

(f) Require governmental agencies at all levels to develop standards and procedures necessary to protect environmental quality.

(g) Require governmental agencies at all levels to consider qualitative factors as well as economic and technical factors and long-term benefits and costs, in addition to

short-term benefits and costs and to consider alternatives to proposed actions affecting the environment.

Pursuant to Public Resources Code section 21083, guidelines for the implementation of CEQA have been developed as regulations contained in the California Code of Regulations, Title 14. These regulations are known as the State CEQA Guidelines. The State CEQA Guidelines state that the basic purposes of CEQA are to: (1) inform governmental decision makers and the public about the potential significant environmental effects of a proposed project; (2) identify ways that the environmental damage can be avoided or significantly reduced; (3) prevent significant, avoidable damage to the environment by requiring changes in the projects through the use of alternative or mitigation measures; and (4) disclose to the public why a project is approved if significant environmental effects are involved (California Code of Regulations, Title 14, section 15002).

1. Definitions

The State CEQA Guidelines define "environment" as the physical conditions which exist within the area which will be affected by the proposed project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance, including both natural and man-made conditions (Guidelines Sec. 15360). This means that protecting the public from disease-carrying and noxious pests is a form of environmental protection.

A "project" is an activity subject to CEQA (Guidelines Sec. 15002(d)). More broadly, a project is defined as "the whole of an action, which has the potential for resulting in a physical change in the environment, directly or ultimately" (section 15378). This definition means that an agency cannot "segment" or "piecemeal" a project into small parts if the effect is to avoid full disclosure of environmental impacts. Specifically, it is forbidden to chop a project into small segments to avoid preparing an Environmental Impact Report (EIR), if one would otherwise be required (Bozung v. Local Agency Formation Commission (1975) 13 Cal.3d 263). In addition, related activities must be evaluated in the same CEQA document when either 1) one action is a reasonably foreseeable consequence of the other action; or 2) the actions are integral parts of the same project (Bass, et al., 1996).

A "significant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance (section 15382). Though perhaps contrary to common usage, this definition means that substantial beneficial changes in the environment are not considered "significant" by CEQA, and do not require avoidance or mitigation to comply with the Act.

"Regulatory Agency" is not defined in either the CEQA statutes or Guidelines. Under the California Health and Safety Code, Sec. 2200 et seq., the District clearly has broad powers to promulgate and enforce standards for the management of water and potential mosquito habitat by landowners, and as such might be considered a Regulatory Agency under CEQA.

According to the CEQA Guidelines (Guideline Appendix G), a project will normally have a significant effect on the environment if it will (emphasis added):

(a) Conflict with adopted environmental plans and goals of the community where it is located;
(b) Have a substantial, demonstrable negative aesthetic effect;
(c) Substantially affect a rare or endangered species of animal or plant or the habitat of the species;
(d) Interfere substantially with the movement of any resident or migratory fish or wildlife species;
(e) Breach published national, state, or local standards relating to solid waste or litter control;
(f) Substantially degrade water quality;
(g) Contaminate a public water supply;
(h) Substantially degrade or deplete ground water resources;
(I) Interfere substantially with ground water recharge;
(j) Disrupt or adversely affect a prehistoric or historic archaeological site or a property of historic or cultural significance to a community or ethnic or social group; or a paleontological site except as part of a scientific study;
(k) Induce substantial growth or concentration of population;
(l) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system;
(m) Displace a large number of people;
(n) Encourage activities which result in the use of large amounts of fuel, water, or energy;
(o) Use fuel, water, or energy in a wasteful manner;
(p) Increase substantially the ambient noise levels for adjoining areas;
(q) Cause substantial flooding, erosion or siltation;
(r) Expose people or structures to major geologic hazards;
(s) Extend a sewer trunk line with capacity to serve new development;
(t) Substantially diminish habitat for fish, wildlife or plants;
(u) Disrupt or divide the physical arrangement of an established community;
(v) **Create a potential public health hazard** or involve the use, production or disposal of materials which pose a hazard to people or animal or plant populations in the area affected;
(w) Conflict with established recreational, educational, religious or scientific uses of the area;
(x) Violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentration.
(y) Convert prime agricultural land to non-agricultural use or impair the agricultural productivity of prime agricultural land; or
(z) Interfere with emergency response plans or emergency evacuation plans.

B. Exemptions to CEQA

CEQA generally requires state and local agencies to prepare an environmental document (either an environmental impact report (EIR) or negative declaration) assessing the potential environmental impacts of discretionary projects that may effect the environment, and to mitigate "potentially significant impacts". CEQA exempts from this requirement certain activities that are not considered "Projects", projects declared exempt by the Legislature ("statutory exemptions"; listed at CEQA Guidelines sections 15260-15282), and other classes of projects that the State Secretary for Resources has determined do not have a significant effect on the environment ("categorical exemptions"; listed at CEQA Guidelines sections 15301-15329). The District previously concluded that its mosquito control activities were generally exempt from CEQA, and declared a policy of issuing CEQA environmental documents in those cases where specific activities were not exempt. (See District Board of Trustees Resolutions No. 196, etc., Appendix C)

1. Statutory Exemptions

Statutory exemptions from CEQA, granted by the legislature, which may apply to actions of the District include "non-projects", ongoing projects, feasibility and planning studies, ministerial projects, emergency projects, and establishment of rates, tolls, fares, and other charges by public agencies to meet operating expenses and financial reserve needs and requirements.

Some activities by government agencies are not considered "projects" under CEQA (Guidelines Secs. 15061(b)(3), 15378(b)(1), 15378(b)(3), 15378(b)(5)). "Non-projects" must generally be either specifically exempted from CEQA by state law, or involve activities for which "it can be seen with certainty" that no environmental effect will occur (Bass, et al., 1996). Examples relevant to the District include "continuing administrative or maintenance activities, such as purchases of supplies, personnel-related actions, and general policy and procedure making (except as they are applied to specific instances which might have environmental impact)" (Guidelines Sec. 15378(b)(3)).

Ongoing projects are activities that were being carried out by a public agency prior to November 23, 1970 (Guidelines Sec. 15261(a)). This exemption is not valid if either: 1) "a substantial portion of public funds allocated for the project have not been spent (by that date), and it is still feasible (at that date) to modify the project to mitigate potentially adverse environmental effects, or to choose feasible alternatives to the project" (Guidelines Sec. 15261(a)(1)); or 2) if the public agency modifies the Project after that date so that the project might "have a new significant effect on the environment" (Guidelines Sec. 15261(a)(2)). Most current District activities predate November 23, 1970, and some of these have remained essential and unchanged during this time. Specifically, direct field surveillance for standing water and mosquito populations by field personnel, and maintenance of access paths to surveillance sites are apparently exempt from further CEQA requirements as ongoing projects. Specific direct mosquito control activities, on the other hand, generally have potentially viable alternatives, and would not be covered by this exemption.

Projects are exempt if they involve only feasibility or planning studies for possible future actions which the District and its Board has not approved, adopted, or funded (Guidelines Sec. 15262).

Ministerial projects are governmental decisions involving little or no personal judgment by the public official as to the wisdom or manner of carrying out the project (Guidelines Secs. 15268, 15357, 15369). The public official merely applies the law to the facts as presented but uses no special discretion or judgment in reaching a decision. Ministerial projects conducted by the District may include determinations that nuisances exist, orders of compliance with notices, assessment of civil penalties, and liens on property for cost to the District in abating nuisances which are defined by law in the California Health and Safety Code, commencing with section 2274.

Emergency projects are actions taken due to a sudden, unexpected occurrence involving a clear and imminent danger, to prevent or mitigate loss of or damage to life, health, property, or essential public services (Pub. Res. Code Secs. 21080(b)(2), (3), (4), 21060.3; Guidelines Secs. 15269, 15359). Emergency projects can include actions required to prevent or mitigate an emergency (Guidelines Sec. 15269(c)). CEQA does not require a formal declaration of an emergency to invoke this exemption. Emergency projects conducted by the District may include the control of mosquitoes in response to known disease activity.

CEQA does not apply to the establishment, modification, structuring, restructuring, or approval of rates, tolls, fares, and other charges by public agencies which the public agency finds are for the purpose of meeting operating expenses; purchasing or leasing supplies, equipment, or materials; meeting financial reserve needs and requirements; and obtaining funds for capital projects (Guidelines Sec. 15273). The District collects property taxes, and negotiates contracts with large land owners, all to provide for the operating expenses, purchase of equipment and supplies, and financial reserves of the District. These activities are exempt from CEQA.

2. Categorical Exemptions

Categorical exemptions are exemptions from CEQA for a class of projects based on a finding by the Secretary of Resources that the class of projects does not have a significant effect on the environment, except in exceptional circumstances. Categorical exemptions which may apply to actions of the District include existing facilities (class 1), replacement or reconstruction (class 2), minor alterations to land (class 4), information collection (class 6), actions by regulatory agencies for protection of natural resources (class 7), actions by regulatory agencies for protection of the environment (class 8), inspections (class 9), enforcement actions by regulatory agencies (class 21), and educational or training programs involving no physical changes (class 22).

Class 1 consists of the operation, repair, maintenance, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that previously existing. District activities which are within the scope of this exemption include operation, repair, maintenance, or minor alteration of existing District facilities; public facilities, such as existing drainage works or sewer treatment facilities; and private facilities, such as ornamental fish ponds, swimming pools and agricultural waste

water ponds; and maintenance of existing landscaping, native growth, and water supply reservoirs.

Class 2 consists of replacement or reconstruction of existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced. District activities which are within the scope of this exemption include replacement or reconstruction of existing District facilities, including the structures and utility systems, or levees, culverts, tide gates, pumps and other water control structures, providing the replacement or reconstruction is substantially the same size, purpose, capacity and involving negligible or no expansion of capacity; public facilities, such as drainage facilities; and private facilities, such as ornamental fish ponds and swimming pools.

Class 4 consists of minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of mature, scenic trees. District activities which are within the scope of this exemption include new landscaping at District facilities; removal of minor vegetation or sediment in creeks and other natural channels, agricultural irrigation and drainage ditches, other ditches and flood control channels, storm water retention basins, waste water ponds, spreading grounds, and other environments to assist in water flow which prevents breeding of mosquitoes; and removal of minor vegetation to access mosquito breeding sources.

Class 6 consists of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. District activities which are within the scope of this exemption include collection of mosquitoes for mosquito borne disease surveillance; placement of sentinel chicken flocks for mosquito-borne disease surveillance; collection of other insects, such as mosquitoes and mosquito predators to determine population density; and most other research activities undertaken by the District.

Class 7 consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment. Because District practices involve detailed procedures for protection of the environment, District activities which might be within the scope of this exemption include all mosquito surveillance and control activities in areas of natural resources such as jurisdictional wetlands.

Class 8 consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Because District practices involve detailed procedures for protection of the environment, District activities which might be within the scope of this exemption include all mosquito surveillance and control activities throughout the District.

Class 9 consists of activities limited entirely to inspections, to check for performance of an operation, or quality, health, or safety of a project. District activities which are within the scope of this exemption include inspections for the presence of mosquitoes throughout the District, and

formal studies or other activities to determine the efficacy of specific control operations.

Class 21 consists of actions by regulatory agencies to enforce laws, general rules, standards, or objectives, administered or adopted by the regulatory agency. District activities which are within the scope of this exemption include enforcement of the California Health and Safety Code, commencing with section 2200, and other federal, state, and local laws, regulations, ordinances, and resolutions. California Health and Safety Code sections 2200 through 2360, are hereby incorporated by reference (Appendix F).

Class 22 consists of the adoption, alteration, or termination of educational or training programs which involve no physical alteration in the area affected or which involve physical changes only in the interior of existing school or training structures. District activities which are within the scope of this exemption include the District's public education program which includes newsletters, exhibits at city and other local fairs and special events, elementary education programs available to public and private schools, and public speaking engagements. In addition, staff training, as required by the California Occupational Safety and Health Administration, California Department of Food and Agriculture, California Environmental Protection Agency, Department of Pesticide Regulations, and the California Department of Health Services, may be exempt under this class.

3. Exceptions to the Categorical Exemptions

Pursuant to State CEQA Guidelines Section 15300.2, categorical exemptions may not be used in any of the following situations:

(i) Categorical exemption classes 3, 4, 5, 6, and 11 may not be used where the project "may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies."

(ii) All classes of categorical exemptions "are inapplicable when the cumulative impact of successive projects of the same type in the same place, over time, is significant."

(iii) A categorical exemption may not be used for an activity "where there is a reasonable possibility that the activity will have a significant effect on the environment due to unusual circumstances."

In the remainder of this CEQA preliminary assessment, the District reevaluates the CEQA exemption status of its mosquito control Program/Project in light of current operations, activities and conditions.

II. DISTRICT POWERS

The District is a regulatory agency with broad powers, formed pursuant to section 2200 et seq of the California Health and Safety Code. Pursuant to Section 2270, the District Board may do any or all of the following:

(a) Take all necessary or proper steps for the control of mosquitoes, flies, or other vectors, either in the district or in territory not in the district but so situated with respect to the district that mosquitoes, flies, or other vectors may disperse from the territory into the district.

(b) Abate as nuisances all standing water and other breeding places for mosquitoes, flies, or other vectors, either in the district or in territory not in the district but so situated with respect to the district that mosquitoes, flies, or other vectors from the territory disperse into the district.

(c) Purchase the supplies and materials, employ the personnel and contract for the services which may be necessary or proper in furtherance of the objects of this chapter.

(d) If necessary or proper in the furtherance of the objects of this chapter, build, construct, repair, and maintain the necessary dikes, levees, cuts, canals, or ditches upon any land and acquire by purchase, condemnation, or by other lawful means, in the name of the district, any lands, rights-of-way, easements, property, or material necessary for any of those purposes.

(e) Make contracts to indemnify or compensate any owner of land or other property for any injury or damage necessarily caused by the use or taking of property for dikes, levees, cuts, canals, or ditches.

(f) Enter upon any property without hinderance or notice, either within the district or so reasonably adjacent thereto that vectors may disperse into the district, for any of the following purposes:
  (1) To inspect to ascertain the presence of vectors or their breeding places.
  (2) To abate public nuisances in accordance with this article, either directly or by giving notice to the property owner to abate a nuisance.
  (3) To ascertain if a notice to abate vectors has been complied with.
  (4) To treat property with appropriate physical, chemical, or biological control measures.

(g) Sell or lease any service, land, rights-of-way, easements, property or material acquired by the district. Equivalent properties may be exchanged, if it is in the best interests of the district to do so.

(h) Borrow money in any fiscal year and repay it in the same or in the next ensuing fiscal year. The amount borrowed in any fiscal year shall not exceed fifteen cents ($0.15) on each one hundred dollars ($100) of assessed valuation of property in the district.

(I) Issue warrants payable at the time stated in the warrant to evidence the obligation to repay money borrowed or any other obligation incurred by the district. Warrants so issued shall draw interest at a rate fixed by the board not to exceed 5 percent per year, payable annually or semiannually as the board may prescribe.

(j) Provide a civil service system for any or all employees of the district.

(k) Assess civil penalties, as determined in the discretion of the board, but not to exceed five hundred dollars ($500) per day for each day that a notice or hearing order to abate a nuisance has not been complied with.
Any sum which may be collected shall become part of the district's general fund to be used solely for vector control purposes.

(l) Levy, by resolution or ordinance, a service charge against any or all parcels of land within the district to pay for the cost of vector surveillance and control. The schedule of charges shall be made, reviewed, and adopted annually after notice and hearing in connection with the schedule. Following the hearing, the board may classify parcels of property according to their use in relation to the cost of vector surveillance and control. The board may bill for the charges annually or more frequently. The charges shall be collected and paid by the county in the same manner as property taxes by the county. The service charge shall be reasonably related to the district's cost for providing vector surveillance and control and shall not be deemed a tax of any kind. Any sum collected shall be used solely for purposes of vector surveillance and control.

(m) Set the tax or assessment rates which are necessary to carry out the purposes of this article.

(n) Do any and all things necessary for, or incident to, the powers granted by, and to carry out the objects specified in, this chapter.

III. PROGRAM/PROJECT DESCRIPTION

The District's Board of Trustees has defined the District's Mission as "to protect the public health and welfare through area-wide, responsive services and programs". Therefore, the District protects the environment by protecting the health and safety of the people living and working within our service area, and by conducting mosquito control activities in a manner that minimizes adverse impacts to other environmental functions.

A. Program/Project Location

The District's activities are conducted within a 796 square mile jurisdiction encompassing all areas contained within Napa County, California. Under section 2270(a) of the Health and Safety Code, the District can also take limited action in bordering areas of Lake, Solano, Sonoma and Yolo Counties if needed to provide mosquito control for residents of Napa County. Therefore, areas actually or potentially impacted by the Project include (Appendix A).

1. The incorporated cities of American Canyon, Calistoga, Napa, St Helena and Yountville.

2. The unincorporated areas of Napa County.

3. Other bordering areas in Lake, Solano, Sonoma and Yolo Counties.

B. Mosquitoes and Mosquito-borne Diseases in the District Service Area

The California Health and Safety Code defines a vector as "any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal." (Section 2200(f))

The District's Project involves the control of mosquitoes which cause human disease and/or human discomfort to the residents of the District. Certain species of mosquitoes found in Napa County can transmit malaria, St. Louis encephalitis, western equine encephalomyelitis, and potentially other encephalitis viruses. A few species of mosquitoes are also capable of transmitting *Dirofilaria immitis*, the dog heartworm. Although some species of mosquitoes have not been shown to transmit disease, all species can cause human discomfort when the female mosquito bites to obtain blood. Reactions may be as limited as irritation in the area of the bite or as severe as allergic reactions or secondary infections resulting from scratching the irritated area. Additionally, an abundance of mosquitoes can cause economic losses, loss of use of recreational, agricultural, or industrial areas, and loss of the enjoyment of property.

Mosquitoes are extremely mobile and cause the greatest hazard or discomfort away from their breeding site. Each species of mosquito has unique biological requirements and most of them occupy different habitats. In order to effectively control mosquitoes, an integrated mosquito management program must be employed. District policy is to locate and identify mosquito populations, to recommend techniques for their prevention and control, and to anticipate and minimize any interaction between new or uncommon mosquitoes and humans.

C. Integrated Mosquito Management

The District's Project is the surveillance and control of mosquitoes which consists of the following general principles and policies, including identification of mosquito problems, responsive actions to control existing populations of mosquitoes, prevent new sources of mosquitoes from developing and manage their habitat to minimize mosquito production; education of landowners and others on how to minimize mosquito production or interaction with mosquitoes; and provision and administration of funding and institutional support necessary to accomplish these goals.

In order to accomplish effective and environmentally sound mosquito control, the management and manipulation of mosquitoes must be based on careful surveillance of their abundance and/or potential contact with people, and be accomplished by selecting from a wide range of control methods. This dynamic combination of surveillance and control activities into one thoughtful, ecologically sensitive program is generally known as integrated pest management (IPM) (Durso, 1996).

The District's mosquito control Program/Project, like any other IPM program, by definition involves procedures for minimizing potential environmental impacts. The District's Project employs IPM principles by first determining the species and abundance of mosquitoes through

evaluation of public service requests and field surveys of immature and adult mosquito populations. Then, if mosquito populations exceed predetermined criteria, the most efficient, effective, and environmentally sensitive means of control is used. For all mosquito species, public education is an important control strategy, and for some mosquitoes it is the District's primary control method. In some situations, water management or other physical control activities (historically known as "source reduction" or "permanent control") can be instituted to reduce mosquito breeding sites. The District also uses biological control such as the planting of mosquitofish in some settings. When these approaches are not effective or are otherwise inappropriate, then pesticides are used to treat specific mosquito-producing or mosquito-harboring areas.

In order to maximize familiarity by the operational staff with specific mosquito sources in the Project area, the District is divided into six mosquito zones. Each zone is assigned a full time mosquito control technician or vector biologist, whose responsibilities include minor physical control, inspection and treatment of known mosquito sources, finding and controlling new sources, and responding to service requests from the public.

Mosquito control activities are conducted at a wide variety of sites throughout the District's Project area. These sites can be roughly divided into those where activities may have have an effect on the natural environment either directly or through drainage, and sites where the potential environmental impacts are negligible. Examples of environmental sites in the project area include tidal marshes, duck clubs, other diked marshes, lakes and ponds, rivers and streams, vernal pools and other seasonal wetlands, storm water detention basins, flood control channels, spreading grounds, street drains and gutters, wash drains, irrigated pastures, or agricultural ditches. Examples of "non-environmental" sites include animal troughs, artificial containers, tire piles, fountains, ornamental fish ponds, swimming pools, and animal waste detention ponds.

1. Surveillance and Site Access

Besides being nuisances by disrupting human activities and causing our environment to be uninhabitable, certain mosquitoes may transmit a number of diseases. The diseases of most concern in Napa County are malaria, St. Louis encephalitis (SLE) and western equine encephalomyelitis (WEE) and dog heartworm.

Mosquito populations are surveyed using a variety of field methods and traps. Small volume larval mosquito "dippers" and direct observation are used to evaluate immature populations. Service requests from the public, field landing counts, light traps and carbon dioxide baited traps are used to evaluate adult populations.

Mosquito-borne diseases are surveyed using sentinel chickens, adult mosquitoes, and rarely wild birds. Coops with sentinel chickens are maintained on the property of willing landowners. The District employs standard practices of good animal husbandry to ensure the health and well being of the sentinel animals.

Adult mosquitoes are collected and tested for infection with SLE and WEE virus. Collection is

made with small light traps baited with carbon dioxide in the form of dry ice. Although the traps must be placed in vegetated areas with little light competition, care is taken to ensure that placement of traps does not significantly damage any vegetation.

The District might collect wild birds in crow traps that are designed specifically for the collection of small birds such as sparrows and finches. The crow traps are supplied with food and water and remain in good repair to protect the birds from predators. Prior to catching wild birds, banding permits are obtained from the Department of Fish and Game and the District strictly complies with all requirements of the permit. After obtaining a blood sample from the wild bird, the bird is released.

Disposable supplies that are contaminated while collecting blood and tissue are stored in appropriate biohazard containers in the District's laboratory and disposed of in accordance with all applicable laws. Reusable items are cleaned and sterilized before they are used again. The disposal of animal carcasses is in compliance with all Federal, State, and local laws and regulations.

Surveillance is also conducted to determine mosquito habitat (eg. standing water) and the effectiveness of mosquito control operations. Inspections are conducted using techniques with insignificant impacts on the environment. Staff routinely use preexisting accesses such as roadways, open areas, walkways, and trails. Vegetation management (i.e. pruning trees, clearing brush, and herbicide application) is conducted where overgrowth impedes safe access. All of these actions only result in a temporary/localized physical change to the environment with regeneration/regrowth occurring within a span of six to nine months.

In order to access various sites throughout the District for surveillance and control, District staff utilize specialized equipment such as light trucks, all terrain vehicles, boats, and helicopters.

2. **Education**

The primary goal of the District's activities is to prevent mosquitoes from reaching public nuisance or disease thresholds by managing their habitat while protecting habitat values for their predators and other beneficial organisms. Mosquito prevention is accomplished through public education, including site specific recommendations on water and land use, and by physical control (discussed in a later section of this document).

The District's education program teaches the public how to recognize, prevent, and suppress mosquito breeding on their property. This part of the Project is accomplished through the distribution of brochures, fact sheets, newsletters, participation in local fairs and events, presentations to community organizations, contact with District staff in response to service requests, and public service announcements and news releases. Public education also includes an elementary school program that teaches future adults to be responsible by preventing and/or eliminating mosquito breeding sources, and educates their parents or guardians about District services and how they can reduce mosquito-human interaction.

D. Mosquito Control

When a mosquito source produces mosquitoes above District treatment thresholds (Appendix D), the Technician will generally work with the landowner or responsible agency to reduce the habitat value of the site for mosquitoes ("physical control"). If this is ineffective, then the technician will determine the best method of further treatment, including biological control and chemical control.

1. Physical Control

The District physically manipulates and manages mosquito habitat areas ("breeding sources") to reduce mosquito production. This may include removal of containers and debris, removing standing water from unmaintained swimming pools and spas, removal of vegetation or sediment, interrupting water flow, rotating stored water, pumping and/or filling sources, improving drainage and water circulation systems, breaching or repairing levees, and installing, improving, or removing culverts, tide gates, and other water control structures in wetlands.

In addition to using herbicides at some sites (primarily agricultural ditches and water ponds) to assist with mosquito surveillance, the District also uses herbicides in some areas to reduce mosquito habitat suitability. While the goal is similar to that of physical control, use of herbicides will be discussed under "chemical control", in the CEQA analysis, because the environmental concerns tend to be more similar to those of chemical insecticides than to more conventional physical control activities.

2. Biological Control

The mosquitofish, *Gambusia affinis*, is the District's primary biocontrol agent used against mosquitoes. Mosquitofish are not native to California, but have been widely established in the State since the early 1920's, and now inhabit most natural water bodies. The District rears mosquitfish in ponds throughout Napa Valley and periodically uses nets to collect these fish for use and distribution to appropriate mosquito breeding sites located within the District. When catching mosquitofish from natural settings, other aquatic animals, such as blue gill, sunfish, other freshwater fish, and crustaceans, are sometimes caught accidentally but are returned to the habitat.

District staff place mosquitofish in natural and man-made settings where either previous surveillance has demonstrated a consistently high production of mosquitoes, or where current surveillance indicates that mosquito populations will likely exceed chemical control thresholds without prompt action. Mosquitofish are also made available to the public to control mosquito production only in artificial containers such as ornamental fish ponds, water plant barrels, horse troughs, and abandoned swimming pools.

3. Chemical Control

Since many mosquito breeding sources cannot be adequately controlled with physical control measures or mosquitfish, the District also uses chemical insecticides to control mosquito production where observed mosquito production exceeds District thresholds. The primary types of insecticides used are selective larvicides, which are described in the following section. In addition, when large numbers of adult mosquitoes are present and/or public health is threatened, the District may apply selective, low persistence aerosol adulticides (described later in this document) to mosquito habitats that are a certain distance from residential areas (Appendix D).

F. District Funding

The District's activities are funded through property taxes, service contracts, grants, and civil liabilities, pursuant to Health and Safety Code Sections 2291.2 et seq.

Because mosquitoes are mobile, the District's activities provide general benefits to every property within the District, promoting the habitability of the property by protecting public health and welfare and enhancing the economic development, recreational use, and enjoyment of the property. In addition to the District-wide benefit, each parcel within the District receives an additional special benefit from the District's activities which takes place on, or is available to, each particular parcel.

The District also maintains service contracts with some large land-owners and/or water dischargers, and solicits grants for research and interagency habitat management projects. In some cases, the District accepts civil liability settlements from the Napa County District Attorney or the California Department of Fish and Game when these settlements are directed at habitat management projects consistent with the Districts Mission and IPM Program.

IV. CEQA ANALYSIS OF PROGRAM/PROJECT

The District's Program/Project includes surveillance and site access, education, and physical, biological, and chemical control activities for mosquitoes. The potential application of CEQA requirements, exemptions, and exceptions to each of these classes of activities is analyzed below.

In general, the environmental impacts of the District's different programs are insignificant. In recent years, this view has been strongly supported by a number of large scale programmatic reviews of other mosquito and vector control agencies. Examples include the "Program Evaluation Report" of the Metropolitan Mosquito Control District (Minneapolis/St. Paul, Minnesota) issued by the State of Minnesota's Office of the Legislative Auditor (1999); "Florida Mosquito Control", issued by the inter-agency Florida Coordinating Council on Mosquito Control (1998); the final report of the Scientific Peer Review Panel on nontarget effects in Minnesota (1996); and the EIS and Final Supplemental EIS of the Metropolitan Mosquito Control District (1976, 1986). All of these are cited in the References Section of this document.

A. Surveillance and Site Access

No endangered or threatened species or other legally protected animals are used to test for the presence of disease. For those species that are used, sample sizes are small relative to the indigenous population. Surveillance and inspection activities do not impact an environmental resource of hazardous or critical concern, do not cause a cumulative impact, and do not have a significant effect on the environment and are therefore exempt under class 6 and class 9 categorical exemptions.

Equipment is generally operated using existing passageways such as roads and trails. In some cases, there are no existing roads or trails, but low ground pressure all-terrain vehicles can be used with minimal environmental impacts. If vegetation clearing is needed for foot access to sites, only minor vegetation is removed. If an area does not have an existing passageway, and one is required, the District contacts the landowner or agency with appropriate jurisdiction to request that access be made available. In these cases, the landowner or agency is responsible for determining the environmental impact of constructing an access road or trail. Use of all-terrain vehicles and the removal of minor vegetation, excluding mature scenic trees, does not generally cause significant environmental impact, and would therefore be exempt from CEQA under the class 4,6, and 9 categorical exemptions.

B. Education

Because the public education component of the Project does not directly result in change in the environment, it does not meet the State CEQA Guidelines definition of a "project" and is therefore exempt from further CEQA review. Furthermore, the class 22 categorical exemption covers the adoption, alteration, or termination of educational or training programs which involve no physical alteration in the area affected or which involve physical changes only in the interior of existing school or training structures. Therefore, the District's education activities are exempt under a class 22 categorical exemption. To ensure that the District does not indirectly encourage environmental impacts without CEQA review, the District informs landowners and others who might modify the physical environment in response to our educational programs that they have specific environmental obligations, including compliance with CEQA and permit requirements.

Educational activities also include making recommendations on specific property development and land and water management practices or proposals, in response to ongoing or proposed developments or management practices that may create sources of mosquitoes. The District is not a permitting agency and is not responsible for implementing or approving the recommendations; therefore, property owners or developers are required to prepare and submit their own documents for projects which require CEQA review.

C. Physical Control

The removal of containers, debris, and standing water from unmaintained swimming pools and spas is exempt because these activities will not result in a physical change in the environment,

directly or ultimately, and therefore, do not constitute a project under the Public Resources Code Section 21065. These activities would also be categorically exempt from CEQA under class 1 (minor alteration of private and public structures) and class 4 (minor alteration in the condition of land, water, and/or vegetation).

In some cases, the District's involvement in physical control activities is limited to the enforcement of regulations through issuing notices to abate. Enforcement of regulations are exempt under a class 21 categorical exemption. Any physical alteration to the environment is typically carried out by private parties or other governmental agencies. In such cases, the actual physical control activity would be subject to obtaining permits or approval from other agencies, in which case these other agencies would then be the lead agency for CEQA purposes. If the responsible person or entity fails to comply with the District's directives, the District may perform the physical control activity directly. In such case, the District will first evaluate whether or not the emergency statutory exemption from CEQA applies. If so, the District will proceed with the physical control activity. If the emergency statutory exemption does not apply, the District will evaluate whether or not the exceptions to the use of categorical exemptions would apply (designated hazardous or critical areas, significant cumulative impacts, or unusual circumstances). If such limitations do not apply, the District would proceed with the physical control activity under a class 1 and class 4 categorical exemption. If it is determined that exceptions to the exemptions apply, the District would perform a new CEQA review of the specific activity before proceeding, or again approach the landowner for compliance.

On public lands, District staff perform minor physical control through removal of accumulated vegetation or sediment using hand tools, which are generally covered by the class 1 and class 4 categorical exemptions. Where more extensive work is needed, then the District obtains and strictly complies with permits from the U.S. Army Corps of Engineers, the San Francisco Bay Conservation and Development Commission, the San Francisco Regional Water Quality Control Board, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, and any other appropriate regulatory agency. Where the District determines that a physical control project exceeds the scope of the class 1 and class 4 categorical exemptions, then it prepares other CEQA documentation as needed prior to commencement of the proposed work.

D. Biological Control Activities

Mosquitofish are opportunistic feeders and, in addition to mosquitoes, will readily prey on their newborn young, other small fish, and other small aquatic organisms (Ahmed, et al., 1970; Barnickol, 1939; Farley, 1980; Swanson, et al., 1996). Specifically, some researchers have claimed that mosquitofish are implicated in the extirpation of red-legged frogs and other protected species. In order to protect threatened and endangered species and beneficial organisms, the District only releases mosquitofish into environmental sites under strict stocking protocols (Appendix E). Members of the public seeking mosquitofish are explicitly informed not to release *Gambusia* into the environment.

The District's biological control activities, including fish collection, rearing, and release, constitute an ongoing project. Biological control projects conducted by Mosquito Control Districts are

generally exempt from further CEQA requirements under the class 7 and class 8 categorical exemptions, and under statutory exemptions for emergency projects to control mosquitoes which present imminent danger to the health and comfort of the residents of the District.

E. Chemical Control (Pesticides)

Chemical control of mosquitoes will be performed with either larvicides (pesticides that kill the organism in the larval stage) or adulticides (pesticides that kill the organism in the adult stage). Larvicides will be selected that are highly selective with little or no effect on non-target organisms, not harmful to plants, biodegradable, non-toxic to mammals, birds, amphibians, and fish, effective, and reasonably priced. Adulticides will be selected that are biodegradable, non-toxic to mammals and birds, and not harmful to vehicles or built structures. If needed for access to mosquito habitat, or to reduce the mosquito larval habitat value of sites overgrown with weeds, specific herbicides might be used by the District.

Every regular employee of the District who handles, applies, or supervises the use of any pesticide for public health purposes is certified by the California Department of Health Services as a vector control technician in mosquito control, terrestrial invertebrate vector control, and vertebrate vector control. The District sometimes employs Seasonal Aides. Pursuant to Title 17 of the California Code of Regulations section 30013, these employees need not be certified by the California Department of Health Services. Seasonal Aides apply pesticides under the instructions and direct supervision of a Certified Vector Control Technician who is responsible for the actions of that person and who is available if and when needed even though the certified technician may not be physically present at the time the pesticide is applied. All employees who handle and apply pesticides are trained pursuant to Title 3 of the California Code of Regulations section 6724. All regular employees who are certified by the California Department of Health Services attend three annual continuing education programs pursuant to Title 17 of the California Code of Regulations section 30061. Training activities will not result in a physical change in the environment, directly or ultimately; therefore, the District's training activities are exempt under a class 22 categorical exemption.

The District uses pesticides that are selective and non-persistent to minimize the risk of significant or cumulative adverse impact on non-target plant or animal life in "environmental sites". All pesticides are stored, handled, and used in accordance with all State, Federal, and local regulations and the manufacturer's recommendations and instructions. Adherence to these regulations, instructions, and recommendations, together with the District's own policies and procedures, will ensure that the District's use of pesticides will not adversely affect the environment.

All liquid pesticide application equipment is equipped with a pressure regulator or other means to measure application volumes and rates, and is calibrated at regular intervals to insure that the proper amount of pesticide is applied. All non-liquid pesticide application equipment is calibrated before use to insure that the proper amount of pesticide is applied.

Some pesticides have different names and slightly different formulations but essentially similar

ingredients and modes of action. Therefore, where trade names are listed below, they indicate the current formulations used by the District. The District reserves the right to change materials at any time, and has determined that new materials with essentially the same formulation, mode of action, and mode of application, are adequately covered by this review.

1. Mosquito Larvicides

a. *Bti*

The "Program Evaluation Report" of the Metropolitan Mosquito Control District noted that "our conclusion from reviewing the scientific literature is generally consistent with EPA's position that *BTi* and methoprene.....pose little risk to people and most nontarget species" (State of Minnesota, Office of the Legislative Auditor, 1999).

Pesticides that contain the active ingredient of the bacterium *Bacillus thuringiensis* subspecies *israelensis (Bti),* which includes VectoBac® G (biological larvicide granules), VectoBac® 12AS (biological larvicide aqueous suspension), Vectobac TP (biological larvicide technical powder), and Teknar® HP-D (high potency Dipteran biological larvicide), are used for mosquito control. The active ingredient is composed of viable *Bti* endospores and delta-endotoxin crystals. *Bacillus thuringiensis* var. *israelensis*, which occurs naturally in soils and aquatic environments globally, has a highly specific mode of action against a narrow host spectrum, more specifically larvae of mosquitoes and black flies. Larvicidal activity is dependent upon ingestion of these components by the mosquito larvae. Upon ingestion, pH conditions and enzymes in the gut of the larvae rapidly hydrolyze the bacterial endospore material into active subunits which attack the midgut cells. General gut paralysis occurs within a few hours, and the cells of the midgut become extensively damaged causing the formation of holes or ulcers in the stomach wall. The subsequent flow of toxic substances into the larval body cavity causes death within 48 hours.

Biological larvicides, like *Bti*, may be applied to virtually any mosquito breeding source except treated, finished drinking water reservoirs and drinking water receptacles. Oral, dermal, and inhalation toxicity studies have not found any mammalian toxicity (de Barjac, et al., 1980; Mayes, et al., 1989; Siegel and Shadduck, 1990; Siegel, et al., 1987; Shadduck, 1980). Numerous studies have been conducted regarding the effect of *Bacillus thuringiensis* on non-target organisms and the environment. When products that contain *Bti* are applied within label rates, no harmful effects have been found against non-target organisms including tree frog tadpoles, toad tadpoles, California newts, mosquitofish, rainwater killifish, two spine stickleback, bluegill, scuds, side swimmers, purple shore crabs, fairy shrimp, water fleas, mayfly nymphs, damselfly nymphs, dragonfly nymphs, water boatmen nymphs, backswimmers, pygmy backswimmers, scavenger water beetle larvae, predaceous water beetles, flatworms, earthworms, fresh water snails, and mussels (Garcia, et al., 1981; Merritt et al., 1989; Miura et al., 1980; Purcell et al., 1981; Tietze et al., 1993, 1992, 1991). Additionally, some long-term studies in wetland habitats revealed no significant effects on the food chain or inhabitants of the wetlands (Scientific Peer Review Panel, 1996). Based on the technical data and scientific research, *Bti* is generally considered to have minimal immediate or cumulative impact on the environment, and the District uses this type of

pesticide in environmental and non-environmental sites.

Some published research has indicated potentially significant environmental impacts of Bti use under some circumstances. In particular, researchers have indicated that Bti can adversely affect midges (Ali et al, 1981; Garcia et al, 1981; Miura, 1981; Miura, 1980; Molloy, 1992; Mulla, et al, 1990; Rodchareon, et al, 1991). These studies are hard to compare to District practices because application rates of the material in these studies often exceeded label rates and District policies. If midge reduction at label rates were demonstrated, then routine Bti applications could affect food supplies for waterfowl in some times and places.

b. *Bacillus sphaericus*

Insecticides that contain the active ingredient of the bacterium *Bacillus sphaericus*, which includes VectoLex® CG (biological larvicide granules), are used for mosquito control in a number of sites, generally where highly organic water or other criteria make *Bti* less appropriate. The mode of action of *Bacillus sphaericus* is the same as *Bti* except that fresh *Bacillus sphaericus* spores that proliferate in the mosquito larvae are released when the larvae dies. These spores are then ingested by other larvae. Oral, dermal, and inhalation toxicity studies have not found any mammalian toxicity (Shadduck, et al, 1980; Siegel and Shadduck, 1990). When *Bacillus sphaericus* products are applied within label rates, no harmful effects have been found against non-target organisms including dragonfly nymphs, damselfly nymphs, mayfly nymphs, chironomids, water boatmen nymphs, backswimmers, diving beetles, water scavenger beetles, marine amphipods, fairy shrimp, copepods, crawfish, mollusks, and amphibians (Ali, 1991; Aly et al., 1985; Holck and Meek, 1987; Mulla, et al., 1984; Walton and Mulla, 1991). This type of pesticide is used in environmental and non-environmental sites. Based on the technical data and scientific research, *Bacillus sphaericus* is generally considered to have minimal immediate or cumulative impact on the environment, and the District may use this type of pesticide in any site.

c. Methoprene

Pesticides that contain the active ingredient methoprene, which includes Altosid® XR Briquets, Altosid® Liquid Larvicide, and Altosid® Pellets, are used to control mosquitoes and midges. Methoprene is an insect growth regulator which controls mosquitoes and midges by interrupting normal metamorphosis. Methoprene is a true analog of mosquito juvenile hormone. During the fourth larval instar stage, juvenile hormone levels drop to very low levels. Methoprene artificially maintains juvenile hormone levels at a higher than normal titer. This higher hormonal level during the latter instar stages prevents the insect from developing into a normal pupa. Since the biology of midges and mosquitoes are similar, methoprene is effective on both insects. Oral, dermal, and inhalation toxicity studies have not found any mammalian toxicity (Hawkins et al., 1977). When methoprene products are applied within label rates, no harmful effects have been found against non-target organisms including 35 species of protozoa, earthworms, leeches, water fleas, shrimp, damselflies, mayflies, water beetles, snails, tadpoles, mosquitofish, ducks, geese,

frogs, toads, salamanders, crabs, shrimp, oysters, clams, and algae, and there has been no impact on the food chain. (Batzer and Sjogren, 1986; Barber et al., 1978; Bircher and Ruber, 1988; Boley, 1992; Meyer, 1994; Miura and Takahashi, 1973; Miura and takahashi, 1974; Reish et al., 1985; Scientific Peer Review Panel, 1996; Tietze, et al., 1993, 1992, 1991).

Based on the technical data and scientific research, methoprene is generally considered to have minimal immediate or cumulative impact on the environment, and the District uses this type of pesticide in environmental and non-environmental sites. The District applies methoprene in a variety of formulations, including liquid, pellets, briquettes, and mixed with Bti ("duplex").

Some published research has indicated potentially significant environmental impacts of methoprene use under some circumstances. In particular, researchers have indicated that methoprene can adversely affect midges (Ali, 1991a, b; Lothrop and Mulla, 1998). Many of these studies are hard to compare to District practices because application rates of the material in these studies often exceeded label rates and District policies.

d. Golden Bear 1111 Oil

Pesticides that contain the active ingredient aliphatic petroleum hydrocarbons, which includes Mosquito Larvicide GB-1111® ("Golden Bear 1111" -- the only petroleum oil currently registered in California), are used to control mosquitoes. Golden Bear 1111 evaporates and photodegrades in the environment, has no residual effect, and is slightly phytotoxic when applied at label rates. Golden Bear 1111 kills by suffocation and can be toxic to some air-breathing aquatic insects (diving beetles, immature dragonflies and damselflies), although it has no documented impact to bottom-dwelling organisms (Mulla and Darwazeh, 1981). Studies on a wide range of fish species have demonstrated no toxic effects when applied at label rates (Tietze, et al., 1991; Tietze, et al., 1992; Tietze, et al., 1993; Tietze, et al., 1994). The relatively low persistence of Golden Bear 1111 in the environment indicates that significant movement of this material into open waters is highly unlikely following application to mosquito producing sites.

e. Agnique

Pesticides that contain the active ingredient ethoxylated fatty alcohol, which includes Agnique™ MMF (monomolecular surface film), may be used to control mosquitoes once registered in California. This type of pesticide reduces the surface tension of water and makes it difficult for mosquito larvae and pupae to attach. The film also blocks their breathing tubes and the larvae and pupae drown. Resting adult males and adult egg-laying females that come in contact with the film will also drown. This product can be used in virtually any source of water including potable water and biodegrades into carbon dioxide and water. The lethal inhalation concentration during four hours of exposure is 1.5 to 3.0 milligrams per liter. Ingestion of large quantities may cause gastrointestinal disturbances. Contact with eyes causes irritation which subsides in seven days and prolonged or repeated exposure with skin causes irritation. Studies on non-target effects were conducted on the fresh-water green tree frog, two species of fresh

water fish, five species of salt water fish, longnose killifish, grass shrimp, freshwater shrimp, fiddler crab, crayfish, freshwater amphipod, freshwater isopod, fairy shrimp, snails, polychaetes, mayfly nymphs, diving beetles, midges, clam shrimp, backswimmers, water boatmen, water striders, beetle larvae and adults, black mangrove, saltwort, cordgrass, arrowhead, and rice. The only non-target effects observed when the product was applied at label rates were dead adult midges and adult water striders. Based on the available technical data and scientific research, Agnique^{TM} MMF has no apparent significant or cumulative impact on the environment.

2. Mosquito Adulticides

a. Pyrethrins, Pyrethroids and Piperonyl Butoxide

Pesticides that contain the active ingredients resmethrin with piperonyl butoxide (trade name Scourge), permethrin with piperonyl butoxide (trade name Biomist 4+12), and pyrethrin with piperonyl butoxide (trade name MGK Pyrocide 7396), are synthetic or natural pyrethroids used to control adult mosquitoes. These products stimulate nerve cells to produce repetitive discharges and eventually cause paralysis of the insect. Acute toxicity of these materials, depending on formulation and type of synergist used, is low to mammals (Pyrethrin oral LD_{50} = 900 mg/kg; Resmethrin oral LD_{50} = 2,000 mg/kg; permethrin oral LD_{50} is greater than 4,000 mg/kg) (Worthing and Hance, 1991; Matsumura, 1975). Scientific research has also shown that neither Bobwhite quail or Mallard ducklings are harmed when fed 5,000 part per million of the active ingredients in Scourge®. Neither of these products are listed as carcinogens. Recent research in controlled plots in the Central Valley indicated no reductions in the total abundance or biomass of aquatic macroinvertebrates or fish, and a return to previous abundance in 24 hours for flying insects, following label-rate treatments of Pyrethrin and Permethrin [Lawlor, 1997].

Some non-target, beneficial insects may be killed during the ultra-low volume aerosol application of these insecticides. These mosquito adulticides are highly toxic to bees and may only be applied when bees are not present. Fortunately, treatment with these materials for mosquitoes is conducted when bees are not foraging. Scientific research has shown that when Scourge® is applied according to the label, foraging bees are not effected by residual pesticide.

The Legislative Audit of the Metropolitan Mosquito Control District concluded that "studies by EPA and the World Health Organization found that resmethrin and permethrin are broad-spectrum insecticides with the potential to harm other types of insects and aquatic organisms, but they should not be harmful to humans or the environment if applied according to label instructions" (State of Minnesota, Office of the Legislative Auditor, 1999). Although generally safe to humans and the environment, these products are generally only used under unusual situations to control adult mosquitoes when diseases may be transmitted by mosquitoes or when the insect population is so high that they interfere with the enjoyment of the environment. Consistent with the California Legislature's policy for environmental quality, control of adult mosquitoes may be necessary for the health and safety of the people to provide a satisfying living environment.

3. Herbicides

Rodeo and Round Up are glyphosate-based herbicides used by the District to control weeds that overgrow mosquito habitat and obstruct access by fish and/or mosquito control staff. These are selective materials with very low animal toxicity. Rodeo is labeled for aquatic application, while Round Up is labeled for terrestrial use, and both are used in strict conformance with the labels.

Karmex DF is a diuron based herbicide that is used by District staff to prevent growth of grasses and low growing annual weeds on the levees and along the shorelines of waste water ponds of sewage treatment facilities and wineries. This material is also used in strict conformance with the label.

V. EXCEPTIONS TO THE USE OF CATEGORICAL EXEMPTIONS

As noted earlier, Pursuant to State CEQA Guidelines Section 15300.2, categorical exemptions to CEQA requirements for environmental assessment and documentation may not be used in any of the following situations:

(i) Categorical exemption classes 3, 4, 5, 6, and 11 may not be used where the project "may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies."

(ii) All classes of categorical exemptions "are inapplicable when the cumulative impact of successive projects of the same type in the same place, over time, is significant."

(iii) A categorical exemption may not be used for an activity "where there is a reasonable possibility that the activity will have a significant effect on the environment due to unusual circumstances."

The District has carefully considered these exceptions. Since CEQA was passed, the potential environmental impacts of routine mosquito control activities have diminished through the use of increasingly selective pesticides and more extensive surveillance. However, during this same time, there have been dramatic increases in the number of legally protected species associated with wetland habitats, the number of wetland acres that are considered "sensitive", and the general awareness of the ecological and recreational values of wetlands.

In particular, explicit and implicit definitions of "environmental resources of critical concern" and "unusual circumstances" have become increasingly broad. Known or potential habitat for a number of species including the California Clapper Rail, Black Rail, Western Snowy Plover, Salt Marsh Harvest Mouse, Red-Legged Frog, Delta Smelt, Chinook Salmon, Vernal Pool Fairy Shrimp, California Freshwater Shrimp, and Soft Bird's Beak are all found in areas where District activities may occur (see Appendix B for a listing of federal and state species of concern).

In addition, a number of researchers have suggested that routine vector control activities have produced or can produce cumulatively significant environmental impacts. For example, there have been several published claims that non-native fish, including mosquitofish, have contributed to the decline of legally-protected species, including the California Red-legged Frog. Furthermore, the relatively selective and non-persistent pesticides used by the District have also been cited as potentially detrimental to important food resources for waterfowl and wading birds. Finally, concerns over the possible detrimental impacts of ATV use on wetlands have been increasingly issued by the U.S. Fish and Wildlife Service, particularly in regard to federally managed lands.

Therefore, although these exceptions do not ordinarily apply to the District's mosquito surveillance and control activities, it appears that portions of our ongoing and routine actions may now be considered outside the scope of the categorical exemptions.

VI. CONCLUSIONS

Based upon the foregoing discussion and the documents incorporated by reference therein, the District concludes that most District activities are exempt from further CEQA review. However, some specific activities within the District's Project might exceed the scope of the exemptions to CEQA, or might trigger one or more of the exceptions to the exemptions. Therefore the District will undertake an Initial Study, as described in the CEQA Guidelines, of our Project.

A. District Funding, Planning, and Administration

The District is funded through a variety of mechanisms, as described before. No District funding mechanism or activity meets the State CEQA Guidelines definition of a "project" and therefore, CEQA is not applicable to these activities. Furthermore, CEQA does not apply to the establishment, modification, structuring, restructuring, or approval of rates, tolls, fares, and other charges by public agencies which the public agency finds are for the purpose of meeting operating expenses, purchasing or leasing supplies, equipment, or materials, meeting financial reserve needs and requirements, and obtaining funds for capital projects. Therefore, funding of the Project is statutorily exempt.

Planning and routine administrative activities by the District or its Board are also either "non-project" or are otherwise statutorily exempt from further review.

B. Surveillance and Site Access Activities

The District's surveillance, inspection, and site access activities are generally statutorily exempt from further CEQA requirements as ongoing projects. In addition, these activities are generally exempt under the class 6 and class 9 categorical exemptions, and under statutory exemptions for emergency projects to control mosquitoes which present imminent danger to the health and comfort of the residents of the District.

However, evidence exists that under some foreseeable circumstances, use of all-terrain vehicles by the District on some sites might either exceed the scope of these exemptions, or might trigger the exceptions to these exemptions. Therefore, the District will include its surveillance and inspection projects in the proposed CEQA Initial Study.

C. Public Education and Consultation

The public education and training component of the Project does not meet the State CEQA Guidelines definition of a "project" and therefore, CEQA is not applicable to this activity. Furthermore, the class 22 categorical exemption consists of the adoption, alteration, or termination of educational or training programs which involve no physical alteration in the area affected or which involve physical changes only in the interior of existing school or training structures. Therefore, the District's education and training activities are exempt under a class 22 categorical exemption.

D. Physical Control Activities

The District's physical control activities constitute both an ongoing maintenance project and a series of discrete site-specific projects. Physical control projects conducted by Mosquito Control Districts are generally exempt from further CEQA requirements under the class 1,2, 4,7, and 8 categorical exemptions, and under statutory exemptions for emergency projects to control mosquitoes which present imminent danger to the health and comfort of the residents of the District.

However, evidence exists that under some foreseeable circumstances, physical control actions undertaken by the District might either exceed the scope of these exemptions, or might trigger the exceptions to these exemptions. Therefore, the District will include its physical control projects in the proposed CEQA Initial Study.

E. Biological Control Activities

The District's biological control activities, including fish collection, rearing, and release, constitute an ongoing project. Biological control projects conducted by Mosquito Control Districts are generally exempt from further CEQA requirements under the class 7 and class 8 categorical exemptions, and under statutory exemptions for emergency projects to control mosquitoes which present imminent danger to the health and comfort of the residents of the District.

However, evidence exists that under some foreseeable circumstances, mosquitofish stocking undertaken by the District might either exceed the scope of these exemptions, or might trigger the exceptions to these exemptions. Therefore, the District will review its biological control activities in the proposed CEQA Initial Study.

F. Chemical Control Activities

The District's chemical control activities, including use of mosquito larvicides, mosquito adulticides, and herbicides, constitute an ongoing project. Chemical control projects conducted by Mosquito Control Districts are generally exempt from further CEQA requirements under the class 7 and class 8 categorical exemptions, and under statutory exemptions for emergency projects to control mosquitoes which present imminent danger to the health and comfort of the residents of the District.

However, evidence exists that under some foreseeable circumstances, pesticide applications undertaken by the District might either exceed the scope of these exemptions, or might trigger the exceptions to these exemptions. Therefore, the District will review its chemical control activities in the proposed CEQA Initial Study.

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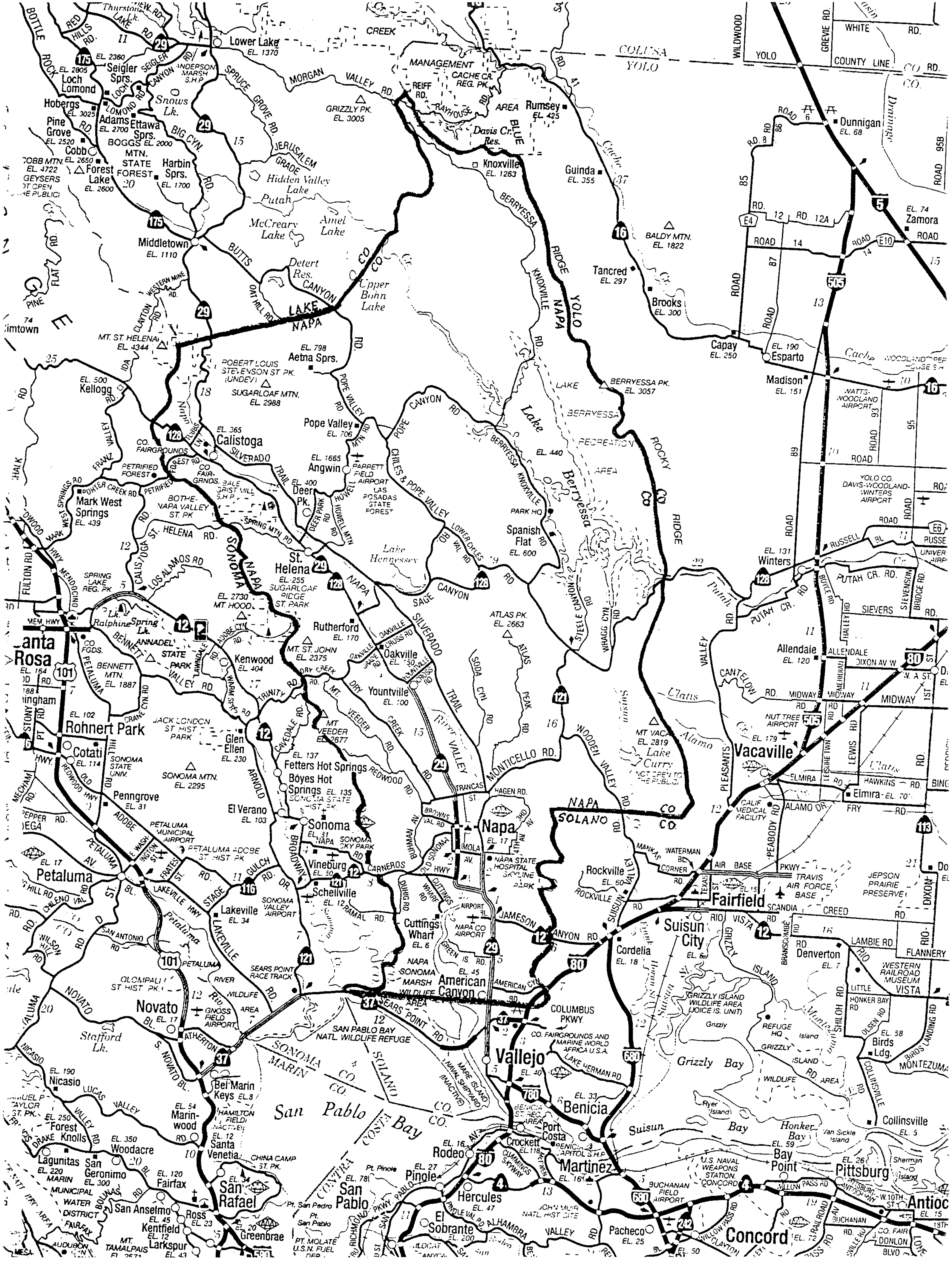
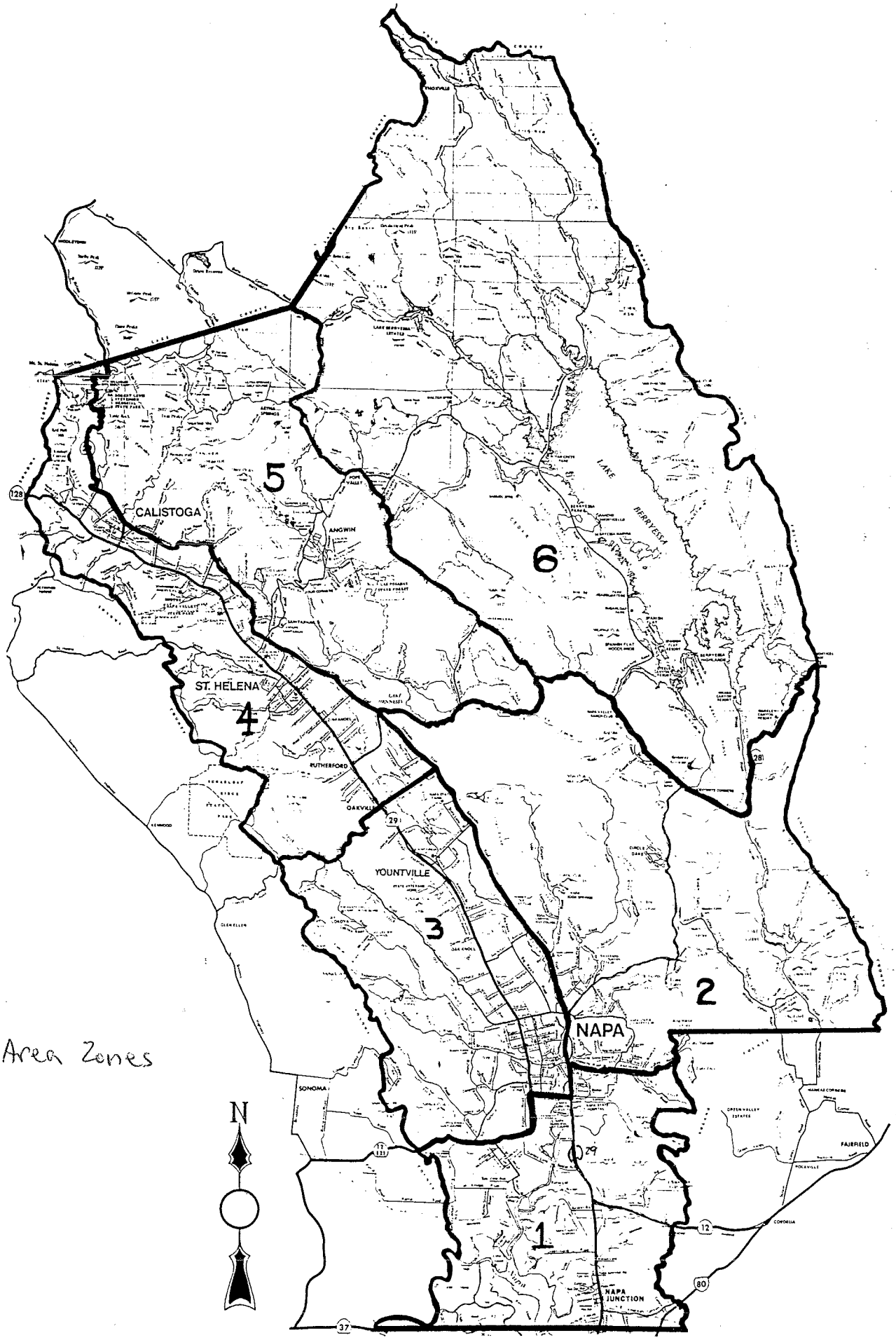
APPENDIX A

DISTRICT BOUNDARIES



Lower Lake
EL. 1370
COLUSA
YOLO
YOLO COUNTY LINE
WHITE RD.
MORGAN VALLEY RD.
MANAGEMENT
CACHE CR. REG. PK.
Rumsey
EL. 425
Seigler Sprs.
Loch Lomond
Hobergs
Pine Grove
Cobb
Adams
Ettawa Sprs.
BOGGS MTN. STATE FOREST
Snows Lk.
GRIZZLY PK. EL. 3005
Davis Cr. Res.
Knoxville
EL. 1263
Dunnigan
EL. 68
Guinda
EL. 355
COBB MTN. EL. 4722
Forest Lake
Harbin Sprs.
Hidden Valley Lake
Putah
McCreary Lake
Amel Lake
BERRYESSA
Zamora
EL. 74
Middletown
EL. 1110
BUTTS
Detert Res.
CANYON
BALDY MTN. EL. 1822
Tancred
EL. 297
Upper Bohn Lake
LAKE
NAPA
Brooks
EL. 300
KNOXVILLE
RIDGE
MT. ST. HELENA EL. 4344
Aetna Sprs.
EL. 798
Capay
EL. 250
Esparto
EL. 190
ROBERT LOUIS STEVENSON ST. PK. (UNDEV)
SUGARLOAF MTN. EL. 2988
BERRYESSA PK. EL. 3057
Madison
EL. 151
Kellogg
EL. 500
Pope Valley
EL. 706
Lake Berryessa
RECREATION AREA
ROCKY RIDGE
Calistoga
EL. 365
Angwin
EL. 1665
PARRETT FIELD AIRPORT
YOLO CO. DAVIS-WOODLAND-WINTERS AIRPORT
Mark West Springs
EL. 439
BOTHE-NAPA VALLEY ST. PK
Deer Pk.
LAS POSADAS STATE FOREST
PARK HQ
Spanish Flat
EL. 600
Lake Hennessey
St. Helena
EL. 255
Winters
EL. 131
SPRING LAKE REG. PK
SUGARLOAF RIDGE ST. PARK
SAGE CANYON
PUTAH CR. RD.
Lk. Ralphine
Spring Lk.
MT. HOOD EL. 2730
Rutherford
EL. 170
ATLAS PK. EL. 2663
Santa Rosa
EL. 164
ANNADEL STATE PARK
BENNETT MTN. EL. 1887
Kenwood
EL. 404
MT. ST. JOHN EL. 2375
Oakville
EL. 150
Allendale
EL. 120
Yountville
EL. 100
Rohnert Park
EL. 102
JACK LONDON ST. HIST PARK
MT VEEDER EL. 2677
MT. VACA EL. 2819
Lake Curry
(NOT OPEN TO THE PUBLIC)
Cotati
EL. 114
SONOMA STATE UNIV.
Glen Ellen
EL. 230
Fetters Hot Springs
EL. 137
NUT TREE AIRPORT
Vacaville
EL. 179
SONOMA MTN. EL. 2295
Boyes Hot Springs
EL. 135
SONOMA STATE HIST. PK.
Penngrove
EL. 31
El Verano
EL. 103
Sonoma
EL. 31
Napa
EL. 17
NAPA SOLANO CO.
Elmira
EL. 70
CALIF MEDICAL FACILITY
PETALUMA MUNICIPAL AIRPORT
PETALUMA ADOBE ST. HIST PK
SONOMA SKY PARK
NAPA STATE HOSPITAL
SKYLINE PARK
Vineburg
EL. 50
Schellville
EL. 12
Rockville
EL. 50
Petaluma
EL. 17
TRAVIS AIR FORCE BASE
JEPSON PRAIRIE PRESERVE
Fairfield
EL. 15
Lakeville
EL. 34
SONOMA VALLEY AIRPORT
NAPA CO AIRPORT
Cuttings Wharf
EL. 6
Suisun City
EL. 6
Cordelia
EL. 18
Denverton
EL. 7
SEARS POINT RACE TRACK
NAPA SONOMA MARSH WILDLIFE AREA
American Canyon
EL. 45
WESTERN RAILROAD MUSEUM
OLOMPALI ST HIST PK
Novato
EL. 17
GNOSS FIELD AIRPORT
RIVER WILDLIFE AREA
COLUMBUS PKWY
GRIZZLY ISLAND WILDLIFE AREA (JOICE IS. UNIT)
Stafford Lk.
SAN PABLO BAY NATL. WILDLIFE REFUGE
CO. FAIRGROUNDS AND MARINE WORLD AFRICA U.S.A.
SONOMA MARIN CO.
SOLANO CO.
Vallejo
MARE ISLAND NAVAL SHIPYARD (INACTIVE)
Grizzly Bay
Birds Ldg.
EL. 58
Nicasio
EL. 190
Bel Marin Keys
EL. 8
Benicia
EL. 33
San Pablo Bay
CONTRA COSTA CO.
Marinwood
EL. 54
HAMILTON FIELD (INACTIVE)
BENICIA ST. REC. AREA
Suisun Bay
Honker Bay
Collinsville
EL. 5
Forest Knolls
Woodacre
EL. 350
Santa Venetia
EL. 12
CHINA CAMP ST. PK.
Rodeo
EL. 16
Crockett
EL. 118
Port Costa
BENICIA CAPITOL S.H.P.
Bay Point
EL. 59
Pittsburg
EL. 26
Lagunitas
EL. 220
San Geronimo
EL. 300
Fairfax
EL. 120
San Rafael
Pinole
EL. 27
Martinez
EL. 16
U.S. NAVAL WEAPONS STATION, CONCORD
San Pablo
Hercules
EL. 47
BUCHANAN FIELD AIRPORT
MARIN MUNICIPAL WATER DISTRICT
San Anselmo
Ross
EL. 23
Kentfield
EL. 45
Larkspur
Greenbrae
El Sobrante
EL. 200
JOHN MUIR NATL. HIST SITE
Pacheco
EL. 25
Concord
EL. 72
Antioch
PT. MOLATE U.S.N. FUEL DEP.



Project Area Zones

APPENDIX B

ENDANGERED AND THREATENED SPECIES IN NAPA COUNTY

Special Status Plants and Animals of Napa County

Common Name	Scientific Name	Status
Plants		
Suisun Marsh Aster	*Aster lentus*	FSC
Clara Hunt's Milk Vetch	*Astragalus clarianus*	FE, ST
San Joaquin SaltBush	*Atriplex joaquiniana*	FSC
Mt St Helena Morning Glory	*Calystegia collina oxyphylla*	FSC
Tiburon Indian Paintbrush	*Castilleja affinis neglecta*	FE, ST
Rincon Ridge Ceanothus	*Ceanothus confusus*	FSC
Calistoga Ceanothus	*Ceanothus divergens*	FSC
Sonoma Ceanothus	*Ceanothus sonomensis*	FSC
Soft Bird's Beak	*Cordylanthus mollis mollis*	FE, SR
Adobe Lily	*Fritillaria pluriflora*	FSC
Two carpellate Western Flax	*Hesperolinon bicarpellatum*	FSC
Brewer's Western Dwarf Flax	*Hesperolinon breweri*	FSC
Drymaria-Like Western Dwarf Flax	*Hesperolinon drymarioides*	FSC
Northern California Black Walnut	*Juglans hindsii*	FSC
Contra Costa Goldfields	*Lasthenia conjugans*	FE
Delta Tule Pea	*Lathyrus jepsonii jepsonii*	FSC
Legenere	*Legenere limosa*	FSC
Mason's lilaeopsis	*Lilaeopsis masonii*	FSC, SR
Sebastopol Meadowfoam	*Limnanthes vinculans*	FE, SE
Hall's Madia	*Madia hallii*	FSC
Few Flowered Navarretia	*Navarretia leucocephala pauciflora*	FE, ST
Calistoga Popcorn Flower	*Plagiobothrys strictus*	FE, ST
Napa Blue Grass	*Poa napensis*	FE, SE
Marin Knotweed	*Polygonium marinense*	FSC
Marin Checkerbloom	*Sidalcea hickmanii viridis*	FSC
Socrates Mine Jewel-Flower	*Streptanthus brachiatus brachiatus*	FSC
Showy Indian Clover	*Trifolium amoenum*	FE
Invertebrates		
California Freshwater Shrimp	*Syncaris pacifica*	FE, SE
Valley Elderberry Longhorn Beetle	*Desmocerus californicus dimorphus*	FT
Vertebrates		
California Red-Legged Frog	*Rana aurora draytonii*	FT
Foothill Yellow-Legged Frog	*Rana boylii*	FSC
Northwestern Pond Turtle	*Clemmys marmorata marmorata*	FSC
Tricolored Blackbird	*Agelaius tricolor*	FSC
Burrowing Owl	*Athene (=Speotyto) canicularia*	FSC
Western Snowy Plover	*Charadrius alexandrinus nivosus*	FT
Saltmarsh Common Yellowthroat	*Gleothypis trichas*	FSC
Bald Eagle	*Haliaeetus leucocephalus*	FT, SE
California Black Rail	*Laterallus jamaicensis coturniculus*	FSC, ST
California Clapper Rail	*Rallus longirostris obsoletus*	FE, SE
Northern Spotted Owl	*Strix occidentalis caurina*	FT
Townsend's Western Big-Eared Bat	*Plecotus townsendii*	FSC
Salt Marsh Harvest Mouse	*Reithrodontomys raviventris raviventris*	FE, SE
Suisun Shrew	*Sorex ornatus sinuosus*	FSC

FE = Federally Endangered **FT = Federally Threatened** **FSC = Feredal Species of Concern**
SE = State Endangered **ST = State Threatened** **SR = State Rare**

APPENDIX C

RELEVANT DISTRICT RESOLUTIONS

RESOLUTION OF THE NAPA COUNTY MOSQUITO ABATEMENT DISTRICT ADOPTING PROCEDURES TO BE USED BY THE DISTRICT IN THE ADMINISTRATION OF ITS RESPONSIBILITIES UNDER THE CALIFORNIA ENVIRONMENTAL QUALITY ACT, AND ADOPTING THE STATE CEQA GUIDELINES BY REFERENCE

RESOLUTION NO. 196

At a meeting of the Board of Trustees of the Napa County Mosquito Abatement District, a special district organized and existing under the laws of the State of California, held on the 14th day of April, 1999, at 964 Imola Avenue, Napa, California, a quorum being present, the following Resolution was adopted:

WHEREAS, the Napa County Mosquito Abatement District (District) is required to adopt procedures for administering its responsibilities under the California Environmental Quality Act (CEQA); and

WHEREAS, the State CEQA Guidelines were amended and revised effective October 26, 1998; and

WHEREAS, the District may meet its requirements by adopting the State CEQA Guidelines (Guidelines) by reference and by further adopting specific procedures needed to tailor the guidelines to the District's operations; and

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF TRUSTEES OF THE NAPA COUNTY MOSQUITO ABATEMENT DISTRICT as follows:

Section 1.

The State CEQA Guidelines, revised as of October 26, 1998, and found in Title 14 Section 15000 et seq. of the California Code of Regulations are hereby adopted and by this reference incorporated into this Resolution as though fully set forth herein.

Section 2.

A. The District has not determined any list of ministerial projects in addition to those set forth in the Guidelines. The Manager of the District may determine what is a ministerial project on a case-by-case basis, which may be followed by District Board determination.

B. The District Board hereby determines that the operation, repair, maintenance or minor alteration of the District's administrative facilities and other District facilities are exempt activities pursuant to CEQA Guidelines Section 15301, so long as such operation, repair, maintenance, or minor alteration involves negligible or no expansion of use beyond that previously existing.

C. The District Board hereby determines that the replacement or reconstruction of existing facilities comprising the District's administrative facilities and other District facilities are exempt activities pursuant to CEQA Guidelines Section 15302, so long as such replacement or reconstruction is for structures or facilities where the new structure or facility will be located on the same site as the old, and will have the same purpose and capacity as the structure or facility replaced.

D. The District Board hereby determines that the construction and location of limited numbers of new, small facilities or structures necessary or advisable for the provision of mosquito and vector control related services, and the installation of small, new equipment and facilities in small structures for the provision of such services are exempt activities pursuant to CEQA Guidelines Section 15303, so long as successive projects consisting of such construction and location or installation of the same type in the same place over time do not result in significant cumulative impact. This exemption shall not apply where a project may impact upon an environmental resource of hazardous or critical concern where designated, precisely mapped and officially adopted pursuant to law by federal, state, or local agencies.

Section 3.

The following delegation of responsibility is made pursuant to Section 15025 of the Guidelines.

The Manager of the district, or his/her designee, shall be responsible for the following functions:

A. Initially determining whether a project is exempt, followed by Board determination regarding exemption.

B. Conducting an initial study and deciding whether to prepare a draft EIR or Negative Declaration.

C. Preparing a Negative Declaration or EIR.

D. Evaluating and preparing responses to comments on environmental documents.

E. Filing of notices.

F. Consulting with and obtaining comments from other public agencies and members of the public, as the Manager or his/her designee deems appropriate and as required by law, with regard to the environmental effects of projects.

G. Providing adequate comments on environmental documents that are submitted to the public agency for review.

H. Administering, monitoring, or reporting programs adopted by the Board related to revisions and mitigation measures required by the Board.

Section 4.

A. The public review period for draft EIR's referred to in Section 15087(e) of the Guidelines shall be 30 days from the date of the notice of availability of draft EIR, except that the Manager may extend that period for an additional 30 days, or for an additional 60 days when he or she determines that the draft EIR is unusually complex or lengthy or that the additional time is necessary to allow the public adequate time to review and comment upon the draft EIR. When a draft EIR is submitted to the State Clearinghouse for review by State agencies, the public review period shall not be less than 45 days, unless a shorter period, not less than 30 days, is approved by the State Clearinghouse. The public review period for Negative Declarations shall be 20 days from the date the Notice of Proposal to Adopt Negative Declaration was first posted, published, or mailed as set forth in the Guidelines or such other period as is provided by law, unless in the cases when Negative Declarations are submitted to the State Clearinghouse for review by State agencies, when the public review period shall be not less than 45 days, unless a shorter period, not less than 30 days, is approved by the State Clearinghouse. In the event a Negative Declaration is substantially revised after public notice of its availability has been given but prior to its adoption, the Negative Declaration shall be recirculated pursuant to the procedures and for the time periods set forth in this Section. The public review period for draft EIR's and Negative Declarations submitted to the State Clearinghouse for review by State agencies shall be at least as long as the review period established by the State Clearinghouse.

B. The Manager may submit written requests for shortened review periods to the State Clearinghouse.

Section 5.

The Manager or his/her designee shall compile a list of public agencies, which have jurisdiction by law and/or special expertise with respect to various projects and project locations (Section 15087(h), Guidelines). Depending upon the specific project and the requirements of law, some or all of the listed agencies must be given the opportunity to review and comment upon a draft EIR.

Section 6.

The District's Board of Trustees shall be responsible for determining the adequacy of an EIR or Negative Declaration.

Section 7.

To the extent a District website is available, notices of availability of draft EIR's, notices of intent to adopt Negative Declarations, and notices of public meetings or hearings where an EIR,

Negative Declaration, or Notice of Exemption may be acted upon shall be posted on such website.

Section 8.

This Resolution is intended to govern certain procedures pursuant to which the District will prepare, process, and review environmental determinations required by CEQA. CEQA and the Guidelines will govern all substantive issues related to environmental determinations, and procedures not addressed by this Resolution. Where the contents of the Resolution conflict with CEQA or the Guidelines, CEQA or the Guidelines shall control.

I, STEVEN ROSA, the undersigned Secretary of the said Board of Trustees of the Napa County Mosquito Abatement District, a special district, hereby certify that I am the Secretary of said special district, the foregoing is a full, true and correct copy of the Resolution passed by the Board of Trustees thereof at a meeting of said Board held on the day and at the place therein specified, and that said Resolution has never been revoked, rescinded or set aside, and is now in full force and effect.

PASSED AND ADOPTED by the Board of Trustees of the Napa County Mosquito Abatement District April 14, 1999, by the following vote.

AYES: BAILEY, CABRAL, FLINDY, JOHNSON, ROSA, SOMPLE

NOES: NONE

ABSENT: NONE

ABSTAIN: NONE

Steven Rosa

Steven Rosa, Secretary, Board of Trustees

The Board of Trustees of the Napa County Mosquito Abatement District, in order to comply with provision of Sections 21000 through 21174, California Public Resources Code, hereby sets forth procedures it will use to apply the California environmental Quality Act of 1970, consistent with provisions of Sections 15000 through 15166, California Administrative Code.

1. Definitions.
   a. District means the Napa County Mosquito Abatement District.
   b. Vector means any insect or other animal capable of transmitting human disease or causing human annoyance.
   c. Jurisdiction means within the boundaries of the District or in proximity close enough so that vectors produced outside of the District may affect people within the District.
2. Preparation of environmental impact reports by the District.
   a. Abatement procedures, notices and directions to prevent the recurrence of vector production within the jurisdiction of the District are categorically exempt from the need for environmental impact reports under Section 15108, California Administrative Code.
   b. Routine rearing, transporting, and stocking of the mosquito fish, Gambusia affinis, or similar species within the jurisdiction of the District is categorically exempt from the need for an environmental impact report under Section 15101, California Administrative Code.
   c. Routine pesticide use within the jurisdiction of the Distric under cooperative agreement with the California Department of Health is categorically exempt from the need for an environmental impact report under Section 15108, California Administrative Code.
   d. Physical change in land or water management systems to mitigate vector production within the jurisdiction of the District is categorically exempt from the need for an environmental impact report if the proposed project meets the criteria enunciated in Section 15104 or other sections of the California Administrative Code. If the project does not meet the stated criteria the District

will prepare or cause to be prepared an environmental impact report or a negative declaration and will comply with preparation, review and filing procedures as set forth in Sections 15083 through 15166, California Administrative Code.

3. Review by the District of environmental impact reports prepared by other public agencies.
   a. The District is empowered by law and possesses special expertise in specific fields, and therefore asserts that, consistent with Section 15161, California Administrative Code, it is to receive for review environmental impact reports prepared by other public agencies if the proposed projects may affect production of vectors within the jurisdiction of the District.
4. The foregoing statements may be amended by motion of the Board of Trustees of the District.
5. The foregoing statements are adopted by motion of the Board of Trustees of the Napa County Mosquito Abatement District on March 14, 1973.

APPENDIX D

DISTRICT TREATMENT AND EQUIPMENT CRITERIA

LARVAL SOURCE TREATMENT CRITERIA

SPECIES	DISTANCE TO POPULATED AREA	TOTAL L/P DENSITY OTHER FACTORS
Ae. dorsalis	0 yards – 5 miles	1 per 10 dips and source ¼ acre or more
Ae. sierrensis	0 – 500 yards	1 per "slurp" with turkey baster
Ae. squamiger	0 – 5 miles	1 per 10 dips and source ¼ acre or more
Ae. washinoi	0 – 500 yards 500 yards – 1 mile	1 per 10 dips 1 per dip and source ¼ acre or more
Cx. erythrothorax	0 – 500 yards	1 per dip
Cx. pipiens	100 – 500 yards 500 yards – 1 mile	1 per 10 dips 5 per dip and source ¼ acre or more
Cx. stignatosoma	0 – 100 yards	1 per 10 dips
Cx. tarsalis	0 – 500 yards 500 yards – 1 mile 1 mile – 2 miles	1 per 10 dips 1 per dip 5+ per dip and source ¼ acre or more
Cs. Incidens	0 – 500 yards 500 yards – 1 mile	1 per dip 10 per dip and source ½ acre or more
Cs. Inornata	500 yards – 1 mile	3 – 5 per dip

NAPA COUNTY MOSQUITO ABATEMENT DISTRICT

PESTICIDE USE CRITERIA

CONDITIONS	OIL	LIQUIDS		GRANULES			FISH
		ALTOSID	BTI	B.S.	ALTOSID	BTI	
Water Temperature less than 65°F	X		X	X		X	
Water Temperature more than 65°F							
Larval Instar 1st – 2nd		X			X		
Larval Instar 4th – pupae			X	X		X	
Fresh Water							
Brackish Water			X			X	*
Low Organic Load							
High Organic Load		X	X		X	X	*
Emergent Vegetation less than 50%							
Emergent Vegetation more than 50%	X	X	X				
Predators Not Abundant							
Predators Abundant	X						**
Endangered Species Absent							
Endangered Species Present		X			X		**

X= DO NOT USE
* need to acclimate fish
** have biologist evaluate before stocking

B.S. = Bacillus sphaericus

ceqapesticide.tbl

EQUIPMENT CRITERIA

ITEM	CRITERIA FOR TREATMENT USE
Argo with boom	2 acres or more Non-driveable terrain Light to moderately dense vegetation Foot access hazardous (e.g. cracks, etc)
Argo with granulator	1 acre or more Non-driveable terrain Moderate to very thick vegetation
Argo with hose reel	1 acre or more Not accessible by 4x4 with hose reel Spray gun sufficient to treat target area
4x4 with boom	.25 acre or more Driveable terrain Water depth 8 inches or less Sparse to moderate vegetation
4x4 with hose reel (200' hose)	.25 acre to 5 acres Non-driveable terrain but accessible by hose Foot access safe Sparse to moderate vegetation
Polaris ATV with boom	.5 acre to 15 acres Unaccessible by full size 4x4 Treatment does not entail crossing ditches or hazardous terrain Light to moderate vegetation Water depth less than 10 inches
Polaris ATV with power sprayer	Channel over 1,000 yards with access along side Pond .5 acre to 3.5 acres Unaccessible by full size 4x4 Light to moderate vegetation Water depth less than 10 inches Off all public roads
ATV bridges with Argo or Polaris	To be used with the ATV's to cross ditches in the marshes or pastures
Leco, hand-held	Less than 10 acres Foot access Wind less than 8 miles per hour
Leco, with Argo	Less than 10 acres No 4x4 access Wind more than 2 miles per hr. & less than 8 miles per hr.
Leco or Microgen with 4x4	Less than 10 acres Vehicle access Wind more than 2 miles per hr. & less than 8 miles per hr.
Leco, with Polaris	Less than 5 acres Driveable terrain No access by 4x4
Backpack Blower	Walkable terrain Dense vegetation

ceqaequipcriteria

AERIAL TREATMENT CRITERIA

Aerial control measures to control immature mosquitoes may be instituted when one or more of the following conditions exist:

The area to be treated is inaccessible by conventional ground control methods and fits our treatment criteria

OR

The acreage and conditions are excessive and/or extreme enough to be cost effective to treat by air and fits our treatment criteria

OR

An urgent situation exists where timing is critical or the number of support vehicles are limited because of existing jobs

All aerial treatments must be approved and ordered by a supervisor.

If conditions fit the Aerial Treatment criteria, the operator must supply the supervisor with the following:

1. Thomas Brothers map coordinates.

2. Source number(s) if available.

3. Physical map of target area for pilot, including:
   a. Date of request.
   b. Maximum number of days pilot has to be able to treat the larval population effectively.
   c. Material.
   d. Rate of application.
   e. Acreage to be treated drawn in and marked in red (see example).

4. Written description of location of source.

APPENDIX E

MOSQUITOFISH STOCKING PROTOCOLS

Mosquitofish Stocking Policy

In an effort to minimize unwanted environmental impacts mosquitofish are not placed in sources known or thought to be habitats for endangered, threatened or rare species. Care must be taken when introducing mosquitofish into sources where they can migrate to habitats used by endangered, threatened or rare species. Mosquitofish can still be used in ornamental fish ponds, water gardens and abandoned swimming pools in urban and suburban areas without worrying about endangered species conflicts.

It is against California Department of Fish and Game regulations for private citizens to plant mosquitofish in waters of the State without a permit (Title 14 CCR, Fish and Game Code, Sections 1.63, 238.5 and 6400).

Mosquitofish provided by Napa County Mosquito Abatement District are intended for mosquito control purposes only and should not be introduced in potential mosquito breeding sources by anyone other than certified mosquito control technicians or Fish and Game personnel.

APPENDIX F

PUBLIC HEALTH AND SAFETY CODE, SECTIONS 2200 - 2360

CALIFORNIA HEALTH AND SAFETY CODE

DIVISION 3. PEST ABATEMENT

CHAPTER 5. MOSQUITO ABATEMENT DISTRICTS OR VECTOR CONTROL DISTRICTS

Article 1. General Provisions

§ 2200. Except where the context otherwise requires, the following definitions shall govern construction of this chapter:

(a) "Board" or "district board" refers to the board of trustees of a district.

(b) "City" includes a city and county.

(c) "District" refers to any mosquito abatement district or vector control district formed pursuant to this chapter or pursuant to any law which it supersedes.

(d) "Property" includes water, and the person or agency claiming ownership, title or right to water or who controls the diversion, delivery, conveyance, or flow of water is responsible for abatement of public nuisances, as specified in this chapter or Chapter 8 (commencing with Section 2800), which are caused by or as a result of diversion, delivery, conveyance or control.

(e) "Public nuisance" means any of the following:

(1) (A) Any breeding place for mosquitoes, flies, or other vectors of public health importance which exists by reason of any use made of the land on which it is found, or of any artificial change in its natural condition. Presence of immature arthropods of public health importance shall constitute prima facie evidence that a place is a breeding place for arthropods.

(B) If the board determines that an agricultural operation is growing or processing crops or raising fowl or animals in a manner consistent with proper and accepted practices and standards, as established and followed by similar agricultural operations in the same locality, and employing measures for fly control, for manure management, removal, and disposal, and for disposal of agricultural crop waste, which prevent excessive domestic fly larval development and excessive adult fly emergence on the property, then that place shall not be deemed a public nuisance.

(C) As used in this paragraph, "excessive" means the presence of domestic flies associated with agricultural operations, which do all of the following:

(i) Occur in immature stages and as adults in numbers considerably in excess of those found in the surrounding environment.

(ii) Are associated with the design, layout, and management of agricultural operations.

(iii) Disseminate widely from the property.

(iv) Cause detrimental effects on the public health and well-being of a majority of the surrounding population, as determined by the board.

(2) Water which is a breeding place for mosquitoes, flies, or other arthropods of public health importance.

(3) The presence of rodents or evidence of rodent activity, such as rodent droppings, trails, or evidence of feeding activity.

(f) "Vector" means any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal.

§ 2201. (a) Every notice required by this chapter to be published shall be published in a daily, weekly, or semiweekly newspaper. If there is no daily, weekly, or semiweekly newspaper published within the district or within a subdivision of the district or other territory in which it is required to be published, legal notice shall be posted for the length of time required for its publication in three public places of the district, subdivision, or other territory, as the case may be.

(b) A district may be organized and managed as provided in this chapter, and is authorized to exercise the powers expressly granted or necessarily implied by this chapter.

(c) No district formed or proposed to be formed under this chapter shall be subject to the District Investigation Law of 1933 provided for in Chapter 2 (commencing with Section 58500) of Division 2 of Title 6 of the Government Code.

§ 2202. (a) Except as otherwise provided in subdivision (b), every mosquito abatement district or vector control district employee who handles, applies, or supervises the use of any pesticide for public health purposes, shall be certified by the state department as a vector control technician, in at least one of the following categories commensurate with the assigned duties:

(1) Mosquito control.

(2) Terrestrial invertebrate vector control.

(3) Vertebrate vector control.

(b) The state department may establish, by regulation, exemptions from the requirements of this section which are deemed reasonably necessary to further the purposes of this section.

(c) The state department shall establish by regulation minimum standards for continuing education for any government agency employee certified under Section 116110 and regulations adopted pursuant thereto, who handles, applies, or supervises the use of any pesticide for public health purposes.

(d) An official record of the completed continuing education units shall be maintained by the state department. If a certified technician fails to meet the requirements set forth

under subdivision (c), the state department shall suspend the technician's certificate or certificates and immediately notify the technician and the employing district. The state department shall establish by regulation procedures for reinstating a suspended certificate.

(e) The state department shall charge and collect a nonreturnable renewal fee of twenty-five dollars ($25) to be paid by each continuing education certificant on or before the first day of July, or on any other date which is determined by the state department. Each person employed in a position on the effective date of this section which requires certification shall first pay the annual fee the first day of the first July following that date. All new certificants shall first pay the annual fee the first day of the first July following their certification.

(f) The state department shall collect and account for all money received pursuant to this section and shall deposit it in the Mosquitoborne Disease Surveillance Account provided for in Section 25852 of the Government Code. Notwithstanding Section 25852 of the Government Code, fees deposited in the Mosquitoborne Disease Surveillance Account pursuant to this section shall be available for expenditure upon the appropriation by the Legislature to implement this section.

(g) Fees collected pursuant to this section shall be subject to the annual fee increase provisions of Section 110425.

Article 2. Formation

§ 2210. Any territory in one or more counties, having a population of not less than one hundred inhabitants, may be organized as a district.

§ 2211. A petition to form a district may consist of any number of separate instruments. It shall be presented at a regular meeting of the board of supervisors of the county in which the greater portion of the proposed district is located. The petition shall be signed by registered voters residing in the proposed district equal in number to 10 percent of the votes cast for Governor at the last preceding gubernatorial election.

Before a city can be included in the proposed district, its governing body shall request the inclusion of the city by resolution, duly authenticated.

§ 2212. The petition shall set forth and describe the boundaries of the proposed district, and shall request that it be organized as a mosquito abatement district or vector control district. The text of the petition shall state the basis on which the property in the district shall be taxed or assessed for district purposes. The petition may include a plan for zones of benefit or any

other proposal which would provide equity in financing the district's purposes. The petition shall be published, for at least two weeks before the time it is to be presented, in the county where the petition is presented, and in each city a portion of which is included in the proposed district.

§ 2213. If any portion of the proposed district lies in another county, the petition and notice shall be likewise published in that county.

§ 2214. When signatures are contained upon more than one instrument, only one copy of the petition need be published. No more than five of the names attached to the petition need appear in the publication of the petition and notice, but the number of signers shall be stated.

§ 2215. The publication of the petition shall include a notice of the time and place of the meeting of the board of supervisors when the petition will be considered, stating that all persons interested may appear and be heard.

§ 2215.5. The districts may also be organized upon the adoption by the board of supervisors of a resolution of intention so to do, in lieu of the procedure provided by this article for the presentation of petitions. In the event the board of supervisors adopts a resolution of intention, the resolution shall follow the procedures established in Sections 2212 and 2215.

§ 2216. At the time stated in the notice of the filing of the petition or the time mentioned in the resolution of intention the board of supervisors shall consider the organization of the district and hear those appearing and all protests and objections to it. It may adjourn the hearing from time to time, not exceeding two months in all.

§ 2217. No defect in the contents of the petition or in the title to or form of the notice or signatures, or lack of signatures thereto, shall vitiate any proceedings, if the petition has a sufficient number of qualified signatures.

§ 2218. On the final hearing the board of supervisors shall make such changes in the proposed boundaries as are advisable, and shall define and establish the boundaries.

§ 2219. If the board of supervisors deems it proper to include any territory not proposed for inclusion within the proposed boundaries, it shall first cause notice of its intention to do so to be mailed to each owner of land in the territory whose name appears as owner on the last completed assessment roll of the county in which the territory lies, addressed to the owner at his

address given on the assessment roll, or if no address is given, to his last known address; or if it is not known, at the county seat of the county in which his land lies. The notice shall describe the territory, and shall fix a time, not less than two weeks from the date of mailing, when all persons interested may appear before the board of supervisors and be heard.

§ 2220. The boundaries of a district lying in a city shall not be altered unless the governing board of the city, by resolution, consents to the alteration.

§ 2221. Upon the hearing of the petition the board of supervisors shall determine whether or not the public necessity or welfare of the proposed territory and of its inhabitants requires the formation of the district, and shall also determine whether or not the petition complies with the provisions of this chapter, and for that purpose shall hear all competent and relevant testimony offered.

§ 2222. A finding of the board of supervisors in favor of the genuineness and sufficiency of the petition and notice is final and conclusive against all persons except the State in a suit commenced by the Attorney General.

§ 2223. If, from the testimony given before the board of supervisors, it appears to that board that the public necessity or welfare requires the formation of the district, it shall, by an order entered on its minutes, declare that to be its finding, and shall further declare and order that the territory within the boundaries so fixed and determined be organized as a district, under an appropriate name to be selected by the board of supervisors. The name shall contain the words "mosquito abatement district" or "vector control district."

§ 2224. The county clerk shall immediately file for record in the office of the county recorder of each county in which any portion of the land embraced in the district is situated, and shall also forward to each board of supervisors of each of the other counties, if any, in which any portion of the district is situated, and also shall file with the Secretary of State, a certified copy of the order of the board of supervisors. From and after the date of the filing of the certified copy with the Secretary of State, the district named therein is organized as a district, with all the rights, privileges, and powers set forth in this chapter, or necessarily incident thereto.

§ 2225. If at any time after the board of supervisors has entered its order for organization good cause appears therefor, the district board may, by a two-thirds vote of its members, adopt a resolution reciting the facts, declaring the advisability

for a change of the district's name, and setting forth therein a new name for the district. A certified copy of such resolution shall be transmitted to the board of supervisors of the county in which the district, or the greater portion of the land of the district, is situated.

§ 2226. Upon receipt of the certified copy of the resolution the board of supervisors shall:

(a) Enter an order changing the district's name to the name set forth in the resolution.

(b) Transmit a certified copy of the order to the board of supervisors of any other county in which any portion of the district is situated.

(c) Record a certified copy of the order in the office of the county recorder of each of the counties in which any portion of the district is situated.

(d) File a certified copy of the order in the office of the Secretary of State.

(e) File a certified copy of the order in the office of the State Board of Equalization.

From and after the date of the filing of the certified copy with the Secretary of State the new name shall be the official name of the district.

Article 3. Officers

§ 2240. Within 30 days after the filing with the Secretary of State of the certified copy of the order of formation, a governing board of trustees for the district shall be appointed. The district board shall be appointed as follows:

(a) If the district is situated in one county only and consists wholly of unincorporated territory, five members shall be appointed by the board of supervisors of the county.

(b) If the district is situated entirely in one county and includes both incorporated and unincorporated territory, one member may be appointed from the district at large by the board of supervisors of the county, and one member may be appointed from each city, the whole or part of which is situated in the district, by the governing body of the city. If the district board created consists of less than five members, the board of supervisors shall appoint from the district at large enough additional members to make a board of five members.

(c) If the district is situated in two or more counties and is comprised wholly of unincorporated territory, one member shall be appointed from each county or portion of a county situated in the district by the board of supervisors. If the district board created consists of less than five members, the board of supervisors of the county in which the greater portion of the district is situated shall appoint from the district at large

enough additional members to make a board of five members.

(d) If the district is situated in two or more counties and consists of both incorporated and unincorporated territory, one member may be appointed by the board of supervisors of each of the counties from that portion of the district lying within its jurisdiction, and one member may be appointed from each city, a portion of which is situated in the district, by the governing body of the city. If the board created consists of less than five members, the board of supervisors in which the greater portion of the district is situated shall appoint from the district at large enough additional members to make a board of five members.

(e) At any time after the appointment of the initial district
board of trustees, the board of supervisors of any county having territory in whole or in part in a district, may at the written request of the existing district board of trustees, increase or decrease the number of members of the board of trustees representing unincorporated territory in the district. The written request of the district board of trustees shall specify the number of members and the region or regions in the unincorporated territory for which an increase or decrease is requested. However, the district board of trustees shall, under no circumstances, consist of less than five members, nor shall the number of members representing unincorporated territory in the entire district exceed five members.

§ 2241. The district board shall be called "The board of trustees of _____ mosquito abatement district" or "The board of trustees of _____ vector control district."

§ 2242. Each member of the board appointed by the governing body of a city shall be an elector of the city from which he is appointed, and a resident of that portion of the city which is in the district.

§ 2243. Each member appointed from a county or portion of a county shall be an elector of the county and a resident of that portion of the country which is in the district.

§ 2244. Each member appointed at large shall be an elector of the district.

§ 2245. (a) The members of the first board in any district shall classify themselves by lot at their first meeting so that either of the following shall occur:

(1) If the total membership is an even number, the terms of one-half the members shall expire at the end of one year, and the terms of the remainder at the end of two years, from the second

day of the calendar year next succeeding their appointment.

(2) If the total membership is an odd number, the terms of a bare majority of the members shall expire at the end of one year, and the terms of the remainder at the end of two years, from the second day of the calendar year next succeeding their appointment.

(b) The term of each subsequent member shall be two years from and after the expiration of the term of his predecessor.

(c) The first term of any member shall not exceed two years. Each subsequent consecutive reappointment, if any, may be for a term of two or four years, at the discretion of the appointing power.

§ 2246. In the event of the resignation, death, or disability of any member, his successor shall be appointed by the governing body which appointed him.

§ 2247. The members of the first district board shall meet on the first Monday subsequent to 30 days after the filing with the Secretary of State of the certificate of incorporation of the district. They shall organize by the election of one of their members as president and one as secretary.

§ 2248. The members of the district board shall serve without compensation, but the necessary expenses of each member for actual traveling in connection with meetings or business of the board shall be allowed and paid. In lieu of expenses, the district board may by resolution provide for the allowance and payment to the members of the board of a sum not exceeding fifty dollars ($50) per month per member for expenses incurred in attending business meetings of the board.

§ 2249. The secretary shall receive such compensation as shall be fixed by the district board.

§ 2250. The district board shall provide for the time and place of holding its regular meetings, and the manner of calling them, and shall establish rules for its proceedings.

§ 2251. Special meetings may be called by three members, notice of which shall be given to each member at least three hours before the meeting.

§ 2252. All of its sessions, whether regular or special, shall be open to the public.

§ 2253. A majority of the members shall constitute a quorum for the transaction of business.

Article 4. District Powers

§ 2270. The district board may do all of the following:

(a) Take all necessary or proper steps for the control of mosquitoes, flies, or other vectors, either in the district or in territory not in the district but so situated with respect to the district that mosquitoes, flies, or other vectors may disperse from the territory into the district.

(b) Abate as nuisances all standing water and other breeding places for mosquitoes, flies, or other vectors, either in the district or in territory not in the district but so situated with respect to the district that mosquitoes, flies, or other vectors from the territory disperse into the district.

(c) Purchase the supplies and materials, employ the personnel and contract for the services which may be necessary or proper in furtherance of the objects of this chapter.

(d) If necessary or proper in the furtherance of the objects of this chapter, build, construct, repair, and maintain the necessary dikes, levees, cuts, canals, or ditches upon any land and acquire by purchase, condemnation, or by other lawful means, in the name of the district, any lands, rights-of-way, easements, property, or material necessary for any of those purposes.

(e) Make contracts to indemnify or compensate any owner of land or other property for any injury or damage necessarily caused by the use or taking of property for dikes, levees, cuts, canals, or ditches.

(f) Enter upon any property without hinderance or notice, either within the district or so reasonably adjacent thereto that vectors may disperse into the district, for any of the following purposes:

(1) To inspect to ascertain the presence of vectors or their breeding places.

(2) To abate public nuisances in accordance with this article, either directly or by giving notice to the property owner to abate a nuisance.

(3) To ascertain if a notice to abate vectors has been complied with.

(4) To treat property with appropriate physical, chemical, or biological control measures.

(g) Sell or lease any service, land, rights-of-way, easements, property or material acquired by the district. Equivalent properties may be exchanged, if it is in the best interests of the district to do so.

(h) Borrow money in any fiscal year and repay it in the same or in the next ensuing fiscal year. The amount borrowed in any fiscal year shall not exceed fifteen cents ($0.15) on each one hundred dollars ($100) of assessed valuation of property in the district.

(i) Issue warrants payable at the time stated in the warrant to evidence the obligation to repay money borrowed or any other obligation incurred by the district. Warrants so issued shall

draw interest at a rate fixed by the board not to exceed 5 percent per year, payable annually or semiannually as the board may prescribe.

(j) Provide a civil service system for any or all employees of the district.

(k) Assess civil penalties, as determined in the discretion of the board, but not to exceed five hundred dollars ($500) per day for each day that a notice or hearing order to abate a nuisance has not been complied with.

Any sum which may be collected shall become part of the district's general fund to be used solely for vector control purposes.

(*l*) Levy, by resolution or ordinance, a service charge against any or all parcels of land within the district to pay for the cost of vector surveillance and control. The schedule of charges shall be made, reviewed, and adopted annually after notice and hearing in connection with the schedule. Following the hearing, the board may classify parcels of property according to their use in relation to the cost of vector surveillance and control. The board may bill for the charges annually or more frequently. The charges shall be collected and paid by the county in the same manner as property taxes by the county. The service charge shall be reasonably related to the district's cost for providing vector surveillance and control and shall not be deemed a tax of any kind. Any sum collected shall be used solely for purposes of vector surveillance and control.

(m) Set the tax or assessment rates which are necessary to carry out the purposes of this article.

(n) Do any and all things necessary for, or incident to, the powers granted by, and to carry out the objects specified in, this chapter.

§ 2272. Except as otherwise provided in Section 2272.5, a public nuisance may be abated in any action or proceeding by any remedy provided by this chapter or any other provision of law.

§ 2272.5. Section 2272 shall not apply to a public nuisance which exists at an agricultural operation by reason of excessive domestic fly larval development and excessive adult fly emergence as defined in subparagraph (C) of paragraph (1) of subdivision (e) of Section 2200. An agricultural nuisance described in this section may be abated in any action or proceeding only by the remedies provided by this chapter. This chapter shall provide the exclusive source of costs and civil penalties which may be assessed by reason of the agricultural nuisance against the owner or operator of an agricultural operation at which the nuisance is found to exist.

§ 2273. The procedures for abatement of nuisances and assessment of the cost thereof as a lien against properties, as provided for pest abatement districts in Chapter 8 (commencing with Section

2800) of this division, may be utilized by the district board as an alternative to the abatement procedures set forth in this chapter.

§ 2274. Whenever a nuisance specified in this chapter exists upon any property, either in the district or in territory not in the district but so situated with respect to the district that mosquitoes, flies, or other vectors from the territory disperse into the district, the district board may notify in writing the owner or party in possession, or the agent of either, of the existence of the nuisance.

§ 2275. The notice shall do all of the following:

(a) State the finding of the district that a public nuisance exists on the property and the location of the nuisance on the property.

(b) Direct the owner or party in possession to take appropriate steps to eliminate, or prevent the recurrence of, the nuisance.

(c) Inform the owner or party in possession that failure to comply with the requirements of subdivision (b) shall subject the owner or party in possession to civil penalties of not more than five hundred dollars ($500) per day for each day the nuisance continues after the time specified for the abatement of the nuisance in the notice.

(d) Inform the owner or party in possession that before complying with the requirements of the notice, the owner or party in possession may appear at a hearing before the district board at a time and place stated in the notice.

§ 2277. The notice shall be served upon the owner of record, or person having charge or possession, of the property upon which the nuisance exists, or upon the agent of either.

§ 2278. The notice may be served by any person authorized by the district board in the same manner as a summons in a civil action, or it may be served by registered mail or personal delivery with proof of service.

§ 2279. If the property belongs to a person who is not a resident of the district, and is not in charge or possession of any person, and there is no tenant or agent of the owner upon whom service can be made, who can after diligent search be found; or if the owner of the property can not after diligent search be found, the notice may be served by posting a copy in a conspicuous place upon the property for a period of 10 days, and by mailing a copy to the owner addressed to his address as given on the last completed assessment roll of the county in which the property is situated, or, in the absence of an address on the roll, to his last known address.

§ 2280. Before complying with the requirements of the notice the owner or party in possession may appear at a hearing before the board at a time and place fixed by the board and stated in the notice. At the hearing the district board shall determine whether the initial findings a set forth in the notice is correct and shall permit the owner or party in possession to present testimony in his behalf. If, after hearing all the facts, the board makes a determination that a nuisance exists on the property, the board shall order compliance with the requirements of the notice or with alternate instructions issued by the board.

Any failure to comply with any order of the board issued pursuant to this section shall subject the owner or party in possession to civil penalties as determined by the discretion of the board which shall not exceed five hundred dollars ($500) per day for each day such order is not complied with.

§ 2280.1. Any judicial review of administrative procedure provided for in this chapter shall be pursuant to Section 1094.5 of the Code of Civil Procedure.

§ 2281. Any recurrence of the nuisance may be deemed to be a continuation of the original nuisance.

§ 2282. In the event that the nuisance is not abated within the time specified in the notice or at the hearing, the district board may abate the nuisance by destroying the larvae or pupae and by taking appropriate measures to prevent the recurrence of further breeding.

§ 2283. All or part of the cost of abatement of a nuisance shall be repaid to the district by the owner of the property, as determined by the district board. However, the owner shall not be required to pay the cost unless, either prior or subsequent to the abatement by the district, a hearing is held by the district board, the property owner is afforded an opportunity to be heard, and it is determined by the district board that a nuisance actually exists, or existed prior to abatement by the district. The district board may use a civil penalty assessment in lieu of charging for actual costs to abate the nuisance, or it may include reasonable costs for abatement as part of a civil penalty assessment.

§ 2283.5. When any nuisance specified in this chapter is found to exist on any property subject to the control of any state or local agency, the district shall notify the state or local agency of the existence of the nuisance. Sections 2275, 2277, 2278, 2280, 2281, and 2282 shall govern the contents of the notice and the manner of serving it, the right of the state or local agency to a hearing before the board, the hearing before the board, and the power of the district to abate the nuisance if it is not abated by the state or local agency. If the state or local agency determines that the order to prevent recurrence of the breeding specified in the notice to abate the nuisance is excessive or inappropriate for the intended use of the land, or if the state or local agency determines that a nuisance, as specified in Section 2200, does not exist, the agency may appeal the decision of the board to the State Director of Health Services within 10 days subsequent to the hearing. The director shall decide the matters on appeal and convey his or her decision to the agency and district within 30 days of the receipt of the appeal. The decision of the director shall be final and conclusive. If the control of the nuisance is performed by the district, the cost for the control is a charge against, and shall be paid from, the maintenance fund or from other funds for the support of the state or local agency.

Any state or local agency and a district may enter into contractual agreements to provide control of nuisances as defined in this chapter. The authority which is granted by this paragraph is in addition to any other authority which a state agency and a district may have to enter into contractual agreements for the control of vectors.

As used in this section, "state agency" means an agency specified in Section 11000 of the Government Code, and "local agency" means a city, county, city and county, district, or other public corporation.

§ 2284. Upon the failure of the property owner or person in possession to pay the cost to the district for all sums expended by the district in abating a nuisance or preventing its recurrence and all civil penalties, the costs shall become a lien

upon the property on which the nuisance is abated, or its recurrence prevented, when notice of the lien is filed and recorded as provided in Section 2285. However, if the property has been conveyed prior to the recordation of the lien, the lien shall not attach to the real property, but shall remain the debt of the person who owned the land at the time the costs were incurred, and the debt may be recovered in a civil action by the district board against the debtor.

§ 2285. Notice of the lien, particularly identifying the property on which the nuisance was abated and the amount of such lien, and naming the owner of record of such property, shall be recorded by the district board in the office of the county recorder of the county in which the property is situated within one year after the first item of expenditure by the board or within 90 days after the completion of the work, whichever first occurs. Upon such recordation, such lien shall have the same force, effect and priority as if it had been a judgment lien imposed upon real property which was not exempt from execution, except that it shall attach only to the property described in such notice, and shall continue for 10 years from the time of the recording of such notice unless sooner released or otherwise discharged.

§ 2285.5. The district board may at any time release all or any portion of the property subject to a lien imposed pursuant to Sections 2284 and 2285 from the lien or subordinate such a lien to other liens and encumbrances if it determines that the amount owed is sufficiently secured by a lien on other property or that the release or subordination of such lien will not jeopardize the collection of such amount owed. A certificate by the board, or its designee, to the effect that any property has been released from such lien or that such lien has been subordinated to other liens and encumbrances shall be conclusive evidence that the property has been released or that the lien has been subordinated as provided in such certificate.

§ 2286. An action to foreclose the lien shall be commenced within six months after the filing and recording of the notice of lien.

§ 2287. The action shall be brought by the district board in the name of the district.

§ 2288. When the property is sold, enough of the proceeds to satisfy the lien and the costs of foreclosure shall be paid to the district; and the surplus, if any, shall be paid to the owner of the property if known, and if not known, shall be paid into the court in which the lien was foreclosed for the use of the owner when ascertained.

§ 2289. The lien provisions of this chapter do not apply to the property of any county, city, district, or other public corporation. However, the governing body of the county, city, district, or other public corporation shall repay to any district the amount expended by the district upon any of its property under this chapter upon presentation by the district board of a verified claim or bill.

§ 2290. Any district organized on or after August 14, 1931, and any such district organized prior to that date that elects to do so by a vote taken at an election called and conducted as provided for an election for a tax to raise additional funds for the district, may provide for the destruction and extermination of rats in the district; and may include suitable sums for that purpose in its expense estimates, which shall be raised in the manner provided by law for the raising of other sums for the district.

The district board shall supervise and manage the destruction and extermination of rats in the district by the officers, agents, and employees of the district.

§ 2290.5. Any district may also abate as a nuisance any infestation of rats either by court proceeding or by administrative action and may collect the costs thereof in the same manner provided for the abatement of breeding places for mosquitoes, flies, and other insects.

§ 2291. Any district may conduct vector surveillance and control projects for any part of the district.

§ 2291.1. The district board shall determine which of the projects authorized by Section 2291 shall be carried out and shall determine, as to each project, that it is one of the following:

(a) For the common benefit of the district as a whole.

(b) For the benefit of two or more zones, which may be referred to as participating zones.

(c) For the benefit of a single zone.

§ 2291.2. (a)(1) The district board may institute projects for one or more zones, for the financing and execution of vector surveillance and control projects of common benefit to the zone or zones.

(2) Before beginning a project, the district board shall adopt a resolution which shall specify its intention to undertake the project, estimate the cost to be borne by the zones, state the duration of the assessment, state the general objectives of the surveillance or control project, and fix a time and place for a public hearing and a public meeting on the project. In the

case of more than one zone, the resolution shall specify the proportionate cost to be borne by each of the zones.

(3) Notice of the public meeting and the public hearing shall be given pursuant to Section 54954.6 of the Government Code [within Chapter 9 of Part 1 of Division 2 of Title 5; see also "Ralph M. Brown Act"].

(b) At any time before the time set for the hearing, any owner of any property which is proposed to be assessed may make written protest against the proposed project and assessment. The written protest shall contain a description of the property sufficient to identify the property. If the signer is not shown on the last equalized assessment roll as the owner of that property, the written protest shall contain written evidence that the signer is an owner of the property proposed to be assessed.

(c) At the time and place stated in the notice for the public meeting and the public hearing, the district board shall hear and consider any objections and protests to the proposed project and assessments.

The district board may continue the public meeting and the public hearing from time to time. Any written protest may be withdrawn in writing by the person making the protest at any time before the conclusion of the hearing.

(d) Following the conclusion of the hearing, if the district board finds that the written protests filed and not withdrawn represent 50 percent or more of the total amount of expected revenue from the proposed assessment, the board shall abandon the proposed project and assessment. If the district board finds that the written protests filed and not withdrawn represent less than 50 percent of the total amount of expected revenue from the proposed assessment, the district board may, at its discretion, proceed with or abandon the proposed project and assessment.

(e) The assessments levied pursuant to this section shall be collected at the same time and in the same manner as county taxes. The county may deduct its actual costs incurred for collecting the assessments before remitting the balance to the district. The assessments shall be a lien on all the property benefited thereby. Liens for the assessments shall be of the same force and effect as liens for taxes, and their collection may be enforced by the same means as provided for the enforcement of liens for county taxes.

(f) For the purposes of an assessment levied under this section, the property so assessed within a given zone is equally benefited.

§ 2291.3. The provisions of Section 2291.2 shall be exclusive in determining the proper procedure for the institution of projects under Sections 2291, 2291.1, and 2291.2, any other provision of law notwithstanding.

§ 2291.4. In addition to the powers enumerated in Article 5 (commencing with Section 2300), the board may do any of the

following:

(a) Levy taxes or assessments in each or any of the zones and participating zones to pay the cost and expenses of carrying out the projects within, or on behalf of, the respective zones, according to the benefits derived or to be derived by the respective zones, by a levy or assessment upon any or all property within a zone or participating zone, including land, improvements, and personal property.

It is declared that for the purposes of any tax or assessment levied under this subdivision, the property so taxed or assessed within a given zone is equally benefited.

(b) Levy taxes or assessments by the method authorized by subdivision (a) in each or any of the zones, according to the special benefits derived or to be derived by the specific properties therein, to pay the cost and expenses of carrying out any of the projects within or on behalf of the respective zone or zones.

§ 2291.5. Any ordinance or resolution adopted by a district prior to January 1, 1987, pursuant to subdivision (*l*) of Section 2270 which levies an assessment which otherwise meets the requirements of Section 2291.2, shall be deemed to satisfy the requirements of Section 2291.2 and shall continue to be levied and collected notwithstanding the amendment to subdivision (*l*) of Section 2270 by the chapter of the Statutes of 1986 which added this section.

§ 2291.7. In Lake County, any mosquito abatement district, as authorized by the district board, may notwithstanding Section 2291.3, conduct or contract for algae research projects and algae control or abatement projects for any part of the district. In undertaking these projects, the district board shall comply with the procedures set forth in subdivisions (a), (b), (c), and (d) in order to levy a benefit assessment for these projects.

(a) Prior to levying any benefit assessment, the board shall comply with all of the following:

(1) The board shall adopt a resolution which shall specify its intention to undertake the project. The resolution shall include all of the following:

(A) A description of the plan, including, but not limited to, all of the following:

(i) The causes of the algae.

(ii) Alternative methods and associated costs of algae prevention, reduction, and control.

(iii) Mitigation measures, including mitigation of the effects of potential treatment on humans, and on fish and wildlife habitat.

(iv) The agency or agencies with responsibilities for algae prevention, reduction, and control. The plan may reference the environmental document prepared pursuant to Division 13 (commencing with Section 21000) of the Public Resources Code.

(B) The establishment of a benefit assessment zone or zones.
(C) A description of the properties to be assessed.
(D) A description of the cost of each assessment.
(E) A statement specifying the duration of the assessment.
(2) The board shall hold public hearings after notice has been published for three successive weeks in a newspaper of general circulation published in the county seat.
(3) The board shall send notice of the resolution and of the hearings to those owners of property to be assessed at least 14 days prior to the public hearing.
(4) After the public hearing, the plan shall be approved by a majority of the owners of property to be assessed. The board shall take no action to implement the plan or the assessment until after the plan is approved by a majority of owners of property to be assessed.
(b) Any herbicide application for the purpose of algae abatement pursuant to this section shall be subject to the approval of the Department of Fish and Game. The department shall grant approval unless it is determined that the application would cause significant diminishment of green or yellow-green algae or zooplankton.
(c) The assessments levied pursuant to this section shall be collected at the same time, and in the same manner, as county taxes. The county may deduct its actual costs incurred for collecting the assessments before remitting the balance to the district. The assessments shall be a lien on all the property benefited thereby. Liens for the assessments shall be of the same force and effect as liens for taxes, and their collection may be enforced by the same means as for the enforcement of liens for county taxes.
(d) For the purposes of an assessment levied under this section, all properties so assessed within a given zone are equally benefited.
The requirements set forth in this section shall only apply to algae research projects and algae control or abatement projects in Lake County.
In enacting this section, the Legislature does not intend to amend the power of any other district to use any other power authorized by this chapter.

§ 2292. Any person who restrains, hinders, obstructs, or threatens any officer or employee of a district in the performance of that person's duties, or any person who interferes with any work done by, or under the direction of, the district is guilty of a misdemeanor.

§ 2294. In case of dispute between government agencies on the need, or the methods and materials used, to abate or prevent a public health nuisance under this chapter, the matter shall be subject to appeal to the State Director of Health Services within 10 days. The director shall take testimony on the issue, and

shall decide the matter on appeal and convey his or her decision to the parties within 30 days of the receipt of the appeal. The decision of the director shall be final and conclusive.

Article 5. Finances and Taxation

§ 2300. On or before August 1 of each year, the district board of each district shall prepare a written estimate of the amount of money necessary for the district's purposes during the next ensuing fiscal year. The amount of money necessary for the district's purposes may include a general reserve for the purpose of defraying district expenses between the beginning of a fiscal year and the time of distribution of tax receipts in a fiscal year. The general reserve shall not exceed 60 percent of the estimated expenditures for a fiscal year.

The amount of money necessary for the district purposes may also include an unappropriated reserve for the purpose of defraying unusual and unanticipated expenses.

Expenditures from the unappropriated reserve may be made only upon an affirmative vote of four-fifths of the members of the district board. The emergency fund shall not exceed 25 percent of the estimated expenditures for a fiscal year.

§ 2302. The county auditor shall allocate to a district its share of property tax revenue pursuant to Chapter 6 (commencing with Section 95) of Part 0.5 of Division 1 of the Revenue and Taxation Code.

§ 2303. Whenever it appears to the district board that the amount of funds required during an ensuing fiscal year will exceed the amount available, the district board may call an election to submit to the electors of the district the question of whether a special tax shall be voted for raising the additional funds pursuant to Article 3.5 (commencing with Section 50075) of Chapter 1 of Part 1 of Division 1 of Title 5 of the Government Code.

§ 2304. Notice of the election shall be published for at least four weeks prior to the election.

§ 2305. No particular form of ballot shall be required, nor shall any informalities in conducting the election invalidate it if it is otherwise fairly conducted

§ 2306. At the election the ballots shall contain the words "Shall the district vote a tax to raise the additional sum of $____?", or words equivalent thereto.

§ 2307. The district board shall canvass the votes cast at the

election, and, if two-thirds of the votes cast are in favor of the imposition of the tax, shall report the result to the board of supervisors of the county in which the district is situated, stating the additional amount of money required to be raised. If the district is more than one county, the additional amount shall be prorated for each county by the district board in the same way that the district's original total estimate of funds is prorated. The district board shall furnish the board of supervisors and auditor of each county a written statement of the apportionment for that county.

§ 2308. The board of supervisors of each county receiving the written statement shall, at the time of levying county taxes, levy an additional tax upon all the taxable property of the district in the county sufficient to raise the amount apportioned to that county.

§ 2309. All taxes and assessments levied under this chapter shall be computed and entered on the county assessment-roll by the county auditor and collected at the same time and in the same manner as other county taxes. When collected, the taxes and assessments shall be paid into the county treasury for the use of the district.

§ 2310. If the district is in more than one county the treasury of the county in which the district is organized is the depository of all funds of the district.

§ 2311. The treasurers of the other counties shall, at any time, not oftener than twice each year, upon the order of the district board settle with the district board and pay over to the treasurer of the county where the district is organized all money in their possession belonging to the district. The last named treasurer shall receipt for the money and place it to the credit of the district.

§ 2312. The funds shall only be withdrawn from the county treasury depository upon the warrant of the district board signed by its president or acting president, and countersigned by its secretary or acting secretary. However, if the county in which the district is situated has adopted a requisition system covering the withdrawal of funds for the purchase of services or supplies, the district board may, by resolution, adopt such system and make withdrawals in accordance therewith.

The board may by resolution authorize the withdrawal of funds from the county treasury depository upon a warrant signed by the principal administrative officer of the district and by a member of the board.

Article 5.1. Standby Charges for Public Health Emergencies

§ 2315. The Legislature finds and declares that unabated outbreaks of mosquitoes pose a serious threat to the public health and safety and that public agencies, including mosquito abatement districts and vector control districts, must be prepared to abate extraordinary outbreaks of mosquitoes. The Legislature further finds and declares that to protect the public health and safety from unabated outbreaks of mosquitoes, it is necessary to enact this article to provide mosquito abatement districts and vector control districts with the ability to abate mosquitoes.

§ 2316. (a) On or before August 10 of each year, the district may adopt an ordinance to fix an emergency mosquito abatement standby charge in the district or any portion of the district.

(b) The ordinance shall establish schedules varying the charges according to land uses. The emergency mosquito abatement standby charge shall not exceed ten dollars ($10) per year for each parcel of land on which the charge is levied.

(c) Any ordinance to fix an emergency mosquito abatement standby charge shall be adopted pursuant to Article 7 (commencing with Section 25120) of Division 2 of Title 3 of the Government Code. The ordinance shall be subject to Article 1 of Chapter 4 (commencing with Section 9300) of Division 9 of the Elections Code.

(d) The ordinance shall not apply to any parcel owned by a local agency, as defined in Section 2211 of the Revenue and Taxation Code.

§ 2317. (a) All revenues generated from the emergency mosquito abatement standby charge ordinance shall be deposited in a separate emergency mosquito abatement trust fund in the county treasury of the county in which the district is organized, except that the county may retain an amount not to exceed the actual costs of performing the duties required by Section 2318.

(b) The trust fund shall not exceed fifty thousand dollars ($50,000) or 25 percent of the district's expenditures for operations and maintenance in the immediately preceding fiscal year, whichever is greater, except that the trust fund may exceed these limits by the amount of interest earned.

(c)(1) The emergency mosquito abatement trust fund shall be used solely for the abatement and extermination of mosquitoes, as provided by Section 2270, except that the district may use 50 percent of any interest earned on the trust fund for the general purposes of the district. Not more than 50 percent of any interest earned on the trust fund may be appropriated for deposit on or before June 30 of each fiscal year in the Mosquitoborne Disease Surveillance Account in the General Fund, created by Section 25852 of the Government Code. Districts which agree to contribute to the Mosquitoborne Disease Surveillance Account

Article 6. Annexation

§ 2330. (a) Any territory lying contiguous to a district may be annexed to the district. Noncontiguous territory may be annexed to a district if the board of supervisors of each county in which a portion of the territory proposed to be annexed is situated determines, by resolution, that the portion is within a reasonable operational distance of the district.

(b) The provisions of Sections 2291 to 2291.4, inclusive, may be used during the annexation procedures to designate the territory to be annexed as one or more zones of benefit, and the provisions of subdivision (*l*) of Section 2270 may be used to fund vector control in any territory so annexed.

§ 2331. Prior to the annexation of any territory, the district board shall obtain the consent, by resolution, from the board of supervisors of each county in which territory is proposed to be annexed and, by resolution, from the city council of each city in which territory is proposed to be annexed.

§ 2332. The procedures for authorizing and financing control projects under Sections 2291.2 to 2291.4, inclusive, may be used concurrently with, and as the procedures for, annexation of any territory authorized under Section 2331.

Article 7. Consolidation

§ 2360. Two or more contiguous districts may be consolidated.

CHAPTER 8. PEST ABATEMENT DISTRICTS

Article 1. Definitions and General Provisions

§ 2800. "Pest," as used in this chapter, includes any plant, animal, insect, fish, or other matter or material, not under human control, which is offensive to the senses or interferes with the comfortable enjoyment of life, or which is detrimental to the agricultural industry of the State, and is not protected under any other provision of law.

§ 2800.5. As used in this chapter, "public nuisance" includes, but is not limited to, both of the following [also see Civil Code Sections 3479-3484]:

(a) Any breeding place or place of growth of a pest for which a district may be initiated under Section 2822, which exists by reason of any use made of the land on which it is found, or which exists by reason of any artificial change in the

Comment Letters and Notices

STATE OF CALIFORNIA

Governor's Office of Planning and Research
State Clearinghouse

Gray Davis
GOVERNOR

STREET ADDRESS: 1400 TENTH STREET ROOM 222 SACRAMENTO, CALIFORNIA 95814
MAILING ADDRESS: P.O. BOX 3044 SACRAMENTO, CA 95812-3044
916-445-0613 FAX 916-323-3018 www.opr.ca.gov/clearinghouse.html

Loretta Lynch
DIRECTOR

October 1, 1999

Wesley A. Maffei
Napa County Mosquito Abatement District
P.O. Box 655
Napa, CA 94559

Subject: Integrated Mosquito Management Program
SCH#: 99092008

Dear Wesley A. Maffei:

The State Clearinghouse submitted the above named Negative Declaration to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on September 30, 1999, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's eight-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Terry Roberts

Terry Roberts
Senior Planner, State Clearinghouse

Enclosures
cc: Resources Agency

Document Details Report
State Clearinghouse Data Base

SCH# 99092008
Project Title Integrated Mosquito Management Program
Lead Agency Napa County

Type neg Negative Declaration

Description On going program of surveillance and control of mosquitues and mosquito-borne disease. General elements include 1) surveillance, 2) Public Education, 3) Physical Control = Habitat Manipulation, 4) Vegetation Management, 5) Biological Control, & 6) Chemical Control

Lead Agency Contact

Name Wesley A. Maffei
Agency Napa County Mosquito Abatement District
Phone 707-258-6044 **Fax**
email
Address P.O. Box 655
City Napa **State** CA **Zip** 94559

Project Location

County Napa
City
Region
Cross Streets
Parcel No.
Township **Range** **Section** **Base**

Proximity to:

Highways
Airports
Railways
Waterways
Schools
Land Use All Designations

Project Issues Air Quality; Archaeologic-Historic; Coastal Zone; Drainage/Absorption; Flood Plain/Flooding; Noise; Soil Erosion/Compaction/Grading; Toxic/Hazardous; Vegetation; Water Quality; Wetland/Riparian; Wildlife

Reviewing Agencies Resources Agency; Department of Conservation; Department of Fish and Game, Region 3; Department of Parks and Recreation; Caltrans, District 4; Department of Health Services; State Water Resources Control Board, Clean Water Program; Regional Water Quality Control Board, Region 2; Department of Toxic Substances Control; Native American Heritage Commission; State Lands Commission

Date Received 09/01/1999 **Start of Review** 09/01/1999 **End of Review** 09/30/1999

Note: Blanks in data fields result from insufficient information provided by lead agency.

DEPARTMENT OF TRANSPORTATION
BOX 23660
OAKLAND, CA 94623-0660
(510) 286-4444
TDD (510) 286-4454

September 14, 1999

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9/30/99
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NAP000016
99092008

Mr. Wesley A. Maffei, Manager
Napa County Mosquito Abatement District
P O Box 94559
Napa, California 94559

Dear Mr. Maffei:

Integrated Mosquito Management Program

Thank you for including the California Department of Transportation (Caltrans) in the review of the above referenced project. We have no comments regarding this project.

We appreciate the opportunity to work with you on this project. Should you require additional information or have any questions regarding this letter, please call Bonnit Braxton of my staff at (510) 622-1645.

Sincerely,

HARRY Y.YAHATA
District Director

By Jean CR Finney

JEAN C. R. FINNEY
District Branch Chief
IGR/CEQA

Enclosure

Notice of Completion & Environmental Document Transmittal

SCH # 99092008

Mail to: State Clearinghouse, 1400 Tenth Street, Sacramento, CA 95814 916/445-0613

Project Title: INTEGRATED MOSQUITO MANAGEMENT PROGRAM
Lead Agency: NAPA COUNTY MOSQUITO ABATEMENT DISTRICT **Contact Person:** WESLEY A. MAFFEI
Street Address: P.O. Box 655 **Phone:** (707) 258-6044
City: NAPA **Zip:** 94559 **County:** NAPA

RECEIVED
SEP 1 1999
STATE CLEARINGHOUSE

RECEIVED OCT 04 1999

Project Location:
County: NAPA **City/Nearest Community:** ALL AREAS
Cross Streets: **Zip Code:** **Total Acres:** 510,016
Assessor's Parcel No. **Section:** **Twp.** **Range:** **Base:**
Within 2 Miles: State Hwy #: **Waterways:** **Schools:**
Airports: **Railways:**

SEP 07 1999

Document Type:
CEQA: ☐ NOP ☐ Early Cons ☒ Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ☐ Other
NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI
Other: ☐ Joint Document ☐ Final Document ☐ Other

Local Action Type:
☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☐ Other

Development Type:
☐ Residential: Units Acres Employees
☐ Office: Sq.ft. Acres Employees
☐ Commercial: Sq.ft. Acres Employees
☐ Industrial: Sq.ft. Acres Employees
☐ Educational
☐ Recreational
☐ Water Facilities: Type MGD
☐ Transportation: Type
☐ Mining: Mineral
☐ Power: Type Watts
☐ Waste Treatment: Type
☐ Hazardous Waste: Type
☐ Other:

Funding (approx.): Federal $ State $ Total $ 450,000 Annually

Project Issues Discussed in Document:
☐ Aesthetic/Visual ☐ Agricultural Land ☒ Air Quality ☒ Archeological/Historical ☒ Coastal Zone (SF BAY) ☒ Drainage/Absorption ☐ Economic/Jobs ☐ Fiscal
☒ Flood Plain/Flooding ☐ Forest Land/Fire Hazard ☐ Geologic/Seismic ☐ Minerals ☒ Noise ☐ Population/Housing Balance ☐ Public Services/Facilities ☐ Recreation/Parks
☐ Schools/Universities ☐ Septic Systems ☐ Sewer Capacity ☒ Soil Erosion/Compaction/Grading ☐ Solid Waste ☒ Toxic/Hazardous ☐ Traffic/Circulation ☒ Vegetation
☒ Water Quality ☐ Water Supply/Groundwater ☒ Wetland/Riparian ☒ Wildlife ☐ Growth Inducing ☐ Landuse ☐ Cumulative Effects ☐ Other

Present Land Use/Zoning/General Plan Designation:
ALL DESIGNATIONS

Project Description:
On going program of surveillance and control of mosquitoes and mosquito-borne disease. General elements include 1) surveillance, 2) Public Education, 3) Physical Control = Habitat manipulation, 4) Vegetation Management 5) Biological Control, & 6) Chemical Control.

Revised 3-31-99

State Clearinghouse Contact: Mosie Boyd (916) 445-0613
State Review Began: 9-1-99
Dept. Review to Agency 9-23-99
Agency to SCH 9-28-99
SCH COMPLIANCE 9-30-99

Please note State Clearinghouse Number (SCH#) on all Comments
SCH#: 99092008
Please forward late comments directly to the Lead Agency
AQMD/APCD 2 (Resources: 9, 4)

Project Sent to the following State Agencies

X Resources
Boating & Waterways
Coastal Comm
Coastal Consv
Colorado Rvr Bd
X Conservation
X Fish & Game # 3
Delta Protection Comm
Forestry & Fire Prot
Historic Preservation
X Parks & Rec
Reclamation Board
Bay Cons & Dev Comm
DWR
OES (Emergency Svcs)

Bus Transp Hous
Aeronautics
CHP
X Caltrans # 4
Trans Planning
Housing & Com Dev
Food & Agriculture
X Health Services

State/Consumer Svcs
General Services
Public School Construction

Cal EPA
ARB
Integrated Waste Mgmt Bd
X SWRCB: Clean Water Prog
SWRCB: Water Rights
SWRCB: Water Quality
SWRCB: Bay-Delta Unit
X Reg. WQCB # 2
X Toxic Sub Ctrl-CTC

Yth/Adlt Corrections
Corrections

Independent Comm
Energy Commission
X NAHC
Public Utilities Comm
Santa Monica Mtns
X State Lands Comm
Tahoe Rgl Plan Agency (TRPA)
Other:
Other:

LEGAL NOTICES

ST Helena Star
Sept 2, 1999

Continued from page 23

(2.) **Zumwalt Ford-Mercury @ 21 Main St.** - Request to reclassify the adjacent parcel to the west at 1286 Sulphur Springs Avenue from MR: Medium Density Residential to SC: Service Commercial to allow the future expansion of the automobile business.

ALL INTERESTED PARTIES are invited to attend said **Hearing** and express opinions or submit evidence for or against the proposal as outlined above.

If a person wishes to challenge the nature of the above action in court, they may be limited to raising only those issues that they or someone else raised at the Public Hearing described in this notice, or in written correspondence delivered to the St. Helena City Council at, or prior to said Public Hearing.

Copies of any staff reports will be available for viewing after Friday noon immediately preceding the hearing, at City Hall in the office of the Planning Director and at the St. Helena Public Library.

Information for the hearing impaired may be obtained by calling the City Clerk at (707)963-2741.
BY ORDER OF THE ST. HELENA CITY COUNCIL.
Dated: August 30, 1999
/S- Delia Guijosa
City Clerk
Pub. 9/2/99

PUBLIC NOTICE

NAPA COUNTY
MOSQUITO
ABATEMENT
DISTRICT

PUBLIC NOTICE OF INTENT TO ADOPT MITIGATED NEGATIVE DECLARATION

Pursuant to the provisions of the California environmental Quality Act, the Napa County Mosquito Abatement District has prepared an initial Study and Draft Mitigated Negative Declaration for the DISTRICT's ongoing Integrated Mosquito Management Program.

The Integrated mosquito Management Program of the Napa County Mosquito Abatement District is a long-standing, ongoing program of surveillance and control of mosquitoes, covering the whole of Napa County. The program consists of six types of activities: 1) **Surveillance** for mosquito populations, mosquito habitats, disease pathogens, and public distress associated with mosquitoes: this includes trapping and laboratory analysis of mosquitoes to evaluate populations and disease threats, direct visual inspection of known or suspected mosquito habitats, the use of all-terrain vehicles, maintenance of paths, and public surveys; 2) **Public Education** to encourage and assist reduction or prevention of mosquito habitat on private and public property; 3) Management of mosquito habitat, especially through water control and maintenacce or improvement of channels, tide gates, levees, and other water control facilities, etc. **("Physical Control");** 4) applications of herbicides and other forms of **Vegetation Management** to improve survveillance or reduce mosquito populations; 5) Application of the "mosquito fish" *Gambusia affinis,* the bacterium *Bacillus sphaerious*, the fungus *Lagenidium giganteumm,* and possibly other predators or pathogens of mosquitoes **("Biological Control");** and 6) Application of non-persistent selective insecticides to reduce populations of larval or adult mosquitoes **("Chemical Control").**

Copies of the documents are available for public review from 8:00 am to 4:30 pm Monday to Friday at the District offices at 964 Imola Ave., Napa, CA 94559. (707)258-6044. Please submit comments to Mr. Wesley A. Maffei, Manager, NCMAD, P.O. Box 655, Napa, CA 94559. Written comments will be accepted until 4:30 pm on Monday, October 4, 1999.

The DISTRICT proposes to adopt the Mitigated Negative Declaration at the regular meeting of its Board of Trustees at 7:00 pm on Wednesday, October 13, at the DISTRICT offices at 964 Imola Ave., Napa, CA 94559. This meeting is open to the public, and time will be available for verbal comments.

Pub. 9/2/99

PUBLIC NOTICE

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(NVR#222 9-2)

NAPA REGISTER
2 SEPT 1999

The Weekly Calistogian

PUBLIC NOTICE

NAPA COUNTY MOSQUITO ABATEMENT DISTRICT

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Pub. 9/2/99

PUBLIC NOTICE

NOTICE OF PUBLIC HEARING BY THE CALISTOGA PLANNING COMMISSION TO CONSIDER AN APPLICATION FROM MORE FOR LESS FOR A VARIANCE OF THE ZONING ORDINANCE REQUIREMENTS REGARDING MAXIMUM SIGN COVERAGE

NOTICE IS HEREBY GIVEN by the Planning Commission of the City of Calistoga that a PUBLIC HEARING will be conducted Monday, September 27, 1999, at 7:00 p.m. in the Calistoga Community Center, 1307 Washington Street, City of Calistoga, County of Napa, State of California, at which time and place testimony will be considered on:

V 99-3, Variance request of More for Less to exceed the allowable sign area of 32 square feet. The property is located at 940 Petrified Forest Road, Assessor's Parcel #11-370-024. The request for a variance is exempt from the California Environmental Quality Act (CEQA) under Section 15305.

If you challenge the action of the Planning Commission on the above stated item in court, it may be limited to only those issues raised at the public hearing described in this notice, or in written correspondence delivered to the Planning Commission at, or prior to, the public hearing.

BY ORDER OF THE CITY OF CALISTOGA PLANNING COMMISSION
-S- James C. McCann
Planning and Building Director
City of Calistoga
Pub. 9/2/99

99-0092

ENDORSED

October 13, 1999

NOTICE OF DETERMINATION

OCT 15 1999
JOHN TUTEUR
Napa County Recorder, County Clerk
By _____ DEPUTY RECORDER - CLERK

To: ___ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

___ County Clerk & Recorder
Napa County
Napa, CA

From: Napa County Mosquito Abatement District
P.O. Box 655
Napa, CA 94559

Subject: Filing of Notice of Determination in Compliance with Section 21108 or 21152 of the California Public Resources Code.

Project Title: INTEGRATED MOSQUITO MANAGEMENT PROGRAM

99092008	Wesley A. Maffei	(707) 258-6044
State Clearinghouse Number (If submitted to Clearinghouse)	Lead Agency Contact Person	Area Code/Telephone/Extension

Project Location: The whole of Napa County

Project Description: The Integrated Mosquito Management Program of the Napa County Mosquito Abatement District is a long-standing, ongoing program of surveillance and control of mosquitoes. The program consists of six types of activities: 1) **Surveillance** for mosquito populations, mosquito habitats, disease pathogens, and public distress associated with mosquitoes; this includes trapping and laboratory analysis of mosquitoes to evaluate populations and disease threats, direct visual inspection of known or suspected mosquito habitats, the use of all-terrain vehicles, maintenance of paths, and public surveys; 2) Public **Education** to encourage and assist reduction or prevention of mosquito habitat on private and public land; 3) Management of mosquito habitat, especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities, etc. ("**Physical Control**"); 4) Applications of herbicides and other forms of **Vegetation Management** to improve surveillance or reduce mosquito populations; 5) Application of the "mosquito fish" *Gambusia affinis,* the bacterium *Bacillus sphaericus,* the fungus *Lagenidium giganteum,* and possibly other predators or pathogens of mosquitoes ("**Biological Control**"); and 6) Application of non-persistent selective insecticides to reduce populations of larval or adult mosquitoes ("**Chemical Control**").

This is to advise that the Napa County Mosquito Abatement District, as the CEQA Lead Agency, has approved the above described project on October 13, 1999 and has made the following determination regarding the above described projects.

1. The project **will not** have a significant effect on the environment.
2. A **Negative Declaration** was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures **were** made a condition of the approval of the project.
4. A statement of Overriding Considerations **was not** adopted for this project.

This is to certify that the final Mitigated Negative Declaration with comments and responses and record of project approval is available to the General Public at the Napa County Mosquito Abatement District.

Wesley A Maffei	Manager	15 OCT 99
Signature (Public Agency)	*Title*	*Date*

Date received for filing and posting at OPR:

RECEIVED
OCT 15 1999
STATE CLEARINGHOUSE

NAPA COUNTY

JOHN TUTEUR
ASSESSOR-RECORDER-COUNTY CLERK
RECORDER-COUNTY CLERK DIVISION

COUNTY CLERK'S CERTIFICATE OF POSTING

AS REQUIRED BY CEQA, SECTION 21152 (C) OF THE PUBLIC RESOURCE CODE, I, Karen Burzdak DEPUTY RECORDER-COUNTY CLERK CERTIFY THAT I POSTED THE ATTACHED NOTICE IN THE OFFICE OF THE RECORDER-COUNTY CLERK AT 900 COOMBS STREET, ROOM 116, NAPA, CALIFORNIA FOR THE FOLLOWING TIME PERIOD: October 15, 1999 - November 23, 1999.

DATE: November 23, 1999

JOHN TUTEUR
RECORDER-COUNTY CLERK

K Burzdah
BY: DEPUTY RECORDER-COUNTY CLERK

(cpostg)

PO BOX 298 - 900 COOMBS ST - RM 116 - NAPA, CA 94559-0298 (707) 253-4246 FAX (707) 259-8149