# AQUATIC PESTICIDE APPLICATION PLAN FOR THE CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE HYDRILLA ERADICATION PROGRAM

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**For**
**The State Water Resources Control Board**

# Aquatic Pesticide Application Plan for the California Department of Food and Agriculture Hydrilla Eradication Program

## 1. Background and Overview

It is the mission of the California Department of Food and Agriculture (CDFA) Division of Plant Health and Pest Prevention Services (PHPPS) to protect California from damage caused by the introduction or spread of invasive pests that threaten California's agriculture, water supply, and natural landscape. Invasive pests are biological organisms that are artificially introduced into an area beyond their natural range and become pests in the new environment. Aquatic pests are especially harmful as they threaten California's waterways and have the potential of causing serious agricultural, economic, and environmental harm or harm to human health. The Integrated Pest Control Branch of the PHPPS works in partnership with other cooperative governmental agencies to protect waterways from becoming infested with invasive species and/or by slowing infestations when they occur with a goal of eradication. The ability to act quickly in response to an invasive aquatic pest allows for localized eradication with minimal disturbance to native habitats, including less pesticide use.

The Hydrilla Eradication Program is a program that is administered by the CDFA to protect waterways from invasive aquatic weeds including *Hydrilla verticillata*. Invasive aquatic weeds multiply rapidly displacing native species, choking off waterways and clogging equipment. Hydrilla is of limited distribution in California and poses a threat to many waterways including the Sacramento Delta. According to the Association of California Water Agencies, the Delta supplies water to more than 25 million California citizens and 2.5 million acres of productive farmland. The Delta is also an estuary which provides critical habitat for native wildlife. It is the goal of the Hydrilla Eradication Program to control all existing infestations of hydrilla in California and prevent current uninfested areas from becoming infested in the future. The California Food and Agricultural Code (FAC) provides authority specific to this mission in Division 4, FAC Section 6048. The Secretary of CDFA may also, under the authority set forth in the Food and Agricultural Code, Division 1, Section 403; Division 4 Plant Quarantine and Pest Control, Sections 5301, 5302, 5321, 5322, 5761, 5762 & 5763 thoroughly investigate the existence and the probability of the spread of a pest and to abate the pest from the established eradication area. The CDFA applied for a statewide general National Pollutant Discharge Elimination Systems (NPDES) Permit from the State Water Resources Control Board to continue application of aquatic herbicides when necessary for the continued control of these pests.

The Hydrilla Eradication Program was developed based upon input from CDFA professional staff and recommendations from experts familiar with the pest species. When encountering new aquatic weed species, a technical advisory panel (TAP) may be established and all options (pesticidal and non-pesticidal) are considered. The options selected are based upon minimal public intrusiveness, biological efficacy, and economic and environmental impacts.

Control options can include manual removal, biological controls and traditional chemical pesticides.

## 1.3 Description of Target Species

The CDFA is the lead agency in the state for noxious weed control. The main focus of the CDFA's Hydrilla Eradication Program is to protect the state's water systems from infestations of hydrilla (*Hydrilla verticillata*) by surveying waterways and eradicating hydrilla when it is found. As the lead agency, CDFA works in cooperation with county agricultural commissioners, federal, state, county and other local agencies and private entities to stop the spread of invasive aquatic weeds. In order to accomplish this goal, the Hydrilla Eradication Program will occasionally engage in the control of other invasive weed species or large mats of native or introduced plant species that interfere with survey or control procedures.

Infestations of invasive aquatic plants are an environmental concern that can also impact local commerce and communities. In addition to their aggressive nature, invasive non-native plants lack natural enemies such as insects and other predators that have evolved with them. This leaves the new environment especially susceptible to damage from rapid overgrowth of the invasive species displacing native plants. This rapid development can cause environmental impacts such as changes in water quality, fish population decline, loss of wildlife habitat, and alteration of fish predator-prey relationships. Important economic impacts have also been observed, such as clogging of rivers, streams, canals and ditches which affect agricultural, industrial and domestic water uses. Recreational uses of waterways are impacted as fishing in shallow waters becomes difficult, watercraft are unable to navigate around large weed mats and drownings due to entanglement can occur. This depresses local economies from reduced tourism and the decline of waterfront property values.

### 1.3.1 Hydrilla

The main focus of the Hydrilla Eradication program is hydrilla (*Hydrilla verticillata*). Hydrilla is a non-native, aggressive, submerged water weed. Once hydrilla invades an aquatic ecosystem, it drives out all other aquatic plants, creating a pure stand. Hydrilla's appearance can vary depending on the environment it is growing in. Its appearance is quite similar to *Elodea sp. and Egeria densa,* common American waterweeds. A distinguishing characteristic of hydrilla is the presence of sharp teeth along leaf margins and spines or glands on the under the midrib. It grows very aggressively in a wide variety of water conditions and temperatures, so few habitats are safe from it. Hydrilla can thrive in a range of physicochemical water parameters including, variable nutrient levels, increased salinity, and a wide pH variation. Due to its rapid and dense growth, it shades out all other plant species, including natives, reducing diversity

to a single species. Hydrilla outcompetes other plants using several strategies, including, but not limited to; 1. Ability to grow under extremely low light conditions. 2. Ability to switch to using bicarbonate as a carbon source when carbon dioxide is low or unavailable. 3. Reproductive and dispersal capacities. 4. Rapid growth. 5. Few or no natural enemies.

Hydrilla proves itself to be a strong competitor in many areas. It can grow under extremely low light conditions (approx 1% available sunlight) allowing it to survive at greater depths and grow beneath native weed beds. Its ability to use lower light intensity allows it to capture most of the available carbon dioxide in water, because it can start photosynthesizing earlier in the morning compared to other plants. If most or all of the available carbon dioxide gets depleted from the system, hydrilla simply switches to a C4-like carbon metabolism and is able to use inorganic carbon sources for growth. Although it does not produce much seed, its reproductive strategies include a 50% viability rate from a stem fragment consisting of just one whorl of leaves. Hydrilla also produces special survival structures on the stems called “turions” and “tubers” They are developmentally identical and both are modified apical stem buds. Turions form in leaf axils of normal stems in the open water column, while tubers form in the sediment on the tips of modified stems that have turned down into the sediment. Each turion or tuber leads to the production of a new plant. Turions can break off and drift for long distances before sinking and developing into a new plant. A single tuber can lead to the production of hundreds of others in the course of one growing season. The tubers are long-lived and can survive on average 4 - 7 years, in some cases even longer in the sediment waiting for ideal conditions for plant growth. Tubers can remain viable even if water is not present. This long term survival of the tubers is the major challenge in eradication.

The rapid growth of hydrilla is one of the main reasons that it is able to choke out all existing vegetation. The plant itself is over 90% water, so it can increase its biomass very quickly with very little available nutrients. In summer conditions, it is able to double its biomass every two weeks. A single one-foot stem can take as few as eight days to grow to a length of ten feet, and in five weeks a single nine-inch shoot can lead to a total of over 3200 inches of stem length (because of multiple branching). This rapid growth along with increased photosynthetic abilities allows it to monopolize all of the available nutrients required for plant growth. Additionally, hydrilla will grow up the water column to the water surface very quickly, then branch out across the surface and shade out all other aquatic species causing rapid decline of native habitat.

### 1.3.2 South American Spongeplant

South American spongeplant (*Limnobium laevigatum*), was first discovered in California’s East Bay hills around 1996, but was quickly eradicated. The next discovery was in a Redding pond in 2003 where the spongeplant choked out other aggressive water weeds such as parrotsfeather and water primrose.

Spongeplant was found again in 2007 in the San Joaquin River in Fresno. A few months later, it was found in the Sacramento River Delta but seemed to disappear shortly after a storm occurred. In 2008 plants were found near the Kings River in a canal east of Fresno. It was then found in several canals in the Fresno area. In 2009, it was found in the Delta again and there is an active infestation in the Delta today.

Spongeplant leaves are circular with a glossy upper surface and a thick layer of air-filled spongy tissue beneath. In uncrowded conditions, leaves will lay flat on the surface of the water, but in crowded conditions the leaves turn upright, the stems lengthen and leaves thin and expand. Spongeplant is an invasive aquatic weed due to its prolific reproduction and ability to quickly monopolize pond environments. Spongeplant produces many seeds, allowing for rapid dispersal. Seeds can survive at least 5 years, so, once a seed bed is established, it becomes very difficult to eradicate. Due to the unique leaf and stem structure, the crowded plants pack very tightly together, and large mats can form a membrane-like covering that can obscure the entire surface of a pond, reducing available oxygen to fish and completely shading light sources for other submerged native aquatic plants.

### 1.3.3 Giant Salvinia

Giant Salvinia (*Salvinia auriculata complex*) is a type of floating aquatic fern that can create dense mats up to 2 feet thick. Noxious types of salvinia can be distinguished from other non-invasive species by “egg-beater” shaped hairs 2-4 mm long on the upper surfaces of floating leaves. Giant salvinia has not been reported in California since it was eradicated in 2002.

### 1.3.4 Weed Species that interfere with surveys or treatments for targets

If invasive non-native aquatic plants are allowed to become established in an ecosystem, they are very difficult to manage and have long term environmental consequences. Eradication is not considered successful until an area is found to be free-from all viable propagules of the target invader for a minimum of 3 years. The lead agency must work within existing funds and follow the most aggressive, yet least environmentally disturbing protocol possible to achieve this goal. Because of this, the Hydrilla Eradication program may occasionally control other weed species that interfere with eradication or survey efforts of a target species.

## 1.2 Description of Water Body Systems

### 1.2.1 Small, Still Water Bodies (Ponds)

Finding and controlling aquatic weed infestations in a pond environment can be particularly challenging. Many ponds are located in areas that are not accessible by conventional vehicles. Smaller ponds are often located on private property or

rangeland. They receive water from natural permanent or intermittent streams or from irrigation canals or flumes. Elevations and temperature can vary depending on location, but the target pest is rarely located in ponds that freeze over the winter. The ponds discharge into permanent or intermittent streams. Historically, many infested ponds have been located within a few hundred feet of the Sacramento Delta posing a real and immediate threat to California's water supply system. During peak flow, infested ponds can become part of larger bodies of water such as rivers or lakes. Some examples of this are infested ponds that feed into the Feather River drainage or the Tule River. Due to the inaccessibility and ephemeral characteristics of ponds, they often act as reservoirs allowing for invasive species populations to build for some time before the problem is discovered. All ponds that become infested with invasive aquatic weeds are examined and evaluated prior to treatment by environmental compliance staff and mitigation measures are implemented as needed. If there is any direct discharge of pesticides to the body of water, CDFA will identify and describe the waters, application and treatment areas, and any representative monitoring location. In addition, CDFA will describe any site specific BMP's for the environmental setting. This information will be posted on the CDFA web page and provided electronically to affected public agencies 15 days prior to first application each year.

### 1.2.2 Large, Still Water Bodies (Lakes)

Lakes used for recreational purposes are particularly susceptible to infestations of invasive aquatic pest species due to the high volume of visitors to the sites. In the case of aquatic weeds, small portions of the plant get caught on the propellers or on the hulls of boats or other watercraft and can be artificially transferred if they are not properly removed. Lakes can be very large and infestations can take several years to eradicate. Infestations can have severe economic impacts on surrounding communities that depend on annual revenue from tourism and recreation. In 1989, Eastman Lake near Chowchilla was closed to all recreation uses for 3 years to remove a hydrilla infestation from the site. Currently, Clear Lake a lake with approximately 43,000 acres of surface area and 100 miles of shoreline has an active infestation of hydrilla. Clear Lake is in Lake County and is the largest freshwater lake in California. Often used for bass tournaments throughout the year, it is almost 22 miles long and eight miles wide. The lake is relatively shallow with an average depth of 26 feet. Due to its shallow depth, afternoon winds move and mix the water thoroughly, even near the bottom. Due to this mixing, the lake does not develop temperature based layering (thermocline, stratification) that is typical of most lakes in late summer. Over the course of a year, water temperatures can range from 5° - 30° Celcius (40 – 86°+ Fahrenheit). Clear Lake currently follows a program of surveys, treatment, and public education as recommended after review by a Technical Advisory Panel following the initial infestations. All lakes that become infested by invasive aquatic weeds are examined and evaluated prior to treatment by environmental compliance staff and mitigation measures are

implemented as needed. If there is any direct discharge of pesticides to the body of water, CDFA will identify and describe the waters, application and treatment areas, and any representative monitoring location. In addition, CDFA will describe any site specific BMP's for the environmental setting. This information will be posted on the CDFA web page and provided electronically to affected public agencies 15 days prior to first application each year.

### 1.2.3 Small Moving Water Bodies

Irrigation canals and natural streams can have water available intermittently throughout the year. In early spring, heavy water flow can transfer debris including aquatic weeds via these channels from immobile water bodies into uninfested areas. Although creeks can dry up during the summer, invasive plants can sometimes still flourish there. For example, hydrilla was found in Bear Creek, a small intermittent creek which eventually empties into the Delta near Stockton. The San Joaquin River has also been threatened with infestations from the smaller Chowchilla River which was infested in the early 90's. Small moving water bodies that become infested with invasive aquatic weeds are examined and evaluated prior to treatment by environmental compliance staff and mitigation measures are implemented as needed. If there is any direct discharge of pesticides to the body of water, CDFA will identify and describe the waters, application and treatment areas, and any representative monitoring location. In addition, CDFA will describe any site specific BMP's for the environmental setting. This information will be posted on the CDFA web page and provided electronically to affected public agencies 15 days prior to first application each year.

## 2. Treatment and Alternative Options

### 2.1 Alternatives

#### 2.1.1 No Action

No action would mean that invasive aquatic weeds would not be controlled by CDFA using a coordinated statewide effort. Aquatic weed populations would be expected to increase statewide. Although CDFA uses minimally invasive tactics including education and exclusion to prevent the artificial spread of these weeds, this would not reduce or slow the population build up of existing infestations. Lack of a statewide effort would leave control efforts to private individuals such as dock owners, boaters and other groups. This can result in more pesticide being applied without seeing a resulting decrease in invasive aquatic weed populations due to lack of a coordinated approach.

#### 2.1.2 Prevention

The CDFA Pest Exclusion branch is the first line of defense for the prevention of pests becoming established in our state. Pest Exclusion Inspectors are stationed at points of entry to evaluate and mitigate the threat of invasive pests on incoming shipments. Each year, California's agricultural border stations intercept thousands of unwanted pests including hydrilla from cars, trucks and buses entering the state each year. These inspectors are trained to inspect boats and other watercraft as they enter the state for all aquatic pests including invasive weed fragments. The CDFA works jointly with county agricultural inspectors to inspect pet stores, aquaculture centers, water gardens and aquatic nurseries for invasive aquatic species. Education also plays a key role in preventing the spread of aquatic weed infestations inside the state. The Hydrilla Eradication Program works with other key agencies to develop and distribute materials that describe the various target species and their impact to the environment. These materials are placed at public and private boat docks and public recreational or commercial water use areas. Educational materials are also provided to private citizens within quarantine areas by the local county agricultural commissioner's office and occasionally to boat owners through the DMV.

On the whole, the prevention system seems to work fairly well with regard to hydrilla. . The drawback with prevention is that it does not address existing infestations within the state.

#### 2.1.3 Mechanical or Physical Methods

Physical management tactics include the use of human or mechanical means to remove or control a pest, or the use of physical barriers to isolate a pest or host. The Hydrilla Eradication program uses physical barriers and physical and mechanical methods of weed removal when there are a small number of target weeds that can be effectively removed and contained. Physical barriers include

screening of outlets to prevent further spread of the target pest when feasible (this is standard procedure in relatively small bodies of water). Manual or mechanical removal of hydrilla tubers can be an important complement to other methods, as they immediately remove the 4 - 7+ year threat that a tuber otherwise represents. A variety of techniques for tuber removal have been tested. Several have seemed to hold promise under small, well-controlled conditions, but almost all have proved too difficult to control or too energy and equipment intensive for operational use. The method that routinely has proved useful in some conditions is small-scale dredging. Usually it involves small hand-directed suction dredges. As such, it is generally only useful where water is shallow enough for wading or minor free-diving. The areas must also be very small, perhaps a few tenths of an acre. When used where plant densities have been high, it can remove tens of thousands of tubers that otherwise could take years to sprout. Recently, dredging has often come to have as many or more regulatory challenges as applying herbicides, making it less of an option.

Mechanical harvesting is not an option. It creates large numbers of plant fragments that are nearly impossible to contain completely, resulting in the rapid spread of infestations. In an eradication effort against a new, localized infestation, it causes additional harm. Further, mechanical harvesting, especially in dense stands, can have significant by-catch of non-target animals, including fish. Its potential negative environmental effects need to be taken into account when choosing strategies.

### 2.1.4 Cultural

Cultural management includes techniques that alter environmental or other factors related to the survival of a pest population in a manner that reduces the size of the population. The Hydrilla Eradication program uses cultural methods when possible to reduce or control aquatic weed populations. Cultural methods include burying (filling in the water body), lining the water body (with plastic, cement or asphalt), draw down (lowering the level of water), or complete drainage. Cultural methods can be very effective in controlling invasive aquatic weed infestations. Unfortunately cultural methods are not always possible or the best choice for the environment as each carries the risk of damaging other native populations and wildlife habitat. Burying completely destroys the water body. Lining with plastic, cement or asphalt removes habitat for natives as well as introduces unnatural materials into the environment. Draw down by itself is only effective if there is a high level of control of the water levels. Complete drainage removes the water body. It is is only effective if can be kept completely dry for long periods as aquatic weeds that produce tubers, such as hydrilla, can survive in moist soil for 4-7 years.

### 2.1.5 Biological Control Agents

Biological control tactics involve the use of biological organisms to reduce the number or density of pests in a pest population. In the case of invasive aquatic weeds there are several biological organisms located in their home environment that are predacious or otherwise detrimental to the survival of the target pest. In many instances, these agents are not allowed entry into the state of California for control of the target due to concerns that they will become more damaging to the environment then the original target. In every situation where a new biological control organism is introduced into the environment, an assessment of the organism must be performed to weigh the benefits of the control versus the potential harm of the organism on the environment. In most cases, only highly specialized host-specific organisms are allowed, and the evaluations usually take years before they are approved or denied for use.

Occasionally, agencies are allowed to use other means to modify biocontrol agents, such as sterilization, so that they may be removed from or made harmless to the environment while still achieving control of the target pest. The Hydrilla Eradication program employs a type of modified grass carp, commonly referred to as triploid grass carp, for control of hydrilla in irrigation canals in the Imperial, California, irrigation district. In the wild, grass carp are voracious feeders that will consume aquatic vegetation nearly to the point of extinction. The grass carp used as biocontrol agents for hydrilla are subjected to a specialized process that gives them a triploid chromosome number, making them unable to reproduce if ever allowed into the wild. Since they have potential for damaging the environment if the sterility process is not complete, additional regulatory safeguards have been put in place by the California Department of Fish and Wildlife. These safeguards require that the triploid carp only be used in areas where complete containment can be achieved and they are not allowed north of the Tehachapi Mountains.

The triploid grass carp has been very effective in certain circumstances for the control of hydrilla, as was demonstrated in the Imperial infestation. When the infestation was discovered in 1976, it covered about 300 miles of canals. By the time the triploid grass carp were ready for release in the mid-eighties, the irrigation district had some 600 miles of heavily infested canals. This occurred despite the heavy use of copper herbicides and mechanical removal (the continued increase was possibly due to mechanical harvesting fragmenting the plant and inadvertently spreading the infestation). After the introduction of the carp, combined with an ongoing canal-lining effort, hydrilla was rare in the canal system by the late nineties. It completely disappeared by the early 2000's except for scattered plants in three to five miles of drains, where the fish could not be used because of the highly irregular water levels. Due to the risk of environmental damage the carp could cause to native species in some of the northern infestations and restrictions by the Department of Fish and Wildlife, they cannot be used in other infestations.

## 2.2 Chemical Treatments

### 2.2.1 Factors Influencing Pesticide Use

*Hydrilla verticillata* is designated a noxious weed by the federal government (CFR Title 7, Section 360.2) and the State of California (CCR Title 3, Section 4500). Control and eradication efforts for certain aquatic noxious weed species such as hydrilla, are considered an emergency in California (CCR Title 3, Section 3962). California's Legislation (FAC 6048) mandates an ongoing survey and detection program for hydrilla with a requirement to perform eradication efforts whenever it is found. When encountering new aquatic weed species, a technical advisory panel (TAP) may be established and all options (pesticidal and non-pesticidal) are considered.

The decision to use pesticides for eradication at a site will be influenced by immediate need and available alternatives. All eradication efforts will include an initial examination and evaluation of the site by environmental compliance staff. Control and eradication options considered may include one or more of the methods described within this section. The choice of options is based on their feasibility, biological efficacy, environmental impacts, minimal public intrusiveness, and availability of fiscal resources. Whenever possible an integrated management approach will be used. In order to choose the most appropriate eradication tool for each site the following characteristics are considered:

- Site accessibility: the more difficult the access, the more appropriate the use of herbicides, from an applicator safety as well as efficacy point of view.
- Water clarity: only relatively clear water sites are appropriate for divers and diver assisted dredging
- Water depth: the deeper the water the more appropriate the use of slow release pellet herbicide formulations.
- Water flow: the faster the water flow the more appropriate the use of slow release pellet formulations or copper aquatic herbicides through metering devices
- Weed size: large hydrilla plants or plant mats require either hand pulling, mechanical control, or use of copper aquatic herbicides for rapid control before tubers can form. Smaller plants can be treated with flouridone
- Tuber Bank: the presence of a tuber bank requires either dredging for tuber removal (if practical) or persistent, frequent (every two to three weeks) chemical application to prevent further tuber formation and to dissipate the tubers already formed. Germinating tubers can be treated with fluridone.

- Size of infested area: small infestations can be controlled with hand or mechanical control methods, larger infestations tend to require herbicide use.
- Non-target plants: the more sensitive the non-target plants, the more care is taken in the selection of herbicides or herbicide rates, and the more consideration is given to mechanical or other non-chemical control methods.
- Location: for hydrilla infestations south of the Tehachapi Mountains (Riverside, San Bernardino, and Imperial counties) consideration is given to use of the biocontrol agent, the triploid grass carp, to complement or replace herbicides.

### 2.2.2 Herbicides Used and General Treatment Protocols

The Program uses various aquatic herbicides. The active ingredient the Program uses most heavily is fluridone. Others used occasionally are copper ethylenediamine complex, triclopyr, diquat, and endothall. Following is a table listing current and proposed pesticides that the program currently uses or forsees may be useful. The table lists active ingredients and their corresponding breakdown by-products, adjuvants, and application methods used.

| CDFA Hydrilla Program - active and potential use herbicides 2013 | | | | |
|---|---|---|---|---|
| Trade name | Active ingredient(s) | Breakdown by-product | Surfactant added y/n | Application method |
| ***Herbicides*** | | | | |
| Sonar SRP | fluridone | n-methyl formamide (NMF)* and 3-trifluoromethyl benzoic acid. | N | spreader |
| Sonar AS | fluridone | n-methyl formamide (NMF)* and 3-trifluoromethyl benzoic acid. | N | spreader |
| Sonar Genesis | fluridone | n-methyl formamide (NMF)* and 3-trifluoromethyl benzoic acid. | N | submerged injection |
| H4C | fluridone | n-methyl formamide (NMF)* and 3-trifluoromethyl benzoic acid. | N | spreader |
| Komeen | copper ethylenediamine | None | N | submerged injection |
| Harpoon | copper ethylenediamine | None | N | submerged injection |

| | | | | |
|---|---|---|---|---|
| Galleon | penoxsulam | BSTCA, 2-amino-TCA, 5-OH-penoxsulam, SFA, sulfonamide, and 5,8-di-OH | foliar application Y / submerged N | foliar spray/ submerged injection |
| Clearcast | Imazamox | nicotinic acid and di- and tricarboxylic acids | foliar application Y / submerged N | foliar spray/ submerged injection |
| Habitat | Imazapyr | pyridine hydroxy-dicarboxylic acid, pyridine dicarboxylic acid (quinolinic acid), and nicotinic acid. | Y | foliar spray |
| AquaMaster | Glyphosate | aminomethyl phosphonic acid, carbon dioxide | Y | foliar spray |
| Green Clean | sodium carbonate peroxhydrate | water and dissolved oxygen | N | spreader |
| PAK27 | sodium carbonate peroxhydrate | water and dissolved oxygen | N | spreader |
| Aquathol K | dipotassium salt of endothall 40.3% | carbon, hydrogen, and oxygen | N | submerged injection |
| Teton | mono(N,N-dimethylalkylamine salt of endothall 53.0% | carbon, hydrogen, and oxygen | N | drip/ submerged injection |
| Cascade | dipotassium salt of endothall 40.3% | carbon, hydrogen, and oxygen | N | drip/ submerged injection |
| Renovate 3 | Triclopyr | 3,5,6-trichloro-2 pyridinol | foliar application Y / submerged N | foliar spray/ submerged injection |
| Renovate OTF | Triclopyr | 3,5,6-trichloro-2 pyridinol | N | spreader |
| Nautique | copper ethylenediamine , copper triethanolamine | none | N | submerged injection |
| ***Surfactants*** | | | | |
| Competitor | Ethyl Oleate, Sorbitan Alkylpolyethoxylate Ester, Dialkyl Polyoxyethylene Glycol | | | foliar spray |
| Cygnet-plus | D'Limonene,terpinehydrocarbon, nonylphenol polyethylene glycol ether | | | foliar spray |
| | | | | |

***(NMF) has not been detected under field conditions, including those at the maximum label rate.***

All herbicides will be applied according to label requirements. Herbicides used will be determined after weighing efficacy, pros and cons of each formulation, the immediate need for pesticide use, and the availability of alternatives.

For any given water body, a decision has to be made whether to treat the entire water body or treat only limited areas (treatment areas). This decision depends on the distribution of the target plants, the size of the water body, and the amount of water movement within the water body, which strongly affects how much a treatment will be diluted. There is no exact model for the switch from whole-body treatment to treatment areas. With a five-acre minimum treatment area, contained water bodies with little or no flow-through, and a single small infested area, the critical water body size tends to run in the range of 15 to 30 acres. If the Program decided to employ a treatment area, it would verify its effectiveness by measuring herbicide concentrations within the treatment area and monitoring the population response. The area would be adjusted if the treatment was found to be inadequate, or of course if the infestation spread.

The size of a treatment area size depends upon the target species and its distribution, the characteristics of the water body, and the herbicide. Normally, the Program attempts to treat the smallest area that can reasonably be expected to provide adequate control of the target.

For many floating and emergent species (eg, spongeplant, salvinia), sprays are directed only at the target plants, and onto the foliage above the water surface. The area treated then closely matches the area covered by the target plants themselves, and the only herbicide that is applied to the water is the spray that misses the foliage. Such control efforts do not employ treatment areas in the sense of those found at Clear Lake.

For submerged plants such as hydrilla, the area treated usually depends on the size of the water body and its level of water movement. When the Program decides to use a particular herbicide, we attempt to determine a general estimate of the minimum area that can be treated and have a good chance of adequate control. We make this determination by consultation with the label, the herbicide manufacturer, local experts in aquatic plant control, or, if necessary, a TAP. We then base our treatments on that estimate. For example, the effective treatment area for fluridone and our copper complex has been estimated at five acres, and is the basis for the treatment areas described for Clear Lake.

### 2.2.3 State Implementation Policy (SIP) Exception

The CDFA Hydrilla Eradication Program has applied for and been granted a SIP section 5.3 exception for the use of copper. Applications of copper by the CDFA Hydrilla Eradication Program are only applied when it is determined to be the best course of action.

## Section 3. Sampling and Monitoring Procedures

When proposing this monitoring plan, the CDFA considered the questions posed under the guidelines for a Monitoring and Reporting program (MRP) located in appendix C of the permit 1) Does the residual algaecides and aquatic herbicides discharge cause an exceedance of receiving water limitations? 2) Does the discharge of residual algaecides and aquatic herbicides, including active ingredients, inert ingredients, and degradation byproducts, in any combination cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective?

### 3.1 Monitoring Site Types

The different site types treated by the Hydrilla Eradication Program generally fall into three categories:

1. Lakes and ponds that drain into "waters of the United States"
2. Canals and streams that drain into "waters of the United States"
3. Ponds, canals and streams that do not drain into "waters of the United States"

#### 3.1.1 Lakes and ponds that drain into "waters of the United States"

Category 1, which is described as "lakes and ponds that drain into 'waters of the U.S,'" is currently limited to Clear Lake. The following discussion will focus on the features of Clear Lake specifically and will also include theoretical references to other ponds that may be found infested at a later date.

#### 3.1.2 Canals and streams that drain into "waters of the United States"

There are no current hydrilla infestations located in canals and streams that drain into waters of the United States. If an area within this category was to become infested, the program would take into account the flowing nature of these types of water bodies and choose a monitoring site that would follow the pathway of residue flows based on application points.

#### 3.1.3 Ponds, canals and streams that do not drain into "waters of the United States"

As part of its standard practice, the CDFA will monitor aquatic herbicide applications to water bodies that do not drain into "waters of the United States". However, this monitoring is independent of the Monitoring and Reporting Plan described in this document.

### 3.2 Clear Lake

#### 3.2.1 Description of Treatment Areas

Clear Lake is currently the only water body within the “waters of the U.S.” as defined by the permit that is being routinely treated by the Hydrilla Eradication Program. Due to its size, treatments in Clear Lake are mapped into a grid along the shoreline that is divided into 80 numbered “management units”. Management units extend along the shoreline and into the water body 600-800 feet from shore covering a total area of approximately 8,460 acres. “Treatment areas” are the actual areas within the lake that are receiving treatment, and area identified according to the management unit number they fall in. A treatment area is centered at the location of a hydrilla (the target weed pest) find and extends out a little over 80 meters around the find, such that a 5-acre square is centered on the find as is illustrated in the figures below (larger treatment areas arise when they enclose more than one plant find). When an area is free of hydrilla for four to six years (depending on location and infestation intensity), treatments are ended in the treatment area and it is moved to a monitoring status. If a new plant location is found outside the active treatment areas, a new treatment area is drawn within the management unit. If a plant were found in a treatment area that had been in monitoring status, treatments would resume there.

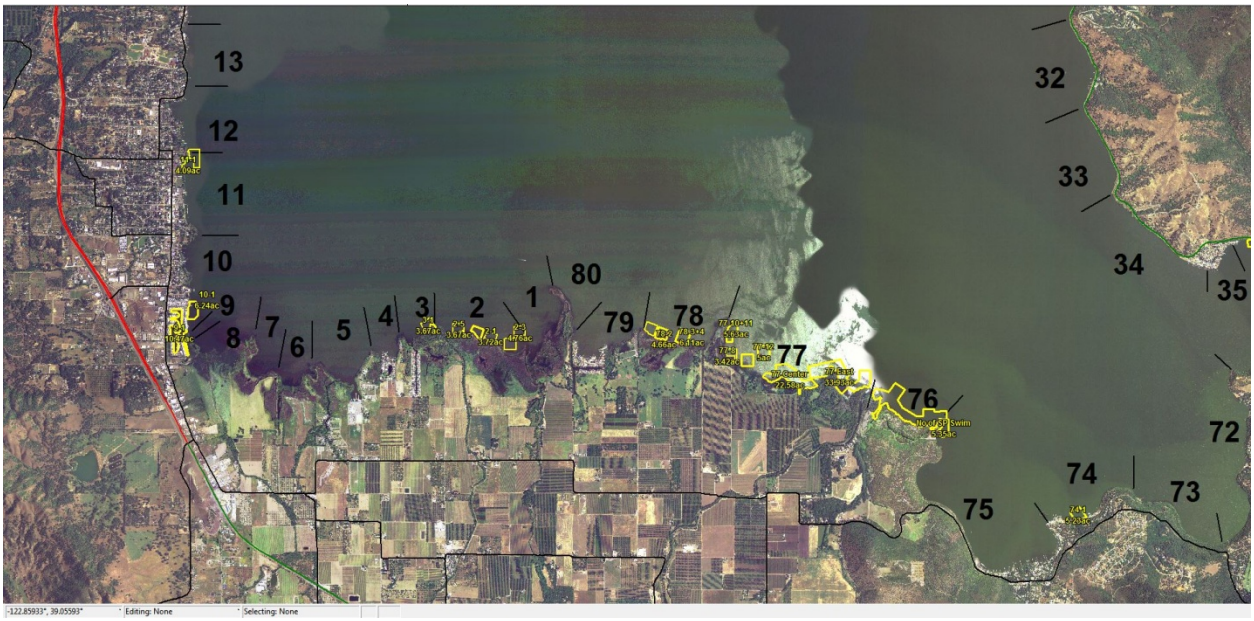

Figure 1 - Area 1 showing numbered Clear Lake treatment “management units”. Treatment areas are drawn in yellow.

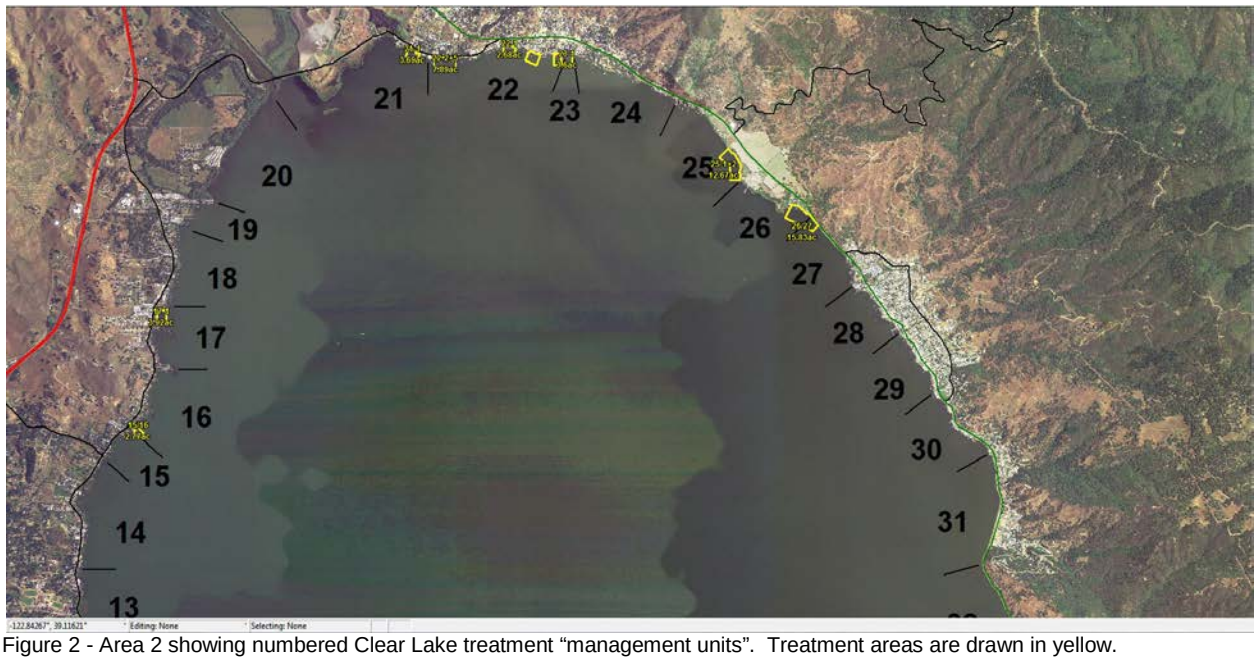

Figure 2 - Area 2 showing numbered Clear Lake treatment “management units”. Treatment areas are drawn in yellow.

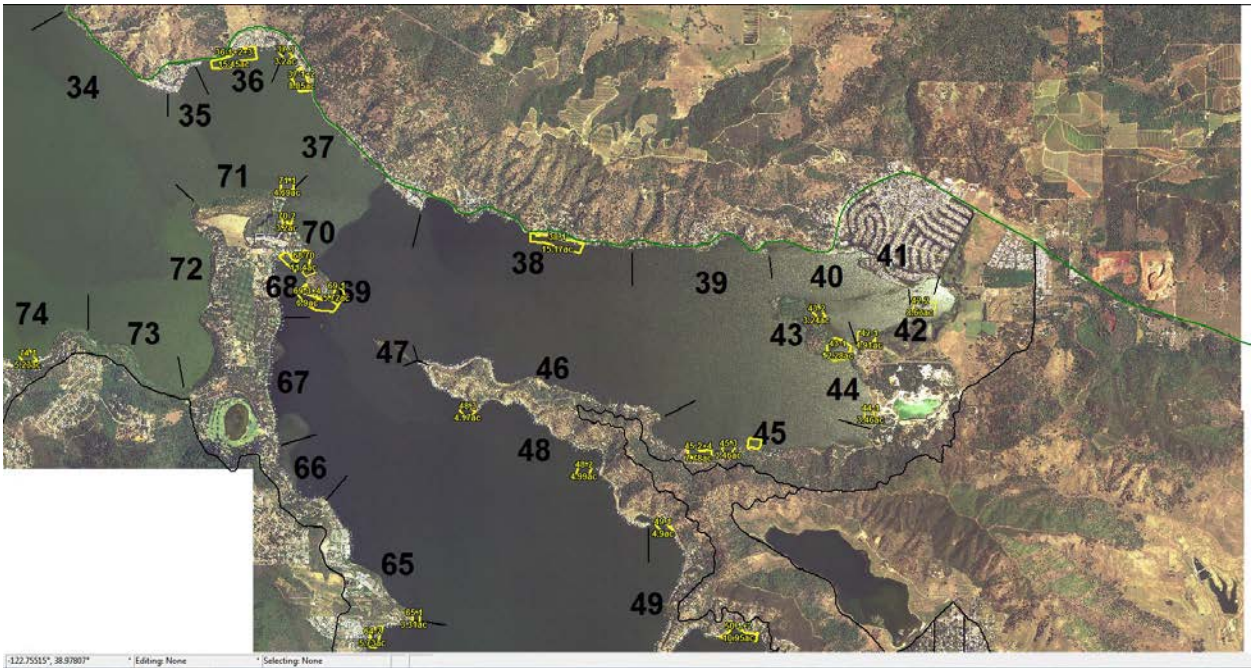

Figure 3 - Area 3 showing numbered Clear Lake treatment “management units”. Treatment areas are drawn in yellow.

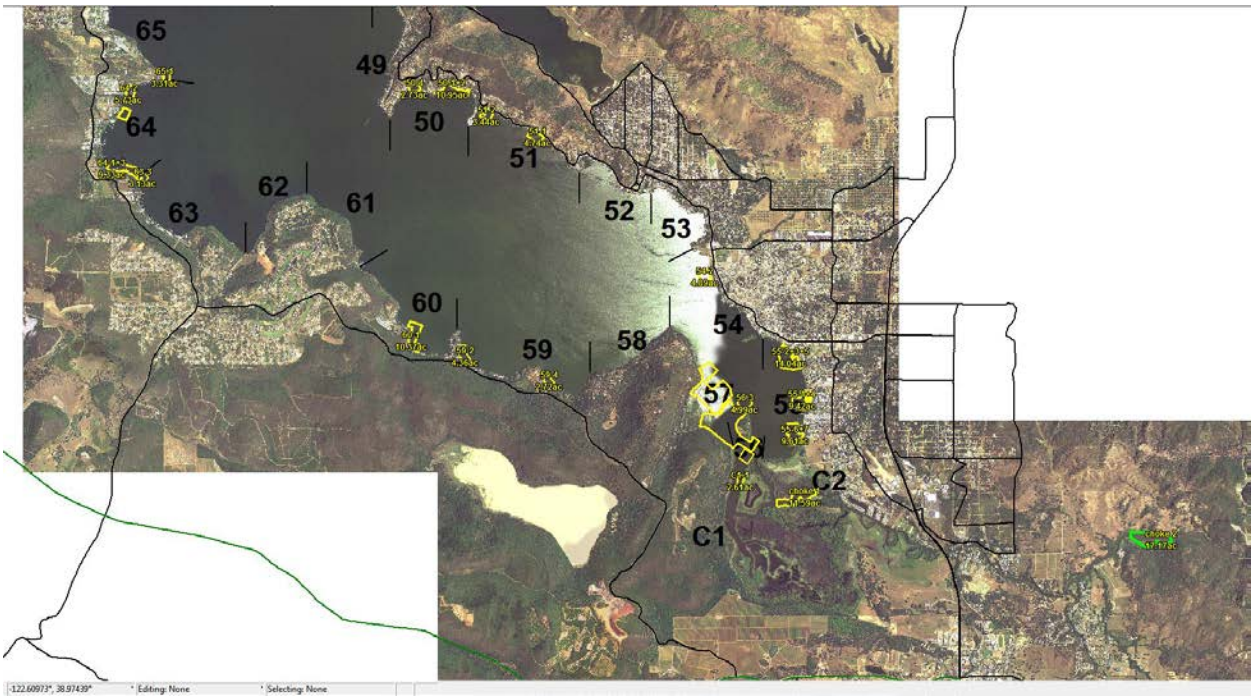

Figure 4 - Area 4 showing numbered Clear Lake treatment "management units". Treatment areas are drawn in yellow.

### 3.2.2 Pesticide Application Practices

The herbicides currently used by the Hydrilla Eradication Project for the eradication of hydrilla in Clear Lake are Sonar® fluridone herbicide and copper ethylenediamine complex (Komeen® or Harpoon®). Fluridone applications differ in intent and strategy from the copper treatment. Copper is a fast-acting (hours) contact herbicide which is effective on most submerged plants and particularly hydrilla. The copper treatment is considered a one-time treatment that is intended to "burn down" the general plant biomass in the area, knock back the hydrilla, and minimize the uptake of fluridone by non-target vegetation. Fluridone is a slow-acting (weeks) systemic herbicide that must remain in contact with its target for extended periods to be effective. Hydrilla is more susceptible to fluridone than nearly any other plant, and at very low concentrations (as low as 3-6ppb).

When a location with hydrilla is found in Clear Lake, copper aquatic herbicide is applied in a single pulse (application) of 1 part per million (ppm), spread underwater by boat to the treatment area. Typically, copper is applied only once for any given infested area, so a "treatment" is considered a single application. Sometimes copper may be applied again to an area if problems develop with excessive plant biomass that interfere with fluridone uptake by the hydrilla, or rapid hydrilla regrowth appears to be outrunning the effects of the fluridone. Such re-treatments are unusual, but are considered a separate treatment when they occur.

Fluridone is the main herbicide used to eradicate hydrilla. Because of its slow action, fluridone is applied in ways that attempt to extend its contact with the

target as long as possible. This is critical in Clear Lake where there is high water exchange and only a small fraction of the water body is being treated, both of which tend to move and dilute the herbicide. A number of strategies are employed in Clear Lake to extend fluridone's contact. For example it is formulated in slow release pellets to spread out its time in the water. The pellets also help keep the fluridone near the bottom, where hydrilla plants are most susceptible as they emerge as small, young plants from the sediment. Also, a single season's dose is applied in separate, regular pulses during the growing season so that the cumulative total dose for the year does not exceed the allowed label rate. This defines a "treatment" of fluridone as being a series of smaller applications throughout the year. The extended treatment also targets the continuous sprouting of new hydrilla plants, which emerge throughout the growing season. An eradication effort cannot succeed if it allows plants to establish and become vigorous at any time in the growing season.

In the Clear Lake project, a treatment of fluridone typically consists of five to seven applications of slow release pellets at 20-30 ppb each to the bottom six feet of the water column several weeks apart, to give a cumulative application rate of 100-140 ppb. Currently, the general Clear Lake prescription is five treatments of 25 ppb in each treatment area, approximately five weeks apart, for a cumulative dose of 125 ppb in a year.

### 3.2.3 Proposed Water Monitoring Studies

Water Monitoring Studies are performed in compliance with the Monitoring and Reporting Program (MRP) for Water Quality Order No. 2013-0002-DWQ. Samples will be collected and analyzed per MRP guidelines as stated the table below, "Monitoring Requirments" listed in Appendix C as Table C-1 of the General NPDES Permit.

**Table C-1. Monitoring Requirements**

| Sample Type | Constituent/Parameter | Units | Sample Method | Minimum Sampling Frequency | Sample Type Requirement | Required Analytical Test Method |
|---|---|---|---|---|---|---|
| Visual | 1. Monitoring area description (pond, lake, open waterway, channel, etc.)<br>2. Appearance of waterway (sheen, color, clarity, etc.)<br>3. Weather conditions (fog, rain, wind, etc.) | Not applicable | Visual Observation | [1] | Background, Event and Post-event Monitoring | Not applicable |
| Physical | 1. Temperature[2] | ºF | Grab[4] | [5] | Background, Event and Post-event Monitoring | [6] |
| | 2. pH[3] | Number | | | | |
| | 3. Turbidity[3] | NTU | | | | |
| | 4. Electric Conductivity[3] @ 25°C | µmhos/cm | | | | |
| Chemical | 1. Active Ingredient[7] | µg/L | Grab[4] | [5] | Background, Event and Post-event Monitoring | [6] |
| | 2. Nonylphenol[8] | µg/L | | | | |
| | 3. Hardness (if copper is monitored) | mg/L | | | | |
| | 4. Dissolved Oxygen[2] | mg/L | | | | |

[1] All applications at all sites.
[2] Field testing.
[3] Field or laboratory testing.
[4] Samples shall be collected at three feet below the surface of the water body or at mid water column depth if the depth is less than three feet.
[5] Collect samples from a minimum of six application events for each active ingredient in each environmental setting (flowing water and non-flowing water) per year, except for glyphosate. If there are less than six application events in a year, collect samples during each application event for each active ingredient in each environmental setting (flowing water and non-flowing water). If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation/trigger for an active ingredient in an environmental setting, sampling shall be reduced to one application event per year for that active ingredient in that environmental setting. If the yearly sampling event shows exceedance of the receiving water limitation/trigger for an active ingredient in an environmental setting, then sampling shall return to six application events for that active ingredient in each environmental setting. For glyphosate, collect samples from one application event from each environmental setting (flowing water and non-flowing water) per year.
[6] Pollutants shall be analyzed using the analytical methods described in 40 C.F.R. part 136.
[7] 2,4-D, acrolein, dissolved copper, diquat, endothall, fluridone, glyphosate, imazamox, imazapyr, penoxsulam, and triclopyr.
[8] It is required only when a surfactant is used.

### 3.2.4 Sampling Frequencies

Background monitoring - Background monitoring samples shall be collected upstream at the time of the application event or in the application area just prior to (up to 24 hours in advance of) the application event.

Event monitoring – one sample shall be collected immediately downstream of the treatment area in flowing waters or immediately outside of the treatment area in non-flowing waters, immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area. One sample shall also be taken within the treatment area.

Post-Event Monitoring – one sample shall be collected within the treatment area within one week after the application event, and one sample outside the treatment area in the same location as the event monitoring sample.

System-wide Monitoring – samples shall be collected in water upstream and downstream (inlet and outlet) from the water body. This will represent the cumulative effect of all the treatments in the lake and is performed pre-season, postseason, and several times throughout the year.

### 3.2.5 Monitoring Locations

Monitoring for copper and fluridone differ in Clear Lake because their use patterns are very different. The program chooses monitoring locations for sampling based on the active ingredient used and consideration of best and worst case scenarios. These monitoring locations may be chosen to be representative of the other treated units.

#### 3.2.5.1 Fluridone

There are 80 management units in the Hydrilla Eradication Program in Clear Lake, as previously described, with 75 active treatment areas as of 2013. These areas are treated almost exclusively with fluridone, generally to a fixed prescription. In the past and currently, the Program chooses two treatment areas for sampling, one to represent a best case scenario and one to represent a worst case scenario. These treatment areas bracket the other treated units. The worst case situation is chosen to maximize the concentration of fluridone in the area, which occurs in areas with the least water movement (sheltered, enclosed areas) and largest treated areas. The best case situation is chosen where concentrations of fluridone should be minimized, that is, in small treatment areas with high water movement (along the open shore). Since Clear Lake has high water movement and few areas that are highly sheltered, most treatment areas are similar to the best case scenario.

The same monitoring sites are used from one year to the next. Sampling stations are set at the center of the treated area and at 30 and 100 meters outside of the station. Sampling occurs before, one day after, and five to seven days after each of the five applications during a season, as well as at two week intervals for several weeks after treatments end in the fall. We have maintained such monitoring locations since 2004, but occasionally circumstances drive a change. For example, in 2013 we had to move to a new “worst case” treatment area when our previous “worst case” area went into monitoring status after having been free of hydrilla for four to five years.

| Monitoring Locations for Fluridone in Clear Lake | | | |
|---|---|---|---|
| Active Ingredient | Monitoring Location | GIS | Frequency |
| Fluridone | Area 76-2007-11 | Center of treatment. 39.020132 N/ - | Background, Event, Post- |

| | | | |
|---|---|---|---|
| | | 122.808950 W | event |
| Fluridone | Area 76-2007-11 | 30 meters outside edge of treatment area towards lake center. 39.020505 N/ -122.808445 W | Background, Event, Post-event |
| Fluridone | Area 76-2007-11 | 100 meters outside edge of treatment area towards lake center.39.020646 N/ -122.808268 W | Background, Event, Post-event |
| Fluridone | State Park | Center of treatment. 39.0184 N/ -122.8033 W | Background, Event, Post-event |
| Fluridone | State Park | 30 meters outside edge of treatment area towards lake center.39.0185 N/ -122.8033 W | Background, Event, Post-event |
| Fluridone | State Park | 100 meters outside edge of treatment area towards lake center.39.0185 N/ -122.8022 W | Background, Event, Post-event |
| Fluridone | Inlet | 39.118251 N/ -122.886710 W | System-wide |
| Fluridone | Outlet | 38.922678 N/ -122.605636W | System-wide |

In 2010, the Hydrilla Program summarized results of 462 water samples for fluridone taken during 2004 – 2010. The samples came from inside and next to treatment areas. Of 462 samples, two had fluridone concentrations over 5 ppb. One of them had 5.7 and the other had 10.4 ppb. Most samples were much lower: 322 samples had less than 0.5 ppb, 83 had 0.5 to 1 ppb, and another 38 had 1 to 2 ppb. Over 99.5% of the time, the Sonar in the water could not harm even the most sensitive plants. Furthermore, since treatments resumed in 2007, one of the two permanent sampling sites has been in one of the largest, most sheltered and enclosed treatment areas, in Soda Bay. Such conditions lead to higher concentrations of fluridone, and the sampling site was intentionally placed in what should be a “worst case” situation.

The CDFA has followed an intensive system of testing for residual herbicide discharge from fluridone in the past 10+ years that Clear Lake has been treated for the purposes of Hydrilla Eradication. The results have shown that it is highly unlikely that applications applied by CDFA would result in an exceedance of “no toxics in toxic amounts” or impact “beneficial use” of lake waters. Results have been very consistent from year to year and completely in line with what would be expected from the dynamics of fluridone in the water and sediment, and given the water movement in Clear Lake and the small proportion of the lake that is treated (in considering the period with greatest concentrations, we were

treating about 730 acres in a year, or about 1.7% of 43,000-acre Clear Lake).

While we have no immediate alternatives to our current sampling scheme, we are well past the point where we are learning anything new for the effort and expense. We intend to actively seek questions about fluridone behavior or application effects that could benefit from some sampling. We will then design a sampling scheme to test that question. While such sampling may not fit the base question posed by the Board, roughly 10 years of intensive data already provide an answer. It would be profitable to move on to other questions.

3.2.5.2 Copper

Copper is not applied according to a prescribed schedule in Clear Lake. It is applied on an "as needed" basis in two circumstances: 1) as the first application establishing a new treatment area, for a new hydrilla location outside current treatment areas; 2) when a hydrilla plant within an existing treatment area escapes the fluridone treatment and establishes vigorous growth. The latter happens very occasionally, perhaps once a year or less. When it does happen, a copper treatment will burn back the hydrilla plant to the sediment surface and bring it back under the influence of the fluridone. Neither of these events is predictable, so there are no predetermined monitoring areas for hydrilla copper treatments. For the purpose of monitoring, we have established one fixed five-acre site in a location that helps Lake County with the annual seaplane event at Clear Lake and prevents the planes from carrying aquatic pest plants from the lake, meeting quarantine requirements. We sample this area before treatment, and one and four days after treatment, at three locations (center of treatment and 30 and 100 m outside the edge of the treatment toward the lake center). If there were additional applications of copper for the treatment of hydrilla during the year, we would monitor the treatment location where it was applied according to permit requirements. Per the permit, if the results from six sampling events in a year show copper concentrations that are less than the receiving water limitation/trigger, then sampling would be reduced to one application event per year in this environmental setting. The monitoring location in this scenario would remain the 5$^{th}$ Street seaplane launch area.

| Monitoring Locations for Copper in Clear Lake | | | |
|---|---|---|---|
| Active Ingredient | Monitoring Location | GIS | Frequency |
| Copper | 5$^{th}$ Street | Center of treatment 39.04654N/ 122.91264W | Background, Event, Post-event |
| Copper | 5$^{th}$ Street | 30 meters outside edge of treatment area towards lake center.39.04654N/ 122.91205W | Background, Event, Post-event |

| | | | |
|---|---|---|---|
| Copper | 5th Street | 100 meters outside edge of treatment area towards lake center.39.04650 N/ 122.91180W | Background, Event, Post-event |

## 3.3 Other Infested Areas within "waters of the U.S."

3.3.1 Description of Treatment Areas

Areas within the definition of "waters of the U.S." that are found by the program to be newly infested with a target weed pest would be evaluated on a site by site basis. If a decision to apply herbicide was made, they would be evaluated for treatment strategy, including the establishment of treatment areas, if any, as outlined in Section 2.2.2.

3.3.2 Pesticide Application Practices:

Application practices are based on the label requirements of the active ingredient selected.

### 3.3.3 Proposed Water Monitoring Studies

Water Monitoring Studies are performed in compliance with the Monitoring and Reporting Program (MRP) for Water Quality Order No. 2013-0002-DWQ. Samples will be collected and analyzed per MRP guidelines as stated the table below, "Monitoring Requirments" listed in Appendix C as Table C-1 of the General NPDES Permit.

**Table C-1. Monitoring Requirements**

| Sample Type | Constituent/Parameter | Units | Sample Method | Minimum Sampling Frequency | Sample Type Requirement | Required Analytical Test Method |
|---|---|---|---|---|---|---|
| Visual | 1. Monitoring area description (pond, lake, open waterway, channel, etc.)<br>2. Appearance of waterway (sheen, color, clarity, etc.)<br>3. Weather conditions (fog, rain, wind, etc.) | Not applicable | Visual Observation | [1] | Background, Event and Post-event Monitoring | Not applicable |
| Physical | 1. Temperature[2] | ºF | Grab[4] | [5] | Background, Event and Post-event Monitoring | [6] |
| | 2. pH[3] | Number | | | | |
| | 3. Turbidity[3] | NTU | | | | |
| | 4. Electric Conductivity[3] @ 25°C | µmhos/cm | | | | |
| Chemical | 1. Active Ingredient[7] | µg/L | Grab[4] | [5] | Background, Event and Post-event Monitoring | [6] |
| | 2. Nonylphenol[8] | µg/L | | | | |
| | 3. Hardness (if copper is monitored) | mg/L | | | | |
| | 4. Dissolved Oxygen[2] | mg/L | | | | |

[1] All applications at all sites.
[2] Field testing.
[3] Field or laboratory testing.
[4] Samples shall be collected at three feet below the surface of the water body or at mid water column depth if the depth is less than three feet.
[5] Collect samples from a minimum of six application events for each active ingredient in each environmental setting (flowing water and non-flowing water) per year, except for glyphosate. If there are less than six application events in a year, collect samples during each application event for each active ingredient in each environmental setting (flowing water and non-flowing water). If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation/trigger for an active ingredient in an environmental setting, sampling shall be reduced to one application event per year for that active ingredient in that environmental setting. If the yearly sampling event shows exceedance of the receiving water limitation/trigger for an active ingredient in an environmental setting, then sampling shall return to six application events for that active ingredient in each environmental setting. For glyphosate, collect samples from one application event from each environmental setting (flowing water and non-flowing water) per year.
[6] Pollutants shall be analyzed using the analytical methods described in 40 C.F.R. part 136.
[7] 2,4-D, acrolein, dissolved copper, diquat, endothall, fluridone, glyphosate, imazamox, imazapyr, penoxsulam, and triclopyr.
[8] It is required only when a surfactant is used.

### 3.3.4 Sample Monitoring Frequencies

Background monitoring - samples shall be collected upstream at the time of the application event or in the application area just prior to (up to 24 hours in advance of) the application event.

Event monitoring – samples shall be collected immediately downstream of the treatment area in flowing waters or immediately outside of the treatment area in non-flowing waters, immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area.

Post-Event Monitoring – Post event samples shall be collected within the treatment area within one week after the application event.

### 3.3.5 Monitoring Locations

Monitoring locations are chosen to be representative of treated areas and will be environmentally similar areas with similar hydrology, algaecides and aquatic herbicides used, and environmental setting (flowing or non-flowing water).

## 3.4 Other Water Quality Parameters

This monitoring plan is designed to demonstrate that water treated with aquatic herbicides as a part of the CDFA, Hydrilla Eradication Program are returned to full "Beneficial Use." Therefore, the primary target of the monitoring program is to follow the dissipation of the aquatic herbicides themselves. However, certain other visual water quality, chemical and physical parameters will also be measured at each sampling time in order to demonstrate the general water quality and as required by the General Permit. This additional monitoring will be done during background, event and post-event sample collection.

### 3.4.1 Visual Observations of Sampling Site

Visual observations of the water body will be noted on a sampling field data sheet log for each water sampling site chosen. Observations will include:

- Water Body Description-(pond, lake, canal, creek, stream, etc.)
- Appearance of water way-(sheen, color, clarity, etc.)
- Weather Conditions-(rain, wind, fog, etc.)
- Flow Conditions

Attention will be given and noted to the presence of:

- Floating or suspended matter
- Discoloration
- Bottom deposits
- Aquatic life
- Visible films, sheens, or coatings
- Fungi, algal slimes or objectionable growths
- Potential nuisance conditions

### 3.4.2 Physical Measurements of Sampling Site

In addition to monitoring for the dissipation of each active ingredient at each site, the following will also be measured to provide additional data for characterizing water quality:

1) Temperature
2) pH
3) Turbidity
4) Electric Conductivity @ 25°C

5) Nonylphenol (if applicable)
6) Hardness (if applicable for copper)
7) Dissolved Oxygen

Measurements will be made during water sampling and recorded on a sampling field data sheet. An YSI-556-MPS meter or equivalent will be used to take physical measurements. The meter will be calibrated prior to use. Measurements will be made by inserting the probe directly within the water, just downstream from the point where a water sample will be extracted.

### 3.4 Laboratory Information

All water samples will be analyzed by the CDFA Center for Analytical Chemistry, Pesticide Monitoring and Compliance Laboratories Program (the Center), as described below.
The Center is accredited by ISO 17025.

| Laboratory | Primary Contact Person | Phone | Email | Secondary Contact Person |
|---|---|---|---|---|
| **The Center** | Elaine Wong | (916) 262-2062 | ewong@cdfa.ca.gov | . Stephen Siegel |

The address of the Center is 3292 Meadowview Road, Sacramento, CA 95832.

### 3.5 Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained CDFA personnel following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in CDFA's Quality Assurance Plan and include:

1) Wearing new, disposable plastic gloves while taking the sample
2) Wearing clean, freshly laundered clothing. Use separate life preservers, boots, waders, etc. than those used for making herbicide applications
3) The person who takes the sample shall not treat the same day, and shall have showered thoroughly and washed his/her hands carefully before going out to take samples
4) Treatment boat shall not be used to take samples. Instead, a cleaned boat will be used
5) ALL materials used for sample collection shall be kept away from herbicide storage areas. This includes sample bottles, gloves, coolers, and the refrigerator
6) A water sampling field data sheet will be used to record water sample data, visual observations, and water quality measurements.
7) Water samples shall be collected using new bottles.
8) Each bottle will be labeled with the collector's name, date, location, time, monitoring type and analysis required (active ingredient or toxicity study).

9) All samples will be refrigerated in the field using a mobile 12v refrigeration unit placed in a vehicle or kept on ice in a cooler. Samples will remain refrigerated while being transported to an indoor refrigeration unit.
10) Coolers used to transport the samples to the laboratory will be prepared as follows:
    - Previous labels will be removed from cooler.
    - Drain plugs will be sealed with tape inside and out.
    - All ice will be double bagged in resealable plastic bags.
11) A Chain-of-Custody form will accompany samples and coolers to the laboratory.
12) Upon receipt by the laboratory, the sample custodian will inspect and certify the condition and presence of all samples.

## 4.1 General BMP's

### 4.1.1 Overview

The following general Best Management Practices (BMP) guidelines have been developed by CDFA for pesticide applications. They will facilitate an optimal pesticide application and protect the natural environment by preventing off-site movement. In order to ensure proper aquatic herbicide application, the CDFA Hydrilla Eradication Program requires that all applications be made under the supervision of an applicator certified for aquatic herbicide applications by the California Department of Pesticide Regulation (CDPR) (Qualified Applicator Certificate or Qualified Applicator License). In order to avoid inadvertent or accidental soil or water contamination with aquatic herbicides, the CDFA, Hydrilla Eradication Program follows the storage, transport, and spill control procedures recommended by the CDPR and the United States Environmental Protection Agency.

### 4.1.2 Measurements/Calculations

In order to ensure the use of correct application rates, the CDFA Hydrilla Eradication Program follows all label directions as to application rates and timings. Water volumes are calculated using surface acreages. Surface acreages are determined using Global Positioning System/Geographic Information System technology. Water depths are determined physically (depth meter sticks) in shallow water and by depth finder in deeper waters.

In order to ensure the use of correct application volumes, the CDFA Hydrilla Eradication Program routinely cleans and calibrates all herbicide application equipment.

In order to avoid spray drift, the CDFA Hydrilla Eradication Program follows all label directions and all CDPR guidelines as to acceptable application weather conditions. For instance, aqueous spray applications are not made in winds above 10 miles per hour, or in temperature inversions (unless they are applied through an underwater nozzle), and never made in rough water.

### 4.1.3 Planning/Coordination

1. Conduct a site assessment.
    a. Identify the pest species to be treated.
    b. Take note of site conditions.
    c. Choose the least persistent and lowest toxicity pesticide that will efficaciously treat the target pest.

2. All equipment must be properly cleaned and calibrated to apply chemicals uniformly and in the correct quantities.

a. Calibrate spray equipment per manufactures specifications.
b. Equipment screening tests.
c. Dedicate specific equipment for specific products.
d. Clean equipment regularly following the manufactures specifications and the pesticide label directions.
e. Select the appropriate nozzle to ensure proper coverage.
f. Maintain an equipment log to track calibration, cleaning and repairs.
g. Conduct visual inspection of equipment prior to use. Check all equipment for leaking hoses, connections and nozzles.
h. Monitor the operation of the nozzles during the application.
i. **DO NOT** use any equipment that appears to be damaged.
j. Discontinue use immediately in the event of an equipment malfunction.

3. Follow pesticide label directions, regulations, or internal procedures whichever is the most conservative.

a. Read pesticide label.
b. Staff is trained to properly apply pesticide.
c. Be aware of any regulations or internal procedures prior to application.
d. Ensure that treatment is consistent with Integrated Pest Management for the pest and crop/location.
e. Use appropriate application methods and rates to minimize over application.
f. Mix and load chemicals out of streamside areas, mix and load in areas where spills can be contained.
g. Annual safety & endangered species training for all personnel mixing or applying pesticides.
h. Annual search for MSDS and Label updates or revisions for materials used.

4. Apply chemicals only under favorable weather conditions.

a. **DO NOT** make spray applications if wind speeds are over 10 miles per hour.
b. Avoid spraying during stable (inversion) conditions (early morning and early evening) when there is little or no vertical mixing of the air. These conditions generate concentrated drift clouds and increase the chance of drift fallout.
c. Check weather service prior to application and **DO NOT** make application if rain (40% chance or higher) is forecast 48 hours prior to planned application.
d. Monitor wind direction and do not spray when there are sensitive crops/areas immediately downwind.
e. Keep records of air temperature, wind speed, and wind direction.

5. Follow integrated pest management and drift reduction techniques.
    a. Use buffer zones to protect sensitive areas, T & E “critical habitat” (as prescribed through Section 7 Consultations).
    b. Use of spotters to avoid accidents and to aide in identifying buffer zones.
    c. Use low pressure application equipment.
    d. Conduct spot treatment when applicable.

6. Clean equipment and dispose of rinse water per label directions.
    a. Rinse equipment according to manufacturer’s label instructions.
    b. Discharge rinse water only in areas that are part of the application site o at a certified waste treatment facility.
    c. Dispose of surplus chemical and containers according to label instructions.
    d. Staff are trained to clean up spills

7. Product Storage
    a. All pesticides are stored at CDFA facilities in original containers.
    b. All pesticides removed from original container for use are sealed within a service container
    c. All service containers are sealed within a tool box inside the bed of a modified truck.
    d. Tool boxes are supervised when not locked.

1) **Treatment conditions:** Every application is made according to label directions and other requirements as directed by DPR or the agricultural commissioner, which not only specify the amounts and situations where pesticides may be applied, but the atmospheric and environmental conditions under which they may be applied. If there are conditions where it is determined that the treatment would be ineffective, CDFA would wait for other conditions or use a different treatment.

2) **Pre-treatment:** Letters to affected members of the public are coordinated through the local Agricultural Commissioner’s Office providing information about the treatment and measures to mitigate harm to any affected crops that may be sensitive to aquatic herbicides through irrigation water. Individuals and entities located within ¼ mile of treatment areas that utilize water intake valves are notified and treatments in these locations are a reduced herbicide dosage. In addition to these safeguards, the CDFA Hydrilla Eradication Program also conducts additional pre-testing (FasTEST) of active ingredient concentrations at treatment sites close to intake valves so that any additional applications may be adjusted if necessary.

3) **Post-treatment:** Surveys also are used for post-treatment assessment of treatment efficacy and non-target effects. As noted elsewhere, the survey

crews are instructed to look for possible non-target impacts that can be seen with the naked eye, such as dead fish or damage to plants on the shoreline.

## 4.2 Pesticide Training

Personnel are trained in the safe and proper mixing, loading and application of pesticides in compliance with both federal and state pesticide regulations and the product label. Each employee that handles pesticides must be trained to safely handle, transport, store, apply and dispose of the pesticide according to California Code of Regulations Title 3. Each employee attends a documented pesticide training session annually or prior to working with pesticides. In addition, employees that supervise the handling and application of pesticides must maintain a Qualified Applicator Certificate, issued by the California Department of Pesticide Regulation. To maintain a certificate, 20 hours of continuing education courses must be completed every two years.

## 4.3 Working with the Public

In order to maintain the best possible working relationship with private landowners and the public, local County Departments of Agriculture are consulted when hydrilla surveys are conducted within their jurisdiction. CDFA staff then work with the County Departments of Agriculture to develop a plan to address the survey findings, and perform any required eradication work.

In order to maintain the best possible working relationship with the public, CDFA staff makes it a policy to stop control activities in order to answer program related questions from interested or concerned citizens.

In order to maintain the best possible working relationship with private landowners, CDFA notifies landowners when hydrilla is detected on their property, and consent is sought for the CDFA staff to eradicate these plants from their lands.

In order to maintain the best possible working relationship with private landowners (and the public), efforts are made as a courtesy, to notify landowners when herbicide treatments are being conducted in nearby areas, adjacent to their lands.

## 4.4 Avoidance of Non-target Sites & Plan to Prevent Fish Kill

Program personnel, through extensive field training and experience, become intimately acquainted with all physical characteristics of the terrain within their assigned districts. This includes familiarity with non-target sites and situations such as human activity, livestock, water sources, endangered species locations and riparian zones.

The close familiarity with treatment areas and delimitation surveys performed during the period prior to the commencement of applications enables Program personnel to predict where non-target sites and situations are likely to occur. Maps provided by private parties, the BLM, National Resource Conservation Service and the U.S. Geological Survey are utilized to record the locations of target pest populations and the position of non-target sites. Program personnel performing applications, leave buffers around non-target sites within the treatment area. In the case of wildlife within treated ponds, the procedure is to treat no more than 1/3 of the water body to allow fish to migrate away from the treatment area and maintain higher dissolved oxygen concentration levels in the untreated water. In the case of sensitive species, aquatic herbicide treatments occur at a lower rate and are spread out over longer periods of time to reduce any toxic effects.

## 4.5 BMP's for T & E Species Habitat

In order to avoid inadvertent or accidental take of listed species, the CDFA Hydrilla Eradication Program consults the CDPR website, PRESCRIBE (http://www.cdpr.ca.gov/docs/endspec/prescint.htm) for Threatened and Endangered Species before starting a new project location. The CDFA Hydrilla Eradication Program consults on an annual basis with the local county Agricultural Commissioners as to the presence of any Threatened and Endangered Species in or near the project areas. The CDFA also participates with Native American groups in a monitoring program for a fish species of special concern, the Clear Lake hitch, in Clear Lake. The presence of listed species will affect the type of eradication method used.

## 4.6 Spill Contingency Plan

The objective of the plan is to:

- Minimize the risk of further pesticide exposure to people, animals, and the environment.
- Provide a list for notifying federal, state, and local government officials of the size and details of the spills.
- Provide clean up of small spills (50 gallons or less) and proper disposal of residual materials.

### 4.6.1 Emergency Procedures

Use common sense in determining the appropriate action in the event of an accidental spill.

**Spill Involving Injury**: If a spill involves personal injury, call an ambulance.

The health and well being of persons in and around the area is the most immediate concern. If someone was exposed to pesticides remove them to a safe location. Remove clothing and wash contaminated skin with soap and water. Do not move a seriously injured person unless it is absolutely essential due to risk of further injury. Do not leave injured or incapacitated persons until proper medical assistance arrives. A pesticide label and/or safety data sheet should accompany exposed people to the hospital.

**Spill Involving Fire:** If a fire hazard exists, call the fire department and notify them of the presence of pesticides. Eliminate all sources of ignition (electric motors, gasoline engines or smoking) to prevent the threat of fire or explosion.

**Spill on Highway:** If the spill occurs on the highway, contact the California Highway Patrol through (911).

**Spill Off-road:** If the spill occurs off-road, call local police or county sheriff.

**Punctured Container:** If a pesticide container becomes punctured, stop the leak and contain the spill.

4.6.2 Minor Spills, 50 Gallons or Less

1. Wear rubber boots, coveralls, rubber gloves and eye protection.
2. Confine the leak or spill to the smallest area possible by using natural terrain, soil or absorbent material.
3. Shovel contaminated material into a leak proof container.
4. Do not hose down area.
5. Work carefully and safely; do not hurry.
6. Dispose of contaminated material the same manner as with excess pesticides or hazardous wastes.

4.6.3 Major Spills (50 Gallons or More)

1. Follow steps listed under minor spills.
2. If the spill is too big, or uncertainty exists as to the appropriate action notify, the Chemical Transportation Emergency Center at 1-800-424-9300.
3. If the spill occurs on the highway, call the California Highway Patrol through (911).
4. If the spill occurs off-road, call local police or county sheriff.

4.6.4 Notification List

Depending of circumstances, it may be necessary to notify and seek assistance from various agencies.

1. The California Department of Food and Agriculture, Division of Plant Health and Pest Prevention.

2. California Highway Patrol, if accident is on the highway. Contact local police or county sheriff if the accident is not on a State Highway.
3. County Agricultural Commissioner's office.
4. California Emergency Management Agency 1-800-852-7550 or public number (916) 845-8911.
5. State Department of Water Resources and the California Department of Fish and Game; if the spill threatens or contaminates water.
6. The National Marine Fisheries Service 1-707-575-6050 if the spill affects a threatened or endangered anadromous or marine species or their critical habitat.
7. The U.S. Fish and Wildlife Service at 1-916-414-6600 if the spill affects a threatened or endangered terrestrial or freshwater species or their critical habitat.
8. The Bureau of Land Management, local resource office, if the spill occurs on BLM administered lands.
9. The Federal Aviation Administration, if the spill involves an aircraft crash.
10. Local county environmental health office.

4.6.5 Safety and Cleanup Materials

The following is a checklist of safety and cleanup materials that accompany mixing-loading vehicles during treatment activities.

1. Safety

   First aid kit
   Fire extinguisher-516, type A-B-C
   Goggles

2. Clean Up

   One shovel
   Large heavy-duty plastic bags
   Rubber boots
   Disposable coveralls
   Water
   Rubber gloves
   Broom and dust pan
   Liquid detergent
   Several bags of absorbent materials

4.6.6 Decontamination

Surfaces such as paved surfaces should be decontaminated. Contaminated material must be shoveled into a leak-proof metal drum for final disposal.

### 4.6.7 Disposal

All materials that have been contaminated by spillage, or exposed to large volumes of pesticides including cloth, soil and wood cannot be decontaminated and must be disposed of in the same manner as with excess pesticides. Contaminated absorbent material and materials that cannot be decontaminated will be stored in a leak-proof container and disposed in a Class I dump.

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