

**APPLICATION FOR THE TAHOE KEYS LAGOONS AQUATIC WEED CONTROL
METHODS TEST INCLUDING AN EXEMPTION TO THE BASIN PLAN PROHIBITION
ON THE USE OF PESTICIDES**

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1. Project Information

1.1. Introduction to the Application

This is a joint application submitted by the Tahoe Keys Property Owners Association (TKPOA) to the Lahontan Regional Water Quality Control Board (Lahontan Water Board) and the Tahoe Regional Planning Agency (TRPA) to implement the Tahoe Keys Lagoons Aquatic Weeds Control Methods Test (CMT). The CMT will test various control methods of invasive aquatic weeds and undesired native weeds (target aquatic weeds) in the Tahoe Keys lagoons. The CMT was designed using best available science and Integrated Pest Management principles with significant input from the Aquatic Invasive Species (AIS) Stakeholder Committee¹. The Stakeholder Committee was created to ensure a collaborative and transparent environmental review process, and to ensure that a broad range of options is considered in

¹ The Stakeholder Committee was convened by TRPA, the Lahontan Water Board and includes representatives from the TRPA, the Lahontan Water Board, the Tahoe Resource Conservation District (TRCD), the League to Save Lake Tahoe, the Tahoe Water Suppliers Association (TWSA), and the Tahoe Keys Property Owners Association (TKPOA) as the project applicant. The Stakeholder Committee is facilitated by Zephyr Collaboration, LLC.

the development of the CMT. The CMT is designed to learn more about the efficacy and potential impacts of new AIS control technologies and the potential use of herbicides in the Tahoe Keys lagoons.

TKPOA is proposing the CMT to test control methods of three target aquatic weeds: Eurasian watermilfoil, curly-leaf pondweed, and coontail. The target aquatic weeds have adversely affected the water quality and ecosystem of the Tahoe Keys lagoons, created optimum habitat for non-native fisheries, and adversely impacted beneficial uses of the waters of the Tahoe Keys lagoons which are: municipal and domestic water supply, agricultural water supply, groundwater recharge, freshwater replenishment, water-contact recreation, non-water contact recreation, navigation, commercial and sport fishing, cold freshwater habitat, wildlife habitat, preservation of biological habitats of special significance, migration of aquatic organisms, spawning, reproduction and development of fish and wildlife, preservation of rare and endangered species, water quality enhancement and flood peak attenuation/flood water storage. A transparent and efficient regulatory and public review process is necessary so that the efficacy of a range of integrated control methods can be tested for effectiveness in preventing irreversible infestations in Lake Tahoe's ecosystem, and so that adverse economic and social impacts related to such infestations can be avoided.

TKPOA is seeking an exemption to the Water Quality Control Plan for the Lahontan Region (Basin Plan) prohibition of the use of aquatic pesticides and approval from TRPA to test aquatic herbicides as a potential AIS control tool. This application was prepared to address the Basin Plan requirements for an exemption to the prohibition on the discharge of pesticides² to surface or ground waters, and the TRPA Code of Ordinances. The specific requirements that were followed can be found in the Basin Plan, Chapter 4.1, Waste Discharge Prohibitions – Exemption Criteria for Controlling AIS and Other Harmful Species, for Projects That Are Neither Emergencies Nor Time Sensitive.

TKPOA initially applied to TRPA and the Lahontan Water Board for a similar test that was reviewed under a TRPA Initial Environmental Checklist and an Initial Study under the California Environmental Quality Act (CEQA). That review identified "Data Insufficiencies" and "Potentially Significant Impacts". As such, TRPA determined that the proposed project may have a significant effect on the environment and an Environmental Impact Statement shall be prepared (April 2018). That decision initiated this new jointly developed application for the CMT.

1.2. Location and Site Description

The area addressed by this application is the Tahoe Keys lagoons on the south edge of Lake Tahoe. The lagoons are part of the Tahoe Keys, a multi-use development situated on approximately 372 acres of land and 172 acres of waterways (known as the lagoons). The Tahoe Keys development was constructed in the 1960s on the Upper Truckee River Marsh by excavating the lagoons and capping the soil with sand to form stable building sites. The development includes 1,529 homes and townhomes, a commercial marina, and a commercial center. Three primary man-made water features exist in the Tahoe Keys: 1) the Main Lagoon

²As defined in Chapter 4, Section 4.1, Waste Discharge Prohibitions, of the Water Quality Control Plan for the Lahontan Region (Basin Plan), "Aquatic Pesticides" are pesticides registered by the California Department of Pesticide Regulation (DPR) and formulated for use in water to control aquatic animal or plant pests. An aquatic pesticide is any substance (including biological agents) applied in, on, or over the waters of the State or in such a way as to enter those waters for the purpose of inhibiting the growth or controlling the existence of any plant or animal in those waters.

(also known as the West Lagoon), 2) the Marina Lagoon (also known as the East Lagoon), and 3) the Lake Tallac Lagoon (Figure 1).

The lagoons are connected to Lake Tahoe via two narrow, direct channels: The West Channel which connects the Main Lagoon; and the East Channel, which connects the Marina Lagoon. Boat access to Lake Tahoe from the lagoons is restricted to these two channels. The Lake Tallac Lagoon flows into Pope Marsh, to the west of the Tahoe Keys, as shown on Figure 1.

1.3 Background

1.3.1 History and Current Status of Aquatic Weeds in the Lagoons

In the 1980s and 1990s, the invasive weed Eurasian watermilfoil (*Myriophyllum spicatum*) became established in the Tahoe Keys lagoons and other areas around Lake Tahoe. As of 2012, 18 infestation sites were known with the possibility of more that were not surveyed (Wittmann and Chandra 2015). Then, in 2003, curlyleaf pondweed (*Potamogeton crispus*) was first discovered in Lake Tahoe. Currently, curlyleaf pondweed is limited to the south and southeastern shores of Lake Tahoe with infestations observed from Taylor Creek to Lakeside Marina (Wittmann and Chandra 2015, LTSLT 2016). Newer infestations were also recently found as far north as Elk Point Marina (Anderson 2016, pers. communication) on the Nevada side of Lake Tahoe. Coontail (*Ceratophyllum demersum*) is classified as a native plant to California, but in recent years has grown in abundance in the Lake Tahoe region, specifically in the lagoons. Coontail has heavily infested the deeper channels of all the lagoons, most abundantly in the Marina Lagoon and Lake Tallac Lagoon, where it comprises over 70% percent of the aquatic plant matter (TKPOA 2016a).

The two invasive, non-native aquatic weed populations in the Tahoe Keys lagoons have been growing rapidly. Recent aquatic plant surveys (2014, 2015, 2016, 2017) show the extent and density of excessive plant growth in the lagoons (Figures 2 and 3). In recent years, 85% to 90% of the available wetted surface in the lagoons has been infested with target aquatic weeds with a large majority being the non-native invasive species. Of particular concern is the recent rapid growth and spread of curlyleaf pondweed, which has the potential to not only infest significantly more of Lake Tahoe's aquatic habitat than Eurasian watermilfoil, but can also be more difficult to control due to the large number and dispersal capacity of its asexual turions, which are produced in mid to late summer (Woolf and Madsen 2003, Wittmann et al. 2015, Xie and Yu 2011). Turions are overwintering buds that become detached and spread throughout the waterway and have the potential to remain dormant at the bottom of the water for several years. Curlyleaf pondweed is also capable of growing in deeper, colder waters, which may potentially be more detrimental to Lake Tahoe if allowed to spread unchecked.

Seasonal harvesting has been the main weed control practice in the Tahoe Keys lagoons since the mid-1980s. Continual harvesting throughout the summer months works to keep the lagoons navigable by boat, however, harvesting operations do not, overall, reduce aquatic weed biomass. Harvesting may actually aid in aquatic weed population growth (Crowell et al. 1994, TKPOA 2015).

The expansion and excessive aquatic weed growth in the lagoons is due to several environmental conditions including abundant nutrient availability, relative warm, stagnant and shallow waters with sufficient light for weed growth. The target aquatic weeds introduced to the lagoons have found these to be ideal habitat conditions for prolific growth. Agency and TKPOA Response to the Infestation

In response to the growing AIS problem in the Tahoe Keys lagoons and the goal to limit non-point sources of pollution, Lahontan Water Board issued Waste Discharge Requirements to TKPOA on July 14, 2014. As part of these requirements, TKPOA was tasked with developing two planning documents. 1) A Non-Point Source Water Quality Management Plan (NPS Plan) to address potential land-based sources of nutrients (not part of this application) and (2) an Integrated Management Plan (IMP) to address the growth of target aquatic weeds. The purpose of the IMP is to optimize management effects on controlling target aquatic weeds by incorporating a suite of feasible and proven control methods that can be tailored to fit site constraints, infestation size, and urgency of control. This application addresses, in part, long-term implementation of the IMP.

The only control methods that can currently be used in the TKPOA IMP are non-chemical control in nature. At this time, these methods consist primarily of weed harvesting and bottom barriers. However, due to the size, density, and dominance of the infestation, these control methods have been shown to produce limited results. In addition, the current primary control method, harvesting, results in the production of large quantities of weed fragments (TKPOA 2014). Without proper controls, these fragments may be transported by wind, aquatic animals, and boat traffic within the lagoons and into Lake Tahoe, thus contributing viable weed fragments and turions that can become established and create new populations in nearshore habitats and marinas.

2. Project Description

Recognizing the environmental review and stakeholder processes for the CMT will guide the ultimate composition of the test, the following section describes a generalized test program that TKPOA proposes to demonstrate the safety, efficacy, compatibility, and utility of methods to control three target aquatic weeds: Eurasian watermilfoil, curlyleaf pondweed, and coontail. The CMT proposes a two-year program to test the use of multiple methods independently and in combination. The CMT will also integrate measures to enhance water quality and minimize the potential for re-infestation or the formation of substantial hazardous algal blooms (HABs). It will also integrate measures to minimize infestations within the Tahoe Keys lagoons from affecting Lake Tahoe. A performance, compliance and mitigation monitoring plan will be developed to track progress towards goals, to ensure control methods are being implemented as approved and that proposed mitigations are effective.

The CMT will include the following treatment methods:

Group A: Large-scale treatment methods for addressing target aquatic weeds using aquatic herbicides⁴ and/or large scale Ultraviolet (UVC) light;

Group B: Localized treatment methods for addressing target aquatic weeds, including UVC light spot treatments, bottom barriers, diver-assisted suction and diver hand pulling techniques.

⁴ Three aquatic herbicides have been identified as potential methods of treatment based on the weeds they are intended to target: Endothall, Triclopyr, Penoxsulam, and ProcettaCOR.

2.1. Goals and Performance Measures

2.1.1. Project Goals:

Test a range of large-scale, localized and long-term target aquatic weed control methods to determine what combination of methods within the test areas will:

1. Reduce target aquatic weed infestations as much and as soon as feasible to help protect Lake Tahoe.
2. Bring target aquatic weed infestations to a manageable level.
3. Improve the water quality of the Tahoe Keys lagoons.
4. Improve navigation and recreational use and enhance aesthetic values.
5. Reduce the potential for target aquatic weed re-infestations after initial treatment.

While not a specific goal, it is anticipated that invasive fish species populations will decrease with any measurable decreases in target aquatic weed populations, as the existing conditions in the Tahoe Keys provides such habitat.

2.1.2 Performance Measures

Project effectiveness will be evaluated based on the following performance criteria:

1. Determine the effect on water quality in the Tahoe Keys lagoons through monitoring.
2. Achieve and maintain at least a 75% reduction of target aquatic weed biomass in test locations from baseline (invasive weed biomass from hydroacoustic scans in summer of 2019).
3. Achieve and maintain a minimum three feet of vessel hull clearance within navigation channels year-round to maintain beneficial uses and prevent weed fragment generation and dispersal.

The performance measure to reduce target aquatic weed biomass by at least 75% reflects prior studies on the efficacy of some Group A methods (Anderson 2017). In addition, reducing target aquatic weed biomass by at least 75% presents the most realistic probability for long-term target aquatic weed control that minimizes the need for repeated long-term use of Group A treatment methods. It is also anticipated that a 75% reduction in biomass would be required to achieve and maintain three feet of vessel hull clearance. With a 75% reduction in target aquatic weed biomass, competition for space, light, and nutrients is expected to be sufficiently reduced such that native aquatic habitat may be re-established.

2.2. Project Detail

To determine an optimal suite of target aquatic weed control methods for the Tahoe Keys lagoons setting, the CMT will include tests of direct, large-scale (Group A) and localized (Group B) target aquatic weed control methods to determine the best combination of methods for initial large-scale knock-down of target aquatic weeds and subsequent management of follow-on target aquatic weed growth. The long-term methods for controlling environmental factors favorable to target aquatic weed growth and methods for controlling dispersal of target aquatic weeds may also be effective in addressing adverse environmental effects of direct treatment methods and serve as measures to mitigate those impacts identified during environmental review of the CMT.

The 18 treatment sites and three control sites reflect the range of heterogeneity in the Tahoe Keys lagoons. This heterogeneity includes differences in water depths, water clarity, nutrient inputs, water circulation, shoreline conditions (e.g. bulkheads vs rocky or irregular shores), density and size of docks, and effects of wind and weather. The control sites are a similar size as the proposed treatment sites and exhibit a similar weed distribution and abundance. Control sites would be managed using current standard harvesting operations (existing conditions). The test sites are composed of the following:

- Twelve (12) sites that use only a single Group A technique
- Six (6) sites that use a combination of Group A techniques
- Three (3) control sites

A total of 18 sites are proposed for treatment with Group A methods in year one of the CMT. Currently, two techniques have been identified for Group A methods, as such, a set of treatment sites will receive one of the Group A techniques, another set will receive the other technique, and some will receive a combination. Among these 18 sites, the total area proposed for treatment, is 28.96 acres. This represents approximately 17% of the total surface area (172 acres) of the Tahoe Keys lagoons. An additional three sites would be demarcated as control/reference sites for comparison.

Triplicate testing for each Group A technique is proposed in order to satisfy the requirement for normally accepted and statistically robust comparisons of data both within treatment site and within control sites. The replications provide data on variability among like-treatments (or controls) and documenting this variability which is the basis for detecting significant effects of the treatments.

The year following Group A treatments (year 2 of the CMT), Group B methods will be applied to the 18 test sites to spot-treat target aquatic weed growth following large-scale treatment.

One or more of the Group B techniques would be selected based on considerations including: 1) effectiveness of Group A treatment (i.e. total biovolume of weeds reduced after primary treatment), 2) types of weeds that re-emerge, 3) size of infestation, and 4) limitations and constraints to treatment type based on lagoon geography. The use of some methods (in both Group A and B) are constrained by the space within which an infestation occurs and the underlying topography/geography of the area. Rocky areas and areas with other submersed obstructions are often a poor match for follow-up maintenance actions.

In addition, long-term water circulation and sediment and water quality improvement methods will be tested over the course of the project to evaluate methods for controlling related environmental factors favorable to target aquatic weed growth. The initial suite of methods proposed include laminar-flow aeration (LFA), floating island wetlands, algae control technologies, and targeted water circulation methods. These methods are expected to require long-term implementation to shift existing environmental factors related to circulation that include eliminating water stagnation in dead-ends of the lagoons and breaking up anoxic zones in the lagoons. These methods are also expected to require long-term implementation to shift existing environmental factors related to sediment and water quality including reducing organic sediment muck layers rich in nutrients favorable to target aquatic weed growth to mineralized substrate and controlling water quality factors favorable to algal growth, occurrence of harmful aquatic algae blooms and target aquatic weed growth.

To control target aquatic weed dispersal that can lead to re-infestation of previously treated areas and areas in greater Lake Tahoe, multiple techniques will be tested to contain fragments of target aquatic

weeds generated through routine use of the lagoons and, potentially, as a result of implementing direct treatment methods. The initial suite of methods proposed to be tested includes bubble curtains (with or without bottom barriers), Sea Bins, and boat backup stations.

- Bubble curtains are applied across a water channel and direct aquatic weed dispersal to areas where they can be concentrated and collected. As the name implies, a bubble curtain will prevent aquatic weed fragments from passing through the curtain in the water column thus preventing infestation of areas beyond the curtain.
- Sea Bins are a trade name for a patented device that can collect and contain aquatic weed fragments. Sea Bins are typically installed in conjunction with bubble curtains and placed where the curtain concentrates the aquatic weed fragments to facilitate containment and collection of the fragments.
- Boat back-up stations also prevent dispersal of aquatic weeds that become entangled on boat engine propellers, keels and rudders. These stations require boaters to enter a taxi lane, backup the boat and then exit the station when travelling from infested to un-infested areas. A Sea Bin or manual skimming is employed to collect and contain the aquatic weed fragments freed from boats in the backup station. Lastly, methods to control target aquatic weed fragment dispersal to previously treated areas and areas outside the Tahoe Keys lagoons in greater Lake Tahoe will be tested to evaluate effectiveness in preventing re-infestations and new infestations.

Figure 1, a map of the proposed treatment sites, illustrates the location and size of each of the 18 proposed treatment sites, as well as identifying the location and size of the three control sites. Table 1 corresponds to Figure 1 and identifies the treatment type and site acreage.

Figure 1. Map of Proposed Treatment Sites



The 18 treatment sites and three control sites reflect the range of heterogeneity in the Tahoe Keys lagoons. This heterogeneity includes differences in water depths, water clarity, nutrient inputs, water circulation, shoreline conditions (e.g. bulkheads vs rocky or irregular shores), density and size of docks, and effects of wind and weather. The control sites are a similar size as the proposed treatment sites and exhibit a similar weed distribution and abundance as treatment sites.

Table 1. Site number, treatment type, site acreage and area of herbicide treatment planned per site

Site Number	Site Description	Area (ac)	
1	Treatment	1.02	
2	Treatment	1.00	
3	Treatment	1.10	
4	Treatment	1.45	
5	Control	1.41	
6	Treatment	1.89	
7	Control	1.95	
8	Treatment	0.85	
9	Treatment	3.22	
10	Treatment	1.20	
11	Treatment	1.34	
12	Treatment	1.52	
13	Treatment	1.54	
14	Treatment	1.98	
15	Treatment	2.24	
16	Treatment	2.00	
17	Treatment	1.12	
18	Treatment	2.15	
19	Treatment	2.07	
20	Treatment	1.27	
21	Control	2.06	
TOTAL ACREAGE		34.38	
Total Treatment Area Acreage			28.96

Figure 2. Example of Combination Treatment

