



Date: May 11, 2017

To: Monitoring Team

From: Tahoe Resource Conservation District

Monitoring Plan for UVC Light Aquatic Invasive Plant Control Pilot Project

Introduction

The Ultraviolet-C (UVC) Light Aquatic Invasive Plant Control Pilot Project will test the use of UVC light to reduce the growth and biomass of aquatic invasive plants (AIP). Based on tests conducted in Inventive Resources lab in 2015 and 2016, it is expected that the plant DNA and cellular structure will be damaged, resulting in mortality of the plants. This pilot project will assist in determining the potential of UVC light as a new method for control of aquatic invasive plants in Marinas and open waters of Lake Tahoe. In addition, this pilot project will monitor the effects of this method on physical, chemical and biological parameters where the Pilot is being conducted, including non-target species. This monitoring plan outlines the objectives, methods and parameters of the monitoring aspect of this project. For the full project description and site plans please review Attachment A: Project Description.

Objectives

This monitoring plan is designed to obtain quantitative information on the physical, chemical, and biological characteristics of lake waters and substrate in the project area, and evaluate potential impacts from the use of UVC light in controlling plants. The data collected from this project will serve two purposes. Primarily, data collected will determine the success and efficacy of this treatment method and provide some basis to determine the efficacy of this method as a useful tool at the lake-wide scale. This data will also provide information to support future environmental document analysis and permitting needs, if this method is proposed for use at a lake-wide scale. For example, non-target organisms such as macroinvertebrates and plankton are being monitored because they are an important food source for fish. Additionally, permitting agencies in Lake Tahoe have requirements on turbidity levels exceeding 3NTU, so turbidity levels will be monitored to determine if this method can adhere to those levels.

Questions we expect to answer are:

- How far will UV light penetrate sediment on the lake bed?
- How are macroinvertebrates impacted by UV light treatments?
- How will UV light effect water temperature?
- What are the effects of this method on dissolved oxygen levels in the project area?
- How will this method affect levels of plankton (phytoplankton or zooplankton) or periphyton in the project area?
- What are the regrowth rates for AIP treated with UV light?

- How successful is UVC light as a long-term AIP control method?
- What are effects on fish? Do they avoid the UV exposure apparatus?

Assumptions and Constraints

The following are assumptions and constraints to the design and implementation of this project that need to be noted and considered for the monitoring plan.

- **Overlapping Treatment:** Tahoe RCD has used bottom barriers , diver assisted suction removal and hand pulling to treat AIP at Lakeside Marina and Beach in 2013, 2015, and 2016. In 2017, Tahoe RCD plans to treat the entire marina, with only a portion of the treatment being UVC light. Close coordination between the two operations is necessary and oversight will be provided by Tahoe RCD.
- **UVC treatment area:** This project was designed to test UVC light technology and will only treat plants in a defined area.
- **Scalability:** The original vessel and project was designed for a pilot project only. Design and development can be scaled up to fit further lakewide plant control.
- **Complete Treatment:** 100 percent of the plant infestation in the project area will be treated in 2017 by either UVC light, or benthic barriers and diver-assisted suction removal.
- **Method Success:** This project and method is being tested to assess the effectiveness of UV light as another effective method for plant control at Lake Tahoe to be used in combination with existing methods.

Sampling Parameters

This project will monitor the following parameters pre-treatment, during treatment and post-treatment:

- Water Quality: temperature, turbidity, dissolved oxygen, pH, conductivity
- Biological: macroinvertebrates, plankton/periphyton
- Plant Regrowth: plant density, percent cover, plant species composition

Monitoring Parameter/Time-frame Definitions

Pre Treatment - Prior first round of UV treatment (no longer than 10 days prior to first UV light exposures)

During Treatment - Occurring during round 1 and round 2 treatments

Immediate Post Treatment - 5-10 days after round 1 (and/or round 2) treatments

Monthly Post Treatment - Once per month after round 2 treatment, 3 months total (August - October 2017)

Long-term Post Treatment - Macroinvertebrate and Plankton/periphyton one time the following season June 2018. Plant density, cover and composition twice the following season June and August 2018.

Figure 1: Monitoring Parameters

	WHO	WHO	Pre Treatment	During Treatment	Immediate Post Treatment (5 days)	Monthly Post Treatment (2017)	Long Term Post Treatment (2018)	Method/# of Samples/Frequency

Temperature	IRI	M. Greene	X	X	X			Background (full day) and Continuous during treatment
Turbidity	IRI	M. Greene	X	X	X			Background (Full Day), 1 per visit and multiple samples during treatment (1-5 per day)
Dissolved Oxygen	IRI	M. Greene	X	X	X	X		1 per visit
pH	IRI	M. Greene	X	X	X	X		1 per visit
Conductivity	IRI	M. Greene	X	X	X	X		1 per visit
Macroinvertebrate	MTS	-	X		X		X	PONAR (Petite or Full size?), Suction Lift, Ekman: 7 reference sample sites, 7 in treatment sample sites
Plankton/Periphyton	MTS	-	X		X		X	plankton tows: 2 tows per visit in project area
Plant Density and Aerial Coverage	MTS	-	X			X*	X	Transect-quadrats (0.25m quadrat every 2 meters) and Hydroacoustic
% Cover and Plant Height	MTS	-	X			X*	X	Point - transects (every 2 meters) and Hydroacoustic
Plant Composition	MTS	-	X				X	Point - intercept samples (every 2 meters)
Light Penetration into Sediment	IRI	-	X		X		X	Equipment on boat

* Monthly post treatment survey only for treatment site, not needed for reference site. Reference site only needs end of growing season.

Field Sampling Plan and Schedule

Coordination will be the key to success for the monitoring plan. All parties must confirm dates prior to project start including treatment Round 1 and treatment Round 2.

Pre-treatment: June (prior to first treatment)

During treatment: End of June (round 1) and July/August (round 2)

Immediate Post Treatment: 5 days after Round 2 treatment (or last treatment round)

Monthly Post Treatment: July, August, September (possibly October depending on weather) 2017

Long-term Post Treatment: June (macro) or June and August 2018

Field Logbook and Forms

Field logbooks will be kept by all project coordinators and sub-contractors of the project, and those monitoring implementation. Notes will include weather conditions, lake level, and level of boating activity. All daily activities and data collection will be submitted to Tahoe RCD.

Data Management and Reporting

All data and reports will be submitted to Tahoe RCD, digital and hard copy.

Progress Report	November 30, 2017
Draft Final Report	November 30, 2018
Final Report	December 31, 2018