Appendix A

Notice of Preparation and Public Engagement Plan for Scoping

List of Appendices

NOTICE OF PREPARATION for the TAHOE KEYS LAGOONS AQUATIC WEED CONTROL METHODS TEST

DATE: June 17, 2019

TO:
California State Clearinghouse
California Responsible Agencies
California Trustee Agencies
El Dorado County, County Clerk
US Fish and Wildlife Service
U.S. Army Corps of Engineers
Nevada State Clearinghouse
Other Interested Agencies
Washoe Tribe of Nevada and California
United Auburn Indian Community
Interested Parties and Organizations
Affected Property Owners

FROM:
Tahoe Regional Planning Agency (TRPA)
Lahontan Regional Water Quality Control Board

LEAD AGENCIES:

Tahoe Regional Planning Agency	Lahontan Regional Water Quality Control Board
P.O. Box 5310 128 Market Street Stateline, Nevada 89449	2501 Lake Tahoe Boulevard South Lake Tahoe, CA 96150

CONTACTS:

Dennis Zabaglo, Aquatic Resources Program Manager Tahoe Regional Planning Agency (775) 589-5255 dzabaglo@trpa.org	W. Russell Norman, P.E. Water Resources Control Engineer Lahontan Regional Water Quality Control Board (530) 542-5435 russell.norman@waterboards.ca.gov

SUBJECT

TRPA and Lahontan Regional Water Quality Control Board Notice of Preparation (NOP) to prepare an Environmental Impact Report (EIR) in accordance with the California Environmental Quality Act (CEQA) and a TRPA Environmental Impact Statement (EIS) for the proposed Tahoe Keys Lagoons Aquatic Weed Control Methods Test ("Project"). The joint environmental document will analyze the potential environmental effects of the Project.

PUBLIC REVIEW AND COMMENT PERIOD

The Lead Agencies invite public comment on the scope of the project and content of the EIR/EIS in response to this NOP. Pursuant to Section 15082 of the State CEQA Guidelines, this NOP will be circulated for a minimum 45-day review period beginning on June 17, 2019 and ending on August 2, 2019. In your response, include your name, the name of your agency or organization (if applicable), and contact information.

Comments on the NOP may be received via e-mail to tahoekeysweeds@trpa.org, or via U.S. mail to Dennis Zabaglo, Aquatic Resources Program Manager, at the above TRPA mailing address by 5:00 p.m. on **August 2, 2019.** In addition, comments may be provided at the public scoping meetings, noticed below.

PUBLIC SCOPING MEETINGS

The Lead Agencies have scheduled public scoping meetings at the times and locations indicated below. The purposes of the public scoping meetings are to receive verbal and written input on the scope of the proposed project, project alternatives and environmental document. The Lead Agencies will consider all comments, written and oral, in determining the final scope of the evaluation to be included in the EIR/EIS.

Public Scoping Meetings:

Tuesday, June 25, 2019, 5:00 p.m.
Lahontan Regional Water Quality Control Board
Annex Building
971 Silver Dollar Avenue
South Lake Tahoe, CA

Wednesday, June 26, 2019, 9:30 a.m.
Tahoe Regional Planning Agency
Governing Board Meeting
128 Market Street
Stateline, NV

Tuesday, July 16, 2019, 5:00 p.m.
North Tahoe Event Center
8318 North Lake Boulevard
Kings Beach, CA

BACKGROUND

The Project site is in the lagoons of the Tahoe Keys. The Tahoe Keys was constructed in the 1960s by excavating lagoons in the Upper Truckee River Marsh, and now includes more than 1,500 homes and townhomes, a commercial marina, and a commercial center. Eurasian watermilfoil (*Myriophyllum spicatum*) became established in the 1980s and 1990s, and curlyleaf pondweed (*Potamoeton crispus* L.) was discovered in Lake Tahoe in 2003. Surveys document aquatic weeds growing rapidly to occupy up to 90 percent of the lagoon areas in recent years. Seasonal harvesting has been the main weed control practice since the mid-1980s, removing more than 10,000 cubic yards of biomass annually. Aquatic weeds have the potential to impact all the marinas around Lake Tahoe, and their continued spread constitutes the most immediate threat to the lake, according to the University of Nevada's 2015 Implementation Plan for the Control of Aquatic Invasive Species within Lake Tahoe. The goal of the project is to test control techniques of the populations of aquatic weeds in the designated test areas and reduce the spread of these plants to other parts of Lake Tahoe.

PROJECT DESCRIPTION AND LOCATION

See attachment

POTENTIAL ENVIRONMENTAL IMPACTS

At a minimum, each of the following environmental issue areas below will be addressed in the EIS/EIR.

Hydrology and Water Quality	Geology and Soils
Biological Resources	Land Use and Planning
Human Health	Public Services
Hazards and Hazardous Materials	Greenhouse Gas Emissions
Recreation	Global Climate Change

The NOP and the project file, including the Initial Study/Initial Environmental Checklist prepared under CEQA and TRPA regulations, are available for review between the hours of 9:00 a.m. and 4:00 p.m., Monday through Friday (except Tuesday), at the TRPA office, 128 Market Street, Stateline, NV. Project information may also be found at www.tahoekeysweeds.org. The project file is also available Monday through Friday, between the hours of 8:00 a.m. and 5:00 p.m. at the Lahontan Regional Water Quality Control Board office, 2501 Lake Tahoe Boulevard, South Lake Tahoe, CA.

PUBLIC ENGAGEMENT (SCOPING) PLAN
TAHOE KEYS WEEDS AQUATIC WEED CONTROL METHODS TEST (CMT)

The Tahoe Regional Planning Agency and the Lahontan Water Quality Control Board (Lead Agencies) in conjunction with the Tahoe Keys Stakeholder Committee, will launch a public engagement process in June 2019 for the Tahoe Keys (CMT). A wide range of public meetings and activities will be held to encourage feedback on the proposed project description and the scope of the environmental analysis.

Notice of Preparation

The process will formally kick off with the release of the Notice of Preparation (NOP). An NOP is a document stating that an Environmental Impact Report (EIR) will be prepared for a particular project. It is the first step in the EIR process. The NOP will meet the requirements stated on the CEQA website: (http://resources.ca.gov/ceqa/flowchart/lead_agency/Notice_of_Prep.html)

The NOP will be released on June 17th, 2019 and will include information providing a basis for public and agency understanding of the project and will invite comment on the scope of the project, issues of concern, potential environmental impacts, and alternatives. The NOP will provide for a minimum 45-day scoping period, currently planned to begin June 17, 2019 and close on August 2, 2019. Comments will be due by the end of the scoping period. (Note that CEQA allows Responsible Agencies 30 days to respond to the NOP – see below.)

Included with the NOP:

IEC: A reference and link to the IEC/IS will be sent with the NOP to supply the necessary information. A scoping package will accompany the NOP, including the contents described above. This information will:

- Describe the project and current action alternatives
- Locate the project on a map
- Discuss the potential environmental effects of the project

Provisions for Comment: The NOP and scoping package will explain the opportunities for public and agency comment during scoping. Provisions for comment are described further below.

Proposed Project: The NOP will incorporate the description of the proposed project.

CEQA requires that the NOP be sent to each CEQA Responsible Agency, the county with jurisdiction and each federal agency involved in approving or funding the project. The California State Clearinghouse coordinates State review of environmental documents prepared pursuant to CEQA and will distribute the NOP to California Responsible Agencies. Additional copies of the NOP will be sent directly by TRPA and LWB to parties identified on their mailing lists. See the NOP for the full list of distribution.

Scoping Activities

At least one scoping meeting is required by CEQA and TRPA. However, an extensive outreach and meeting program is planned during the formal scoping period of June 17-August 2. Scoping comments can be collected through the formal scoping meeting and through other scoping activities, as follows:

- **Formal scoping meetings** jointly led by the Lead Agencies.
- **Public workshops** developed to encourage broad participation and focus attention on key issues and concerns, and on alternatives to be considered in the EIR/EIS.
- **Targeted outreach meetings** to be scheduled with key stakeholders, such as with the boards of organizations with an interest in the issues
- **Meeting with Stakeholder Consultation Circle (SCC)**, which includes partner agencies and other organizations interested in AIS issues in Tahoe
- **Public Website** will be launched to provide project information and opportunity to provide feedback to the public at large through a comment link
- **Direct mailing or email at tahoekeysweeds@trpa.org**

Schedule

The formal project and environmental analysis schedule is maintained by TRC and includes the scoping schedule. In brief, the following public engagement /scoping schedule is currently planned:

June 5th	Public Website Launch; Public Workshops Announced
June 17: Official Scoping Begins	Release of NOP
June 25	LWB CEQA Scoping Meeting and Public Workshop in South Shore
June 26	TRPA Governing Board Public Hearing
June 27	Stakeholder Consultation Circle (SCC) Meeting
July 16	Public Workshop North Shore
July 17	Responsible Agencies must respond to the NOP; providing the Lead Agency with specific detail about the scope and content of the environmental information related to the Responsible Agency's area of statutory responsibility within 30 days after receiving the Notice of Preparation.
August 2: Official Scoping Ends	Close of scoping period; all comments due
August/September:	Stakeholder Field Trips
September 3	TRC to provide a draft Scoping Report to the Lead Agencies for Review and approval.
September 17	Lead Agency comments on draft Scoping Report due to TRC
September 25 or 26 TRPA Board Field Trip	
October 1	Final Scoping Report delivered by TRC to Lead Agencies.

Public Workshop Details

Public Workshop 1: June 25, 2019- South Lake: Lahontan Water Board Annex, 971 Silver Dollar Avenue, So. Lake Tahoe, CA 96150

Public Workshop 2: July 16, 2019- North Shore: North Tahoe Event Center, 8318 North Lake Blvd. Kings Beach, CA

Time: 5:00 p.m. to 7:00**.** Two-hour meetings consisting of presentation and open house format (each one hour).

Meeting Goals:

- Inform attendees about the history and extent of the Keys weed problem and control to date
- Present the purpose, goals and focus of the proposed project
- Collect public comment on interests, questions, ideas and concerns for studying Aquatic Invasive Species management in the Tahoe Keys to inform the scope of the project

Proposed agenda:

Time	Agenda Item + Objective	Roles + Format
5:00	Introductions and Agenda Review	Facilitator
5:15	Presentations	TRPA/Lahontan/ TKPOA/Zephyr Collaboration
5:45	Questions + Answer session	ALL
6:00	Open House Session: Participants are invited to discuss project specifics with technical specialists and agency staff. Information stations include: • Tahoe Keys Weeds Existing Conditions • AIS Control Methods • EIR process and public involvement	Staff: TRPA- KC, GH, DZ LWB- RN, LK TRC/ESA-JG, JP, IK Zephyr- CM, JM
6:50	Closing/Call for written comments, questions and information submissions	
7:00	Adjourn	

Facilitation

The meeting will be facilitated by Zephyr Collaboration (Caelan McGee and Jen Mair). The most direct facilitation will occur during the Q&A session following the presentations. During this time, workshop attendees will be directed to ask clarifying questions. If an attendee asks a question that is more than clarification, they will be directed to find out more at the stations and record questions they wish to be answered in the analysis in a formal written comment.

Presentations

A PowerPoint Slide presentation will be developed by TRPA/Lahontan, TKPOA, and Zephyr Collaboration. The goal is to have the total presentation to stay under 30 mins or less. Order of speakers below. Speakers responsible for developing their portion of slide presentation:

- TRPA and LWB - Introduction and goals of meeting, proposed project description and Environmental Review Process, Scoping 101: **Dennis and Russell 10 MINS**
- TKPOA – Extent, nature of problem and history of treatment methods: - **Andy Kopania 10 MINS**
- Zephyr Collaboration - Public and stakeholder committee involvement, collaborative process, how to make meaningful comments: Caelan McGee (with Russell talking again about Scoping 101 and how comments are incorporated into the process) **5-10 MINS**

Open House Stations

- Tahoe Keys History and Existing Conditions
- General AIS Control Methods and Current Tahoe Keys Activities
- Environmental Analysis and Public Engagement

Meeting Materials

Draft meeting materials will be prepared for review by the lead agencies and TRC. A dry-run of presentations will take place on June 18th.

- High-level project timeline showing important milestones. This should fit on one page and/or large poster board. (TRC)
- Project postcard with website and email address to provide comments (Zephyr)
- Handouts for the AIS Program/treatment methods (Dennis for the AIS Station)
- Copies of the NOP and attached project description (TRPA)
- Sign-in Sheet (Zephyr)
- Comment Card (Zephyr)

Meeting Staffing and Roles

Meeting facilitation: Zephyr Collaboration (Caelan and Jennifer)

<u>Stations Staffing:</u>

- Tahoe Keys History and Existing Conditions
  - Jim Good
  - Russell Norman or Laura Korman
  - Andy Kopania
- General AIS Treatment Methods and Current Tahoe Keys Activities
  - Dennis Zabaglo
  - Greg Hoover
  - Mollie Hurt and/or other TRCD
  - Jesse Patterson or other League
- Environmental Analysis and Public Engagement Process
  - Caelan McGee
  - Russell Norman or Laura Korman
  - Jeremy Pratt
  - Paul Nielsen

Public Workshop Advertisement

SC Member	Email Group	Social Media and Websites	Newspaper Article or Notice and date/deadline	Press Release
TRPA	EIP Coordinating Committee AIS Coordinating Committee	TRPA Facebook Page TRPA Website	Tahoe Tribune: Date	YES: Date
The League	League Office and Board Members			
TKPOA	TKPOA Property Owners			
TWSA	TWSA Board Members			
TRCD	TRCD Office and Board Members			
Lahontan			Public notice – which newspaper?	

- Launch of www.TahoeKeysweeds.org ; workshop dates advertised on website
- Newspapers – need deadlines and who is submitting
  - Tahoe Daily Tribune
  - North Tahoe Bonanza (5 day lead time)
  - Sierra Sun
  - Tahoe Keys Breeze

- Tahoe In-Depth
- Moonshine Ink
- Mountain News

Other Electronic Media

- South Tahoe Now Website
- TRPA E-News
- League E-News
- Next Door

Comment collection

Public and agency comments will be gathered through all scoping activities including formal scoping meetings, public and agency workshops, targeted meetings with key stakeholders, and the Stakeholder Committee. In addition, scoping comments will be solicited and facilitated through providing a variety of means and formats by which the general public and individuals associated with any stakeholder group may comment.

- Comments can be emailed to tahoekeysweeds@trpa.org . Linked on website and advertised on postcards.
- Solicitation of written comments and documents during meetings
  - In-meeting comments recorded at podium/microphone at TRPA Board meeting
  - In-meeting questions will be recorded on flip charts during public workshop Q&A session
  - In-meeting comments on comment cards
  - Post-meeting comments received by email, or using mail-back comment forms, or in letters sent to TRPA mailing address

Scoping Report

TRC is responsible for collecting, recording, and transcribing comments (if necessary) during the scoping process. All comments received by the lead agencies will be forwarded to Ian at TRC by August 2. Each comment will be identified by the name and affiliation of the person submitting the comment unless they wish to remain anonymous.

TRC will prepare a concise scoping report to the lead agencies which summarizes:

- **Summary of scoping meetings and activities:** the dates, locations, format, participants, and outcomes of all meetings and activities. These will be individually recorded at the time each meeting or activity is held, and these records will be appended to the scoping report. A concise summary will provide an overview of these scoping events, as well as of comments received outside of these meetings and activities through the comment venues listed above.

- **Summary of comments received:** All comments will be sent to TRC as they are received, to begin collation and curation. All comments received will be appended to the scoping report. Comments will be organized in a database that cross-references the comment source with key issues, elements of the environment, and alternatives (where mentioned). A concise summary will highlight the environmental issues and concerns raised and the comments made on EIR/EIS alternatives.
- **Recommendation of changes to project description, alternatives, and environmental evaluation resulting from public comment**

This draft scoping report will be prepared within 30 days after the close of the scoping period (August 2nd, 2019) for review by the lead agencies (2 weeks). A final scoping report will be prepared one week after consolidated comments on the draft report are received by TRC.

As required by contract, TRC will present the scoping report at the TRPA Advisory Planning Committee (APC) and Governing Board (GB) meetings and at Lahontan Board meetings (dates TBD)**.**

Authorities: TRC and the Stakeholder Committee has developed this scoping plan consistent with the requirements of Title 14. California Code of Regulations, Chapter 3. Guidelines for Implementation of the California Environmental Quality Act, Article 7. EIR Process, Sections 15080 to 15097, and the TRPA Bi-State Compact, Article VII. Environmental Impact Statements, Section (b).

Appendix B

Scoping Report and Comments

1.0 Introduction

The Tahoe Regional Planning Agency and the Lahontan Regional Water Quality Control Board (Lead Agencies) released the Notice of Preparation (NOP; Attachment 1) of an Environmental Impact Report (EIR) for the Tahoe Keys Aquatic Weed Control Methods Test (CMT) on June 17, 2019. In conjunction with the NOP release, and with the Tahoe Keys Stakeholder Committee, the Lead Agencies launched a comprehensive public engagement process that ran from June-August 2019. This outreach included a wide range of public meetings and activities that were held to encourage feedback on the proposed project description and scope of environmental analysis while also guiding the formulation of project alternatives. This Scoping Report incorporates key information provided in the NOP, summarizes the Lead Agencies' scoping activities as well as public response to the project, summarizes comments received, and attaches a comment matrix quoting the comments received and indicating where in the EIR/EIS or the CEQA/TRPA process they will be addressed.

2.0 Background Provided in the NOP

In response to the need to control the abundant growth of non-native and nuisance aquatic weeds, the Tahoe Keys Property Owners Association (TKPOA) developed the Tahoe Keys Lagoons Aquatic Weeds Control Methods Test (CMT). The CMT will test various control methods of weed control methods 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 Committee. The Stakeholder Committee was created to ensure a collaborative and transparent environmental review process, and to ensure that a broad range of options was considered in 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. 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 CMT.

2.1 History & Context

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. 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.

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. TKPOA's exemption 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 the time of the NOP, 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.

2.2 Project Purpose, Need, & Objectives

Purpose: Tahoe Regional Planning Agency: To preserve and protect natural resources throughout the Tahoe Basin, including water quality.

Lahontan Regional Water Quality Control Water Board: To preserve, protect, and restore water quality in the Lahontan region.

Need: Tahoe Regional Planning Agency: Manage and control aquatic invasive species to achieve compliance with the environmental threshold carrying capacities (thresholds) established to set environmental standards for the Lake Tahoe basin.

Lahontan Regional Water Quality Control Water Board: To control AIS and nuisance plants to prevent future threats to long-term water quality within the context of aquatic weeds. Additionally, to uphold and maintain the beneficial uses and water quality objectives specified in the Lahontan Basin Plan. Beneficial uses designated by LRWQCB include: Cold Freshwater Habitat, Navigation, Water Contact Recreation, and Non-contact Water Recreation.

2.3 Goals and Performance Measures

The Project Description attached to the published NOP (Attachment 1) stated the following Project Goals and Preformation Measures. NOTE: These may be subject to change as the project progresses.

2.3.1 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.

2.3.2 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.

3.0 Stakeholder Outreach

From the onset of the development of the proposed project, the lead agencies and TKPOA agreed to pursue a robust collaborative stakeholder process to inform and guide the development of project and the environmental review process. In August 2018, TRPA hired Zephyr Collaboration to serve as third-party neutral facilitators to design and implement the collaborative process. As a first step, an assessment of stakeholder interests, concerns and questions was completed by Zephyr Collaboration in October 2018. The Stakeholder Assessment Report (Attachment 2) summarized various stakeholder interests and perspectives, and included recommendations for a collaborative, transparent, inclusive stakeholder process to inform the Environmental Impact Statement/Environmental Impact Review (EIR/EIS).

Based on recommendations made in the Stakeholder Assessment, the Tahoe Keys Stakeholder Committee and the Tahoe Keys Stakeholder Consultation Circle was formed.

The Stakeholder Committee consisted of the following agencies and organizations:

- Lahontan Regional Water Quality Control Board (listening & advisory role)
- League to Save Lake Tahoe
- Tahoe Keys Property Owners Association
- Tahoe Regional Planning Agency
- Tahoe Resource Conservation District
- Tahoe Water Suppliers Association

The Stakeholder Consultation Circle consisted of the following agencies and organizations:

- California Attorney General's Office
- California Department of Fish & Wildlife
- California State Lands Commission
- California Tahoe Conservancy
- City of South Lake Tahoe
- Key Concerned Citizens
- Lake Tahoe AIS Coordinating Committee
- Lake Tahoe Marina Association
- Lakeside Park Association
- Local Native American Tribes
- Nevada Department of Environmental Protection
- Nevada Tahoe Conservation District
- North Lake Tahoe Resort Association
- Sierra Club
- Southshore Tahoe Chamber
- Tahoe Keys Beach and Harbor Association
- Tahoe Lakefront Homeowners Association
- Tahoe Fund
- TIE Steering Committee
- U.S. Fish & Wildlife Service

Zephyr Collaboration worked with the Stakeholder Committee to design a project website to host all project information: www.tahoekeysweeds.org. The NOP, public workshop announcements, and full project background information is all posted on the project website.

3.1 Scoping Process

A Notice of Preparation (NOP) was issued June 17, 2019, inviting public comment on the proposed project, with a 45-day scoping period beginning on the date of issue and closing on August 2, 2019. Generally, the following scoping schedule was followed:

Date	Activity
June 5, 2019	Public Website Launch; Public Workshops Announced
June 17, 2019: Official Scoping Begins	Release of NOP
June 25, 2019	LRWQCB CEQA Scoping Meeting and Public Workshop 1 in South Shore
June 26, 2019	TRPA Governing Board Public Hearing
June 27, 2019	Stakeholder Consultation Circle (SCC) Meeting
July 16, 2019	Public Workshop 2 North Shore
July 17, 2019	Responsible Agencies must respond to the NOP; providing the Lead Agency with specific detail about the scope and content of the environmental information related to the Responsible Agency's area of statutory responsibility within 30 days after receiving the Notice of Preparation.
July 24, 2019	Tahoe Regional Planning Agency Governing Board Field Trip and Public Hearing
August 2, 2019: Official Scoping Ends	Close of scoping period; all comments due
September 3, 2019	TRC to provide a draft Scoping Report to the Lead Agencies for Review and approval.
September 17, 2019	Lead Agency comments on draft Scoping Report due to TRC
October 1, 2019	Final Scoping Report delivered by TRC to Lead Agencies.

The NOP included a reference to the TRPA Initial Environmental Checklist/CEQA Initial Study that had been prepared in 2017-2018 leading to the decision to prepare an EIR/EIS. This document and is available for review between the hours of 9:00 a.m. and 4:00 p.m., Monday through Friday (except Tuesday), at the TRPA office, 128 Market Street, Stateline, NV.

3.2 NOP Distribution

In addition to being posted on the aforementioned website, the NOP was sent to a public and agency mailing list consisting of public utilities districts, tribes, state departments of environmental protection and natural resources, and non-governmental organizations (Attachment 3). The mailing lists were developed by the Lead Agencies and the Tahoe Keys Stakeholder Committee. The Lead Agencies also notified potentially affected or interested entities and agencies about the scoping process through the following announcements:

- Posted Notice of Public Hearing in *Tahoe World*, published on May 31, 2019 (Attachment 4)
- Posted Notice of Public Hearing in the *Tahoe Daily Tribune*, published on May 31, 2019 (Attachment 5)
- TRPA posted the Governing Board Agenda items/notice of public hearing one week in advance on the TRPA website: www.trpa.org
- TRPA posted public workshop dates and locations on TRPA website, Facebook page, and Instagram profile

- TRPA distributed project postcards with link to project website at front counter and other public meetings, as appropriate (Attachment 6)
- NOP Notice mailed by Lahontan WB to El Dorado County Clerk – June 17, 2019
- NOP Notice Emailed by Lahontan WB to interested parties list on June 17, 2019
- Notice of Upcoming Scoping Meetings sent by Lahontan WB to interested parties on 6/13/19 via Lahontan WB Lyris Email subscription list for 'reg6_tahoe_keys_restoration'
- Posted Notice of Public Hearings/Scoping Meetings in the *Sierra Sun*, published on June 7, 2019, June 21, 2019, July 5, 2019, July 12, 2019 (Attachment 6)
- NOP Notice mailed by Lahontan WB to/ State Clearing house on June 17, 2019
- State Clearinghouse transmittal of NOP to reviewing agencies on June 18, 2019

Submission of comments was invited electronically throughout the scoping period via email address (tahoekeysweeds@trpa.org) provided by the lead agencies, as well as by mail or hand-delivery to a TRPA address. A comment form was provided at all scoping events (Attachment 7).

3.3 Tribal Notification and Consultation

Lahontan Water Board staff have provided AB52 notification of the Project proposal to United Auburn Indian Community (October 17, 2017 and December 13, 2018) Wilton Rancheria (December 13, 2018) and non-AB52 notification to the Pyramid Lake Paiute Tribe (December 13, 2018) and Washoe Tribe of Nevada and California (January 9, 2018 and December 13, 2018). The United Auburn Indian Community was the only tribe to respond to the tribal consultation notice and requested mitigation measures for the inadvertent discovery of Tribal Cultural Resources including a worker tribal cultural resources awareness training program for all personnel involved in the Project. These measures are being incorporated into the final Mitigation Monitoring Plan for the Project. Tribal consultations were completed in June 2019.

3.4 Scoping Meetings

The NOP announced scoping meetings to be held by TRPA and the Lahontan Water Board and the North Shore public scoping workshops (later supplemented by a South Lake workshop), as given below:

- **Lahontan Water Board CEQA Scoping Meeting: June 25, 2019:** Lahontan Water Board Annex, 971 Silver Dollar Avenue, South Lake Tahoe, CA
- **TRPA Governing Board Scoping Meeting: June 26, 2019:** Tahoe Regional Planning Agency 128 Market Street, Stateline, NV

- **South Lake Public Workshop: June 25, 2019**: Lahontan Water Board Annex, 971 Silver Dollar Avenue, So. Lake Tahoe, CA

- **North Shore Public Workshop 2: July 16, 2019**: North Tahoe Event Center, 8318 North Lake Blvd. Kings Beach, CA

During scoping meetings and workshops, the public and agencies were requested to comment on issues, impacts and alternatives that should be evaluated in the EIR/EIS. Attendees of these meetings were provided with:

- A presentation and overview of the proposed project;
- An outline of the environmental review process including the schedule;
- A discussion of the resources and potential impacts to be evaluated in the EIR/EIS;
- A discussion of potential alternatives to the proposed action including the no action alternative;
- A presentation on opportunities for public engagement including the activities of the Tahoe Keys Stakeholder Committee and the Stakeholder Consultation Circle

At the end of the public workshop presentations, the lead agencies opened the floor for public comment and hosted more opportunity for questions and comments in an "open house" format. Staff from the lead agencies, Zephyr Collaboration, and TRC were available during the open house to receive comments and questions from the public. A total of 36 people signed in to the two scoping meetings, during which, 5 written and 81 verbal comments/questions were collected.

4.0 Summary of Comments Received

Scoping comments were collected in one of two ways:

- Written comments: Comments submitted in writing, either by comment form in public workshops, or through the project website, were recorded and catalogued verbatim, as they were received.

- Verbal comments: Comments submitted through discussions in public workshops, were recorded on flip charts by the Zephyr Collaboration team, summarized generally and catalogued.

A total of 316 individual scoping comments were received from 44 commenters, many including more than one comment. Table 1 identifies the comment sources and the comment categories addressed by each. These included 4 commenters who used the scoping Comment Forms and 40 who submitted email letters or messages. In addition, 44 verbal comments were recorded from 26 attendees at the June public workshop, and 37 verbal comments were recorded from the 10 attendees at the July public workshop, and 26 verbal comments were recorded from the Stakeholder Consultation Circle (SCC) Meeting.

Table 1. Number and source of comments received during the scoping period.

	Number of Commenters	Number of Comments	
Source		Individual	Flipchart/Group
Email	40	204	
June Public Workshop	3	4	44
July Public Workshop	1	1	37
SCC Meeting			26

Total	**44**	**209**	**107**
		316	

In the NOP, the following potential environmental issue areas were identified to be addressed in the EIS/EIR.

Hydrology and Water Quality	Geology and Soils
Biological Resources	Land Use and Planning
Human Health	Public Services
Hazards and Hazardous Materials	Greenhouse Gas Emissions
Recreation	Global Climate Change

All substantive comments received were compiled and entered into an Excel spreadsheet that was used to prepare this scoping report (Attachment 8). The spreadsheet groups comments into major categories and themes (columns A and B). It indicates some comments were cross-referenced into more than one category and theme, resulting in the total count for all entries being greater than the raw number of comments. Major classifications are shown, by the number of comments received, in Figure 1. The spreadsheet also uses color-coding to indicate where each comment will be considered or addressed in the EIR/EIS and the CEQA/TRPA process. The summary below includes all resource areas identified in the NOP, even if no comments were received. The number of comments received is indicated in parentheses following each resource header, and additional categories of comments received are added to the summary list below:

- Alternatives – Chemical Alternatives/Herbicides (58)
- Alternatives – Non-Chemical Alternatives (76)
- Alternatives – Proposed Elements of Alternatives (9)
- Alternatives – Proposed Tahoe Keys Modifications (36)
- Alternatives Analysis/Test Protocol (88)
- Anti-Degradation Analysis/Test Analysis (69)
- Aquatic Weeds Management (10)
- Background Information (12)
- Biology/Ecology (21)
- Boating (16)
- Cost/Cost Impacts, Socioeconomics, Financial (11, 2, 13)
- Cumulative & Long-Term Impacts (1)
- Cyanobacteria (12)
- General Opposition or Support (6)
- History (4)
- Hydrology (1)
- Independent Experts and Peer Review (10)
- Indirect Effects (1)
- Jurisdiction (3)
- Mitigation (3)
- No Action Alternative/Risk to Lake Tahoe (5)
- Planning History (7)
- Project Goals and Objectives (1)

- Protection (4)
- Public Outreach and Stakeholder Process (5)
- Recreation (7)
- Regulatory (19)
- Risk Assessment (2)
- Trash (1)
- Water Circulation (7)
- Water Quality (19)
- Water Supply (10)

This summary does not address comments that were not pertinent to the EIR/EIS and the project purpose and need, comments advocating actions contrary to current law and regulation, comments expressing general support or opposition, or purely informational exchanges. Comments addressing project scope, alternatives, and expanded operations are included.

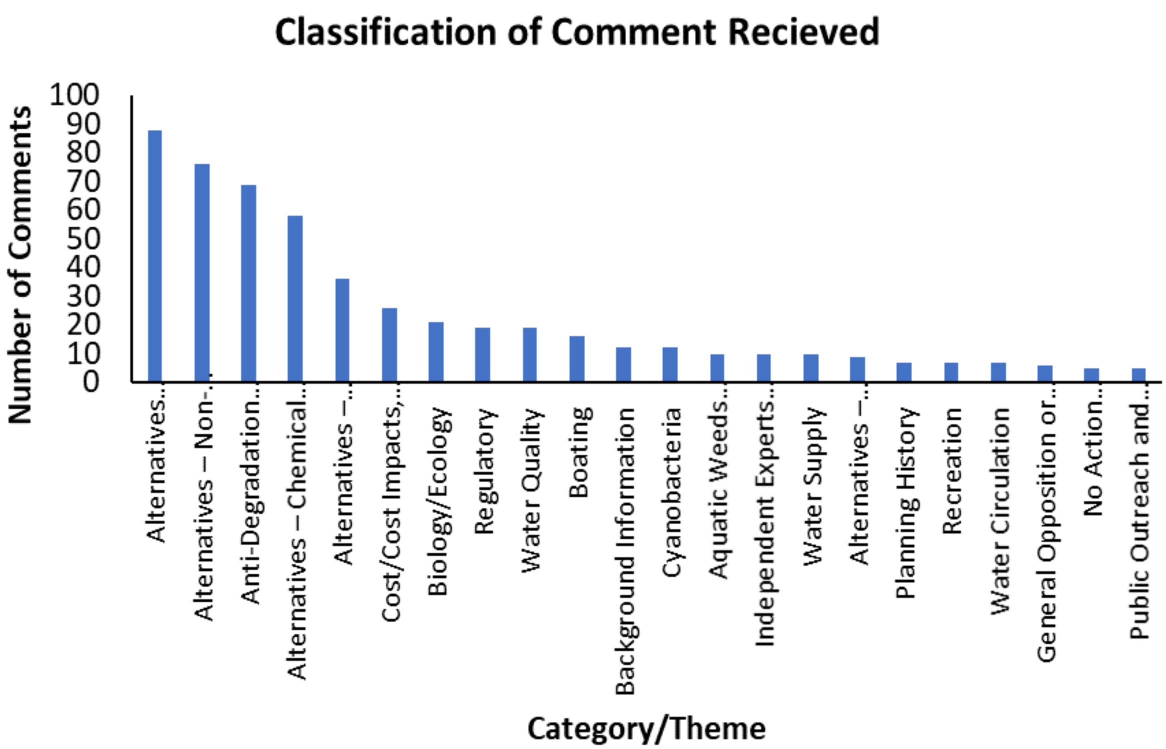

Figure 1. Comment classifications by number of comments received during the scoping period. Note: only classifications with five (5) or more comment are displayed. The following classifications received fewer than 5 comments: history, protection, jurisdiction, mitigation, risk assessment, cumulative & longterm effects, hydrology, indirect effect, project goals & objectives, and trash. More information about the comments within these categories can be found in the comment spreadsheet (Attachment 8).

The comment summary below (Table 2) combines the sorting of comments both by theme and category, and briefly highlights the primary points made in the comments received

Table 2. **Summary of comments received during the scoping period.**

Comment Classification	**Comment Subject(s)**
<u>Alternatives</u>	
Chemical Alternatives/Herbicides	Chemical weed control and anti-degradation analysis
	Background information on chemical treatments
	Objections to use and rational for use (cost)
	Regulatory requirements
	Need for chemical alternatives in CMT
	Need for independent expert support
	Better distribution of chemical hazard information
Non-Chemical Alternatives	Non-chemical method suggestions and use in CMT
	Modification of Tahoe Keys
	Regulatory requirements
	More analysis of non-chemical methods
Proposed Elements of Alternatives	Weed rollers attached to dock pilings
	UV light
	Bottom barriers
	Use of volunteer divers
	Manage lake level
	Laminar Flow Aeration (LFA)
	Enzymes combined with LFA
	Channel deepening for LFA
Proposed Modifications to Tahoe Keys Lagoons	Dewater and dredge
	Fill lagoons
	Replace lagoon substrate with different substrate
	Deploy barriers between lagoons and marina/lake
	Install temporary inflatable dam during CMT
	Eliminate areas with highest temperature and stagnation
	Eliminate areas with greatest weed density
	Restore entire or portions of lagoons to wetland marsh
	Acquire waterways through eminent domain
<u>Alternative Analysis/Test Protocol</u>	Assess adequate range of alternatives/combinations
	Reinfestation risk/need for perpetual treatment
	Long-term weed control after dieback and follow-up survey protocol
	Conduct cumulative effect analysis (CEQA)
	Origin of weeds
	Explain 75% knockback goal and specific success criteria
	Further define Group A vs. B methods
	Objection against mechanical harvesters
	CMT scale, site spacing and size, methodology, and timeline

	Herbicide utilization, selections, combinations, concentrations, frequency, and duration UV light applicability and utility Adaptive management programs Alternative treatments bear bulkhead channel Perform/define control work over summer Removal of biomass after treatment Boat backup stations and vessel restrictions Public/property owner access restriction
Antidegradation and Test Analysis	Relationship between treatment success and long-term management Include active herbicide and breakdown products Time thresholds and chemical persistence Fragment dispersion Literature and case-study review of CMT components Chemical adaptation/resistance and weed hybridization Analyze follow-up Group B maintenance methods Include storm drains and urban and residential runoff
Aquatic Weeds Management	Historic fish assemblage and algae control Utilize ecological principles and science to create long-term AIS plan Include community support actions
Background Information	Herbicide fate/transport Surfactants and adjuvants Health effects Lake Tahoe quality and value Regulatory process
Biology/Ecology	Fish management and historic ecology Turion treatment/control Temperature effects on weed growth Existing ecology of native plants/animals and effects of CMT Aquatic weed invasion ecology Biological survey/inventory Future ecology of Lake Tahoe and Tahoe Keys Non-target species effects and biomass die-off Bioaccumulation potential
Boating	Manage/eliminate boat travel or create new access points Changes Keys to navigation channel entrance Impacts of native plant recovery to vessel hull clearance Boat inspections, back up station, clean/spray for weed control Maintaining open water increases need for management

	Low prioritization of boat recreation
Cost & Cost Impacts/Socioeconomics/Financial	Compensation payments to property owners who lose access Costs of alternative control methods Threshold of cost infeasibility Cost responsibility (TKPOA), practicality, and allocations Economic effects and considerations for the Lake
Cumulative and Long-Term Impacts	Direct, indirect, and cumulative impacts/effects analysis
Cyanobacteria	Suggested background information and experts Associated risks to lake and human health Effects of herbicides and alternatives on HABs Reduction measures and goals
General Opposition or Support	Various levels of opposition or support to CMT and Lead Agencies
History	Historical context of weeds and management Activities undertaken by City of South Lake Tahoe
Hydrology	Delineation of flow between Lake and Keys
Independent Experts & Peer Review, Independent Citizen Review	Utility of independent experts and citizens to review results Tahoe Science Advisory Committee involvement
Indirect Effects	Necessity of official indirect effects analysis
Jurisdiction	CA State Land Commission jurisdiction over navigation channel on bed of Lake Tahoe (leased) City of Lake Tahoe does not claim jurisdiction
Mitigation	Mitigation strategy and plan CDFW requirements Fragment control
No Action Alternative/Risk to Lake Tahoe	Full risk analysis of threats and effects to entire lake if no action is taken
Planning History	Can process expedite long-term management planning City corrected records Environment if Keys were never constructed
Project Goals and Objectives	Include HAB and other nuisance algal species reduction
Protection	Prioritize protection of entire Lake Outstanding National Resource Water requirements

	Precautionary Principle and lack of certainty
Public Outreach & Stakeholder Process	Meeting and documentation notifications Better outreach campaigns Responsiveness
Recreation	All forms of recreations should be considered Marshland could offer additional opportunities Exclude recreation as beneficial use of Lake
Regulatory	Legality of testing aquatic herbicides Exemption criteria and precedent for exemptions Regulator responsibility Low water treatment permitting Previous/current regulatory violations (e.g., CWA Section 10, BMPs, Basin Plan) WDRs for Keys and Marina, NPDES for Keys Flood-Associated Beneficial Use and Minor Wetland Classifications
Trash	Capture trash from properties and boats
Water Circulation	Measures for water circulation Use of existing circulation plant Sprayers, fountains, and sprinklers as treatment Filters on pipes discharging into Lake
Water Quality	Weed problem is rooted in physical, chemical, and biological conditions of lagoons Water quality monitoring and improvement methods Effects of water quality and system on analysis
Water Supply	Effects of herbicides/alternatives to wells and drinking water Prioritization of drinking water over other uses Water company ability to withdraw from Lake

5.0 How Comments will be Used in the EIR/EIS

The EIR/EIS will evaluate potential adverse environmental impacts, alternatives to the proposed action (including a No Action Alternative) and potential mitigation that could avoid or reduce potentially significant impacts.

Public and agency comments are instrumental in determining the issues, range of alternatives, and environmental scope of the EIR/EIS. The comments and issues listed above will be addressed in the EIR/EIS.

Where more than one comment addressed the same substantive issue, they are considered as one. Comments not directly related to the EIR/EIS, are noted but may not require that a specific environmental issue be addressed.

6.0 Project Alternatives

At the time of the NOP, the proposed project and alternatives were presented as they appear below. Based on input received during the scoping process, the Lead Agencies and stakeholder committee continue to develop the alternatives.

6.1 Proposed Project

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 herbicides 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.

6.2 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.

7.0 Future Opportunities for Involvement and Ways to Comment

Even after the scoping process closes, there will be multiple opportunities for comment. Environmental analysis of the proposed alternatives will occur over the next year and will include environmental studies and community involvement. A Draft EIS/EIR will be released for public review in 2020, with a Final EIS/EIR anticipated in spring of 2021. A public hearing will be held for the Draft EIS/EIR, at which public and agency comments will be requested. Written comments on the Draft EIS/EIR will be accepted during a comment period which will be announced at the time the draft is posted for public review.

Appendix C

Aquatic Pesticide Application Plan

Aquatic Pesticide Application Plan

Application for Individual National Pollutant Discharge Elimination System Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control as an Integral Component of the Tahoe Keys Lagoons Restoration Project

July 12, 2018

Aquatic Pesticide Application Plan

Application for Individual National Pollutant Discharge Elimination System Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control as an Integral Component of the Tahoe Keys Lagoons Restoration Project

Submitted to

State Water Resources Control Board
Aquatic Pesticide NPDES Program
P.O. Box 100
Sacramento, CA 95812-0100

Submitted by

Tahoe Keys Property Owners Association
356 Ala Wai Blvd
South Lake Tahoe, CA 96150

Prepared by
Dr. Lars Anderson

In association with

Sierra Ecosystem Associates

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1.0 BACKGROUND INFORMATION

1.1 General State NPDES Permit

The California State Water Resources Control Board on March 5, 2013 adopted a Statewide General National Pollution Discharge Elimination Systems (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications (Permit). The General Permit also identifies registered aquatic herbicides that may be used with an approved Permit. The NPDES Permit requires that dischargers seeking permit coverage submit an Aquatic Pesticide Application Plan (APAP) with the permit application package to the State Water Resources Control Board (Section II.C.3. Permit Coverage and Application Requirements, General Permit Application). When the application package and APAP are deemed complete, the Deputy Director of the Water Board will issue a Notice of Applicability allowing the discharger to apply aquatic pesticides in accordance with the requirements of the permit.

However, after initial consultation and application for a General NPDES Permit in June 2017, the Tahoe Keys Property Owners Association (TKPOA) was informed that a general permit would not be issued for the lagoons and that an individual permit would need to be applied for and issued by the Lahontan Regional Water Quality Control Board (Lahontan). Therefore, this APAP is in support of the new Report of Waste Discharge associated with the individual NPDES permit process and new application for an exemption to the Lahontan Basin Plan prohibition on use of aquatic herbicides.

1.2 Lahontan Regional Water Quality Control Board (LRWQCB), Basin Plan Amendments

Notwithstanding the widespread issuance and use of the General NPDES permit for applications of aquatic herbicides and algaecides throughout California via other Regional Water Quality Control Boards since 2001, the Basin Plan for the Lahontan Regional Water Quality Control Board prohibits the introduction of contaminants (including pesticides) in waters of Lake Tahoe at detectable levels. However, in 2014, an amendment to this Basin Plan was approved by both the LRWQCB and the State Water Resources Control Board which provides criteria and procedures to apply for an exemption to the Basin Plan prohibition of introducing aquatic pesticides into Lake Tahoe waters. The Basin Plan Amendment has subsequently been approved by the US Environmental Protection Agency. Therefore, this APAP is provided as part of the application for exemption to the Lahontan Basin Plan prohibition against using aquatic pesticides.

In order to apply aquatic herbicides in the Tahoe Keys lagoons, the criteria stated in the “Exemption to the Basin Plan” must be met, and an approval must be obtained by Lahontan. The issuance of an NPDES permit alone does not fulfill the regulatory requirements under the Lahontan Basin Plan amendment, and thus the NPDES alone does not provide approval, in and of itself, to apply aquatic herbicides to the Tahoe Keys lagoons. However, the NPDES (with APAP) is required as part of the overall process for obtaining an exemption under the Basin Plan Amendment.

1.3 Aquatic Pesticide Application Plan (APAP)

This APAP directly addresses both the requirement under the NPDES approval process and the relevant Basin Plan Amendment exemption conditions. It satisfies criteria for use of aquatic herbicides and is a comprehensive description of proposed use of EPA and California EPA/DPR registered aquatic herbicides in the small scale Herbicide Validation Study (HVS) at nine sites within the Tahoe Keys West Lagoon (also known as Main Lagoon) and three sites in Lake Tallac. The APAP describes the project site, the treatment site, specific areas where aquatic herbicides will be applied, the aquatic plants targeted for control, aquatic herbicides proposed to be used and associated comprehensive monitoring program, best management practices (BMPs) and contingency plans to protect Lake Tahoe.

This APAP only covers Phase I of the Tahoe Keys Aquatic Restoration Project. Before Phase II begins, a final APAP will be prepared for Phase II and III. Phase II and III will be similar to Phase I in scope and design but have a larger scale. This final APAP will incorporate lessons learned from Phase I of the project, account for the larger scale of Phases II and III, and incorporate any modifications that may be made to the permit conditions.

1.4 Description of the Tahoe Keys Lagoons

The Tahoe Keys is a multi-use development situated at the southern end of Lake Tahoe on approximately 372 acres of land. The development includes 1,529 homes and townhomes, marinas, and a commercial center. There are three primary man-made water features in the Tahoe Keys: the Main Lagoon, the Marina Lagoon, and Lake Tallac Lagoon. These three water features are considered the Tahoe Keys lagoons, referred to throughout this APAP.
(Figure 1).

Figure 1. Overview of Tahoe Keys Lagoons

Note narrow connections to Lake Tahoe proper: West and East channels

The surface area of the water of the Tahoe Keys lagoons are approximately 161 acres in size, or 0.3 square miles, a very small percentage of the surface area of Lake Tahoe, which is approximately 192 square miles. The Tahoe Keys lagoons have two narrow, direct connections to Lake Tahoe: the West Channel connects the Main Lagoon and the East Channel connects the Marina Lagoon. These channels provide the only direct boat access to Lake Tahoe from the Tahoe Keys lagoons. Lake Tallac is periodically connected to the Main Lagoon by a diversion structure between the two water bodies. The west end of Lake Tallac also has an intermittent (seasonal) connection to Lake Tahoe via Pope Marsh during high water events.

Even though Lake Tallac has these situational connections to Pope Marsh and the Main Lagoon, sections of Lake Tallac (e.g. the eastern end) can be hydraulically isolated from Pope Marsh due to mid-summer low flows, and/or through use of physical barriers, such as impermeable turbidity curtains, placed at the 15th Street culvert or localized at the project site to prevent mixing and movement. Thus, isolation of Lake Tallac from Pope Marsh and Lake Tahoe occurs naturally, but can also be achieved through installation of physical barriers.

The Tahoe Keys lagoons differ from Lake Tahoe in several ways (Table 1). The lagoons have shallow waters, approximately 20 to 30 feet at maximum depth with an average depth of 12 feet. Lake Tahoe is 1,645 feet at the deepest point with an average depth of 1,000 feet. The waters of the Tahoe Keys lagoons are typically warmer than the water of Lake Tahoe during the spring and summer months, but can be cooler during the fall and winter months. Typically, much of the Tahoe Keys lagoons are frozen for several months in the winter whereas Lake Tahoe never freezes apart from some accumulated ice cover at the shallow shorelines. The waters of the Tahoe Keys lagoons are typically more turbid than the clear waters for which Lake Tahoe is famous. Lastly, the bottom layer of the Tahoe Keys lagoons is composed of fine sediments, a remnant of the past when the area was a marsh coupled with decades of accumulated organic matter from aquatic plant growth and decay due to seasonal senescence. This is in contrast to the coarse, decomposed granite and rocky areas often found at the near-shore and bottom of Lake Tahoe.

Table 1. Comparison of Environmental Conditions in Lake Tahoe and Tahoe Keys Lagoons

	Tahoe Keys Lagoons	Lake Tahoe
Mean Depth	10-12 ft	1,000 ft
Summer Temps	18-27C	15-18C
Volume (gal)	49×10^7	$29x10^{12}$
Sediments	Unconsolidated organic matter	Sand, rock with far less OM, highly variable
Light Field	10-15ft	60-70ft
Shoreline energy	Low, protected	High, unprotected
Bathymetry	Highly uniform	Extremely variable
Circulation	Restricted, “dead ends”	Unrestricted, dynamic
Nutrients	Moderate (N, P)	Ultra-low, N, P
Water inputs	2 channels (+runoff)	63 creek/river inputs
Wind fetch	Short, 0.4 miles	12-22 miles
Plant Habitat	Entire Keys (95%)	Limited by energy, substrate
Water quality	Highly variable	Highly uniform
Urban Connectivity	Highly Concentrated	Diffuse and Patchy

1.5 Beneficial Uses of the Tahoe Keys Lagoons

The Tahoe Keys lagoons provide boating access to Lake Tahoe via the East Channel in the Marina Lagoon and via the West Channel in the Main Lagoon. The waters of the Tahoe Keys Lagoons are used by the residents and visitors to the area for recreational boating (power boating and non-motorized boating) and for recreational fishing. The aesthetic values of the Tahoe Keys lagoons include the waterways and views of the surrounding mountains and Lake Tahoe, which are key attractions for residents and visitors alike. The massive growth of and wide distribution of invasive aquatic plants impairs all of these beneficial uses within the lagoons.

The Main Lagoon of the Tahoe Keys contains the majority of private residences in the overall development and has many interconnected waterways and coves. The Main Lagoon is controlled by 700 individual private property owners who belong to the TKPOA. The TKPOA itself also has an ownership interest in the Main Lagoon.

The Marina Lagoon contains both residences and commercial space. This is the location of the Tahoe Keys Marina which is a separate entity from the TKPOA. It is a privately owned and operated boat launching facility which is the largest full-service marina at Lake Tahoe. The Tahoe Keys Marina provides boat services, fueling, mooring, boat storage, and launching services to the general public, Tahoe Keys property owners and renters, boat rental and charter and other recreational companies, marine construction companies, law enforcement, and agencies and universities for research activities on Lake Tahoe.

1.6 Conditions in the Tahoe Keys Lagoons

The Tahoe Keys and Keys Marina were constructed in the 1960s on the Upper Truckee River Marsh by excavating the lagoons and capping the soil with sand to form stable building bases. In conjunction with construction of the Tahoe Keys, the Upper Truckee River was diverted to a channel on the east side of the Tahoe Keys Marina (USGS 2000).

Due to successive introduction, establishment and spread of non-native invasive aquatic plants, fish and invertebrates over the past 35 years, and the resultant impacts on water quality and ecosystem services, many of the intended beneficial uses of the lagoons described above are severely impaired. The current abundant growth of non-native plants provides habitat for non-native warm water fish and drive excessive variations in pH, DO, and temperature. The excessive plant growth also contributes to sediment loading and provides sources of continuing infestations in Lake Tahoe near shore areas. These conditions and threats to Lake Tahoe are documented and described in the published "Lake Wide AIS Implementation Plan" (UNR 2015). In fact, the highest priority stated in this repot for management of AIS in Lake Tahoe is the control of invasive aquatic plants in the Tahoe Keys lagoons.

Recent aquatic plant surveys (2014 -2017) show the extent, density and increase in excessive invasive plant growth in the Tahoe Keys lagoons (Figures 2 and 3). In recent years, 85% to 90% of the available surface area in the lagoons is infested with invasive and nuisance aquatic plants. These conditions have persisted for decades, in spite of intense seasonal harvesting that has been the main weed control practice since the mid 1980's. It is clear that continued reliance almost exclusively on harvesting operations has not and will not provide sustainable improvements in aquatic plant management, nor will it reduce the threat from the spread of viable plant fragments to near shore areas outside the Keys lagoons. The increased presence of curlyleaf pondweed (*Potamogeton crispus*) in near shore sites in Lake Tahoe attests to the growing threat to the lake ecosystem. Although Eurasian watermilfoil and coontail have been the dominant weedy species since the 1980's, in 2003 curlyleaf pondweed was found in the West and East Channels. This species has continued to spread within the Keys lagoons and has expanded its presence along the south shore including areas in and offshore of the Ski Run Marina, as well as along the Nevada shoreline to Elk Point Marina in 2016.

The continued presence of excessive aquatic plant weedy growth in the Keys lagoons is due to several environmental conditions including nutrient rich sediment, stable, protected water with low energy (little wave action), and shallow water that provides sufficient light and warms quickly in spring. This excessive growth, which persists throughout the summer during the period of high vessel traffic, will continue to threaten Lake Tahoe habitat unless improved management methods are employed.

Figure 2. 2016 and 2017 Occurrence of Eurasian Watermilfoil in the Tahoe Keys Lagoons

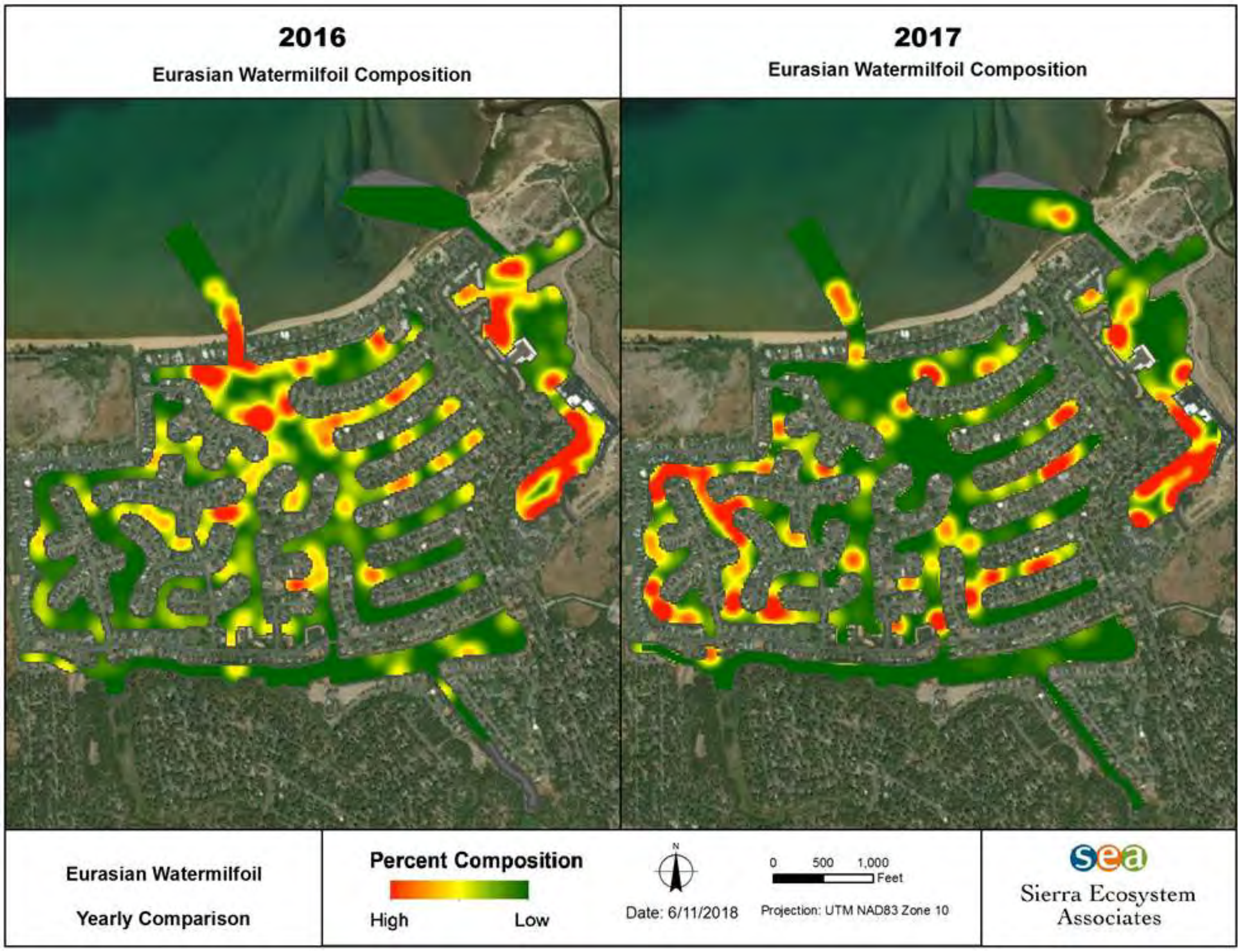
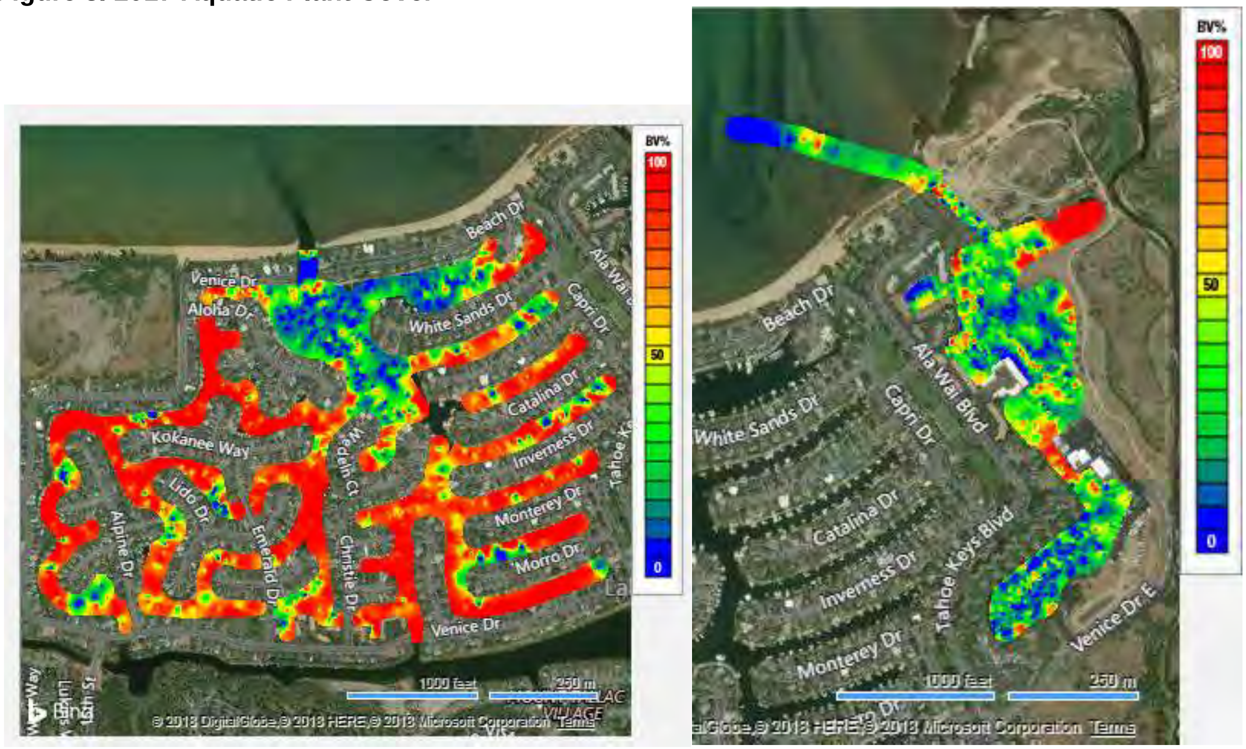


Figure 3. 2017 Aquatic Plant Cover



A. Main Lagoon (8/14/17) B. Marina Lagoon (8/14/17)

1.6 Aquatic plant control methods used now and in the past years

The prohibition on the use of aquatic herbicides in the Tahoe Keys necessitated the use of alternative (non-chemical) methods over the past 35 years. From the 1980's until 2011 the only management method routinely used was (and still is) diesel powered mechanical aquatic plant harvesters coupled with on-shore removal. Each growing season for 4 to 5 months, up to 5 harvesters cut the tops of the plants (canopy) down to approximately a 5 foot depth and collect the bulk of the cut materials on an on-board conveyor system. Cut plants are then transferred to shore-based trailers that transport the cut plants to a drying location before being transported to a compost site outside the Tahoe Basin. During the past 30 years, there has been a trend toward increasing mass of harvested weeds. Current harvests total over 10,000 cubic yards annually.

Harvesters have other limitations and constraints in addition to inefficiency in sustaining control and producing plant fragments. The machines cutting heads are too large to access shallow nursery areas behind docks and near-shore structures, nor can they access areas immediately adjacent to or beneath birthed boats that are tied to docks. Since many coves and open water areas within the lagoons are over 10 feet deep, the harvesters leave rooted plants intact which readily re-grow in a week or two. With these limitations, the harvesters probably only remove 50-60% of plant biomass in areas where they can operate. The net result is only partially, temporarily cleared sites while new plant growth is stimulated by the cutting actions of the harvesters. In addition, fish, and many invertebrates are physically killed or removed along with the plants during harvesting operations.

Even where harvesting operations are effective in clearing navigation zones, this action produces many thousands of plant fragments per harvested acre. A study conducted in 2014 documented from 2,500 to 4,000 fragments per harvested acre and the size distribution that ranged from a few cm in shoot fragments to over a meter in many sites. For Eurasian watermilfoil and coontail, even fragments as small as 2 to 4 cm are viable and can propagate new infestations either in the Keys lagoons or in Lake Tahoe near shore areas. In addition, shoot fragments of curlyleaf pondweed can contain dozens of viable turions, each of which can sprout and establish new populations if they lodge on the bottom in suitable habitats.

Lastly, harvesting action is non-selective: both the targeted non-native and desirable native plants are removed. Therefore, this method is not compatible with the goal of encouraging growth and spread of desirable native plants, which can serve as suitable habitat for native fish and invertebrates.

Since 2012, other types of non-chemical methods have been attempted in small, typically shallow areas within the Tahoe Keys lagoons including hand removal, bottom barriers (both synthetic and natural fiber "jute"), and occasional dredging in the West and East Channels. It should be noted that in 2015, during dredging of the West Channel to improve navigation, aquatic plants were removed. Within one season, plants had become re-established, including Eurasian watermilfoil and curlyleaf pondweed.

TKPOA has taken several steps to reduce the movement of plant fragments to Lake Tahoe: (1) invested in, and deployed various new fragment collection devices including the Omnicat and workboat-mounted screens; (2) ordered stationary collection "bins" in an effort to reduce transport of fragment outside the Keys lagoons (to be installed summer 2018); (3) installed and promoted "Backup Stations" just inside the west channel to encourage boats to reverse their props and release attached plants before exiting the Keys Lagoon to Lake Tahoe; and (4) in spring 2018, installed a "bubble curtain" at the West Channel in an attempt to provide a physical barrier to fragment movement outside the lagoon. This system will be evaluated during the summer of 2018 to assess its effectiveness and utility.

None of these physical or mechanical methods provide lasting weed management for more than one season at most and none are deemed feasible when considering the expansive infested areas (about 150-160 acres) within the Tahoe Keys lagoons, nor are they deemed sufficient to meet the goals of the Integrated Management Plan (IMP). None of the non-herbicide methods by themselves can stop export of plant fragments from the lagoons to Lake Tahoe, nor stop the spread of fragments within the lagoons without the use and integration of proven, approved aquatic herbicides.

In addition to feasibility and sustainability of methods, the constraints and associated risks to non-target species, negative impacts on water quality and potential impairment of beneficial species habitat from using only alternative large or small scale physical or mechanical removal methods arise from several concerns: (1) turbidity generated by physical disturbance of sediment which impedes visibility for divers and any hand removal efforts or dredging operations; (2) production of viable fragments that can be transported by vessels or wind; (3) extreme density and bulk of weeds which greatly impairs diver-assisted hand removal efficiency; (4) sediment bulk density and associated water management needed for large scale dredging; (5) hazardous conditions for divers due to high level of boat traffic; (6) transport and disposal of plant (and sediment) material; (7) increased carbon footprint and related air quality impacts from use of multiple diesel and gasoline powered equipment.

While some alternative methods can be very effective in small, relatively isolated areas, their deployment as a sole means of management in the extensive and heavily vegetated Tahoe Keys lagoons is neither feasible nor effective in meeting the Tahoe Keys Aquatic Restoration Project goals and has unacceptable associated risks to the environment, non-target species, and to Lake Tahoe.

2.0 DESCRIPTION OF THE TREATMENT SITE AND SPECIFIC TREATMENT AREAS

The treatment site is the Tahoe Keys lagoon system. This site defines the treatment zone of potential aquatic herbicide movement. Lake Tahoe is not considered part of the treatment site as movement of applied aquatic herbicides into Lake Tahoe will be prevented by the following actions:

a) Use of "dead-end" coves where water movement is stable for several weeks.
b) Deployment of floating (surface to bottom) impermeable curtains where needed to isolate treatment sites.
c) Use of extensive monitoring for herbicides and, where necessary, their known degradants in addition to use of real-time tracking with RWT dye as a surrogate to estimate movement(s) and dilution of dissolved herbicides.

2.1 Scale of Specific Treatment Areas

Although over 90% of the 161 acre Tahoe Keys lagoons support dense growth of non-native and nuisance aquatic plants, this APAP describes intended applications of aquatic herbicides in a Herbicide Validation Study (HVS) as Phase I of the Project in 2020 to demonstrate efficacy, dissipation, degradation of active ingredients and their known degradants where needed, and to assess compatibility of herbicide use with beneficial uses. Phase I, the HVS, will include a total of 18.2 acres apportioned among 9 dead-end coves in the Main Lagoon and an additional 3 sites at the east end of Lake Tallac. The target plants within the coves are shown in Table 2.

The location of the sites listed in Table 3 are shown in Figure 4. The total area proposed for this HVS is approximately 11% of the total 161 acres within the Tahoe Keys lagoons (see Table 3 for individual site acreages).

Table 2. Treatment sites and target weeds for herbicide demonstration study

Water Body	Target Plants
Tahoe Keys lagoons. Twelve separate sites (see site details in Figure 4)	Eurasian watermilfoil (*Myriophyllum spicatum*) Curlyleaf pondweed (*Potamogeton crispus*) Coontail (*Ceratophyllum demersum*)

Table 3. Proposed Herbicide Validation Study (HVS) Sites and Acreage

Site:	Location	Size (acres)
1	Main Lagoon-Dead end	1.5
2	Main Lagoon-Dead end	1.35
3	Main Lagoon-Dead end	1.3
4	Main Lagoon-Dead end	1.45
5	Main Lagoon-Dead end	2.2
6	Main Lagoon-Dead end	1.25
7	Main Lagoon-Dead end	1.62
8	Main Lagoon-partial Dead end	1.5
9	Main Lagoon-Dead end	1.5
10	Lake Tallac (East end)	1.5
11	Lake Tallac (East end)	1.5
12	Lake Tallac (East end)	1.5
	Total acres (HVS; *with L. Tallac*)	18.2

2.2 Rationale and Basis for Site Selections

Each site shown in Figure 4 has been selected to represent typical aquatic plant species distribution based on historic sampling and surveys, and each site is a "dead-end" cove which minimizes potential movement of herbicide toward untreated areas and provides maximum distances to the West channel. In order to obtain scientifically valid data on the herbicide efficacy and non-target effects of the treatments, each type of herbicide product must be applied to three similar sites (e.g. coves). To properly replicate herbicide treatments (three replicate sites per herbicide) for three products, a total of at least 9 (nine) sites are needed. Furthermore, the minimum size (area) for each site is 1.0 acre in order to encompass sufficient plant diversity and to allow for diffusion of the active ingredients. The minimum scale per site (1 acre) is based on the following criteria:

a) Need to encompass typical plant species distribution including target species and desirable, native plants.
b) Sufficient volume to expose target plants to a small, but operational use of the herbicides. Smaller sites (and volumes) often result in too rapid dilution of herbicides and would not represent conditions under which they would be recommended for use.
c) Sufficient size and depth variations to assess effects of herbicides on water quality such as dissolved oxygen, pH, temperature, and turbidity. Since these parameters vary with depth in normal conditions, sites need to encompass typical bathymetric conditions in the Keys lagoons.
d) In order to obtain similar conditions in replicate treatments sites, they need to be sufficiently large to minimize unusual conditions that may occur in 500 or 1,000 square ft. In other words, an acre (43,560 sq.ft.) typically encompasses variations of plant populations in common with other sites of similar size in the Tahoe Keys lagoons.

There are 12 sites proposed for herbicide applications: 4 sites will be assigned to each herbicide providing replications needed for proper statistical analysis. In addition, three other sites are assigned as untreated “control” sites. The control sites provide reference conditions by which the responses to the herbicides can be measured and quantified. The herbicide to be used in each cove will be determined following aquatic plant surveys conducted in May 2019 but will be limited to those described in Section 4. The individual sites (coves) range from 1.3 to 2.2 acres. Water depths vary with seasonal snow pack and runoff; however typical depths during late May to early June range from 8 to 12 feet. Water depth and total water volume in each cove will be determined 10 days prior to herbicide application since rates of use depend upon total volume of water in the treated sites.

Figure 4: Proposed Sites (Coves) for Use in Aquatic Herbicide Validation Study

3.0 DESCRIPTION OF TARGET AQUATIC PLANTS TO BE CONTROLLED

The following subsections describe the target plant species and their typical mode of reproduction and dispersal.

3.1 Eurasian watermilfoil (*Myriophyllum spicatum*)

Eurasian watermilfoil (*Myriophyllum spicatum* L.) is the most widespread aquatic nuisance plant in the United States. The plant can form a dense canopy at the surface of the water, out-competing other aquatic plants. Heavy infestations can lead to decreased levels of dissolved oxygen under the canopy and changes in pH, both of which can alter aquatic ecosystems by decreasing native species diversity.

Eurasian watermilfoil is an evergreen perennial plant which roots in sediment and grows completely underwater, typically at 15-foot depth but has been found as deep as 30 feet. The leaves are pinnately compound with 14 to 24 pairs of leaflets in groups of four at each stem node. Flowers form on short stems above the water surface and flowers produce up to four nutlets or seeds each. Eurasian watermilfoil can form numerous viable seeds which can disperse readily and can spread by forming new root crowns from rhizomes growing in the sediment or from seeds (Thum et al. 2018).

Eurasian watermilfoil is very similar in appearance to the native aquatic species, northern watermilfoil (*M. sibiricum*) and hybridization between the two species can occur. Both species spread readily by stem fragments formed naturally by abscission from the main plant or by breakage caused by wave action or feeding by waterfowl. These species can travel in boat ballasts but introduction through the aquarium trade is also a contributor to its spread.

3.2 Curlyleaf Pondweed (*Potamogeton crispus* L.)

Curlyleaf pondweed (*Potamogeton crispus L.)* is found in all of the lower 48 states and is considered naturalized throughout this range. Curlyleaf pondweed is a rooted perennial with a fast growth rate. The plant stem is very thin and long and can entrap swimmers. Curlyleaf pondweed aggressively out-competes native submerged vegetation. The plant has wavy-edged leaves which are green early in the growing season and turn red at the water surface. The leaves are oblong, one to three inches long, and are in an alternate arrangement along the stem. Curlyleaf pondweed typically is found in more shallow waters at three to six feet depth but can be found in clear waters as deep as 20 feet.

Curlyleaf pondweed reproduces primarily by turions and rhizomes but can also spread by stem fragments or seeds. Turions are modified, asexual reproductive buds that form prior to plant senescence in early summer. Seed germination rates are low for this species. This species can overwinter with some green growth remaining above the sediment, thus giving these plants an advantage when temperatures rise and growth resumes in the spring. The spread is attributed to boating and fish hatchery activity (Stuckey 1979; Turnage et al. 2018).

Curlyleaf pondweed forms dense mats at the water's surface which inhibits navigation and recreation. The dense mats limit light from reaching native vegetation and can inhibit oxygen exchange along the water column. These conditions reduce the populations of fish or aquatic invertebrates and can create conditions that promote mosquito habitat by removing predators and obstructing water flow

Potamogeton crispus

3.3 Coontail (AKA “Hornwort”) (*Ceratophyllum demersum*)

Coontail (*Ceratophyllum demersum)* is a native aquatic plant that is found nearly world-wide and throughout California up to 6,500 feet in elevation. In natural areas, coontail is considered beneficial and provides food and shelter to other aquatic species. However, it can develop very dense mats which inhibit water flow, interfere with recreation, and promote mosquito habitat.

Coontail is a submersed plant that lacks true roots. It can exist as a free-floating plant or it can form modified stems and anchor itself to other aquatic plants. Young plants readily detach from soil.

Coontail plants have slender stems with single branches at nodes. The leaves are dark green, forked, with small-toothed margins. Coontail reproduces vegetatively, by stem fragments and turions, and by seed, although in cold water, plants produce few to no seeds (DiTomaso 2003).

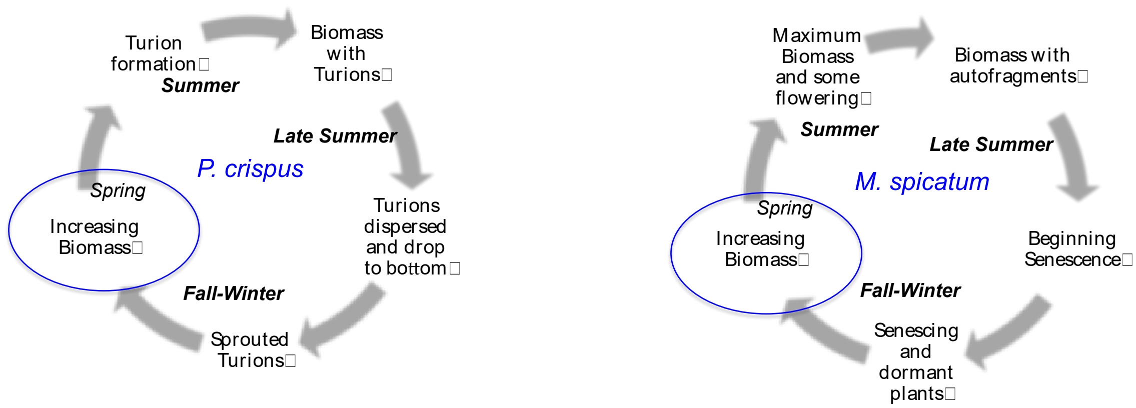
Ceratophyllum demersum

The life cycles of the three target plants differ in important ways and these differences can affect the strategies for management. All three plants undergo rapid growth in early to late spring when water temperatures exceed 12°C. All three species can form new plant colonies from vegetative fragments although Eurasian watermilfoil and coontail more readily proliferate from fragments as small as a few cm in length.

All three can form fruits with seeds but even though their germination is generally limited, the seed is long-lived. This means that a “seed bank” may persist for many years.

Curlyleaf pondweed's ability to form dispersive, vegetative structures called "turions" in spring provide the plant with a very effective dispersal mechanism during summer. A single shoot can form dozens of turions during spring and early summer. The turions typically sprout in early fall, root on the bottom and are ready for rapid growth the next spring. (See Figure 5).

Figure 5: Life Cycles of Eurasian Watermilfoil and Curlyleaf Pondweed



For both species, one of the most effective times for herbicide application is spring which can stop biomass production and also prevent the production of turions in curlyleaf pondweed.

4.0 AQUATIC HERBICIDE PRODUCTS PROPOSED FOR USE AND APPLICATION METHODS

Aquatic herbicides have been used effectively and safely in United States, including California, for over 45 years to control and manage aquatic weeds in lakes, rivers, ponds, aquaculture production systems and irrigation systems. The use of aquatic herbicides is regulated by the US Environmental Protection Agency and by individual states such as the California Department of Environmental Protection's Department of Pesticide Regulation (CAL-EPA/DPR). Only those aquatic herbicide products that have been reviewed extensively by US EPA and CalEPA/DPR and have received a "registration" (i.e. approved) are allowed to be applied to, or in, water to control aquatic weeds.

The uses, approved sites, methods of applications, limitations and restrictions of use, and the targeted aquatic weeds of aquatic herbicides are specified by each product's labeling. Any uses must comply with the approved label. This includes appropriate rate (concentration) of use, proper methods of application, proper equipment, protective clothing and proper disposal of product containers after use. Labeling also provides specific limitations and compliance actions regarding uses in or on potable water, water used for irrigation, swimming, or fishing. Most products must be applied only by a Certified Applicator (e.g. California Certified Applicator) and with an approved NPDES permit.

Two of the aquatic herbicide products proposed for use in this APAP are fully registered (approved) by USEPA and CalEPA/DPR *and* are included in the General NPDES (Permit) for Aquatic Pesticide Applications. The third herbicide, ProcellaCOR™, has been approved by US EPA (2018), and is under review by the CalEPA/DPR and is expected to be approved sometime in late 2018. Table 4 lists the aquatic herbicides proposed for use in the Tahoe Keys lagoons for the demonstration applications and Table 5 lists the proposed herbicides and follow-up actions for each site.

Table 4. Proposed Herbicide Products

Herbicide Active Ingredient (Product name)	EPA Reg. No. (All on Calif. General NPDES Permit)	Maximum allowable (ppm)	Proposed Use (ppm)	Application Method (s)	Target Plants Controlled product labeling
Endothall (Aquathol K) Contact type w/ some systemic characteristics	EPA Reg. No. 70506- 176	5.0	2.0	Drop hoses	Eurasian watermilfoil Coontail Curlyleaf pondweed
Triclopyr (Renovate liquid or OTF granular) Systemic type	EPA Reg. No. 67690-42	2.5	1.0	Drop hoses or granular spreader for OTF formulation	Eurasian watermilfoil
ProcellaCOR™ Systemic type	EPA Reg.No. 67690-79	0.050	0.002-0.004	Drop hoses	Eurasian watermilfoil Curlyleaf pondweed

*No Adjuvants will be used. Products are approved for use under the General NPDES permit in California

Table 5. Proposed Site Acreages, Herbicides, Application Rates (ppm), and Non-Herbicide Follow-up Control Methods

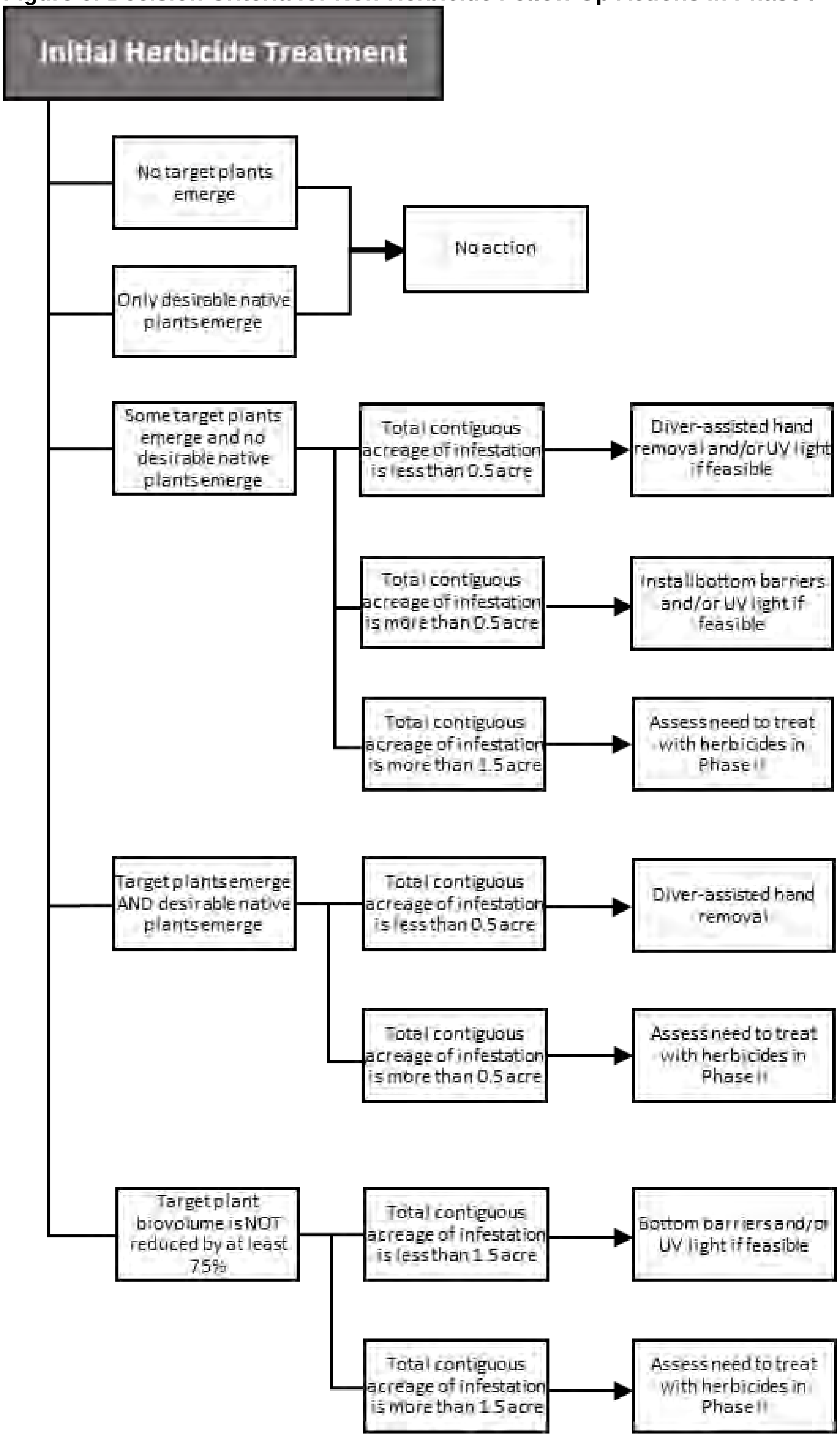
Sites	1	2	3	4	5	6	7	8	9	10	11	12	Total Acres
Surface Area, Acres	1.5	1.35	1.3	1.45	2.2	1.25	1.62	1.5	1.5	1.5	1.5	1.5	18.17
Endothall													6.0
Application Rate, ppm	2.0							2.0	2.0	2.0			
+bottom barrier	X							X	X	X			
+hand removal	X							X	X				
Triclopyr													5.55
Application Rate, ppm		1.0		1.0		1.0					1.0		
+bottom barrier		X		X		X					X		
+hand removal		X		X		X							
ProcellaCOR™													6.62
Application Rate, ppm			0.002 - 0.004		0.002 - 0.004		0.002 - 0.004					0.002 - 0.004	
+bottom barrier			X		X		X					X	
+hand removal			X		X		X						

Since each application site is small (<3 acres), liquid formulations will be applied from a boat-mounted tank mix system with direct pumping into drop hoses that place the herbicide from mid-depth to the bottom. Granular formulations will be applied either by small powered granular spreader, or a powered air-stream (blower) spreader connected to a bow-mounted hopper system. These systems are commonly used and readily available commercially. All systems are calibrated using water (for liquid formulations) or "blank" granules for granular (pelletized) formulations.

Integration and use of follow-up non-herbicide methods.
As part of the herbicide demonstration and efficacy monitoring, alternative sequential management actions may be taken based on the results of plant biovolume and abundance monitoring. Figure 4 summarizes the options and the criteria for deploying each option, or for "no action". This assessment will be made for each of the 12 herbicide application sites since responses may differ due to difference in the herbicide modes of action and plant species distributions.

Decision for use of specific non-herbicide follow up methods will be driven by assessment of control (reduction) of target plants and response(s) of desirable, native plants.

Figure 6: Decision Criteria for Non-Herbicide Follow Up Actions in Phase I



4.1 Endothall (Aquathol K)

Endothall is rapid-acting, contact type herbicide (with some systemic characteristics) applied as a liquid formulation directly to aquatic weed stands. It typically requires a contact time of 12 to 24 hours at 4 to 2 ppm, respectively for control of the target plants. It has some selectivity and has little effect on *Elodea* spp. at normal applications rates of 1-3 ppm. Its residue in water is readily determined through sampling and immunoassays with results available usually in real-time for moderate application levels and up to 24 to 48 hours for low level detection.

4.2 Triclopyr (Renovate Liquid or OTF)

Triclopyr is a systemic, selective herbicide that is either applied as a liquid or a solid (OTF). It is relatively fast acting (2 to 5 days) at concentrations of 0.5- 2.5 ppm for selective control of Eurasian watermilfoil. It has little to no effect on pondweeds, coontail or *Elodea* spp. so it is useful in releasing native pondweeds and *Elodea* spp. It is readily monitored through water sampling and immunoassays which can provide results in 24 to 48 hours after samples are taken.

4.3 Florpyrauxifen-benzyl (ProcellaCOR™)

ProcellaCOR™ is classified as "Reduced Risk" pesticide by USEPA, which is a first for short exposure in water herbicides. It is used at extremely low rates for control of Eurasian watermilfoil (e.g. 2-4 ppb) and has been shown to be effective on newly sprouted turions (Anderson 2017). It has a very short half-life of only a few days and is the first non-copper herbicide for localized treatment without restriction on potable water consumption. See Heilman, M. (2018) (ICAIS meeting pdf) and Beets and Netherland (2018) for more information. It

EPA registered this product in 2018 and stated that there are 'no risks of concern to human health from any route of exposure'. Additionally, there are 'no risk concerns for non-target wildlife.'

5.0 RATIONAL AND JUSTIFICATION FOR CONDUCTING VALIDATION APPLICATIONS OF AQUATIC HERBICIDES FOR AQUATIC WEED MANAGEMENT IN THE TAHOE KEYS LAGOONS

The premise for initiating the proposed aquatic herbicide validation study is that over the past 30 years, during which no herbicides have been allowed in the Tahoe Keys lagoons, there has been no significant progress or improvement in sustainable management of the excessive aquatic plant growth. In fact, the long-term records of harvesting actions show that the problem has increased over the past several decades in spite of increased harvesting and in spite of attempts to apply other “non-herbicide” methods such as bottom barriers, localized hand removal, and even larger scale dredging in the West and East channels. The general conditions of the lagoons provide ideal habitat for prolific plant growth with abundant light, nutrients in the sediment, and near-optimal water temperatures for most of the summer months. Furthermore, continuation of the *status quo* will not reduce the risk of plant fragment production, dispersal and spread of invasive aquatic plants into Lake Tahoe proper.

The alternative methods reviewed and/or attempted are provide here with summaries of their feasibility, efficacy and practical use and limitations. Additional information can be found in Chapter 11: Examination of Possible Alternatives.

a) The use of bottom barriers has produced inconsistent, expensive, and temporary efficacy and this is a non-selective method since both invasive and native beneficial plants are covered. This method is also problematic due to high boat traffic and limited areas of practical use. It may have useful applications in small areas and in areas where successful use of aquatic herbicides has reduced biomass sufficiently.

b) The use of hand pulling and/or diver assisted suction removal has most applicability in small, shallow infestations (e.g. under 1 acre) and primarily in low plant density (low biomass) conditions. Until and unless other methods are used to reduce the high density and biomass within the Keys lagoons, this method has limited practicality in the 150+ infested acres of the Keys lagoon systems. However, once biomass has been reduced sufficiently, then this method could be very useful if employed regularly and with proper timing.

c) Dredging (sediment and associated plant removal) has been used in the following sites in the Tahoe Keys lagoons and other near-shore marinas at Lake Tahoe: Tahoe Keys channels, Elk Point Marina, Fleur de lac, and Ski Run. In none of these operations did sustained management or reduction of aquatic plant biomass persist for more than a few to several months. For example, aquatic plants returned to the West and East Channels within 6 months following dredging operations. At Elk Point Marina, populations of invasive Eurasian water milfoil and native Elodea recolonized the entire marina within one year. Furthermore, Elk Point Marina now supports new populations of invasive curlyleaf pondweed for the first time, as of July 2016, a year after dredging operations. Therefore, the actual, local experiences with dredging have been unsuccessful in providing more than a few months relief from the negative impacts of aquatic weeds and at each site, unacceptable levels of aquatic weeds still persisted within one season or less. These examples include scales of only a few acres in relatively confined sites and yet still did not provide sustainable management. Therefore, it is unreasonable to assume that applying dredging operations to a far more diffuse and widespread scale of the Tahoe Keys Main lagoon would result in improved, sustained aquatic weed management. Furthermore, the complexity and extent of physical structures (piers, pipes, bulkheads) within the Tahoe Keys lagoon systems presents serious hazards and risks for dredging operations as well as infrastructural components.

d) Mechanical rotovating produces thousands of viable fragments that must be thoroughly collected so they do not spread. In the process, rotovating also destroys the integrity of the benthic habitat to depths of 10 to 15 inches because the rotating tines physically tear up the sediment to those depths. This benthic sediment layer provides essential habitats for invertebrates, microbial populations and supports the growth rooted native plants such as Elodea, leafy pondweed, Richardson's pondweed, and water buttercup. (NOTE: The herbicides proposed for this demonstration project do not physically or chemically impair the benthic habitat and thus leave it intact to facilitate the growth of desirable native rooted plants, invertebrates and normal functioning of the microbial populations once the invasive and nuisance aquatic plant populations have been reduced.) Rotovating impacts are inconsistent with the overall goal of restoring and conserving habitat for native species.

e) Several Federal EPA and California EPA-approved herbicides have been used successfully to control Eurasian watermilfoil, curlyleaf pondweed and coontail in both lake and flowing water habitats throughout the US. The concentration of active ingredients of theses herbicides in the waters in which they are used can be determine by sampling and results of analysis are typically available usually within 24 or 48 hours of sampling. Thus, the location and concentration(s) of active ingredients can be readily monitored to determine dissipation and transport away from target application sites.

f) Assessment of herbicide movement. Results of tests conducted in 2011 using the fluorescent water soluble dye Rhodamine WT in typical Tahoe Keys lagoon coves showed that the dye remained within dead-end coves for several weeks after applications that were made in late spring. Thus, the dye surrogate for aquatic herbicide dissipation did not migrate to the channels that connect the Tahoe Key lagoons with Lake Tahoe when applied in late spring. However, dissipation and movement of the dye applied in fall was more rapid (few days to two weeks) and did result in transient, low level detection just outside the West Channel.

   Additional Rhodamine movement and dissipation studies were conducted in 2016. The results of these studies showed that early June injections near the West Channel did not result in net movement out of the Main Lagoon; whereas injection near the West Channel in late June/early July did result in transient movement into the Channel and toward the opening into Lake Tahoe. Mid-summer applications of Rhodamine WT were made in two small dead end areas that have been separated (contained) using double curtains. The results showed that over a two week period, only about 1% of the total RWT had moved from the injection site. When the double barriers were removed, residual RWT moved only about 1,000 ft outside the original contained area. RWT levels were only 15 to 25 ppt (parts per trillion). The monitoring protocol and sampling sites included for this project are designed to provide both real time estimates of movement (RWT as a surrogate) and actual levels of the herbicides in the water inside and outside the treatment zones. (See “Monitoring” section.)

g) In contrast to mechanical harvesting methods, which produce many thousands of viable fragments and actually stimulates plant growth, the proposed herbicides will not produce viable fragments and will also significantly reduce the need for subsequent mechanical harvesting throughout the growing season. The spring application timing provides optimal conditions to reduce subsequent biomass to non-problematic levels in plant density, plant canopy height and biomass. Furthermore, by controlling growth in early spring and summer, the potential for plants to produce seeds, turions, or overwintering capacity is greatly reduced thus reducing the ability of the plants to reestablish in the subsequent year. The gradual diminution of biomass production coupled with reduced reproductive capacity will also result in reduced need for annual use of aquatic herbicides, especially when management is integrated with other non-herbicide methods such as removal of small stands of plants by divers and bottom barrier placement.

h) The desirable attributes of approved and effective aquatic herbicides include: 1) reduction in mid and late season biomass; 2) reduction in plant canopy height and reproductive capacity; 3) reduction or elimination of viable propagules (seeds, turions, plant fragments, shoots, rhizomes, and root crowns) that spread populations; 4) selectivity to control primarily target species: curlyleaf pondweed, Eurasian watermilfoil, and coontail; 5) ability to control plants in, under, around and adjacent to docks and other structures that typically interfere with various mechanical or physical methods; 6) compared to violent, non-selective mechanical methods, herbicides actually reduce risks to non-target animals (fish, invertebrates, waterfowl, pets and people, and harvester and boat operators); 7) reduced carbon footprint due to reduced need for harvester operations.

i) Taken together, the results of the 2011 dye studies coupled with well-established efficacy of the herbicides containing endothall, triclopyr, or ProcellaCOR™ in controlling the major target invasive and nuisance aquatic plants in the lagoons (Eurasian watermilfoil, curlyleaf pondweed and coontail) suggest that these products should be part of the fully integrated weed management program to control these aquatic plants in the Tahoe Keys lagoons. Furthermore, there are multiple advantages of using these types of herbicides in early spring when plant growth is beginning. Applications of herbicide at that time will primarily affect curlyleaf pondweed and overwintering Eurasian watermilfoil and prevent accumulation of dense biomass and tall canopy height.

6.0 CONTAINMENT AND CONTINGENCY CONTROL STRUCTURES USED TO CONTROL MOVEMENT TO RECEIVING WATERS

There are no direct raw, potable water intakes located adjacent to the Tahoe Keys lagoons. There are wells located within the lagoons that draw water from 150 to 430 ft. below the ground surface. The nearest raw water/potable intake is in Lake Tahoe near Lakeside Marina, approximately 4 miles from the Tahoe Keys West Channel. Since the Main Lagoon has a direct connection to Lake Tahoe via the West Channel, precautionary steps will be taken to reduce likelihood of: (1) herbicide movement toward the West Channel; and, (2) to prevent movement of herbicide out of the West Channel.

The Containment and Contingency Actions (CCA's) are multilayered and are driven by both herbicide residue monitoring and monitoring of Rhodamine WT (RWT) dye as a surrogate for the herbicides, and are supported by studies conducted in June, July, and August, 2016 on the movement of RWT from barrier-enclosed sites and an open area (uncontained) site directly adjacent to the West Channel. These studies showed that: (1) deployment of barrier curtains can effectively contain dissolved materials (such as aquatic herbicides) and that they can be deployed within one day; and, (2) dissolved materials (RWT) present near the West Channel in early June is highly unlikely to enter the West Channel and therefore will not pose a risk to Lake Tahoe.

The CCA's described below constitute a robust set of adaptive, protective and precautionary methods that together ensure protection of the beneficial uses of Lake Tahoe as well as waters within the Tahoe Keys Main lagoon and Lake Tallac.

6.1 Contingency Monitoring and Mitigation of Potential Herbicide Residues

If herbicides are detected within the West Channel, then additional monitoring stations will be sampled outside the Tahoe Keys in Lake Tahoe and monitoring will continue south and north of the channel.

6.2 Use of Rhodamine WT Dye to Provide Real-Time Movement Data

Rhodamine dye will be applied during the applications in the coves nearest to the channels and the dye will be tracked to determine if it is moving toward the West Channel. Rhodamine dye may be injected at the location of other known herbicide residue locations to assist in determining movement and dissipation.

6.3 Herbicide Residue Monitoring

Water samples will be taken pre- and post-herbicide applications to determine levels of active ingredients (See Monitoring Protocols Section 8). In the event herbicide residues are detected in the West Channel, the contingency sampling stations (Figure 8) in Lake Tahoe will be initiated.

6.4 Use of Existing Well Water Carbon Filtration Systems

Existing well water carbon filtration systems will be utilized to remove herbicide residues, in the event they detected in the well water system, before water enters distribution systems in the Tahoe Keys.

6.5 Use of Mobile Filtration System

A mobile (truck/trailer mounted) filtration system will be utilized to treat localized areas if herbicide residues exceed allowable label use.

6.6 Residue Breach Notification

In any event, if herbicide residue is detected within 500 ft. of the West Channel, the LRWCQB will be notified within 24 hours. See Figure 5 below for contingency monitoring and notification plan and Figure 6 for contingency monitoring sites.

6.7 Application Preparations

6.7.1 Site Preparation

1. Depth contours (bathymetry) to determine total volume of water to be treated in each specific site
2. Acquire pre-treatment plant samples and water samples (establish sampling stations using buoys, GPS or other landmarks.
3. Assign herbicide treatments to sites (i.e. coves) based on target plant presence
4. Install signage notifying intent to apply herbicides (72 hour before application date).
5. Notify LRWQCB and TRPA of application date, sites and herbicides intended to be applied (7 days before application date)
6. Deploy floating, impermeable turbidity barrier at strategic location to prohibit movement of herbicide toward channels that connect Lake Tahoe.

6.7.2 Apply Approved Herbicide

1. Calibrate herbicide application equipment
2. Confirm safety gear and spill containment equipment
3. Confirm herbicide type, rate and placement
4. Prepare and inject Rhodamine WT (surrogate) to follow potential herbicide movement.

6.7.3 Monitor Rhodamine WT, Herbicide and Degradants

1. Monitor, in real time, level and movement of Rhodamine WT using field fluorometers. Monitoring will be at same frequency as provided below for water samples.
2. Conduct post treatment water sampling for herbicide active ingredient: 6 hour, 24 hr, 72 hr, 7 DAT, 14 DAT, 30 DAT, 60 DAT, 90 DAT, and/or until herbicide is no longer detected.
3. Conduct post treatment water sampling for degradants: 24 hour, 72 hr, 14 DAT, and/or until degradants are no longer detected.
4. Water Quality measurements: Taken three times per week during the course of the season.
5. Preserve, store, and ship samples for analysis of herbicide and degradants

Figure 7: Decision Chart for Monitoring Contingency Plan

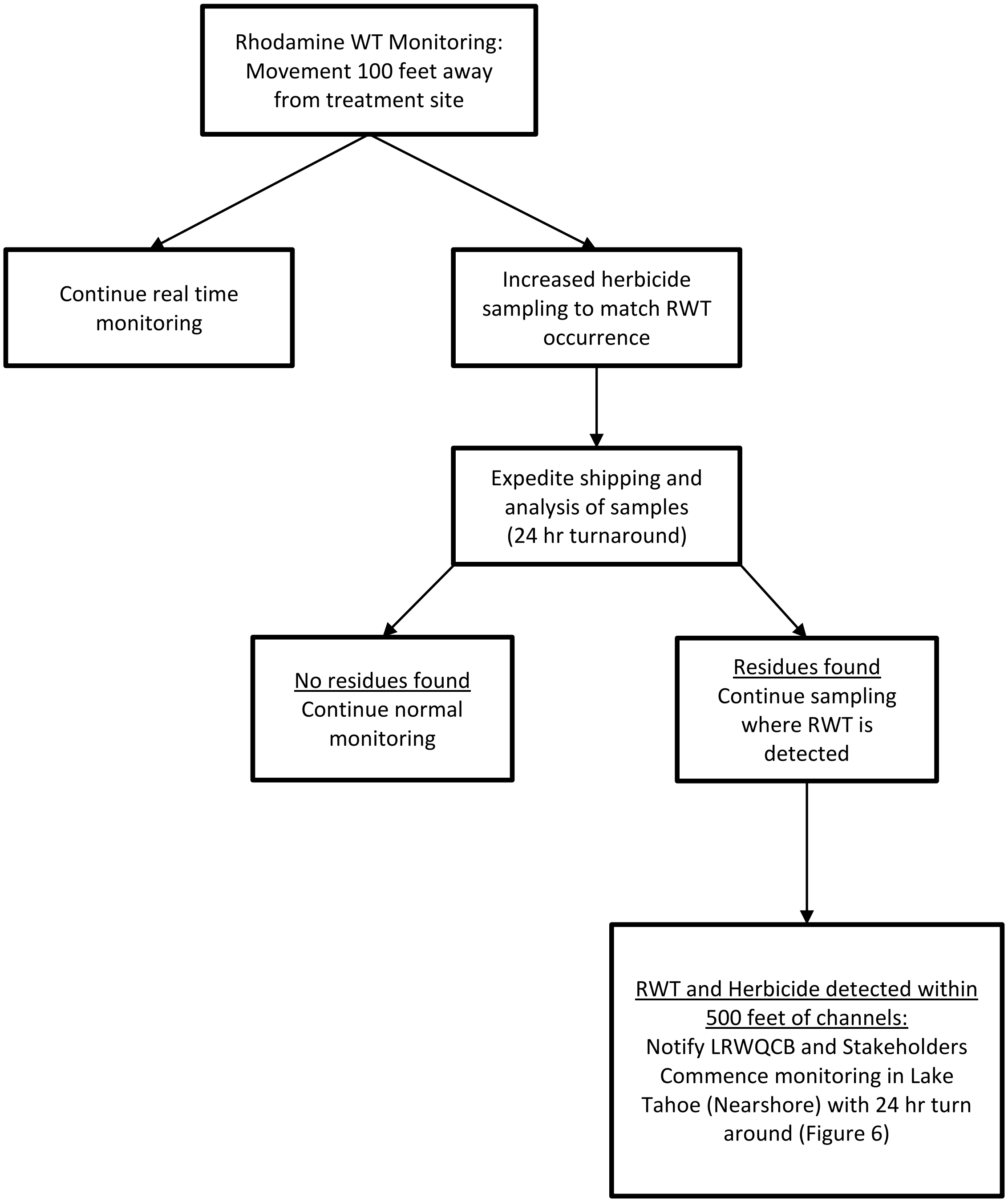
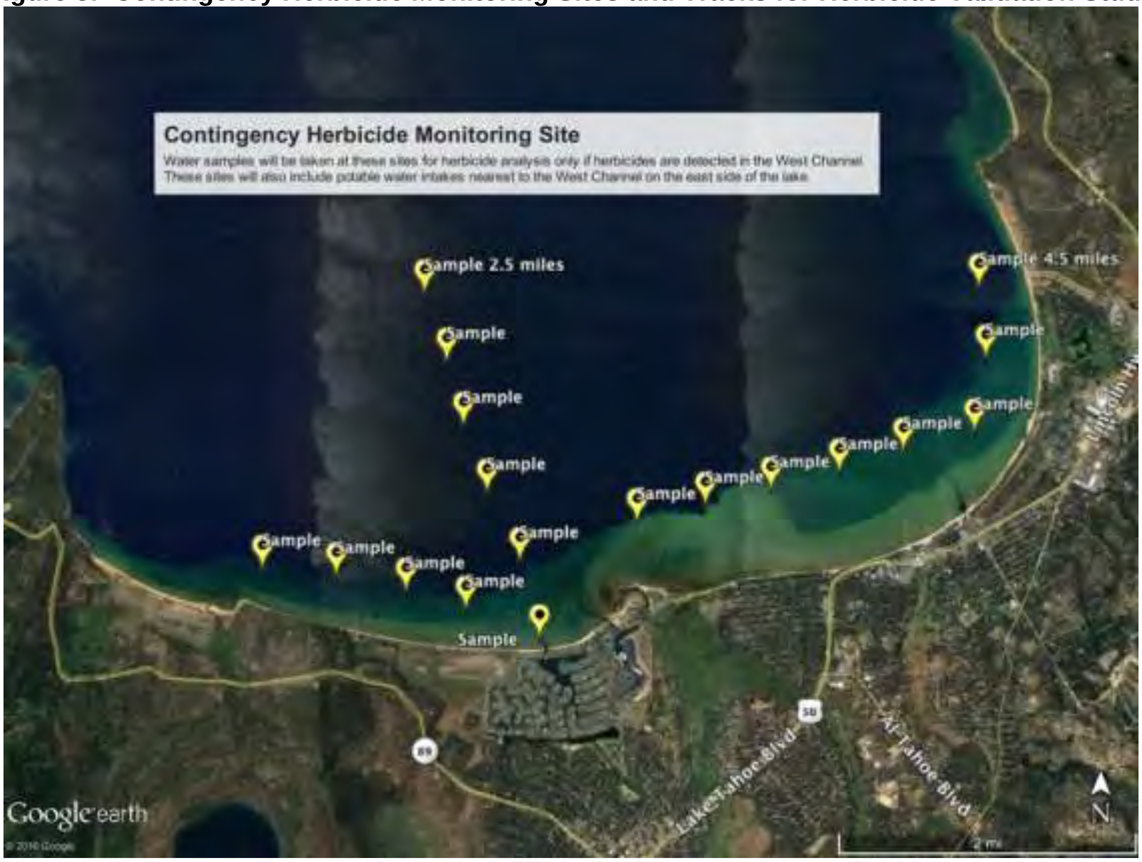


Figure 8: Contingency Herbicide Monitoring Sites and Tracks for Herbicide Validation Study



NOTE: These sites will only be monitored if herbicide residues are detected in the West Channel.

7.0 SHORT TERM SEASONAL EXPECTATIONS

Based upon general bathymetry, prior Rhodamine dye studies and hydraulic conditions, there is a seasonal pattern regarding water flow as follows:

a) As snow melt occurs and the water in Lake Tahoe rises, water is "pushed" into the lagoons and water level there also rises. This leads to a net inflow during late spring through mid-summer (as long as the lake proper is rising)
b) In fall, as lake level drops, there is net out-flow from the lagoons which continues until mid-winter-late winter. Therefore, the water level in the lagoons is typically lowest in November and remains so until subsequent spring runoff.
c) Due to low levels in the late summer in the lagoons, this time can be used for efficient hand removal of plants and potentially other non-herbicide controls as part of the integrated management program.
d) The "end" of the lake filling, and consequently the end of net inflow to the Tahoe Keys lagoons varies from year to year and is dependent upon several environmental events such as timing and extent of snow pack development, water content of snow pack, and melt rate of snow pack.

These features of the spring period provide optimal conditions for herbicide applications because their effectiveness is best on new growth which occurs in spring and because this period of the season generally produces stable water inflow to the Keys lagoons and helps retain herbicide residues within the lagoons.

8.0 DESCRIPTION OF THE MONITORING PROGRAM

The monitoring program has several objectives:

a) Determine the target and non-target plant occurrence and abundance within the Tahoe Keys lagoons and specifically with the treatment sites (e.g. coves).
b) Determine the level, movement and dissipation of herbicide active ingredients during and following their use in the treatment sites.
c) Provide data on half-life of herbicide degradants using the Herbicide Validation Study (HVS).
d) Provide data pertaining to compliance with water quality limits and other parameters such as DO, pH, temperature, turbidity and concentration (residue levels) and movement of herbicide outside the treatment sites.
e) Determine the efficacy and relative selectivity of herbicide treatments within the demonstration locations.
f) Provide data that will be used in determining the potential integration of aquatic herbicides with other management methods.

In summary, the Monitoring Program addresses these key questions:

1. Will the herbicides control the target plants?
2. What effect do the herbicides have on non-target plants and animals?
3. Will the herbicide concentrations and their location remain within the limits of the target treated area and within the Tahoe Keys lagoons?
4. What are the levels and persistence of herbicide degradants?
5. Does the discharge under this permit result in residues exceeding receiving water limitations?

Records of Monitoring will include:
1. Date(s) and time(s) of application(s)
2. Location of application (treatment sites)
3. Name of applicator
4. Type and amount of aquatic herbicide used.
5. Application and site details: area, water depth, water volume, method of application, start and finish time, rate or concentration of aquatic herbicide applied.
6. Visual monitoring assessment (e.g. spillage, proper site)
7. Certification that the applicator followed the APAP

8.1 Data Collection

8.1.1 Plants

At the end of 2019 growing season (approximately September 30, 2019) TKPOA will conduct a final seasonal hydroacoustic and point-sampling survey to determine the extent and composition of aquatic plants in the Keys lagoons. This information, coupled with prior 2017 plant surveys will help identify the appropriate herbicide(s) for use in the spring of 2018. Similar plant surveys will be conducted in Spring 2020 to confirm growth stages of the target plants and their relative abundance.

All surveys will be GPS referenced and plant distribution and biovolume maps will be generated for each treatment site and for the entire Tahoe Keys lagoons. From the point sampling (physical samples), species will be identified and digitally photographed so that effects on both the target plants and non-target plants can be documented.

8.1.2 Herbicides

Water samples will be taken pre- (background) and post-herbicide application at fixed sampling stations (see Section 8.2 for locations and frequency) at the surface (15- 25 cm below surface), mid-depth, and 25-30 cm from the bottom. Starting at 72 hours after application, samples will only be taken at mid-depth based on the assumption that the water column will mix completely within the first 24 hours. Pre-application samples will be taken within 24 hours before applications are made. All samples will be documented and handled according to prescribed methods (EPA). (See Section 9.0 below)

8.2 Monitoring Locations, Timing and Frequency

8.2.1 Plant Monitoring

The 2019 hydroacoustic surveys will be conducted bi-weekly (twice per month) beginning May 2019. By comparing results of the 2019 plant surveys in the treatment sites and untreated sites the efficacy and other effects (e.g. non-target effects on plants) will be determined. Hydroacoustic scans will be made along two parallel transects in each herbicide-treated area and in similar untreated (control) sites. The scans will provide an estimate of biomass by determining “biovolume” as well as plant canopy height. Canopy plant height will be used to estimate vessel hull clearance. This metric, as well as biovolume and relative abundance of plants will be used to compare efficacy of the herbicide applications compared to untreated sites and to sites managed by harvesting, bottom barriers or diver-assisted hand removal.

To determine relative abundance and presence/absence of plants, surveys will be conducted 14 DAT, 30 DAT, 60 DAT, 90 DAT, and 120 DAT. Physical point samples will be taken along the same transects at 100 to 200 ft. intervals. This will provide from 30 to 40 point samples in each site. Example of proposed sampling transects are shown in Figure 7. Along each transect, samples will be taken mid-channel and at approximately right angle (toward the shore) within 3 to 6 ft. from the edge of the shore, or at 2 to 4 ft. depths. This sampling array provides assessments of plant biomass and abundance (pre- and post-herbicide application) in both the main open areas of the site as well as near the shoreline adjacent to piers and floating docks. In less linear sites, transect contours will follow shoreline shape but will still include the main channel and areas near piers and floating docks. Figure 8 provides an example of the total array of plant sampling points.

Figure 9: Example of Plant Sampling Transects (Internal Lines) in Three of the Proposed Herbicide Treatment Sites

Figure 10: Example of Point Sampling for Plant Presence and Abundance

Figure 8 is an example of typical sampling transects in an herbicide (or control) site showing locations of each point (green markers) to be physically sampled for aquatic plant species presence and abundance.

8.2.2 Herbicides Monitoring and Sample Analysis

Sampling stations will be established at three locations within each treatment site (cove): one mid-site (i.e. approximate middle of the cove), one each on either side of the site (cove), and at least three sampling locations will be established outside the treated site at approximately 100 ft. linear intervals. At each station for each sampling event, water will be sampled in duplicate as follows: near the surface (15-30 cm below surface), mid-depth, and 25-30 cm from the bottom. Thus there will be 18 samples taken within each treated area (cove) for each sampling time, and 9 samples taken outside the treated site. Starting at 72 hours, samples will only be taken at mid-depth based on the assumption that the water column will mix completely within the first 24 hours. The provisional locations of sampling sites are shown in Figure 9. The final locations of the outside (from outer edge of site) sample stations will be adjusted based on the final application site locations.

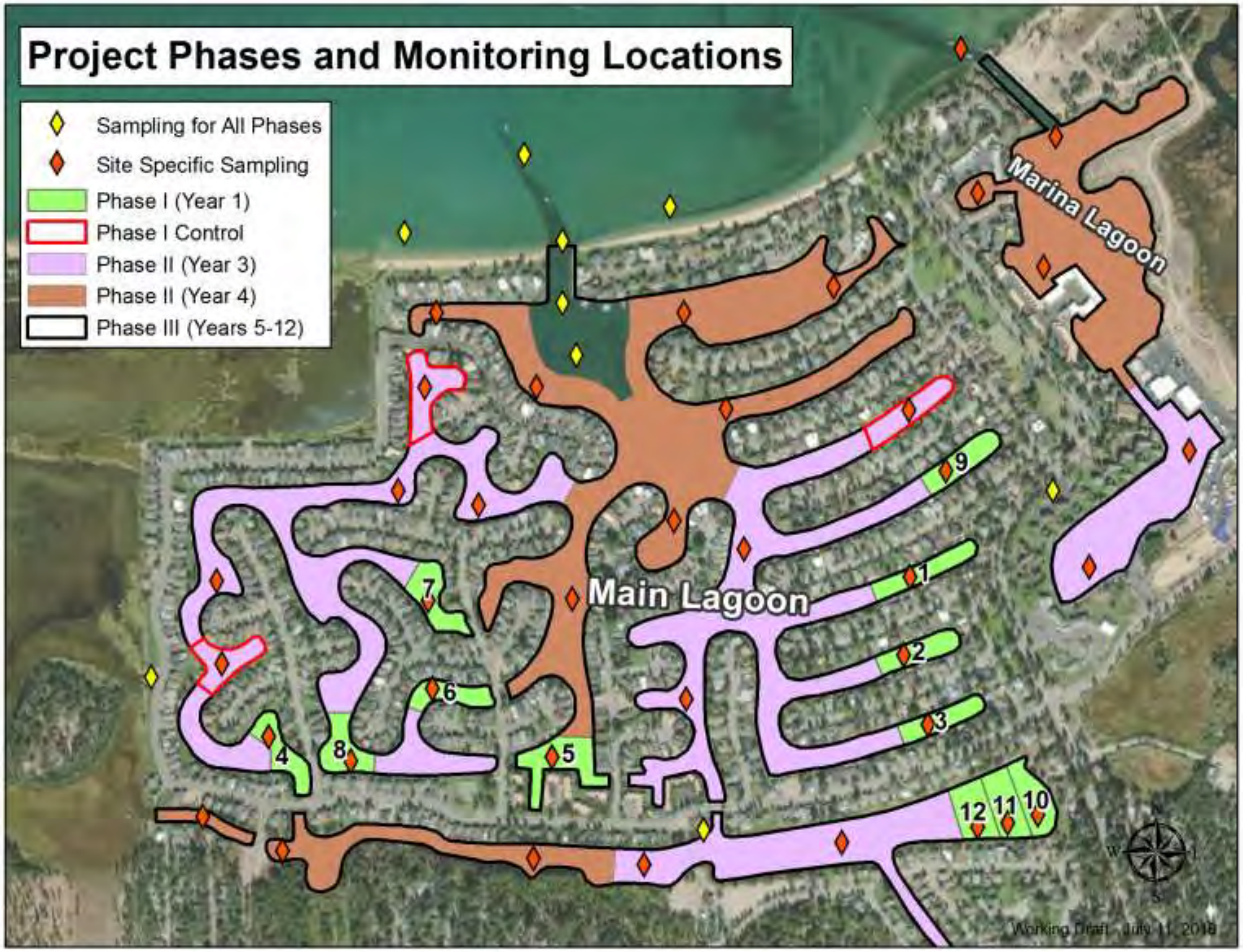
This sampling protocol will be followed at all 12 sites. However for the "within treatment sampling", only one set of samples will be analyzed for each type of herbicide. The unanalyzed samples from the other replicate treatments will be maintained and preserved frozen and archived as a contingency for later analysis. Archived samples will be analyzed if there is a loss of sample(s) from sites chosen for complete sample analysis, and/or to confirm mid-level and end (non-detect) residue levels times based on the results from sites where full analysis were made. Samples for all “outside edge” sample stations will be analyzed to determine if there is movement of the active ingredient from treatment sites.

In addition to sampling locations within and near (but outside) the treated sites, additional sample stations will be established in the following areas: immediately adjacent (and on the lagoon side) of the West Channel; at the mouth of the West Channels and to the West, North, and East of the channel. Water samples for herbicide active ingredient will be taken pre- and at the following post- application intervals: 6 hours, 24 hours, 72 hours, 7 days, 14 days, and 30 days; thereafter, sampling will continue at 60 days, 90 days, and 120 days or until herbicides are no longer detectable at any of the corresponding sampling stations. No herbicide sampling will be conducted at the control sites.

In the event that residues above those allowable by US EPA are detected in samples from the 30-day sampling, or if at any time residues are detected adjacent to the channels, the sampling will continue an additional 6 days.

Water samples taken for degradant analysis will be collected from one site for each herbicide (total of three sites) at three stations within the treatment area and three stations outside the treatment area as described for the active ingredient sampling. Samples will be taken pre- and at the following post-application times: 24 hours, 72 hours, and 14 DAT. Sampling will continue at 30 and 60 DAT if detected in the prior sampling. Additionally, samples will be taken for degradant analysis from Lake Tallac at 14 DAT to confirm levels found in the Main Lagoon samples.

Figure 11: Proposed Monitoring Locations



8.3 *In situ* Measurements (Water Quality)

In situ measurements will be taken at all 12 treatment sites and at the three control sites. At three locations within each site (1 mid, 2 near shore) pre- and post-applications, real time water quality sampling will be conducted using a calibrated, logging device for the following parameters: Dissolved oxygen (DO), pH, temperature, turbidity, redox, and conductivity. Sampling will continue for 30 days after applications in both treatment sites (coves) and similar untreated "control" sites; real time monitoring 3 days each week (typically Monday, Wed., Fri.), mid-day (11 am to 2 pm) at mid-depth.

8.4 Monitoring Records

All monitoring activities and results will be recorded in both hard copy and digitally and will include:

a) Date, time, and GPS referenced location
b) Individual's name who performed the sampling and /or measurements
c) Dates analyses were performed if not real-time data (herbicide residue)
d) Laboratory and/or individual who performed analysis
e) Results of real-time measurements and other sampling analyses.

9.0 SAMPLE METHODS AND GUIDELINES (PREVENTING SAMPLE CONTAMINATION)

This section provides descriptions and methods and guidelines for obtaining various samples as part of compliance with the permit and to ensure consistency in sampling activities

9.1 Degradant Sampling

For samples to be used in analyzing degradants, preservation and shipping protocols and analytical methods will be identified and implemented in consultation with certified laboratories, herbicide registrants, and LRWQCB.

9.2 Sample Locations

Samples will be taken both within and outside treatment sites and inside representative, untreated sites in a manner that will provide a basis comparing pre- and post- application conditions in addition to comparing conditions in treated sites and untreated sites. Sampling for herbicide residues will be done using a battery powered, bilge pump system connected to flexible hose so that sample depth can be adjusted according to monitoring protocols. Between sampling stations and between separate depths, flow will be continued for 30 seconds to ensure that the water at the prescribed depth is correctly collected.

Samples will be placed in pre-labeled bottles and each label will document the date and time of sampling and be coded for location by site and sampling station. Durable labels and marking ink will be used.

9.3 Field Sampling Procedures

All sample actions will be documented in field log books that record each sample date, time, and coded location (by site). At the conclusion of the sampling period the primary sampling staff will sign and date the page on which the records were written.

9.4 Sample Equipment Cleaning

All sampling equipment will be washed with clean tap water between sampling stations and events. The 12-volt (bilge pump) sampling system will be flushed for 1 min with clean tap water between sampling stations and separate sampling systems will be used for the untreated (“control”) sites and the herbicide-treated sites.

9.5 Sample Preservation

As necessary water samples (bottles) will be immediately place in coolers on ice or dry ice and kept out of sunlight until they are transferred to cold (frozen or refrigerated) storage or are shipped for analysis. The specific preservation methods will be tailored to fit the EPA recommended protocol for each type of active ingredient. Most preservation methods require freezing and blocking from light and use of amber glass bottles with Teflon-seal screw on lids. When delays in shipping are necessary, samples will be frozen and then shipped frozen by overnight mail or will be physically picked up and delivered for analysis at certified laboratories

9.6 Sample Packing and Shipping

All samples will be shipped to certified laboratory for analysis either the day of sampling or at prescribed intervals thereafter.

9.7 Sample Preservation and Transportation

As necessary, samples will be shipped frozen with either ice packs or dry ice with required labeling for shipping.

9.8 Chain of Custody (COC)

At shipping or storage and at any transfer of samples, a Chain of Custody form will accompany samples and will list the sample identification (code), number of samples and will be signed by both the recipient and provider of the samples. A copy of the COC forms will be retained by TKPOA in secure files on TKPOA property.

9.9 Field Sampling Kit (Water Samples for Herbicide Residues)

Each sampling kit will consist of the following:

1. Correct sampling bottles or other containers for the samples.
2. COC forms
3. Field collection forms (to record sampling activity)
4. Sample labels and appropriate permanent marker pens
5. Ice packs and/or dry ice and insulated container for sample bottles
6. Appropriate sampling devices (e.g. battery operated pump for water samples)
7. Non-powdered plastic or nitrile gloves
8. Back up portable GPS unit
9. Plastic (e.g. Ziploc) storage bags for samples and COC forms

9.10 Laboratory Quality Assurance and Quality Control (QA/QC)

All laboratory analyses will be performed by a certified laboratory per permit specifications. Laboratory precision and accuracy will be monitored and documented by a series of laboratory–generated quality control samples. For samples analyzed by immunoassay a separate set of coded duplicate samples will be analyzed by alternative equally or more sensitive methods. These confirmation samples will represent 5% of total samples taken during a treatment season.

9.11 Reporting Procedures (Annual Reports) and Record Retaining

Interim progress reports will be provided to LRWQCB by August 30 and October 30 2020. An annual report for the period of January 1 to December 31 will be prepared and submitted to the Lahontan Regional Water Quality Control Board by March 1, 2021.

The Interim Report will contain the following information:
1. Summary of results (narrative, tables, graphs, charts) to date, which includes monitoring data collected to date and efficacy data.
2. Description of problems, solutions or other issues that occurred and that may affect permit compliance.

The Final Report will contain the following:
1. Executive Summary that discusses overall results, issues concerning compliance of the Permit and effectiveness of the APAP.
2. Summary of monitoring data, including improvements or degradation in water quality as a result of the use of the aquatic herbicides.
3. Discussion of BMP's used and recommendation for improvements.
4. Final map showing location of each herbicide application.
5. Amount and type (product) of aquatic herbicide used.
6. Detailed table showing sampling locations (GPS referenced) and associated results by date and site.
7. Summary of aquatic herbicide application logs.

9.12 Emergency Situations

The discharger (Permit holder) will report any event that constitutes non-compliance with the Permit, hazardous condition or adverse impact related to the permitted action as follows:

a) Orally within 1 hour (to LRWQCB).
b) Written report within 5 days of the time the discharger becomes aware of the non-compliance.

9.13 Procedure to Prevent Sample Contaminations

Vessels and personnel used to apply aquatic herbicide will not be used to collect monitoring samples. Personnel responsible for sample collection and monitoring will not be allowed to handle or come in contact with personal protective equipment (PPE) used by applicators and by anyone handling aquatic herbicide containers. During prescribed sampling, sampling equipment will be washed between treatment sites and separate sampling gear will be used for un-treated (control) and treated sites (e.g. water pumps, collection hoses). Sampling personnel will change gloves between sites and before the next round of sampling begins. Any actions that may compromise a sample or sampling event will be logged and explained and signed by the person directing sampling at the time of the event.

10.0 DESCRIPTION OF BMP'S TO BE IMPLEMENTED

TKPOA has established the following Best Management Practices (BMP) to ensure that all aquatic herbicides are used in a safe, effective manner.

10.1 Measures to Prevent Spills and Spill Containment in Event of Spill

Applicators will follow all instructions, precautionary steps and appropriate handling procedures for each herbicide according to its label.

10.1.1 Herbicide Mixing

Applicators will take on board and mix only the amount of herbicide needed for each site. Application equipment (hoses, connections, pumps) will be checked for proper function before herbicides are loaded on board. Applicators will have on-board access to and training is use of absorbent materials including kitty litter and absorbent "pillows".

10.1.2 Spills

Any spills will be cleaned up according to label instructions and all equipment and materials used to clean up any spills will be properly disposed of consistent with federal and state requirements. In the event of a spill into the water, LRWQCB will be notified orally within 1 hour and the location will be immediately documented and geo-referenced with GPS lat/long and time of spill which will be provided to the LRWQCB within 24 hours of the incident.

10.2 Measures to Ensure Appropriate Use Rate

The BMPs listed here ensure that proper use rate is achieved:

a) Site Scouting. Qualified staff will perform site inspections and review plant surveys to confirm species present and condition of the site. If conditions are suitable and plant conditions are appropriate for the herbicide(s) to be used, the application will be made.
b) All applications will be made in accordance and compliance with the current herbicide labeling and in accordance with regulations and conditions of the EPA, CalEPA, LRWQCB, and TRPA.
c) Applications made by qualified applicator certificate holders (QALs). Applications will only be made by applicators that hold current valid QAL's from CADPR and are trained annually in the safe handling, mixing, application, storage and transport of aquatic herbicides. These qualified applicators will be hired by the discharger. The application staff under the direction of the QAL have knowledge on proper equipment loading, selection of application equipment, calibration and use so that spills are minimized and the precise application rates are used according to the label.

d) Discharger’s plan to educate staff and herbicide applicators on how to avoid any potential adverse effect from herbicide applications. As a condition of the contract, the discharger shall receive written documentation and verification of training of applicator and any staff used in this project. These documents will be in possession of the discharger before any application is made and shall be made available to staff of the LRWQCB at least 30 days before applications are made.

e) Planning and coordination with water users in order to minimize impacts during application. No applications will be made outside the Tahoe Keys lagoons and no applications will be made within 500 feet of the channels that connect the Tahoe Keys lagoons with Lake Tahoe proper. Due to the concerns of some water suppliers who pump raw water directly from Lake Tahoe (but not the Tahoe Keys treatment sites), the discharger will hold a workshop and informational meeting with representatives of the Tahoe Water Suppliers Association (TWSA) at least 45 days before applications are made. Through TWSA, water customers will be informed of the application plan and dates of application. Establishment of water sampling (monitoring) stations will be made in consultation with TWSA and specific water suppliers so that proper monitoring of intake water is accomplished.

f) Prevention of fish kills. All precautions provided on the label regarding potential indirect fish kills will be adhered to including limiting the total area to be treated so that precipitous declines in dissolved oxygen (DO) will not occur. Specifically, the proposed sites are well separated and together constitute a small percentage of the total infested surface area of the Tahoe Keys lagoons. Monitoring includes assessing DO in the treated areas three times per week for 30 days following applications.

11.0 EXAMINATION OF POSSIBLE ALTERNATIVES

This demonstration project is designed to provide a representative operational evaluation of the potential for safe and effective inclusion of aquatic herbicides in a fully integrated management plan for the Tahoe Keys lagoons. Although the herbicides proposed for use have been very effective in similar aquatic weed infestations, they have never been applied for control of aquatic weeds in the Tahoe Keys lagoons. However, several alternative methods and strategies have been either used regularly (harvesting) or have been tried more recently (bottom barriers and diver assisted hand removal).

The following subsections briefly outline and discuss alternative types of methods that either are in use or have been considered but found infeasible for a variety of reasons

11.1 No Action

With no action, the established populations of non-native aquatic plants and prolific growth of coontail would rapidly further degrade the beneficial uses of the Tahoe Keys lagoons by:

a) blocking recreational uses of all kinds.
b) creating undesirable habitat for waterfowl and native fish.
c) degrading water quality through creating daily extreme fluctuations in pH, DO, and temperature.
d) creating habitat for mosquitoes and related human health risk of arthropod borne diseases such as West Nile Virus.
e) continued and increased source of further infestations in Lake Tahoe.
f) creating stagnant water conditions, which would result in malodorous conditions that would degrade property values, discourage tourism and reduce revenue derived from home owners, seasonal renters and daily visitors to the South Shore.

11.2 Prevention and Use of Biological Control

Prevention actions have been in place for the past 6 years through the Vessel Inspection program that has been effective in stopping the introduction of additional invasive species. However, this project includes an Early Detection/Rapid Response (EDRR) component (Appendix H to the Tahoe Keys Restoration Project Application) to ensure that new AIS will be detected early and responded to quickly and effectively. The EDRR implementation includes (1) training of TKPOA on-the-water staff to recognize species; (2) voucher sampling and reporting protocols; (3) containment options; (4) reporting protocols (i.e. to regulatory agencies and potentially affected stakeholders; (5) follow up on response methods and permitting needed.

Biological control for all three target species has been considered. Research and published reports for other sites show that at present no host-specific biological control agents are available and proven effective in the highly urbanized, high boat-traffic area like the Tahoe Keys. The only biological control agent with proven efficacy against submersed aquatic plants is the grass carp or “white amur”. However, this fish is non-native and is prohibited for use in waters that are connected natural watersheds (CDFW). In addition, the grass carp is a non-selective herbivore and thus will consume desirable native plants.

11.3 Mechanical and Physical Methods

11.3.1 Harvesting

This is the current primary method and though effective in creating temporary navigation, creates fragments and is not capable of depressing regrowth or reducing inaccessible locations that persist as nurseries for continued infestation.

11.3.2 Diver-Assisted Hand Removal

This has limited scale and is impractical for any significant, sustainable reduction in the 150 to160 acres that are infested with invasive aquatic plants.

11.3.3 Dredging and Removal of Plants and Spoils

This method has been attempted within the Tahoe Keys channels and other small marinas around Lake Tahoe and has failed to provide effective control longer than a few months. (See Section 5.1 c in this APAP.)

11.3.4 Bottom Barriers

This may have localized utility but currently is limited to 5 acres near docks and cannot be deployed in high boat traffic areas. These are a part of the current management program and it is anticipated that several bottom barriers will be deployed in 2019 and 2020. These bottom barriers also may be deployed as part of an integrated use of aquatic herbicides to prevent regrowth in areas treated with herbicides. The proposed validation study will provide data that will help determine if bottom barriers and herbicide uses can be used effectively together (i.e. sequentially in alternative years). Thus, they may be suited for localized applications but will not provide sustainable control of aquatic plants in more that 80-90% of the infested areas.

11.3.5 Rotovating

This method has serious limitations and serious non-target impacts on the benthic organisms and water quality. Its use in other lakes has been reviewed and it has been determined that it is not a feasible approach.

11.3.6 Dredging

Although this method theoretically could remove most of the vegetation in the lagoons it would completely destroy benthic habitat, remove native plants and is likely to produce very high turbidity for several weeks to months due to the unconsolidated sediments in most of the lagoons.

11.4 Aquatic Herbicides

These products have proven safety and efficacy and utility in lakes, ponds, reservoirs, streams, irrigation canals, flood control channels and wetland sites against the same target aquatic plants that are creating negative recreational and environmental impacts in the Tahoe Keys lagoons.

The current amendments in the LRWQCB Basin Plan provide an avenue to consider the uses of these products. This is the one proven, widely used, tool that currently is not part of the integrated management program for the Tahoe Keys lagoons. The results obtained in the proposed validation study will provide science-based data that is Tahoe Keys specific. The results will help regulatory agencies in their review and evaluation of the benefits and limitations of these tools as part of the integrated plan to sustainably manage aquatic weeds in the Tahoe Keys lagoons.

11.5 Use of the Least Intrusive Method of Aquatic Herbicide Application.

Discharger and contracted applicators will use the most recent and best technologies to apply the proposed herbicide in the demonstration areas to minimize non-target effects and to ensure safe, accurate use of herbicide products. These methods include GPS tracking, hydroacoustic sensing systems to determine site volume (bathymetry) and optimal timing based upon plant canopy height and biovolume, and herbicide delivery systems that direct the herbicide into the targeted sites accurately.

11.6 Applying a Decision Matrix Concept to the Choice of Most Appropriate Formulation(s)

The proposed aquatic herbicides are available in several formulate products including liquid and various granular (pelleted) products that are deployed on the bottom where plants emerge. The following decision points and metrics are used to tailor the product, timing of application, rate of applications and optimize control of target plants while minimizing off-target impacts. The result is a prescriptive approach designed to provide optimal control and minimize the amount of herbicide used while fully integrating all feasible tools and methodologies. The three aquatic herbicides selected, and the proposed rates and formulations were chosen to optimize management and control of the target aquatic weeds (Eurasian watermilfoil, curlyleaf pondweed and coontail) while minimizing effects on non-target plants. The following conditions and criteria were considered as part of the decision:

a) Plant species present in demonstration area (non-target vs. target species)
b) Establishment of threshold treatment conditions (plant growth stage)
c) Physical conditions (water movement, wind, total water volume)
d) Method of application
e) Duration and rate of application
f) Potential risks to humans and the natural environment
g) Contingency planning and monitoring access
h) Shown efficacy of herbicide on target plants
i) Ease of use and handling requirements
j) Minimize interference with beneficial uses

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Appendix D
Emissions Calculations

Equipment Use and Schedule
Dredging Alternative - Tahoe Keys Lagoon Project

Site	Construction Phase	Activities	Construction Equipment			Equipment Use		Start Date	End Date	Material Export		Material Import	
			Quantity	Type	HP	Hours per day	Weeks			Haul Truck Loads	One-Way Trip Distance (mi)	Haul Truck Trips	One-Way Trip Distance (mi)
Site 28	Set Up	Pile extraction, turbidity curtain, sheetpile wall	1	excavator w/ vibratory pile driver	60	8	1	4/1/2021	4/8/2021	0	NA	0	NA
		Rip-rap removal	1	barge w/ diesel engine	140	8							
		Pipeline placement	2	small boat	40	8							
	Dredging	Suction dredging	1	barge w/ diesel engine and pump	140	8	6	4/8/2021	5/20/2021	0	NA	0	NA
			1	generator for electric booster pump	84	8							
	Dredge Material Management	Dewatering effluent	1	generator for electric pump	84	24	6	4/8/2021	5/20/2021	130	55	45	31
			1	excavator	158	8				85	3	*	
	Restoration	Pile installation	1	barge w/ diesel engine	140	8	3	5/20/2021	6/10/2021	0	NA	0	NA
		Rip-rap replacement	1	excavator	60	8						20	3
		Backfill	2	small boat	40	8							
Site 29	Set Up	Pile extraction, turbidity curtain, sheetpile wall	1	excavator w/ vibratory pile driver	60	8	1	6/10/2021	6/17/2021	0	NA	0	NA
		Rip-rap removal	1	barge w/ diesel engine	140	8							
		Pipeline placement	2	small boat	40	8							
	Dredging	Suction dredging	1	barge w/ diesel engine and pump	140	8	3	6/17/2021	7/8/2021	0	NA	0	NA
			1	generator for electric booster pump	84	8							
	Dredge Material Management	Dewatering effluent	1	generator for electric pump	84	24	3	6/17/2021	7/8/2021	90	55	30	31
			1	excavator	158	8				60	3		
	Restoration	Pile installation	1	barge w/ diesel engine	140	8	2	7/8/2021	7/22/2021	0	NA	20	3
		Rip-rap replacement	1	excavator	60	8							
		Backfill	2	small boat	40	8							
Site 30	Set Up	Pile extraction, turbidity curtain, sheetpile wall	1	excavator w/ vibratory pile driver	60	8	1	7/22/2021	7/29/2021	0	NA	40	3**
		Rip-rap removal	1	barge w/ diesel engine	140	8							
		Pipeline placement	2	small boat	40	8							
	Dredging	Suction dredging	1	barge w/ diesel engine and pump	140	8	7	7/29/2021	9/16/2021	0	NA	0	NA
			1	generator for electric booster pump	84	8							
	Dredge Material Management	Dewatering effluent	1	generator for electric pump	84	24	7	7/29/2021	9/16/2021	210	55	70	31
			1	excavator	158	8				140	3	*	
	Restoration	Pile installation	1	barge w/ diesel engine	140	8	3	9/16/2021	10/7/2021	0	NA	40	3**
		Rip-rap replacement	1	excavator	60	8							
		Backfill	2	small boat	40	8							

Notes:
Equipment horsepower based on model defaults or information provided by Reno Tahoe Geo Associates [RTGA].
Material import/export volumes based on Table 2-6 in Chapter 2.
Schedule assumes construction activities occur sequentially with no overlap, with the exception of Dredging and Dredge Material Management. The schedule may be adjusted during the final design process.
*Assumes material export to Carson City landfill facility. Material import would potentially be the same trucks removing sediment on the return trip in Gardnerville. 3-mile trip represents trip from dewatering facility to TK boat ramp.
** Assumes that some existing rip-rap material will have to be removed to a stockpile in Tahoe Keys and then replaced. A significant volume of rip-rap will either be moved around within the lagoon, or will be left in place without dredging.

Tahoe Keys Lagoon Project
Work Boat Emission Factor Derivation and Emissions

Assumptions

Work Boat Engine	35	bhp
Site 28 - Daily Usage	8	hours/day
Site 28 - Boats Used Per Day	2	boats
Site 28 - Work Days	24	days
Site 28 - Total Usage	384	hours
Site 29 - Daily Usage	8	hours/day
Site 29 - Boats Used Per Day	2	boats
Site 29 - Work Days	18	days
Site 29 - Total Usage	288	hours
Site 30 - Daily Usage	8	hours/day
Site 30 - Boats Used Per Day	2	boats
Site 30 - Work Days	24	days
Site 30 - Total Usage	384	hours

Emission Equation:

$$E = EF_0 \times F \times (1 + D \times A/UL) \times HP \times LF \times Hr$$

Where:
E is the amount of emissions of a pollutant emitted during one period.
EF_0 is the model year, horsepower and engine use (propulsion or auxiliary) specific zero hour emission factor (when engine is new).

F is the fuel correction factor which accounts for emission reduction benefits from burning cleaner fuel.
D is the horsepower and pollutant specific engine deterioration factor, which is the percentage increase of emission factors at the end of the useful life of the engine.
A is the age of the engine when emissions are estimated.
UL is the vessel type and engine use specific engine useful life.
HP is the rated horsepower of the engine.
LF is the vessel type and engine use specific engine load factor.
Hr is the number of operating hours of the engine.

Constants:

F:	NOx =	0.948		
	PM =	0.852		
D:	NOx =	0.21	HC =	0.44
	PM =	0.67	CO =	0.25
A:	5 yrs			
UL:	17 yrs			
LF:	0.45			

Emission Factors (g/hp-hr)

	ROG	NO_x	PM	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
Work Boat Engine	1.8	5.32	0.22	0.22	0.2134	545.6	0.023	0.02

	Pollutant Emissions (lbs)								
Location	**ROG**	**NO_x**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Site 28									
Hourly Boat Emissions	0.07	0.19	0.01	0.01	0.01	24.47	0.00	0.00	25
Maximum Daily Boat Emissions	1.13	2.97	0.12	0.12	0.12	391.45	0.02	0.01	396
Total Boat Emissions	27.05	71.25	2.99	2.99	2.90	9394.69	0.40	0.34	9507
Site 29									
Hourly Boat Emissions	0.07	0.19	0.01	0.01	0.01	24.47	0.00	0.00	25
Maximum Daily Boat Emissions	1.13	2.97	0.12	0.12	0.12	391.45	0.02	0.01	396
Total Boat Emissions	20.29	53.44	2.24	2.24	2.17	7046.02	0.30	0.26	7130
Site 30									
Hourly Boat Emissions	0.07	0.19	0.01	0.01	0.01	24.47	0.00	0.00	25
Maximum Daily Boat Emissions	1.13	2.97	0.12	0.12	0.12	391.45	0.02	0.01	396
Total Boat Emissions	27.05	71.25	2.99	2.99	2.90	9394.69	0.40	0.34	9507
All Sites									
Maximum Daily Boat Emissions	1.13	2.97	0.12	0.12	0.12	391.45	0.02	0.01	396.13
Total Boat Emissions	74.39	195.94	8.21	8.21	7.96	25835.41	1.09	0.95	26144.85

Notes:
ROG, NOx, and PM emissions calculated using the method outlined in Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, CARB, revised 2012.

PM emissions are estimated to be equivalent to PM10 emissions. The PM2.5 fraction of the PM10 emissions is estimated to be 97% for Work Boats (ICF Consulting, Current Methodologies and Best Practices in Preparing Port Emission Inventories, Final Report, Prepared for U.S. Environmental Protection Agency Sector Strategies Program, April 2006.)
CO_2 emission factor from Appendix G - Assumptions for Estimating Greenhouse Gas Emissions from Commercial Harbor Craft Operating in California.
N_2O and CH_4 emission factors from GHG emission factors in the 2011 Port of Long Beach Air Emission Inventory, Appendix B.

Global Warming Potentials (GWPs) obtained from the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC). GWPs used here do not include climate-carbon feedbacks.

Tahoe Keys Alt 2

El Dorado County AQMD Air District, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Residential	0.00	Dwelling Unit	8.14	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	70
Climate Zone	14			**Operational Year**	2022
Utility Company	Statewide Average				
CO2 Intensity (lb/MWhr)	1001.57	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use -

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tblConstructionPhase	NumDays	230.00	12.00
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2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	1.9012	19.0879	20.8069	0.0473	0.7687	0.7325	1.5012	0.2036	0.7015	0.9052	0.0000	4,674.159 4	4,674.159 4	0.5722	0.0000	4,688.464 3
Maximum	**1.9012**	**19.0879**	**20.8069**	**0.0473**	**0.7687**	**0.7325**	**1.5012**	**0.2036**	**0.7015**	**0.9052**	**0.0000**	**4,674.159 4**	**4,674.159 4**	**0.5722**	**0.0000**	**4,688.464 3**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	1.9012	19.0879	20.8069	0.0473	0.7687	0.7325	1.5012	0.2036	0.7015	0.9052	0.0000	4,674.159 4	4,674.159 4	0.5722	0.0000	4,688.464 3
Maximum	**1.9012**	**19.0879**	**20.8069**	**0.0473**	**0.7687**	**0.7325**	**1.5012**	**0.2036**	**0.7015**	**0.9052**	**0.0000**	**4,674.159 4**	**4,674.159 4**	**0.5722**	**0.0000**	**4,688.464 3**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	1 - Site 28 Set up	Site Preparation	4/1/2021	4/8/2021	6	6	
2	2 - Site 28 Dredging	Building Construction	4/8/2021	5/20/2021	6	36	
3	3 - Site 28 Dredge Material Management	Building Construction	4/8/2021	5/20/2021	6	36	
4	4 - Site 28 Restoration	Building Construction	5/20/2021	6/10/2021	6	18	
5	5 - Site 29 Set up	Site Preparation	6/10/2021	6/17/2021	6	6	
6	6 - Site 29 Dredging	Building Construction	6/17/2021	7/8/2021	6	18	
7	7 - Site 29 Dredge Material Management	Building Construction	6/17/2021	7/8/2021	6	18	
8	8 - Site 29 Restoration	Building Construction	7/8/2021	7/22/2021	6	12	
9	9 - Site 30 Set up	Site Preparation	7/22/2021	7/29/2021	6	6	
10	10 - Site 30 Dredging	Building Construction	7/29/2021	9/16/2021	6	42	
11	11 - Site 30 Dredge Material Management	Building Construction	7/29/2021	9/16/2021	6	42	
12	12 - Site 30 Restoration	Building Construction	9/16/2021	10/7/2021	6	21	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Tahoe Keys Alt 2 - El Dorado County AQMD Air District, Summer

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
1 - Site 28 Set up	Excavators	1	8.00	60	0.38
1 - Site 28 Set up	Other General Industrial Equipment	1	8.00	140	0.34
2 - Site 28 Dredging	Other General Industrial Equipment	1	8.00	140	0.34
2 - Site 28 Dredging	Generator Sets	1	8.00	84	0.74
3 - Site 28 Dredge Material Management	Generator Sets	1	8.00	84	0.74
3 - Site 28 Dredge Material Management	Excavators	1	8.00	158	0.38
4 - Site 28 Restoration	Other General Industrial Equipment	1	8.00	140	0.34
4 - Site 28 Restoration	Excavators	1	8.00	60	0.38
5 - Site 29 Set up	Excavators	1	8.00	60	0.38
5 - Site 29 Set up	Other General Industrial Equipment	1	8.00	140	0.34
6 - Site 29 Dredging	Other General Industrial Equipment	1	8.00	140	0.34
6 - Site 29 Dredging	Generator Sets	1	8.00	84	0.74
7 - Site 29 Dredge Material Management	Generator Sets	1	8.00	84	0.74
7 - Site 29 Dredge Material Management	Excavators	1	8.00	158	0.38
8 - Site 29 Restoration	Other General Industrial Equipment	1	8.00	140	0.34
8 - Site 29 Restoration	Excavators	1	8.00	60	0.38
9 - Site 30 Set up	Excavators	1	8.00	60	0.38
9 - Site 30 Set up	Other General Industrial Equipment	1	8.00	140	0.34
10 - Site 30 Dredging	Other General Industrial Equipment	1	8.00	140	0.34
10 - Site 30 Dredging	Generator Sets	1	8.00	84	0.74
11 - Site 30 Dredge Material Management	Generator Sets	1	8.00	84	0.74
11 - Site 30 Dredge Material Management	Excavators	1	8.00	158	0.38
12 - Site 30 Restoration	Other General Industrial Equipment	1	8.00	140	0.34
12 - Site 30 Restoration	Excavators	1	8.00	60	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
1 - Site 28 Set up	2	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
2 - Site 28 Dredging	2	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
3 - Site 28 Dredge Material Management	2	18.00	0.00	130.00	10.80	7.30	55.00	LD_Mix	HDT_Mix	HHDT
3 - Site 28 Dredge Material Management	2	0.00	0.00	45.00	10.80	7.30	31.00	LD_Mix	HDT_Mix	HHDT
3 - Site 28 Dredge Material Management	2	0.00	0.00	85.00	10.80	7.30	3.00	LD_Mix	HDT_Mix	HHDT
4 - Site 28 Restoration	2	18.00	0.00	20.00	10.80	7.30	3.00	LD_Mix	HDT_Mix	HHDT
5 - Site 29 Set up	2	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
6 - Site 29 Dredging	2	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
7 - Site 29 Dredge Material Management	2	18.00	0.00	90.00	10.80	7.30	55.00	LD_Mix	HDT_Mix	HHDT
7 - Site 29 Dredge Material Management	2	0.00	0.00	30.00	10.80	7.30	31.00	LD_Mix	HDT_Mix	HHDT
7 - Site 29 Dredge Material Management	2	0.00	0.00	60.00	10.80	7.30	3.00	LD_Mix	HDT_Mix	HHDT
8 - Site 29 Restoration	2	18.00	0.00	20.00	10.80	7.30	3.00	LD_Mix	HDT_Mix	HHDT
9 - Site 30 Set up	2	18.00	0.00	40.00	10.80	7.30	3.00	LD_Mix	HDT_Mix	HHDT
10 - Site 30 Dredging	2	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
11 - Site 30 Dredge Material Management	2	18.00	0.00	210.00	10.80	7.30	55.00	LD_Mix	HDT_Mix	HHDT
11 - Site 30 Dredge Material Management	2	0.00	0.00	70.00	10.80	7.30	31.00	LD_Mix	HDT_Mix	HHDT
11 - Site 30 Dredge Material Management	2	0.00	0.00	140.00	10.80	7.30	3.00	LD_Mix	HDT_Mix	HHDT
12 - Site 30 Restoration	2	18.00	0.00	40.00	10.80	7.30	3.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 1 - Site 28 Set up - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528		584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**		**584.2372**	**584.2372**	**0.1890**		**588.9611**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.2 1 - Site 28 Set up - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528	0.0000	584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**	**0.0000**	**584.2372**	**584.2372**	**0.1890**		**588.9611**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.3 2 - Site 28 Dredging - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5707	5.1369	6.3999	0.0107		0.2693	0.2693		0.2612	0.2612		1,019.1624	1,019.1624	0.1599		1,023.1601
Total	**0.5707**	**5.1369**	**6.3999**	**0.0107**		**0.2693**	**0.2693**		**0.2612**	**0.2612**		**1,019.1624**	**1,019.1624**	**0.1599**		**1,023.1601**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.3 2 - Site 28 Dredging - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5707	5.1369	6.3999	0.0107		0.2693	0.2693		0.2612	0.2612	0.0000	1,019.1624	1,019.1624	0.1599		1,023.1601
Total	**0.5707**	**5.1369**	**6.3999**	**0.0107**		**0.2693**	**0.2693**		**0.2612**	**0.2612**	**0.0000**	**1,019.1624**	**1,019.1624**	**0.1599**		**1,023.1601**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.4 3 - Site 28 Dredge Material Management - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0174	0.0000	0.0174	2.6400e-003	0.0000	2.6400e-003			0.0000			0.0000
Off-Road	0.5866	5.3196	6.9565	0.0118		0.2722	0.2722		0.2638	0.2638		1,123.2265	1,123.2265	0.1936		1,128.0657
Total	**0.5866**	**5.3196**	**6.9565**	**0.0118**	**0.0174**	**0.2722**	**0.2896**	**2.6400e-003**	**0.2638**	**0.2665**		**1,123.2265**	**1,123.2265**	**0.1936**		**1,128.0657**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0921	3.3548	0.9785	9.5800e-003	0.2063	0.0146	0.2210	0.0564	0.0140	0.0704		1,001.9005	1,001.9005	9.6700e-003		1,002.1422
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.1840**	**3.3985**	**1.5671**	**0.0111**	**0.3542**	**0.0157**	**0.3699**	**0.0957**	**0.0150**	**0.1106**		**1,148.2946**	**1,148.2946**	**0.0140**		**1,148.6432**

3.4 3 - Site 28 Dredge Material Management - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0174	0.0000	0.0174	2.6400e-003	0.0000	2.6400e-003			0.0000			0.0000
Off-Road	0.5866	5.3196	6.9565	0.0118		0.2722	0.2722		0.2638	0.2638	0.0000	1,123.2265	1,123.2265	0.1936		1,128.0657
Total	**0.5866**	**5.3196**	**6.9565**	**0.0118**	**0.0174**	**0.2722**	**0.2896**	**2.6400e-003**	**0.2638**	**0.2665**	**0.0000**	**1,123.2265**	**1,123.2265**	**0.1936**		**1,128.0657**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0921	3.3548	0.9785	9.5800e-003	0.2063	0.0146	0.2210	0.0564	0.0140	0.0704		1,001.9005	1,001.9005	9.6700e-003		1,002.1422
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.1840**	**3.3985**	**1.5671**	**0.0111**	**0.3542**	**0.0157**	**0.3699**	**0.0957**	**0.0150**	**0.1106**		**1,148.2946**	**1,148.2946**	**0.0140**		**1,148.6432**

3.5 4 - Site 28 Restoration - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528		584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**		**584.2372**	**584.2372**	**0.1890**		**588.9611**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	2.9100e-003	0.1266	0.0361	2.0000e-004	2.7800e-003	2.6000e-004	3.0400e-003	7.6000e-004	2.5000e-004	1.0100e-003		21.3431	21.3431	6.0000e-004		21.3581
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0948**	**0.1703**	**0.6247**	**1.6700e-003**	**0.1507**	**1.3400e-003**	**0.1520**	**0.0400**	**1.2500e-003**	**0.0412**		**167.7372**	**167.7372**	**4.8800e-003**		**167.8591**

3.5 4 - Site 28 Restoration - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528	0.0000	584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**	**0.0000**	**584.2372**	**584.2372**	**0.1890**		**588.9611**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	2.9100e-003	0.1266	0.0361	2.0000e-004	2.7800e-003	2.6000e-004	3.0400e-003	7.6000e-004	2.5000e-004	1.0100e-003		21.3431	21.3431	6.0000e-004		21.3581
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0948**	**0.1703**	**0.6247**	**1.6700e-003**	**0.1507**	**1.3400e-003**	**0.1520**	**0.0400**	**1.2500e-003**	**0.0412**		**167.7372**	**167.7372**	**4.8800e-003**		**167.8591**

3.6 5 - Site 29 Set up - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528		584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**		**584.2372**	**584.2372**	**0.1890**		**588.9611**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.6 5 - Site 29 Set up - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528	0.0000	584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**	**0.0000**	**584.2372**	**584.2372**	**0.1890**		**588.9611**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.7 6 - Site 29 Dredging - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5707	5.1369	6.3999	0.0107		0.2693	0.2693		0.2612	0.2612		1,019.1624	1,019.1624	0.1599		1,023.1601
Total	**0.5707**	**5.1369**	**6.3999**	**0.0107**		**0.2693**	**0.2693**		**0.2612**	**0.2612**		**1,019.1624**	**1,019.1624**	**0.1599**		**1,023.1601**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.7 6 - Site 29 Dredging - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5707	5.1369	6.3999	0.0107		0.2693	0.2693		0.2612	0.2612	0.0000	1,019.1624	1,019.1624	0.1599		1,023.1601
Total	**0.5707**	**5.1369**	**6.3999**	**0.0107**		**0.2693**	**0.2693**		**0.2612**	**0.2612**	**0.0000**	**1,019.1624**	**1,019.1624**	**0.1599**		**1,023.1601**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.8 7 - Site 29 Dredge Material Management - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0246	0.0000	0.0246	3.7200e-003	0.0000	3.7200e-003			0.0000			0.0000
Off-Road	0.5866	5.3196	6.9565	0.0118		0.2722	0.2722		0.2638	0.2638		1,123.2265	1,123.2265	0.1936		1,128.0657
Total	**0.5866**	**5.3196**	**6.9565**	**0.0118**	**0.0246**	**0.2722**	**0.2968**	**3.7200e-003**	**0.2638**	**0.2675**		**1,123.2265**	**1,123.2265**	**0.1936**		**1,128.0657**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1269	4.6247	1.3488	0.0132	0.2785	0.0201	0.2986	0.0763	0.0193	0.0956		1,380.2924	1,380.2924	0.0133		1,380.6259
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.2188**	**4.6684**	**1.9375**	**0.0147**	**0.4263**	**0.0212**	**0.4476**	**0.1156**	**0.0203**	**0.1358**		**1,526.6866**	**1,526.6866**	**0.0176**		**1,527.1270**

3.8 7 - Site 29 Dredge Material Management - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0246	0.0000	0.0246	3.7200e-003	0.0000	3.7200e-003			0.0000			0.0000
Off-Road	0.5866	5.3196	6.9565	0.0118		0.2722	0.2722		0.2638	0.2638	0.0000	1,123.2265	1,123.2265	0.1936		1,128.0657
Total	**0.5866**	**5.3196**	**6.9565**	**0.0118**	**0.0246**	**0.2722**	**0.2968**	**3.7200e-003**	**0.2638**	**0.2675**	**0.0000**	**1,123.2265**	**1,123.2265**	**0.1936**		**1,128.0657**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1269	4.6247	1.3488	0.0132	0.2785	0.0201	0.2986	0.0763	0.0193	0.0956		1,380.2924	1,380.2924	0.0133		1,380.6259
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.2188**	**4.6684**	**1.9375**	**0.0147**	**0.4263**	**0.0212**	**0.4476**	**0.1156**	**0.0203**	**0.1358**		**1,526.6866**	**1,526.6866**	**0.0176**		**1,527.1270**

3.9 8 - Site 29 Restoration - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528		584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**		**584.2372**	**584.2372**	**0.1890**		**588.9611**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	4.3600e-003	0.1898	0.0541	3.1000e-004	4.0900e-003	3.9000e-004	4.4700e-003	1.1200e-003	3.7000e-004	1.5000e-003		32.0146	32.0146	9.0000e-004		32.0371
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0962**	**0.2335**	**0.6427**	**1.7800e-003**	**0.1520**	**1.4700e-003**	**0.1534**	**0.0403**	**1.3700e-003**	**0.0417**		**178.4087**	**178.4087**	**5.1800e-003**		**178.5381**

3.9 8 - Site 29 Restoration - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528	0.0000	584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**	**0.0000**	**584.2372**	**584.2372**	**0.1890**		**588.9611**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	4.3600e-003	0.1898	0.0541	3.1000e-004	4.0900e-003	3.9000e-004	4.4700e-003	1.1200e-003	3.7000e-004	1.5000e-003		32.0146	32.0146	9.0000e-004		32.0371
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0962**	**0.2335**	**0.6427**	**1.7800e-003**	**0.1520**	**1.4700e-003**	**0.1534**	**0.0403**	**1.3700e-003**	**0.0417**		**178.4087**	**178.4087**	**5.1800e-003**		**178.5381**

3.10 9 - Site 30 Set up - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528		584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**		**584.2372**	**584.2372**	**0.1890**		**588.9611**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0175	0.7593	0.2163	1.2300e-003	0.0155	1.5500e-003	0.0170	4.2900e-003	1.4800e-003	5.7700e-003		128.0584	128.0584	3.6000e-003		128.1485
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.1093**	**0.8030**	**0.8050**	**2.7000e-003**	**0.1633**	**2.6300e-003**	**0.1660**	**0.0435**	**2.4800e-003**	**0.0460**		**274.4525**	**274.4525**	**7.8800e-003**		**274.6495**

3.10 9 - Site 30 Set up - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528	0.0000	584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**	**0.0000**	**584.2372**	**584.2372**	**0.1890**		**588.9611**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0175	0.7593	0.2163	1.2300e-003	0.0155	1.5500e-003	0.0170	4.2900e-003	1.4800e-003	5.7700e-003		128.0584	128.0584	3.6000e-003		128.1485
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.1093**	**0.8030**	**0.8050**	**2.7000e-003**	**0.1633**	**2.6300e-003**	**0.1660**	**0.0435**	**2.4800e-003**	**0.0460**		**274.4525**	**274.4525**	**7.8800e-003**		**274.6495**

3.11 10 - Site 30 Dredging - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5707	5.1369	6.3999	0.0107		0.2693	0.2693		0.2612	0.2612		1,019.1624	1,019.1624	0.1599		1,023.1601
Total	**0.5707**	**5.1369**	**6.3999**	**0.0107**		**0.2693**	**0.2693**		**0.2612**	**0.2612**		**1,019.1624**	**1,019.1624**	**0.1599**		**1,023.1601**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.11 10 - Site 30 Dredging - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5707	5.1369	6.3999	0.0107		0.2693	0.2693		0.2612	0.2612	0.0000	1,019.1624	1,019.1624	0.1599		1,023.1601
Total	**0.5707**	**5.1369**	**6.3999**	**0.0107**		**0.2693**	**0.2693**		**0.2612**	**0.2612**	**0.0000**	**1,019.1624**	**1,019.1624**	**0.1599**		**1,023.1601**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0919**	**0.0437**	**0.5886**	**1.4700e-003**	**0.1479**	**1.0800e-003**	**0.1490**	**0.0392**	**1.0000e-003**	**0.0402**		**146.3941**	**146.3941**	**4.2800e-003**		**146.5010**

3.12 11 - Site 30 Dredge Material Management - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0246	0.0000	0.0246	3.7200e-003	0.0000	3.7200e-003			0.0000			0.0000
Off-Road	0.5866	5.3196	6.9565	0.0118		0.2722	0.2722		0.2638	0.2638		1,123.2265	1,123.2265	0.1936		1,128.0657
Total	**0.5866**	**5.3196**	**6.9565**	**0.0118**	**0.0246**	**0.2722**	**0.2968**	**3.7200e-003**	**0.2638**	**0.2675**		**1,123.2265**	**1,123.2265**	**0.1936**		**1,128.0657**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1269	4.6247	1.3488	0.0132	0.2850	0.0201	0.3052	0.0779	0.0193	0.0972		1,380.2924	1,380.2924	0.0133		1,380.6259
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.2188**	**4.6684**	**1.9375**	**0.0147**	**0.4329**	**0.0212**	**0.4541**	**0.1172**	**0.0203**	**0.1374**		**1,526.6866**	**1,526.6866**	**0.0176**		**1,527.1270**

3.12 11 - Site 30 Dredge Material Management - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day								lb/day		
Fugitive Dust					0.0246	0.0000	0.0246	3.7200e-003	0.0000	3.7200e-003			0.0000			0.0000
Off-Road	0.5866	5.3196	6.9565	0.0118		0.2722	0.2722		0.2638	0.2638	0.0000	1,123.2265	1,123.2265	0.1936		1,128.0657
Total	**0.5866**	**5.3196**	**6.9565**	**0.0118**	**0.0246**	**0.2722**	**0.2968**	**3.7200e-003**	**0.2638**	**0.2675**	**0.0000**	**1,123.2265**	**1,123.2265**	**0.1936**		**1,128.0657**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day								lb/day		
Hauling	0.1269	4.6247	1.3488	0.0132	0.2850	0.0201	0.3052	0.0779	0.0193	0.0972		1,380.2924	1,380.2924	0.0133		1,380.6259
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.2188**	**4.6684**	**1.9375**	**0.0147**	**0.4329**	**0.0212**	**0.4541**	**0.1172**	**0.0203**	**0.1374**		**1,526.6866**	**1,526.6866**	**0.0176**		**1,527.1270**

3.13 12 - Site 30 Restoration - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528		584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**		**584.2372**	**584.2372**	**0.1890**		**588.9611**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	4.9900e-003	0.2169	0.0618	3.5000e-004	5.3600e-003	4.4000e-004	5.8000e-003	1.4500e-003	4.2000e-004	1.8800e-003		36.5881	36.5881	1.0300e-003		36.6139
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0969**	**0.2606**	**0.6505**	**1.8200e-003**	**0.1532**	**1.5200e-003**	**0.1548**	**0.0407**	**1.4200e-003**	**0.0421**		**182.9823**	**182.9823**	**5.3100e-003**		**183.1149**

3.13 12 - Site 30 Restoration - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3239	3.1164	4.1194	6.0300e-003		0.1661	0.1661		0.1528	0.1528	0.0000	584.2372	584.2372	0.1890		588.9611
Total	**0.3239**	**3.1164**	**4.1194**	**6.0300e-003**		**0.1661**	**0.1661**		**0.1528**	**0.1528**	**0.0000**	**584.2372**	**584.2372**	**0.1890**		**588.9611**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	4.9900e-003	0.2169	0.0618	3.5000e-004	5.3600e-003	4.4000e-004	5.8000e-003	1.4500e-003	4.2000e-004	1.8800e-003		36.5881	36.5881	1.0300e-003		36.6139
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0919	0.0437	0.5886	1.4700e-003	0.1479	1.0800e-003	0.1490	0.0392	1.0000e-003	0.0402		146.3941	146.3941	4.2800e-003		146.5010
Total	**0.0969**	**0.2606**	**0.6505**	**1.8200e-003**	**0.1532**	**1.5200e-003**	**0.1548**	**0.0407**	**1.4200e-003**	**0.0421**		**182.9823**	**182.9823**	**5.3100e-003**		**183.1149**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Residential	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Residential	10.80	7.30	7.50	42.60	21.00	36.40	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Residential	0.529528	0.038650	0.225199	0.133619	0.030041	0.006237	0.016842	0.009530	0.001608	0.001127	0.005339	0.000802	0.001479

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Residential	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Residential	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Appendix E

Baseline Water Quality in Tahoe Keys Lagoons

Final Summary of Results: Baseline Water Quality in Tahoe Keys Lagoons

Prepared for:
Tahoe Regional Planning Association

December 2019

Prepared by:
Environmental Science Associates

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Acronyms

AA	Antidegradation Analysis
BMI	Benthic macroinvertebrate
°C	degrees Celsius
$CaCO_3$	calcium carbonate
CCC	criterion continuous concentration
CEQA	California Environmental Quality Act
CMC	criterion maximum concentration
COC	chain of custody
DI	deionized
DO	dissolved oxygen
DOC	dissolved organic carbon
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
ESA	Environmental Science Associates
GW	groundwater
HAB	harmful algal bloom
IEC/IS	Initial Environmental Checklist and Initial Study
LCS	laboratory control sample
LRWQCB	Lahontan Regional Water Quality Control Board
MDL	minimum detection limit
mg/kg	milligram per kilogram
MQO	measurement quality objective
MS	matrix spike
MSD	matrix spike duplicate
mg/L	milligrams per liter
mV	millivolt
µg/L	micrograms per liter
N/A	not applicable
NAVD	North American vertical datum
NM	not measured
NTU	nephelometric turbidity units
ORP	oxidation reduction potential
QAPP	Quality Assurance Project Plan
RPD	relative percent difference
SU	standard unit
SW	surface water
TN	total nitrogen
TKLRP	Tahoe Keys Lagoons Restoration Program
TKN	total Kjeldahl nitrogen
TKPOA	Tahoe Keys Property Owners Association
TP	total phosphorus
TRPA	Tahoe Regional Planning Agency
USEPA	United States Environmental Protection Agency
WQO	water quality objective

1 Introduction

This summary of results from 2019 baseline hydrology and water quality data collection has been prepared to support evaluations of Tahoe Keys Lagoons Restoration Program (TKLRP) alternatives in an Environmental Impact Report and Environmental Impact Statement (EIR/EIS) and Antidegradation Analysis (AA), under contract to the Tahoe Regional Planning Agency (TRPA). The 2019 data collection was conducted following a Quality Assurance Project Plan (QAPP) that was reviewed by Lahontan Regional Water Quality Control Board (LRWQCB) staff (ESA 2019). The QAPP includes a detailed description of the data collection project and implementing organization, a summary of study site background and information from previous studies, project schedule, data quality objectives, study design, sampling and measurement procedures, quality control procedures, and procedures for data management and reporting. Most of the information in the QAPP is not repeated in this results summary, but changes from the QAPP that occurred during the data collection project are described.

1.1 Data Collection Locations

Figure 1 shows the locations and coordinates for a rain gauge, piezometers, and surface water level recorders that were installed in and around the Tahoe Keys lagoons. SW1 in the Main Lagoon was moved to the primary Tahoe Keys Property Association (TKPOA) boat dock for easier access. The proposed P6 piezometer was not installed east of the Marina Lagoon due to delays in obtaining landowner access permission.

Name	X-Coordinate	Y-Coordinate
P1	7125387.391	2108442.986
P2	7124290.1	2105993.673
P3	7123331.379	2104453.516
P4	7129288.308	2104336.737
P5	7129109.562	2106394.843
RG1	7127259.986	2105940.254
SW1	7126442.637	2106466.069
SW2	7127321.776	2105959.222
SW3	7129250.029	2107257.2
SW4	7125370.796	2108411.649

Figure 1. Locations and coordinates for piezometers, surface water level recorders, and a rain gauge at Tahoe Keys.

Figure 2 shows the locations and coordinates for baseline water and sediment quality sampling and measurements. On July 9 it was discovered that the buoy, chain, and water quality data loggers were missing from the W6 location. After not finding the W6 equipment, new data loggers were purchased and on July 24 they were deployed at a nearby location and attached to an existing TKPOA speed limit buoy. Coordinates for the new W6 location were X = -102.01250000 and Y = 38.93409722.

Name	X-Coordinate	Y-Coordinate
E1	7129437.343	2108620.804
E2	7129719.487	2107911.023
E3	7129556.953	2107654.862
W4	7127827.916	2109087.103
W5	7128550.519	2107474.524
W6	7127080.456	2108212.371
W7	7125274.705	2106377.103
W8	7124550.687	2106858.291
W9	7125607.912	2107917.8
W10	7126812.326	2108591.224
T11	7129050.091	2106125.036
T12	7127378.959	2105791.302
T13	7125207.362	2105791.753

Figure 2. Tahoe Keys 2019 baseline water and sediment quality sampling and measurement locations.

1.2 Data Collection Schedule

The 2019 data collection schedule (Table 1) closely followed the anticipated weekly schedule for fieldwork included in the QAPP. Some of the planned work during particularly busy weeks was completed during the following week, and weeks that originally had no planned activities were used to catch up on any previously scheduled data collection. Results from fisheries and benthic macroinvertebrate surveys identified in Table 1 are presented in a separate report.

The installation of some piezometers was delayed due to the need to secure access permission. P4 was installed on July 10. Access permission was not secured in time to install P6 as planned, near the Lower Truckee River east of the Marina Lagoon.

The plan to collect water column profile measurements at each lagoon location three times per day each month quickly proved to be unrealistic for two reasons: (1) the multi-parameter sonde measurements took longer than anticipated to stabilize at each 1-foot interval, and (2) monitoring stations were positioned close

Table 1. Tahoe Keys 2019 baseline water quality field work schedule and activities.

Dates, 2019	Installations[1]	Measure depth to groundwater	Profile measurements[2]	Water column sampling[3]	Turbidity measurements	Chlorophyll and phaeophytin sampling	Groundwater sampling	Download data loggers	Stormwater sampling	Water column herbicide sampling	Fisheries and BMI assemblage surveys	Download water level recorders	Hardness and DOC sampling	Sediment aluminum sampling	Sediment nutrient sampling	No activities
May 13-17	x															
May 20-24	x		x	x	x	x										
May 28-31		x	x	x				x				x				
June 3-7		x	x				x	x								
June 10-14			x					x				x				
June 17-21			x	x	x	x					x	x				
June 24-28											x					
July 1-5		x										x				
July 8-12		x	x				x	x								
July 15-19			x	x	x			x								
July 22-26		x				x		x				x	x	x	x	
July 29-Aug 2																x
Aug 5-9		x	x					x				x				
Aug 12-16			x	x		x										
Aug 19-23																
Aug 26-30		x						x				x				
Sept 2-6		x					x									
Sept 9-13			x	x		x										
Sept 16-20			x					x					x	x	x	
Sept 23-27		x	x					x				x				
Sept 30-Oct 4			x		x	x		x				x				
Oct 7-11			x	x							x					
Oct 14-18								x			x					
Oct 21-25								x				x				

[1] Water quality data loggers, lagoon water level recorders, piezometers
[2] Multiparameter data sonde, Secchi disk depth
[3] Conventional water quality parameters and nutrients

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to the deepest water available near each target location resulting in an average water depth of approximately 15 feet instead of the 10-ft average anticipated. The plan was changed to take one set of profile measurements starting in the early morning and a second set of measurements in the afternoon at each station each month. These profile measurements were completed over multiple days each month.

As stated in the QAPP, in addition to baseline turbidity measurements there was an interest in collecting some turbidity samples in the area of bottom barriers while they were being installed and removed. In 2019 the bottom barriers were installed before water quality sampling began. It also proved difficult to coordinate turbidity sampling with bottom barrier removal in the fall, so all of the turbidity measurements in 2019 represent baseline conditions and not conditions during barrier removal.

Storm event or seepage sampling did not occur as planned for two primary reasons. First, the lake level remained high through the 2019 monitoring period leaving lagoon water backed up into storm drains, and seepage pipes inundated with lagoon water. Second, only two runoff-producing rainfall events occurred during the six months of water quality monitoring, both in mid-September. Nearly all of the runoff entering the Tahoe Keys lagoons in 2019 was from snowmelt.

Baseline sampling of lagoon water and surficial sediments for analysis of herbicide chemicals was postponed and not performed in 2019. Time was required to determine the best commercially available laboratory capabilities to analyze the active ingredients and degradants of each proposed herbicide product. It was also decided by the LRWQCB and TRPA staff that it would best to wait and collect the baseline samples shortly before herbicide applications, if approved.

1.3 Other Changes in Implementing Quality Assurance Project Plan

Due to the high water content and soft texture of organic bottom sediments, a depth finder did not prove to be useful in defining the sediment layer to avoid disturbing sediments during the collection of near-bottom lagoon water samples. Also, after the initial sampling in May, aquatic plant growth interfered with use of the horizontal bottle sampler and it became necessary to collect deeper lagoon water samples using a peristaltic pump and tubing. The tubing was attached to a measuring tape with a Secchi disk fixed to the end of the tape, and the disk was gently lowered to the bottom to minimize sediment disturbance and consistently draw water samples from approximately 1 foot off the bottom. The pump was allowed to run for approximately one minute to flush the tubing; after this time, sample containers were rinsed and filled per QAPP protocols.

2 Surface and Groundwater Hydrology

2.1 Precipitation

Precipitation data were collected from late May to late October 2019, near the center of Lake Tallac (Figure 1). For quality control purposes, rainfall data at the site were compared against values measured at the nearby airport, and also at the California Irrigation Management Information System station in Markleeville. In general, precipitation was minimal during the study period, with a cumulative total of about 1 inch (Figure 3). Most of the precipitation occurred in a small number of events in late May (late seasonal snow) and September (early seasonal rain).

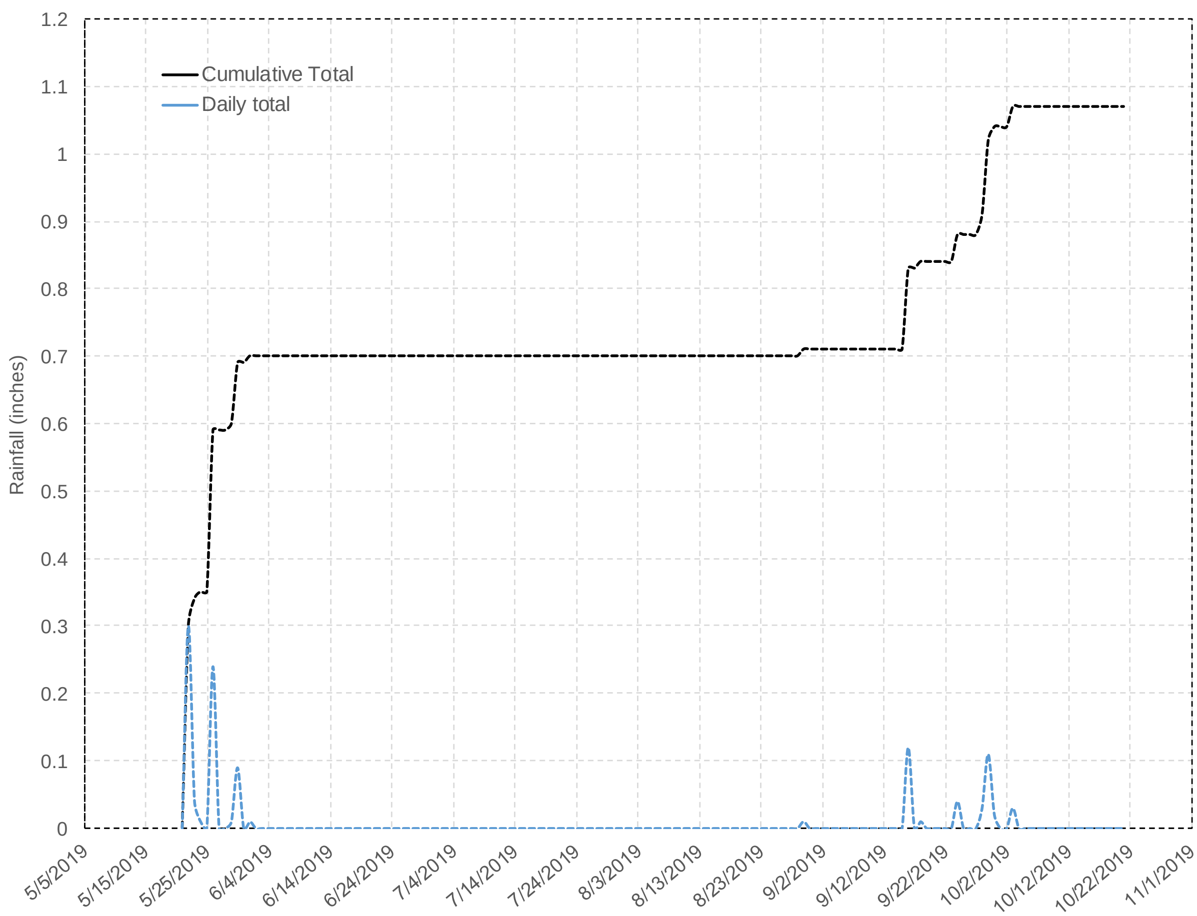

Figure 3. Daily and cumulative rainfall totals at Tahoe Keys during the baseline study period.

2.2 Surface Water Elevations

Surface water levels were relatively stable throughout the study period. At the time of gauge installation in mid-May, water levels on Lake Tahoe were already within approximately one foot of the maximum allowable level. As snowmelt continued through early and mid-summer, lagoon water levels increased gradually, reaching a peak in July. Subsequent levels declined from August through late October when the water level recorders were removed. As expected, the surface water level gauges in the Main

Lagoon and Marina Lagoon (Figures 1 and 4) were dominated by this seasonal change in Lake Tahoe. Both lagoon sites were similar to each other (within one tenth of a foot) throughout the study period.

The surface gauges on northern Pope Marsh and Lake Tallac (Figures 1 and 4) followed a different seasonal pattern, and were closer in pattern to each other than to the levels in the Main and Marina lagoons. Both sites reached a peak level in early June and then declined through the rest of the study period. Lake Tallac had the highest levels of all sites in early June, and in general was consistently about 0.25-1.0 feet higher than Pope Marsh. Lake Tallac receives stormwater runoff from South lake Tahoe, and drains directly into the southern portion of Pope Marsh, so these differences in water elevation were expected. As water levels declined in September, Lake Tallac reached a consistent level while Pope Marsh, and the Main and Marina lagoons, continued to decline. This pattern supports the understanding that Lake Tallac is relatively isolated from the other water bodies at most water levels.

2.3 Groundwater Elevations

Groundwater elevations were monitored with periodic manual readings throughout the study period. The elevation measurements are summarized in Table 2 and Figure 5. The majority of sites were installed between May 15 – 16, 2019; however, due to site access restrictions site P4 installation was delayed until July 10, 2019 (Figure 1). The piezometer at site P6 was previously installed by the California Tahoe Conservancy. However, due to site access restrictions, this piezometer was not accessible until September 10, 2019. Groundwater levels largely mirrored seasonal changes in local surface water levels (described in the above section). These results were expected given the high water levels in 2019.

Table 2. Groundwater levels near Tahoe Keys in 2019 (feet NAVD88).

Date	P1	P2	P3	P4	P5	P6
5/31	6,232.2	6,232.6	Dry	NM	Dry	NM
6/4-5	6,232.2	6,232.5	6,240.0	NM	6,231.9	NM
7/3	6,231.9	6,232.2	Dry	NM	6,232.2	NM
7/10	6,231.9	6,232.1	NM*	NM	NM*	NM
7/22-23	6,231.8	6,232.0	6,238.6	NM	6,231.9	NM
8/6	6,231.8	6,232.0	6,238.3	6,232.8	6,231.8	NM
8/29	6,231.6	6,231.8	6,237.8	6,232.4	6,231.6	NM
9/3-4	6,231.6	6,231.7	6,237.7	NM**	6,231.6	NM
9/24	6,231.4	6,231.6	6,237.1	6,232.9	6,230.5	Dry
10/4	Dry	6,231.6	6,237.1	6,232.7	6,231.5	Dry
11/13	Dry	6,231.6	6,236.9	6,232.8	6,231.2	Dry

Dry = Groundwater level was too low to obtain water level measurement

NM = Not measured, piezometers were not installed due to access permissions

NM* = Piezometers were installed deeper into the aquifer to increase sampling volume

NM** = Groundwater levels on these dates were calculated using data collected during groundwater sample collection. These data included ground surface elevation and the elevation at the top of the piezometer. This information was not known for P4 on these dates; therefore, groundwater level could not be calculated.

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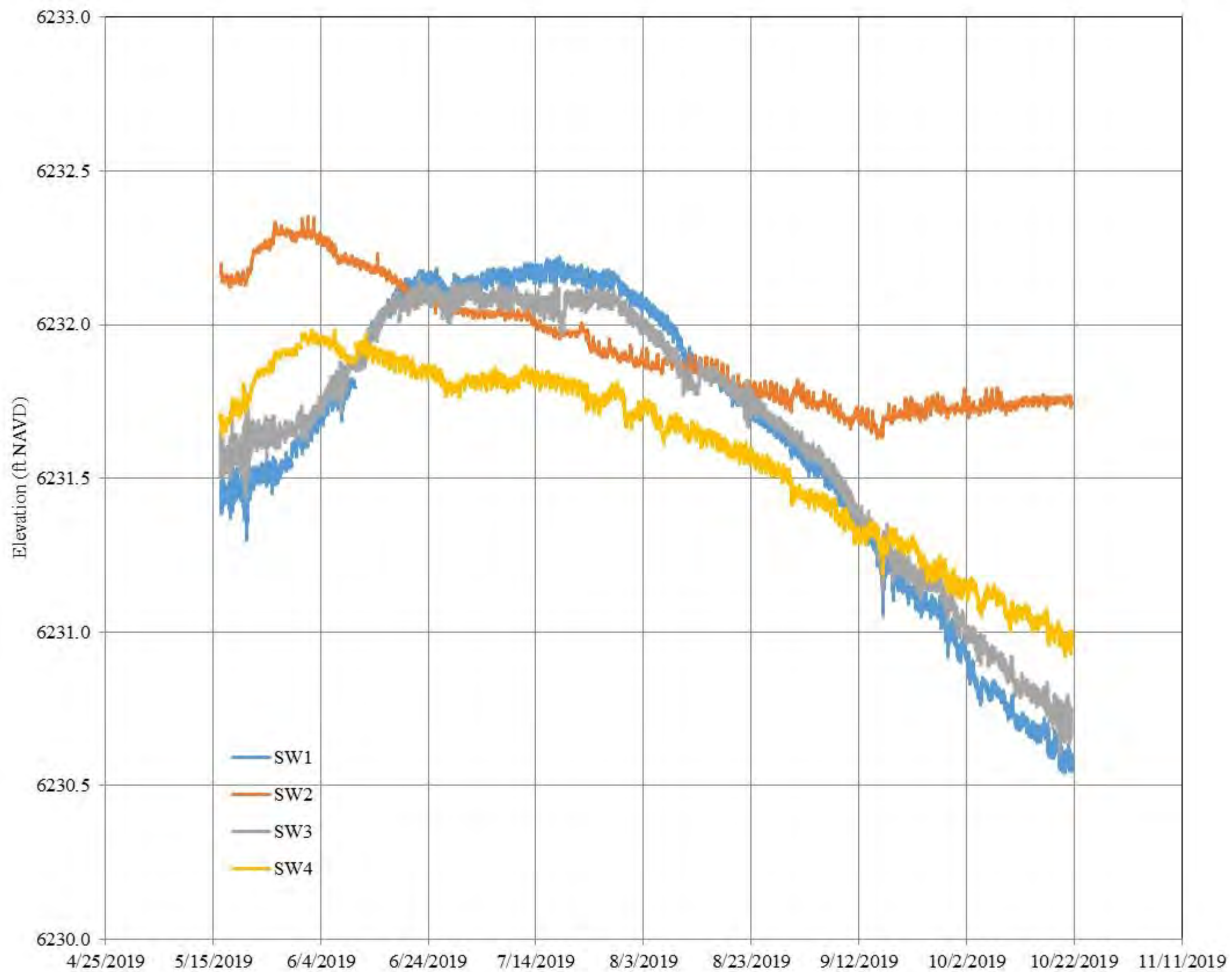

Figure 4. Time series of surface water levels at the Main Lagoon (SW1), Lake Tallac (SW2), Marina Lagoon (SW3), and Pope Marsh (SW4) in 2019.

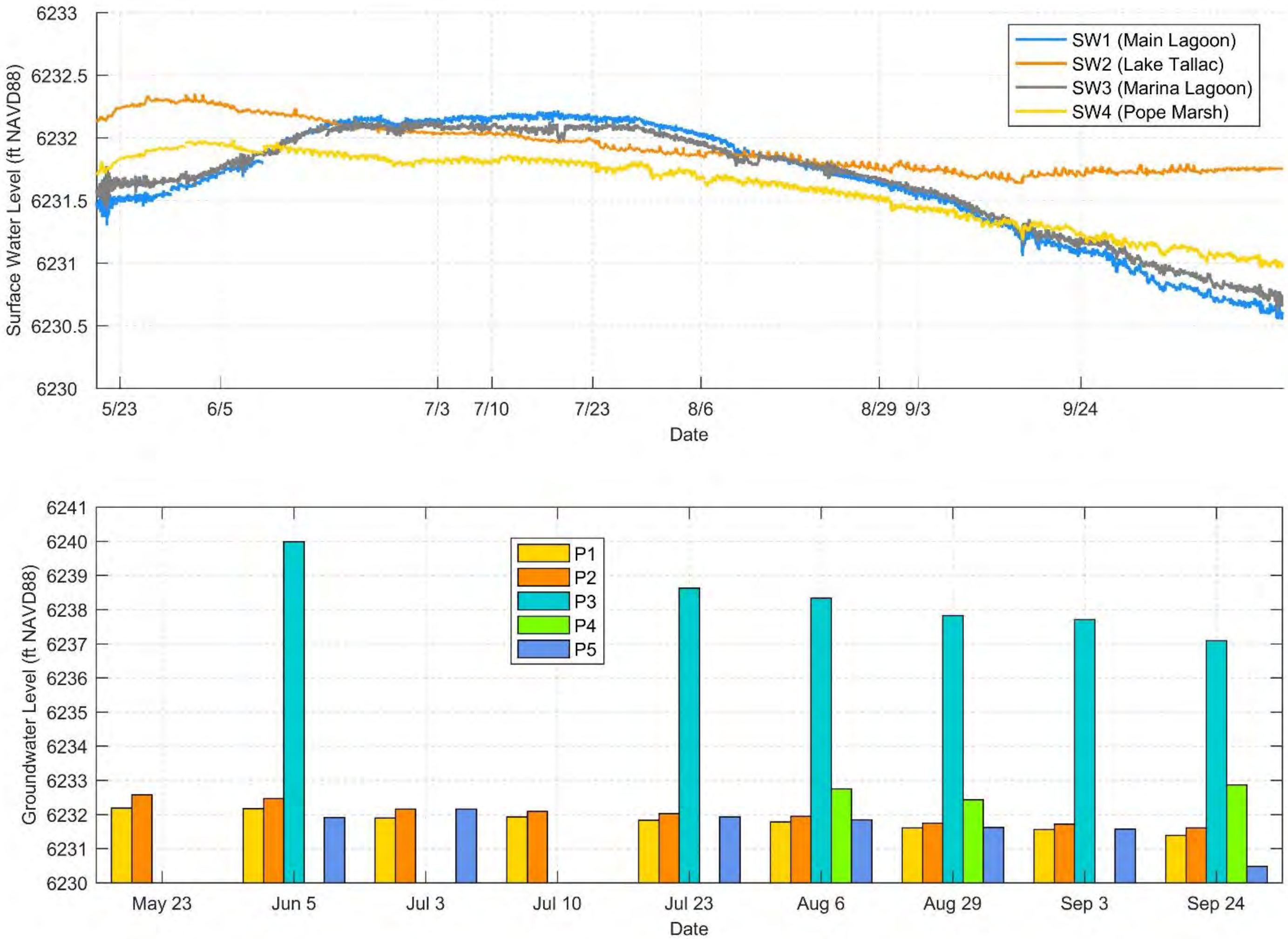

Figure 5. Continuous 2019 surface water levels (top) and discrete groundwater elevation measurements (bottom).

3 Other Physical Characteristics

In addition to evaluating hydrology, other physical characteristics are important factors to consider to provide a comprehensive understanding of the lagoon ecosystems. The following section summarizes additional parameters quantified which may directly or indirectly impact aquatic biota and other beneficial uses.

3.1 Secchi Disk Depth and Turbidity

Primary producers (i.e., phytoplankton and submerged aquatic vegetation) require light as the energy source which fuels growth. Water clarity is the measure of how far down light penetrates through the water column, which can be influenced by many factors including suspended inorganic (clay or silt) and organic (algal cell) particles as well as dissolved organic material. A Secchi disk is the standard measurement tool used to quantify water clarity in lakes, and measurements were taken monthly in Tahoe Keys lagoons in concert with vertical profile measurements. Some Secchi disk depth measurements were at least partially blocked by aquatic plants and therefore, the reported value may be biased low. In other words, water transparency could be underestimated but not overestimated using the disk. Where aquatic plants limited Secchi disk depth, those measurements were assigned a unique alpha code data qualifier (“L”) to explain the potential low bias. Table 3 provides the water transparency measurements for each of the stations. Overall, the greatest water transparency was observed in the Marina Lagoon, ranging from 6.3 to 14.5 feet, and the best visibility was documented during June and July. Secchi disk depth measurements not impacted by aquatic vegetation ranged from 3.6 to 17.5 feet in the Main Lagoon, and 3.6 to 7.8 feet in Lake Tallac.

In addition to Secchi disk depth, turbidity measurements were collected at three depths (surface, mid and near-bottom) to provide an optical measurement of the suspended particle abundance in the water column (Table 4). October turbidity measurements were assigned a unique alpha code qualifier (“C”) to indicate these were estimated values due to calibration failure. Basin Plan water quality objectives (WQOs) state that turbidity should not exceed 3 NTU (Nephelometric Turbidity Units), and increases shall not exceed natural levels by 10 percent. Turbidity values exceeded 3 NTUs at all areas during multiple sampling events. Overall, turbidity increased with depth at all stations. Consistent with water transparency measurements, the Marina Lagoon had the lowest turbidity measurements throughout the water column. Lake Tallac turbidity values were relatively low in the near-surface waters, especially when compared to near-bottom measurements which were the highest of all areas. Turbidity values in the Main Lagoon were variable, increasing slightly with water depth.

Table 3. Secchi disk water transparency measurements (ft) from the Tahoe Keys lagoons in 2019

Date	Time of Day	Lake Tallac			Main Lagoon							Marina Lagoon		
		T11	T12	T13	W4	W5	W6	W7	W8	W9	W10	E1	E2	E3
5/23	PM	5.2	5.0	6.4	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
5/24	AM	5.9	5.7	5.8	NM	6.7	9.3	7.9	8.1	NM	9.0	NM	NM	NM
5/24	PM	NM	NM	NM	11.4	6.0	NM	NM	NM	7.3	NM	10.8	8.0	7.9
6/19	AM	NM	NM	NM	NM	8.3	17.5	9.4	NM	7.5	14.3	NM	NM	NM
6/19	PM	7.0	7L	7.2	NM	NM	NM	NM	12.3	NM	NM	NM	11.8	11.2
6/20	AM	NM	NM	NM	12.3	NM	NM	NM	NM	NM	NM	14.5	NM	NM
7/16	AM	3.6	5.8	7.8	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
7/16	PM	NM	NM	NM	11.0	NM	NM	NM	NM	NM	NM	14.5	12.5	13.2
7/17	AM	NM	NM	NM	NM	6.5	13.0	6.5	4.7	6.0	13.5	NM	NM	NM
7/17	PM	3.6	5.8	7.5	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
8/13	AM	NM	NM	NM	9.0	NM	NM	NM	NM	NM	NM	8.5L	7.5L	8.5L
8/13	PM	6.3	5.0	6.5	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
8/14	AM	NM	NM	NM	NM	6.5	9.7	NM	4.6L	NM	11.3	NM	NM	NM
8/14	PM	NM	NM	NM	NM	NM	NM	6.3	NM	NM	NM	NM	NM	NM
9/10	PM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.3	6.3	6.3L
9/11	AM	NM	NM	NM	NM	3.6	5.1	NM	NM	4.1L	4.8	NM	NM	NM
9/11	PM	NM	NM	NM	NM	NM	NM	2.2L	4.8	NM	NM	NM	NM	NM
9/12	AM	NM	NM	NM	5.0L	NM	NM	NM	NM	NM	NM	NM	NM	NM
9/13	AM	3.3L	3.1L	6.3	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
10/2	AM	NM	NM	NM	NM	5.1	8.9	NM	NM	NM	10.3	NM	NM	NM
10/3	AM	NM	NM	NM	5.1L	NM	NM	4.2	5.7	2.3L	NM	7.6	10.3	10.9
10/3	PM	7.0L	3.6	6.8	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

L= Qualifier for estimated Secchi disk depths where submersed macrophytes blocked the disk resulting in potential low bias

NM = not measured

Table 4. Turbidity (NTU) measurements from near-surface, middle, and near-bottom depths of the Tahoe Keys lagoons in 2019.

Area	Station	Date	Near Surface	Mid	Near Bottom
Marina Lagoon	E1	5/21	1.7	NM	1.7
		6/20	1.7	1.5	2.3
		7/16	1.7	1.9	4.1
		10/3	3.3C	3.9C	4.1C
	E2	5/21	2.2	NM	2.4
		6/19	3.0	1.5	1.4
		7/16	2.6	1.8	4.7
		10/3	4.8C	3.9C	3.7C
	E3	5/21	2.7	NM	3.5
		6/199	1.5	1.9	1.6
		7/16	1.9	1.6	1.8
		10/3	3.9C	3.3C	5.1 C
Lake Tallac	T11	6/19	1.4	NM	NM
		6/20	NM	3.6	8.3
		7/17	2.5	5.8	18.9
		10/4	4.2C	5.2C	6.4C
	T12	6/19	1.6	2.2	6.1
		6/20	NM	2.3	36.0
		7/17	2.7	4.5	11.1
		10/4	5.5C	7.9C	11.3C
	T13	6/19	2.0	5.1	19.9
		7/17	2.3	4.3	37.3
		10/4	4.1C	5.3C	26.9C
Main Lagoon	W4	5/21	2.1	NM	2.2
		6/20	2.4	1.8	1.7
		7/16	1.9	2.0	2.3
		10/3	3.5C	5.5C	9.1C
	W5	6/19	4.2	3.0	5.0
		7/17	4.8	5.3	5.6
		10/2	8.8C	7.4C	16.3C
	W6	5/21	2.2	NM	2.3
		6/19	1.9	1.5	2.4
		7/17	2.5	1.7	6.6
		10/2	4.3C	3.3C	4.2C
	W7	5/21	2.9	NM	3.5
		6/19	2.3	2.4	3.5
		7/17	4.1	4.4	7.1

Area	Station	Date	Near Surface	Mid	Near Bottom
		10/3	7.4C	6.7C	6.9C
	W8	5/21	2.7	NM	3.0
		6/19	2.3	2.1	3.0
		7/17	4.3	8.1	5.6
		10/3	10.1C	6.7C	13.0C
	W9	5/21	2.4	NM	2.5
		6/19	2.2	2.5	2.7
		7/17	5.4	4.3	4.9
		10/3	8.5C	9.2C	14.5C
	W10	5/21	NM	NM	2.7
		6/19	3.1	1.6	1.5
		7/17	2.1	2.8	2.6
		10/2	3.0C	2.9C	3.8C

NM = not measured
C = Estimated turbidity value due to failed calibration of the turbidimeter
Shaded cells denote when values were above Basin Plan WQO (3.0 NTU)

3.2 Water Temperature

The water temperatures of the three Tahoe Keys lagoons were documented using both vertical profiles and multi-parameter sondes. Vertical profiles were collected in both the morning (AM) and afternoon (PM) at each monitoring station at 1-foot intervals using a YSI MS5 multi-parameter sonde (Figures 6 and 7). Near-surface water readings were recorded at 0.1 water depth at the beginning and end of each profile, and the average of the two values is reported. In the Marina Lagoon (E stations), water temperatures remained similar through the water column until an evident decline at the thermocline which occurred at greater than 10-feet water depth during both morning and afternoon measurements in June, July and August. In comparison, the Lake Tallac (T stations) thermocline occurred between 5 and 10 feet water depth during the morning; however, water temperatures presented a more immediate decline with depth in the afternoon. The strongest thermal stratification was evident in Lake Tallac. Water depths were generally more variable in the Main Lagoon (W stations). The water temperature at the stations with water depths near 10 feet (e.g. W4, W5, W7 and W8) remained relatively constant during the cooler months (May, September and October) and thermal stratification was evident during the warmer months (June, July and August) near 5-10 feet water depth. In contrast, the deeper stations W6 and W10 showed a gradual reduction in water temperature with depth that was more pronounced in the afternoon than in the morning. The water temperatures were consistently warmer throughout the water column in August, and coldest in May and October.

Onset U26 dissolved oxygen data loggers, which also record water temperature, were deployed at two fixed depths (near-surface and near-bottom), recording data at 15-minute intervals. The deployment periods for each monitoring station are provided in Table 5. The water temperatures at sites E1, E2, W5, W8 and W9 were similar at the near-surface and near-bottom intervals, indicating a well-mixed water column with no apparent thermocline (Figure 8). In comparison, the sites with greater water depth (T11, T12, W6 and W10) measured near-surface water temperatures that were warmer than waters found deeper in the water column (Figure 8). An increasing trend in water temperature was observed from May 2019 to August 2019 corresponding with an expected seasonal transition from Spring to Summer (Figure 8). Water temperatures began to decline from September 2019 to October 2019 as Summer transitioned to Fall. Monthly summary statistics for each location by sampling depth are provided in Tables 6 through 8. While the minimum and maximum values are provided and include inherent variability in continuous data, the 10th and 90th percentile values are recommended for characterizing water temperature conditions (Figure 9). The loss of equipment resulted in a data gap at Site W6 from June 10 to July 25, 2019.

Table 5. Dissolved oxygen/temperature data logger deployment periods for the Tahoe Keys lagoons in 2019.

Area	Station	Sampling Period	
		Start	Last
Lake Tallac	T11	5/23/2019	10/22/2019
	T12	5/23/2019	10/22/2019
Main Lagoon	W5	5/20/2019	10/22/2019
	W6	5/20/2019	10/22/2019
	W8	5/20/2019	10/15/2019
	W9	5/20/2019	10/15/2019
	W10	5/21/2019	10/22/2019
Marina Lagoon	E1	5/17/2019	10/15/2019
	E2	5/19/2019	10/15/2019

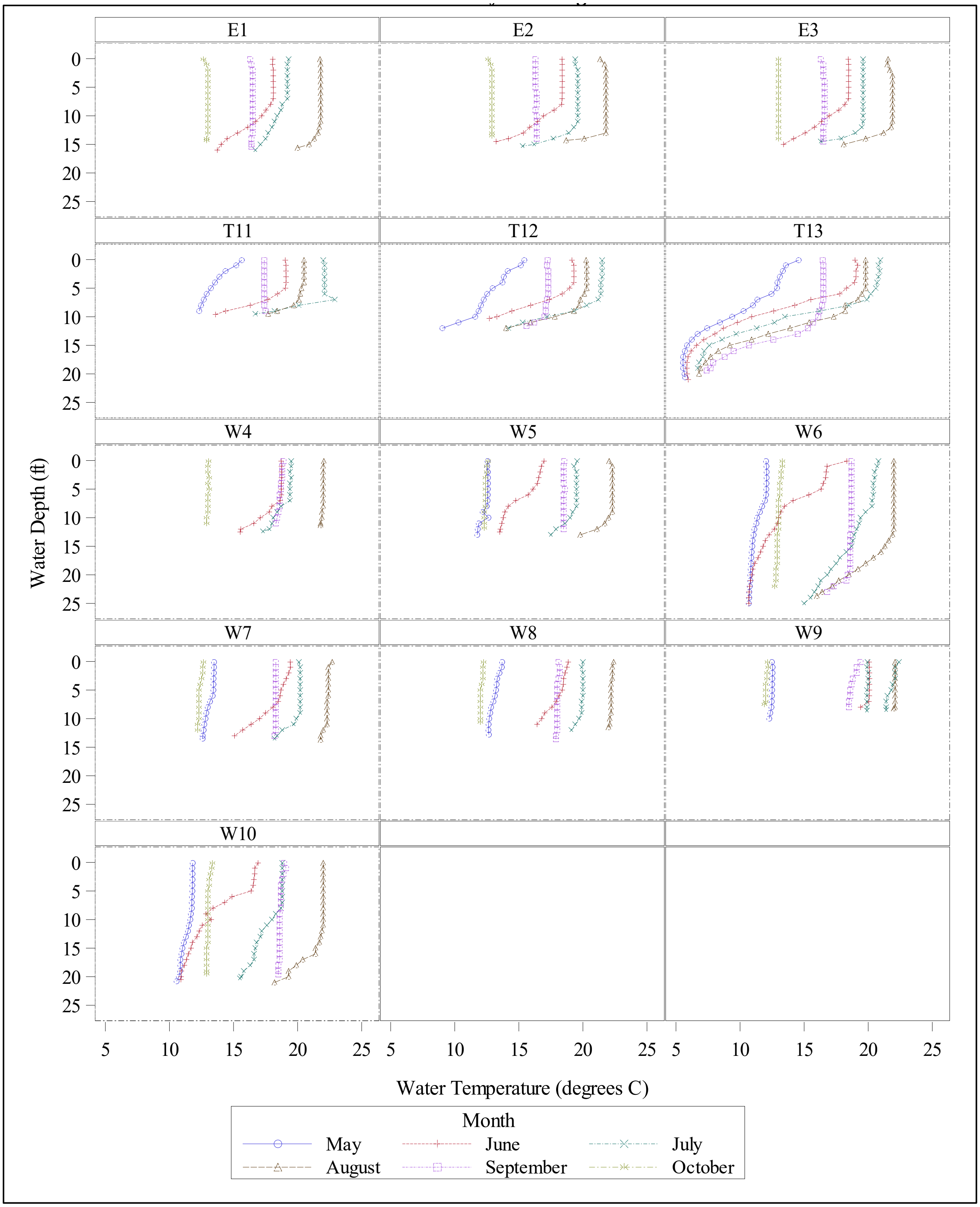

Figure 6. Vertical profile morning water temperature (^{o}C) readings in Tahoe Keys lagoons from May to October 2019.

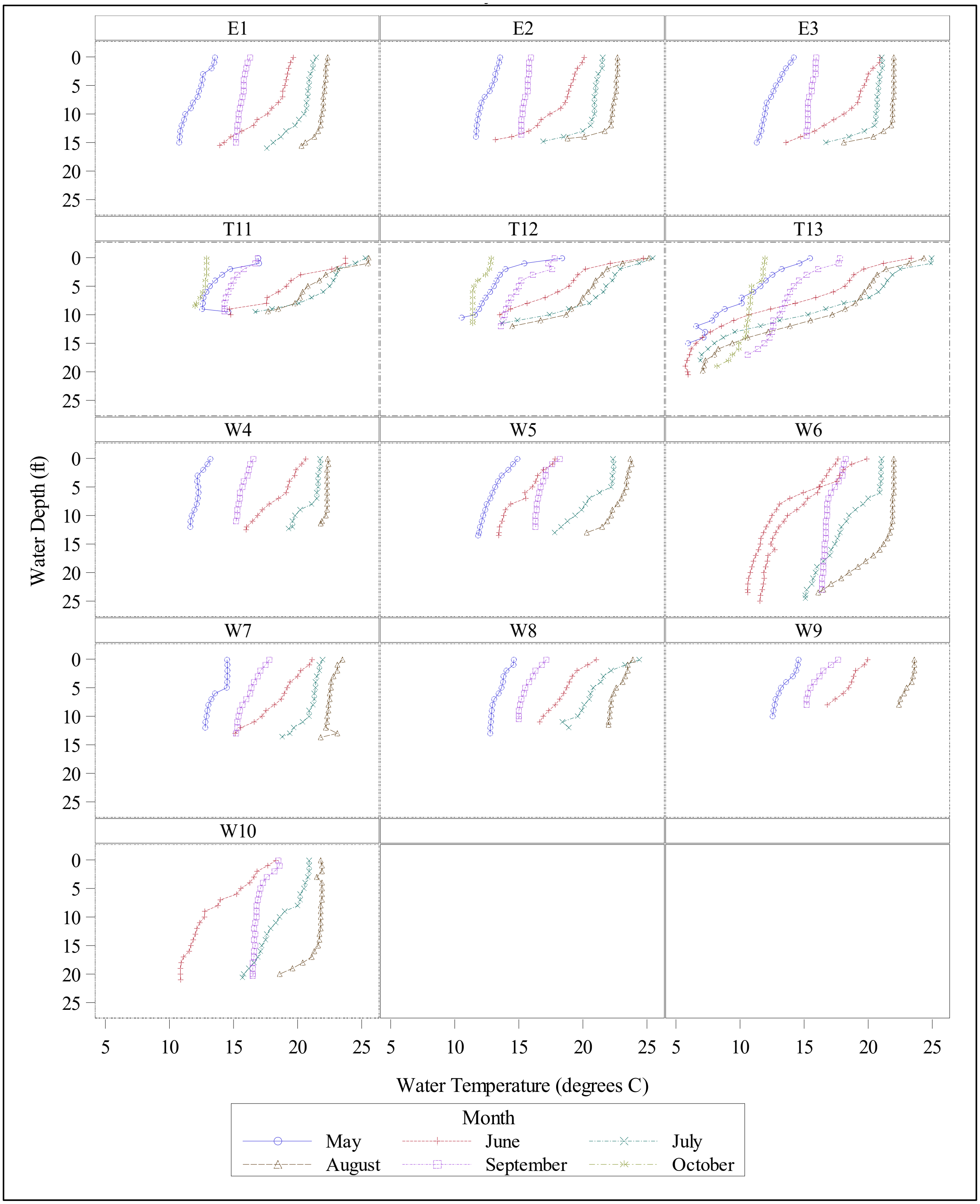

Figure 7. Vertical profile afternoon water temperature (°C) readings in Tahoe Keys lagoons from May to October 2019.

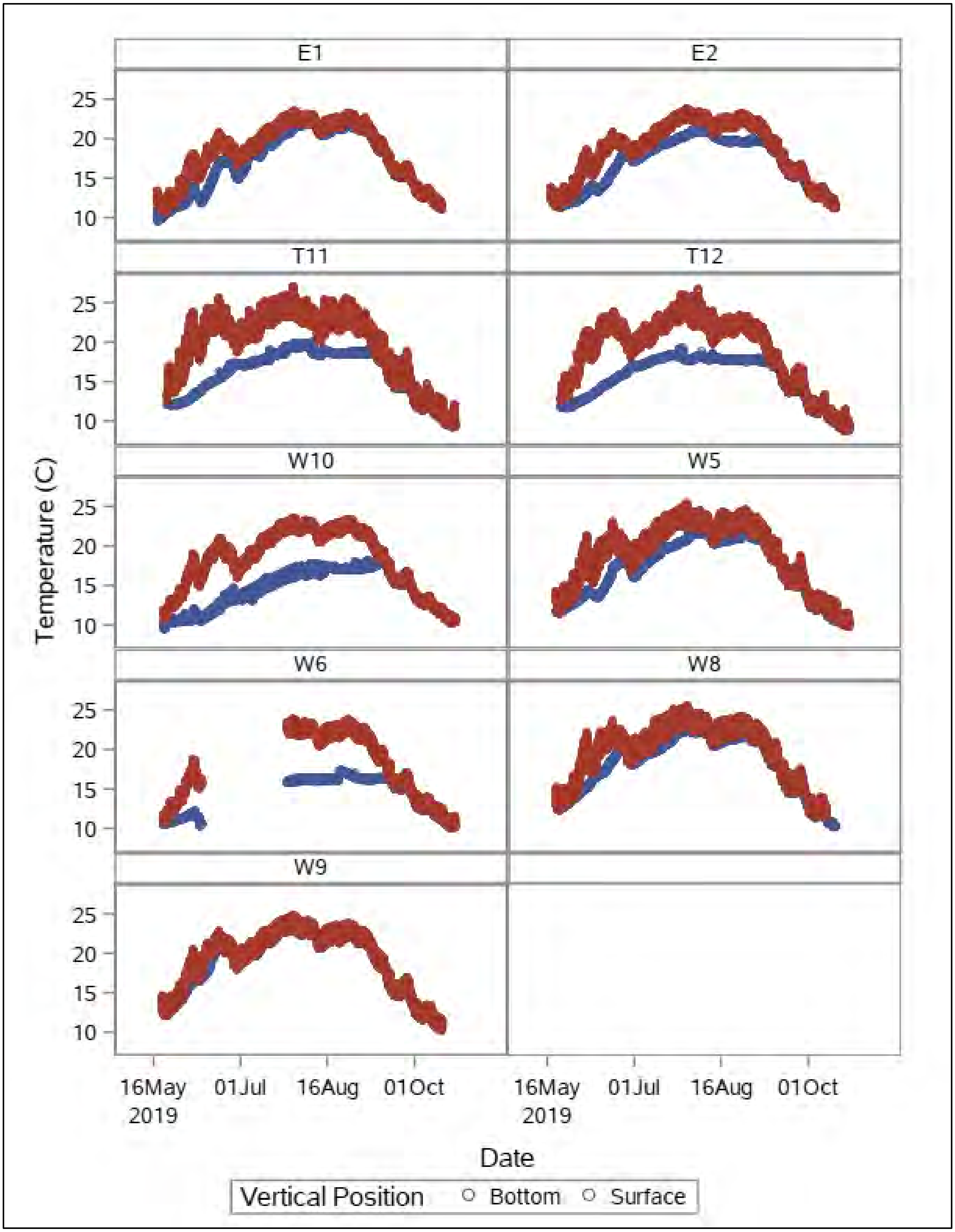

Figure 8. Continuous 15-minute water temperature (°C) readings from near-surface and near-bottom water depths at each Tahoe Keys monitoring site.

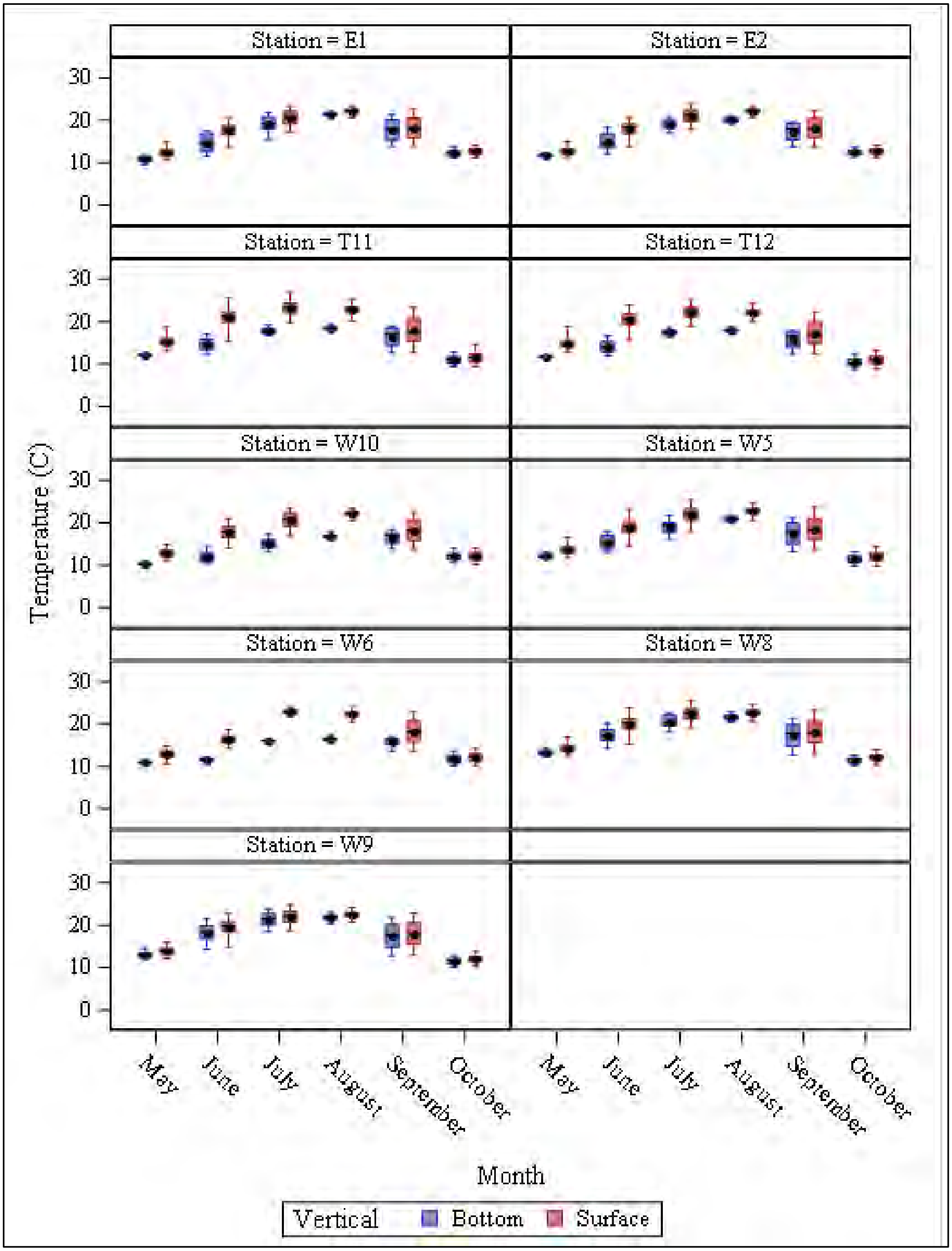

Figure 9. Continuous 15-minute data: water temperature monthly box-and-whisker plots for near-surface and near-bottom depths at each Tahoe Keys monitoring station in 2019 (dot denotes mean, black horizontal line denotes median, and whiskers indicate the 10th and 90th percentiles).

Table 6. Monthly water temperature (°C) summary statistics from continuous 15-minute data in Lake Tallac in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
T11	Near-Bottom	May	820	12.0	12.1	12.1	12.2	12.4	0.1
		June	2,876	12.3	12.6	14.7	16.8	17.0	1.5
		July	2,970	16.7	16.9	17.7	18.5	19.1	0.6
		August	2,971	17.9	18.0	18.4	18.7	19.5	0.3
		September	2,876	12.7	14.2	16.4	18.5	18.9	1.9
		October	2,071	9.4	9.6	10.9	11.9	12.8	0.9
	Near-Surface	May	822	13.1	13.9	15.2	16.4	18.7	1.0
		June	2,878	15.5	18.6	21.0	23.3	25.6	1.8
		July	2,973	19.7	20.9	23.1	25.0	27.0	1.5
		August	2,975	20.1	21.5	22.8	24.1	25.3	1.0
		September	2,877	12.7	14.5	17.9	22.0	23.4	2.9
		October	2,073	9.3	9.8	11.5	12.9	14.6	1.1
T12	Near-Bottom	May	823	11.5	11.5	11.7	11.9	12.1	0.1
		June	2,878	11.9	12.3	14.1	16.0	16.7	1.4
		July	2,973	16.4	16.5	17.4	18.0	18.6	0.5
		August	2,975	17.5	17.7	17.9	18.3	18.7	0.2
		September	2,877	12.3	13.7	15.7	17.7	18.0	1.8
		October	2,072	8.7	8.9	10.3	11.3	12.3	0.9
	Near-Surface	May	825	12.7	13.6	14.7	15.8	18.8	0.9
		June	2,879	15.6	18.4	20.5	22.5	23.9	1.7
		July	2,974	18.9	20.1	22.2	24.1	25.4	1.5
		August	2,975	19.8	21.0	22.1	23.1	24.2	0.8
		September	2,878	12.3	14.0	17.2	21.2	22.3	2.7
		October	2,073	8.8	9.5	10.9	12.2	13.2	1.0

Table 7. Monthly water temperature (°C) summary statistics from continuous 15-minute data in the Tahoe Keys Main Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
W5	Near-Bottom	May	1,086	11.5	11.6	12.2	12.8	13.0	0.4
		June	2,877	12.9	13.5	15.4	17.6	18.0	1.7
		July	2,968	16.0	16.6	18.9	20.5	21.7	1.5
		August	2,973	20.2	20.4	20.9	21.5	21.8	0.4
		September	2,878	13.2	14.9	17.5	20.8	21.2	2.4
		October	2,075	9.7	10.0	11.4	12.4	13.2	0.9
	Near-Surface	May	1,089	11.6	12.2	13.7	15.1	16.5	1.1
		June	2,878	14.6	16.5	18.9	20.9	23.2	1.7
		July	2,974	17.7	19.5	21.9	24.0	25.4	1.7
		August	2,974	20.5	21.7	22.7	23.9	24.6	0.8
		September	2,878	13.4	15.3	18.4	22.2	23.7	2.7
		October	2,075	9.8	10.4	12.0	13.5	14.5	1.1
W6	Near-Bottom	May	1,010	10.5	10.7	11.0	11.2	11.4	0.2
		June	918	10.4	10.6	11.6	12.1	12.3	0.5
		July	613	15.7	15.9	16.0	16.1	16.2	0.1
		August	2,972	16.0	16.1	16.5	17.1	17.5	0.4
		September	2,878	13.6	15.1	15.8	16.4	17.1	0.7
		October	2,081	10.1	10.3	11.7	12.8	13.7	0.9
	Near-Surface	May	1,010	10.6	11.5	12.9	14.2	14.8	0.9
		June	918	14.2	15.2	16.3	17.8	18.7	1.0
		July	614	21.8	22.2	22.9	23.5	24.0	0.5
		August	2,976	20.5	21.5	22.3	23.2	24.0	0.7
		September	2,880	13.6	15.2	18.2	21.7	22.8	2.5
		October	2,080	10.2	10.6	12.1	13.5	14.2	1.1
W8	Near-Bottom	May	1,095	12.4	12.6	13.2	14.0	14.3	0.5
		June	2,876	14.2	15.0	17.4	19.8	20.1	1.7
		July	2,971	18.2	18.6	20.5	22.4	22.7	1.4
		August	2,972	20.5	20.6	21.5	22.3	22.8	0.6
		September	2,876	12.7	14.6	17.3	21.0	21.3	2.6
		October	1,398	10.2	10.6	11.5	12.1	12.7	0.6
	Near-Surface	May	1,096	12.4	12.9	14.2	15.5	17.0	1.0
		June	2,879	15.3	17.7	20.0	22.0	23.8	1.6
		July	2,973	18.9	20.0	22.3	24.2	25.6	1.6
		August	2,974	20.6	21.6	22.7	23.8	24.6	0.8
		September	2,879	12.8	14.9	18.0	21.8	23.2	2.7

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
		October	1,400	10.4	11.0	12.1	13.2	13.9	0.8
W9	Near-Bottom	May	1,092	11.9	12.2	13.0	14.0	14.5	0.7
		June	2,878	14.3	15.9	18.2	20.4	21.5	1.8
		July	2,972	18.5	19.4	21.4	23.1	23.8	1.4
		August	2,970	20.4	21.0	21.8	22.5	23.1	0.6
		September	2,877	12.7	14.5	17.4	21.3	21.8	2.7
		October	1,405	10.1	10.5	11.5	12.1	12.7	0.6
	Near-Surface	May	1,093	12.1	12.6	13.9	15.2	16.0	0.9
		June	2,877	14.8	17.2	19.5	21.5	22.8	1.6
		July	2,971	18.7	19.9	22.0	23.9	24.8	1.5
		August	2,974	20.7	21.6	22.5	23.4	24.1	0.7
		September	2,878	12.9	14.8	17.9	21.8	22.9	2.7
		October	1,404	10.3	10.9	12.0	13.0	13.8	0.8
W10	Near-Bottom	May	1,011	9.6	9.9	10.2	10.5	10.9	0.2
		June	2,876	10.3	10.4	11.9	13.6	14.7	1.2
		July	2,970	13.1	13.7	15.1	16.5	17.3	1.1
		August	2,969	16.1	16.3	16.8	17.2	17.9	0.3
		September	2,873	13.9	15.1	16.5	18.0	18.4	1.3
		October	2,078	10.5	11.0	12.1	13.1	14.0	0.8
	Near-Surface	May	1,011	10.9	11.4	12.8	14.0	14.9	0.9
		June	2,879	14.0	15.6	17.8	19.8	20.9	1.6
		July	2,972	16.9	18.1	20.7	22.7	23.5	1.7
		August	2,973	20.5	21.3	22.1	22.9	23.3	0.6
		September	2,878	13.8	15.3	18.1	21.6	22.4	2.5
		October	2,082	10.2	10.6	12.1	13.4	14.1	1.0

Table 8. Monthly water temperature (°C) summary statistics from continuous 15-mintue data in the Tahoe Keys Marina Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
E1	Near-Bottom	May	1,376	9.6	10.0	10.9	11.6	11.8	0.6
		June	2,879	11.6	12.2	14.6	17.1	17.5	1.9
		July	2,973	15.4	16.5	19.1	21.3	21.8	1.7
		August	2,970	20.5	20.6	21.4	21.9	22.0	0.4
		September	2,878	13.9	15.2	17.7	21.0	21.4	2.4
		October	1,391	11.1	11.5	12.4	13.2	13.9	0.7
	Near-Surface	May	1,376	10.7	11.2	12.4	13.8	14.9	0.9
		June	2,879	13.5	15.5	17.7	19.5	20.7	1.5
		July	2,972	17.2	18.3	20.7	22.6	23.4	1.6
		August	2,974	20.6	21.4	22.1	22.8	23.2	0.5
		September	2,878	13.9	15.4	18.2	21.6	22.6	2.5
		October	1,390	11.2	11.7	12.7	13.6	14.2	0.7
E2	Near-Bottom	May	1,370	11.4	11.5	11.8	12.2	12.4	0.3
		June	2,877	12.1	12.7	15.0	17.8	18.3	1.8
		July	2,967	17.0	17.4	19.0	20.4	20.8	1.1
		August	2,971	19.3	19.5	20.1	20.8	21.1	0.5
		September	2,874	13.7	15.2	17.3	19.4	19.6	1.9
		October	1,386	11.4	11.7	12.5	13.1	13.7	0.5
	Near-Surface	May	1,369	11.3	11.8	12.8	13.9	15.0	0.8
		June	2,879	13.8	15.9	18.0	19.8	20.8	1.5
		July	2,973	17.9	18.9	21.1	23.0	23.8	1.6
		August	2,973	20.6	21.4	22.1	22.8	23.3	0.5
		September	2,877	13.7	15.4	18.2	21.5	22.3	2.4
		October	1,388	11.2	11.7	12.7	13.6	14.1	0.7

3.3 Sediment Sample Descriptions and Laboratory Results for Water Content and pH

Table 9 summarizes field observations of surficial sediment samples collected with a petit Ponar grab sampler in July and September 2019. All samples except from station T13 in Lake Tallac contained some Eurasian watermilfoil fragments. The larger fragments were removed from the sample before the sediment was homogenized for filling sample jars. At some stations the aquatic weeds were caught in the jaws of the sampler preventing complete closure, and those samples contained water that washed out some of the sediment in the grab. This was especially problematic in samples collected at W4, E2 and E3. In those samples the water was homogenized together with the sediment, which increased the moisture content in the sediment and may decreased the organic matter content. These sample were flagged "BH" and "BL", respectively, to indicate high and low bias in the results.

Sediments from the Main Lagoon and Marina Lagoon samples were generally black and predominantly silt. Both samples from the Main Lagoon, two of the three samples from the Marina Lagoon, and one of the two samples from Lake Tallac were characterized as gelatinous. This material was similar to gyttja, a black gelatinous mud that forms from anaerobic digestion of peat materials.

Laboratory analyses of conventional physical and chemical properties of surficial sediment samples are summarized in Table 10. Moisture content was very high, ranging from 83.1 to 94.7 percent, except the sample from station W8 in the Main Lagoon that had a moisture content of 46.7 percent.

Table 9. Field observations of Tahoe Keys lagoons surficial sediment samples, July 2019.

Area	Station	Water Depth (ft)	Sediment Descriptions
Lake Tallac	T12	12.7	Dark grey silt, slightly gelatinous, lots of milfoil, no odor
	T13	19.6	Dark brownish grey, mild organic odor, no weeds in sample
Main Lagoon	W4	12.7	Black silt w/milfoil fragments and water mixed with gelatinous muck
	W5	13.3	Black, gelatinous silt w/milfoil fragments
	W6	24.2	Dark grey, gelatinous, silty, very little sand, no odor, no plant material
	W7	13.8	Black silt, very slight musty odor, no plant fragments
	W8	12.4	Black sandy silt, no odor, a few milfoil fragments
	W10	21.2	Black, gelatinous, silty, very little sand, no plant material, no odor
Marina Lagoon	E1	16.2	Black, gelatinous, silt w/no odor, some milfoil fragments
	E2	14.7	Black, gelatinous, silt, no odor, milfoil fragments & water mixed in sample
	E3	15.6	Black/grey clayey silt, no odor, lots of milfoil and water mixed w/sediment in

Table 10. Physical and chemical properties of Tahoe Keys lagoons surficial sediment samples, July 2019.

Area	Station	Moisture (%)	pH	Organic Matter (%)
Lake Tallac	T12	85.1	6.8	NA
	T13	87.7	6.6	NA
Main Lagoon	W4	86.5 BH	7.0	NA
	W5	85.9	6.8	NA
	W6	87.5	7.0	NA
	W6[d]	83.1	7.1	NA
	W7	88.5 HT	7.1	NA
	W7[d]	89.6 HT	7.1	20
	W8	46.7 HT	7.3	NA
	W10	90.6	7.0	NA
Marina Lagoon	E1	87.6	7.3	NA
	E2	94.7 BH	6.9	30 BL
	E3	88.6 HT, BH	7.1	NA
	E3[d]	89.5 HT, BH	7.1	NA

NA = not analyzed
HT = analyzed beyond the accepted holding time
BL = sample result may be biased low
BH = sample result may be biased high
[d] Duplicate sample result reported

4 Nutrient Concentrations

Primary producers (i.e., phytoplankton and submerged aquatic vegetation) rely on sunlight and nutrients to fuel photosynthetic activity. Nitrogen and phosphorus are the major macronutrients required for continued primary production. Total nitrogen (TN) is comprised of the sum of inorganic nitrogen (nitrate and nitrite), organic nitrogen, and ammonia. Total Kjeldahl nitrogen (TKN) consists of organic nitrogen and ammonia. Inorganic nitrogen is the form most readily available by primary producers for uptake. Total phosphorus (TP) is the measure of all forms of phosphorus, dissolved or particulate. Orthophosphate consists of the dissolved fraction, that which can pass through a filter and is directly available to algae and aquatic plants for productivity.

4.1 Groundwater Nutrients

Groundwater samples were collected in June, July, and September at P1, P2, P3, P4, and P5 (except in June when P4 was not sampled due to lack of access, Figure 1). Samples were collected using a peristaltic pump and silicon tubing, transferred to laboratory-supplied containers, placed on ice in a cooler, and delivered by courier to the laboratory for analyses, consistent with the QAPP. For each sample, nitrogen (nitrate-nitrogen, nitrite-nitrogen, TKN and ammonia) and phosphorus (TP and orthophosphate) were quantified. TN was calculated using the combined concentrations of nitrate-nitrogen + nitrite-nitrogen + TKN. Reported TN values were mostly TKN, and all nitrite values were reported at the minimum detection limit (MDL) and "U" flagged. In these instances, half the value of the MDL was used for each undetected sample and added to the TKN and nitrate concentrations to calculate TN. Because TN was calculated, no qualifiers were assigned. For all nutrient concentrations reported at the MDL with a "U" flag, half the value of the MDL was subsequently used in data analyses, including calculating mean concentrations.

TN concentrations were highest at P2 and P3 in June, measuring 5.6 and 5.3 mg/L, respectively (Figure 10), with mean concentrations of 2.66 and 2.93 mg/L, respectively (Table 11). The lowest concentrations were consistently measured from P1, ranging from 0.13 to 0.72 mg/L, and there was a general trend of declining TN concentrations across all sites from June to September. The majority of the TN concentrations were driven by high TKN concentrations; however, nitrate-nitrogen also contributed to TN, particularly at P3 in June where a high of 0.55 mg/L was detected (Figure 11). All other months and sites were less than 0.1 mg/L nitrate-nitrogen. Ammonia also contributed to the TN concentrations, particularly at P2 during all sample months (averaging 0.73 mg/L).

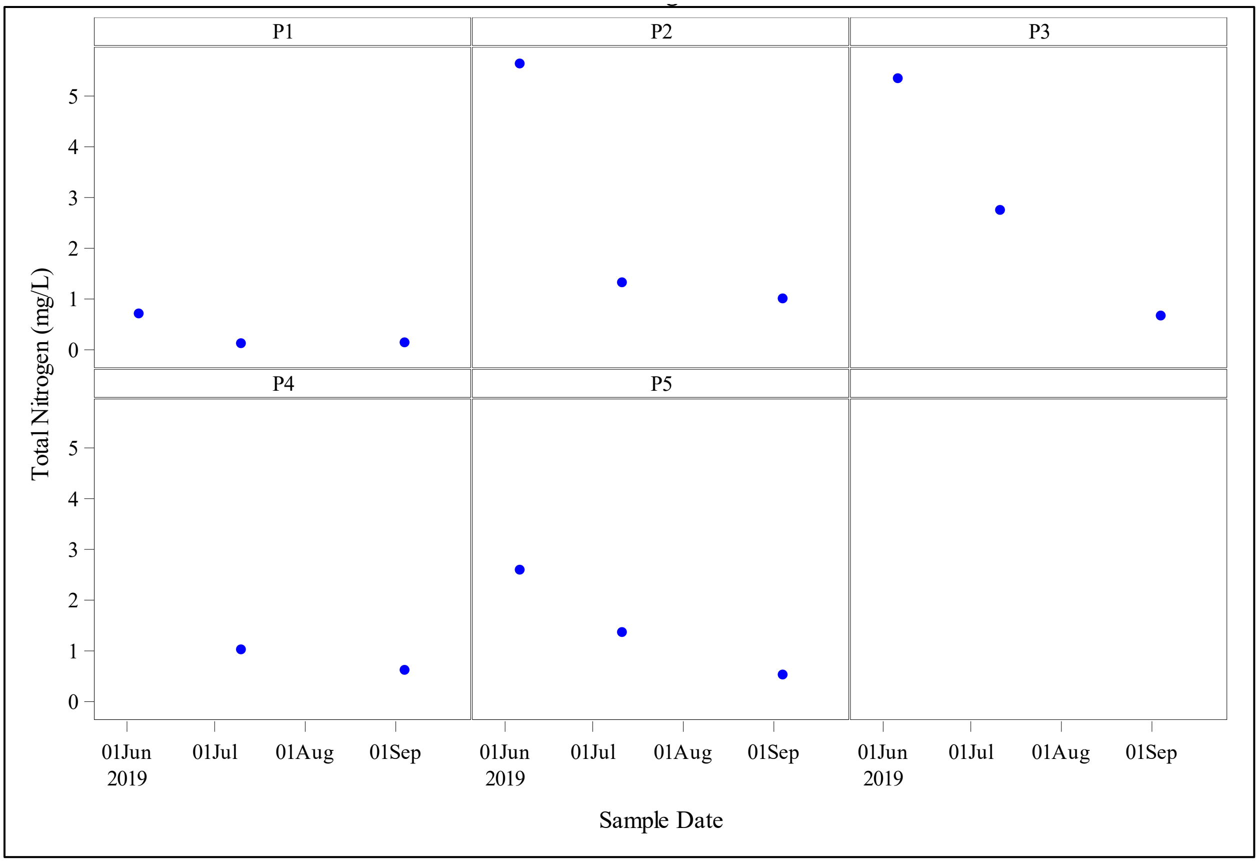

Figure 10. Total nitrogen (mg/L) concentrations in groundwater samples near Tahoe Keys over the 2019 baseline sampling period.

Table 11. Groundwater total nitrogen (mg/L) summary statistics from piezometer samples near Tahoe Keys in 2019.

Station	Sampling Period		# of Samples	Minimum	Mean	Maximum	Standard Deviation
	First	Last					
P1	6/5	9/4	3	0.13	0.33	0.72	0.33
P2	6/6	9/4	3	1.01	2.66	5.64	2.59
P3	6/6	9/4	3	0.67	2.93	5.35	2.34
P4	7/10	9/4	2	0.63	0.83	1.03	0.29
P5	6/6	9/4	3	0.53	1.50	2.60	1.04

J= The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit

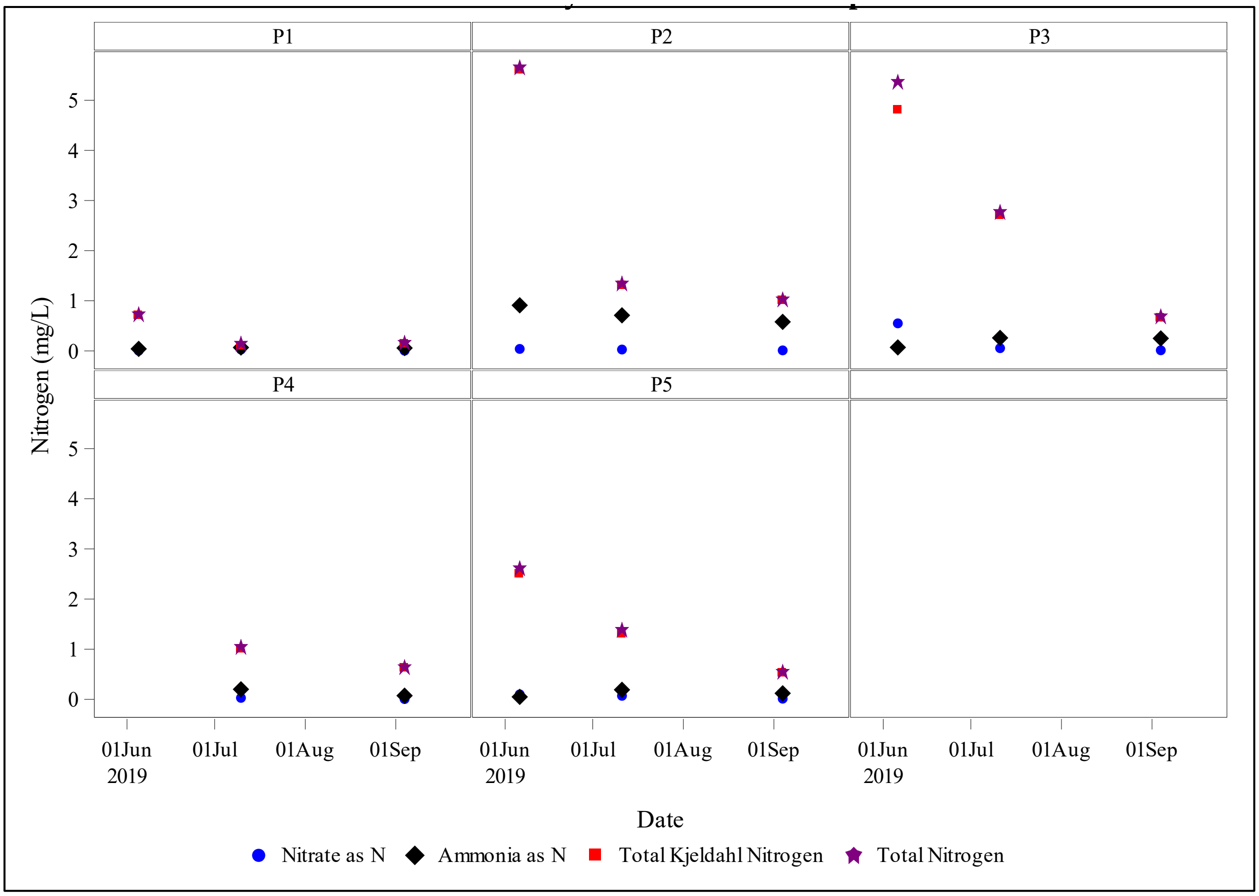

Figure 11. Concentrations of primary nitrogen forms (nitrate, ammonia, TKN; mg/) and total nitrogen (mg/L) in groundwater samples from piezometers near Tahoe Keys in 2019.

TP concentrations were highest at P4 in July and September, measuring 0.21 and 0.17 mg/L, respectively, with a mean concentration of 0.19 mg/L (Table 12). Next highest was P5 in July at 0.16 mg/L (Figure 12). The lowest TP concentrations were reported as below the MDL (0.006 mg/L) and qualified by the laboratory with a "U" to indicate that TP was not detected at the MDL concentration. For the purposes of data analyses, these results are assumed to be one-half the MDL (0.003 mg/L). The lowest concentrations were consistently measured at P3, ranging from the MDL (0.006U mg/L) to 0.06 mg/L. The majority of TP is comprised of the particulate fraction; however, appreciable amounts of orthophosphate were measured in samples from all sites except P2 and P3 (Figure 13). Excluding those sites, orthophosphate concentrations ranged from 0.008 to 0.096 mg/L with a mean of 0.03 mg/L across all sites and all months.

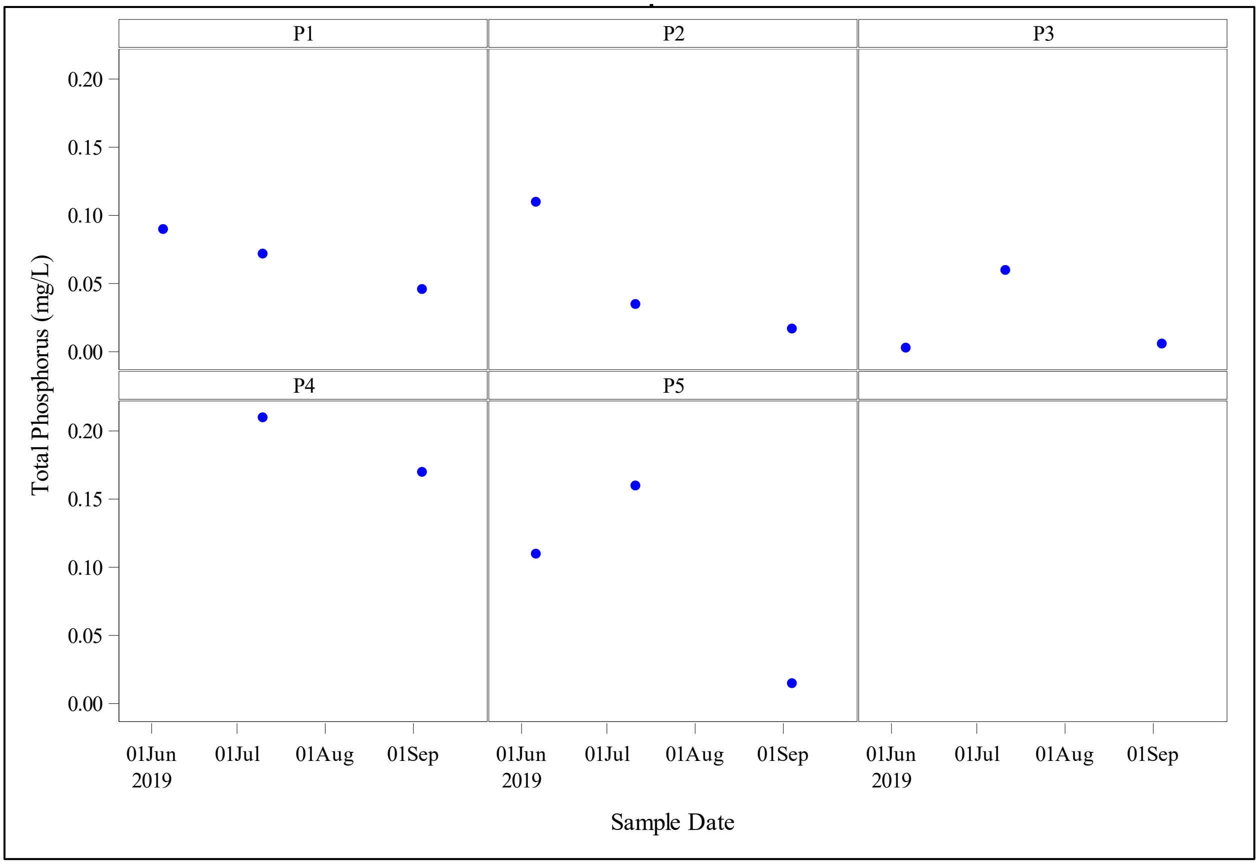

Figure 12. Total phosphorus (mg/L) concentrations in groundwater samples from piezometers near Tahoe Keys over 2019 sampling period.

Table 12. Groundwater total phosphorus (mg/L) summary statistics for samples collected near Tahoe Keys in 2019.

Station	Sampling Period		# of Samples	Minimum	Mean	Maximum	Standard Deviation
	First	Last					
P1	6/5	9/4	3	0.046	0.069	0.090 HTe	0.022
P2	6/6	9/4	3	0.017 J	0.054	0.110 HTe	0.049
P3	6/6	9/4	3	0.006 J,U,HTe	0.023	0.060	0.032
P4	7/10	9/4	2	0.170 P	0.190	0.210	0.028
P5	6/6	9/4	3	0.015 J,HTe	0.095	0.160	0.074

J=The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit
U= The analyte was analyzed, but was not detected above the level of the sample reporting/quantitation limit
HTe= Holding temperature exceeded for sample based on QAPP guidance

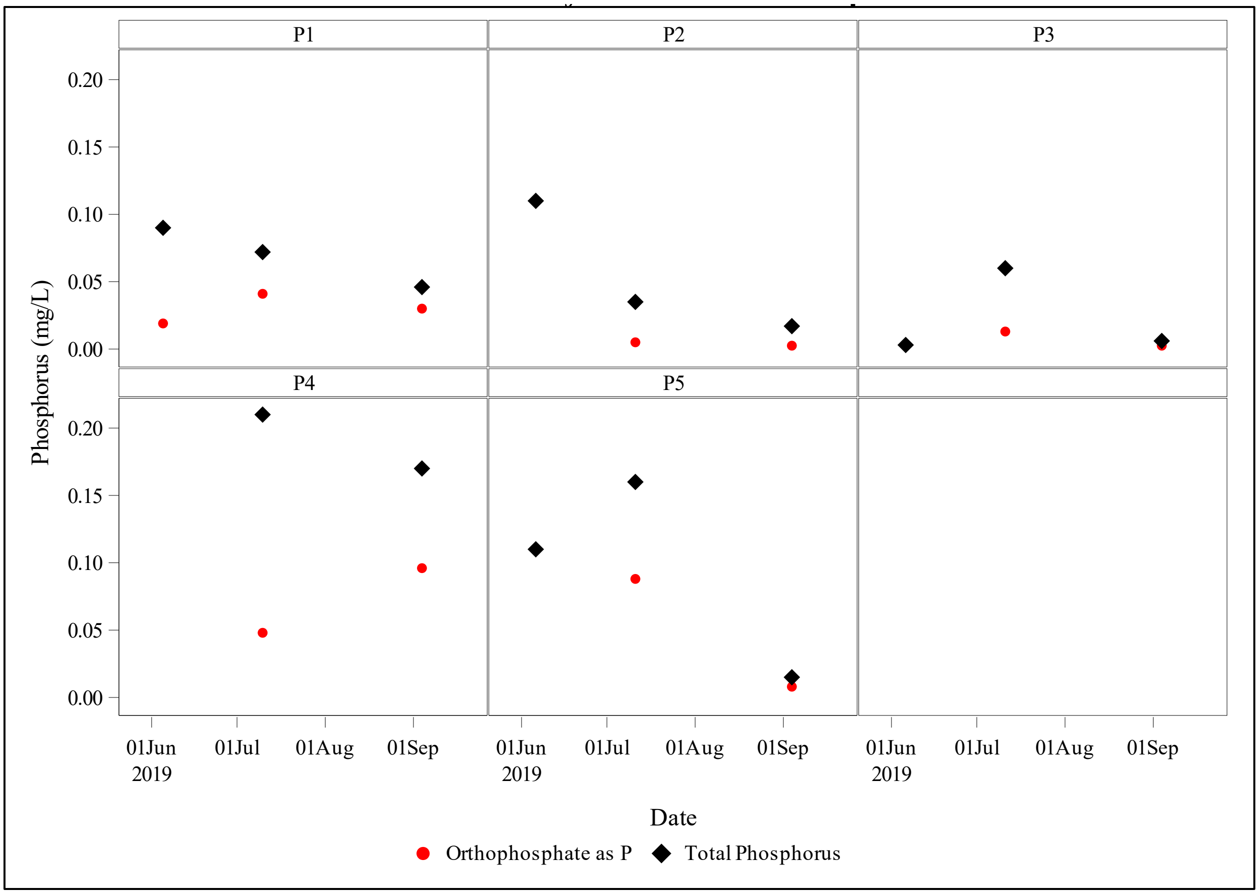

Figure 13. Concentrations of orthophosphate and total phosphorus (mg/L) in groundwater samples collected from piezometers near Tahoe Keys in 2019.

4.2 Lagoon Water Nutrients

Near-surface and near-bottom water samples were collected monthly at each of the monitoring sites using a horizontal bottle sampler or peristaltic pump and tubing, transferred to laboratory supplied containers, placed on ice in a cooler, and provided to the laboratory for analyses consistent with the QAPP. As with groundwater, TN was calculated using the combined concentrations of nitrate-nitrogen + nitrite-nitrogen + TKN. Reported TN values were mostly TKN, and all nitrite values were reported at the minimum detection limit (MDL) and "U" flagged. In these instances, half the value of the MDL was used for each undetected sample and added to the TKN and nitrate concentrations to calculate TN. Because TN was calculated, no qualifiers were assigned. As with groundwater, for all nutrient concentrations reported at the MDL with a "U" flag, half the value of the MDL was subsequently used in data analyses, including calculating mean concentrations.

Basin Plan WQOs state that TN should not be above 0.15 mg/L based on an annual average or 90th percentile, and reference lines delineating the maximum TN objective are included on sample results graphs (Figure 14). The reporting sampling period only encompassed six months; as such, the results were compared against the 90th percentile for near-surface and near-bottom samples. For both sampling depths, TN concentrations for individual sampling events consistently exceeded 0.15 mg/L (Figure 14). Due to low sample size, the 90th percentile and maximum were equivalent (Table 13). For all stations and depths, the 90th percentile TN concentrations were above the 0.15 mg/L numerical WQO indicating that at least 10 percent of the samples from each location exceeded the criterion (Table 13). The lowest TN concentrations were observed in the Marina Lagoon where concentrations ranged from 0.03 to 0.42 mg/L in the near-bottom waters and 0.03 to 0.33 mg/L in near-surface waters, with concentrations remaining relatively stable through the sampling period (Table 13, Figures 15 and 16). Main Lagoon TN concentrations ranged from 0.03 to 1.01 mg/L in near-bottom waters and 0.03 to 0.61 mg/L in near-surface waters (Table 13 and Figures 14 to 16), and concentrations appeared to increase in August through September sampling events. The most variability and greatest TN concentrations were observed in Lake Tallac, specifically at station T13 (Figures 14 and 15). TN concentrations in Lake Tallac ranged from 0.11 to 0.65 mg/L in the near-surface waters and 0.37 to 7.61 mg/L in near-bottom waters (Table 13 and Figures 15 and 16). Most TN was comprised of TKN, and in near-bottom waters ammonia contributed an average of 25 percent of the TN concentration (Figure 17). Nitrite was not detected in near-surface or near-bottom water samples. Nitrate was only detected in two samples, both from near the bottom of Lake Tallac (T13; Figure 18).

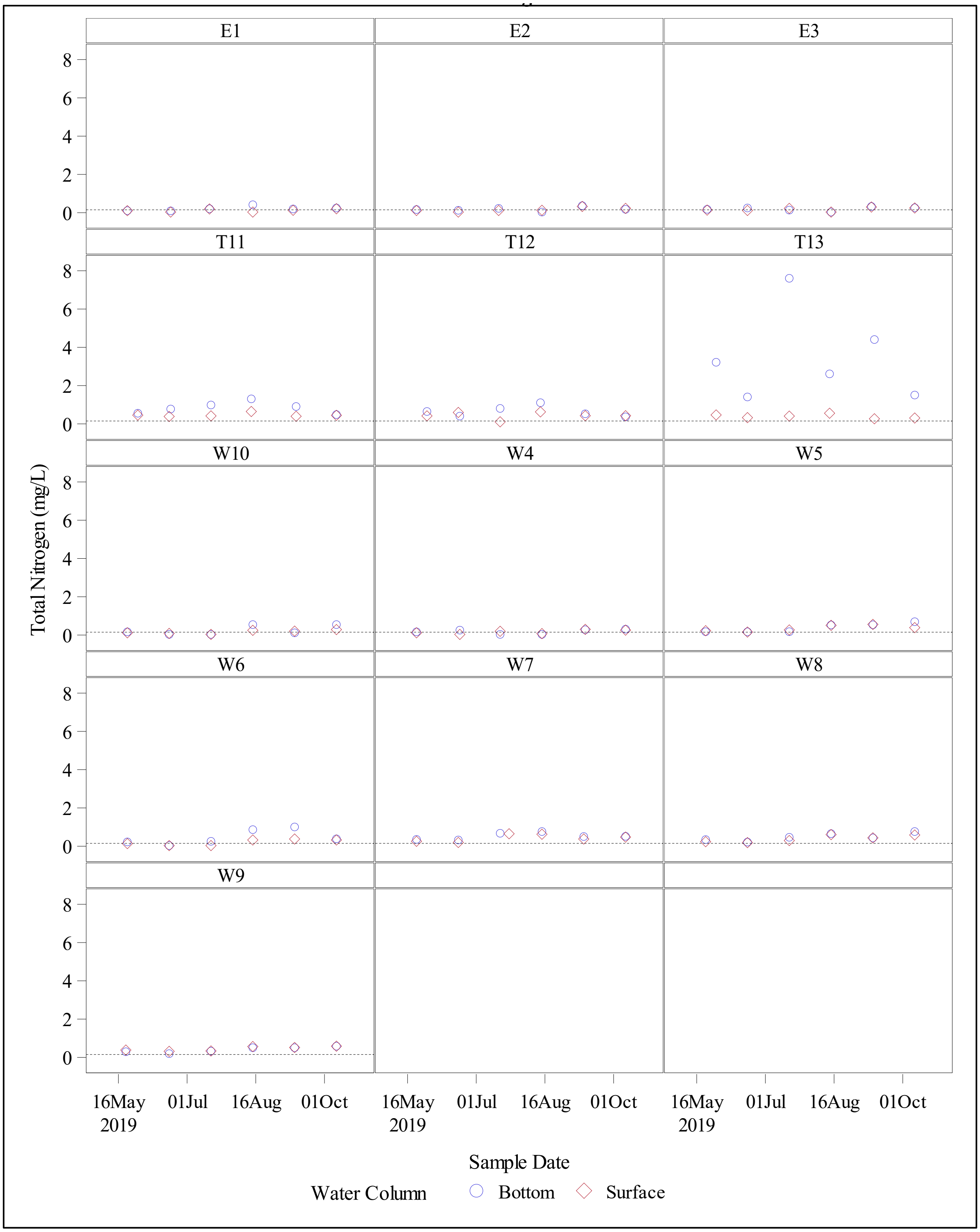

Figure 14. Total nitrogen (mg/L) concentrations in near-surface and near-bottom Tahoe Keys lagoon water samples over the 2019 sampling period (horizontal dashed lines indicate 0.15 mg/L maximum criterion).

Table 13. Total nitrogen (mg/L) summary statistics from near-surface and near-bottom Tahoe Keys lagoons samples in 2019.

Area	Station	Vertical	Sampling Period		# of Samples	Minimum	Mean	90th Percentile/ Maximum*	Standard Deviation
			Fist	Last					
Lake Tallac	T11	Surface	5/29	10/9	6	0.39	0.46	0.65	0.10
	T11	Bottom	5/29	10/9	6	0.49	0.84	1.31	0.30
	T12	Surface	5/29	10/9	6	0.11	0.43	0.63	0.19
	T12	Bottom	5/29	10/9	6	0.37	0.64	1.11	0.28
	T13	Surface	5/29	10/9	6	0.27	0.39	0.56	0.11
	T13	Bottom	5/29	10/9	6	1.41	3.46	7.61	2.32
Main Lagoon	W4	Surface	5/22	10/9	6	0.03	0.16	0.30	0.10
	W4	Bottom	5/22	10/9	6	0.03	0.18	0.31	0.12
	W5	Surface	5/22	10/9	6	0.16	0.35	0.56	0.16
	W5	Bottom	5/22	10/9	6	0.17	0.38	0.70	0.23
	W6	Surface	5/22	10/9	6	0.03	0.21	0.38	0.16
	W6	Bottom	5/22	10/9	6	0.03	0.46	1.01	0.39
	W7	Surface	5/22	10/9	6	0.20	0.43	0.65	0.19
	W7	Bottom	5/22	10/9	6	0.33	0.52	0.77	0.17
	W8	Surface	5/22	10/9	6	0.19	0.39	0.61	0.18
	W8	Bottom	5/22	10/9	6	0.22	0.48	0.77	0.20
	W9	Surface	5/21	10/9	6	0.32	0.45	0.59	0.12
	W9	Bottom	5/21	10/9	6	0.20	0.40	0.59	0.15
	W10	Surface	5/22	10/9	6	0.03	0.16	0.29	0.10
	W10	Bottom	5/22	10/9	6	0.03	0.24	0.55	0.24
Marina Lagoon	E1	Surface	5/22	10/9	6	0.03	0.12	0.21	0.08
	E1	Bottom	5/22	10/9	6	0.10	0.21	0.42	0.12
	E2	Surface	5/22	10/9	6	0.03	0.16	0.33	0.10
	E2	Bottom	5/22	10/9	6	0.03	0.18	0.37	0.11
	E3	Surface	5/23	10/9	6	0.03	0.18	0.30	0.10
	E3	Bottom	5/23	10/9	6	0.03	0.20	0.33	0.10

*90th Percentile and Maximum were equivalent due to low sample size

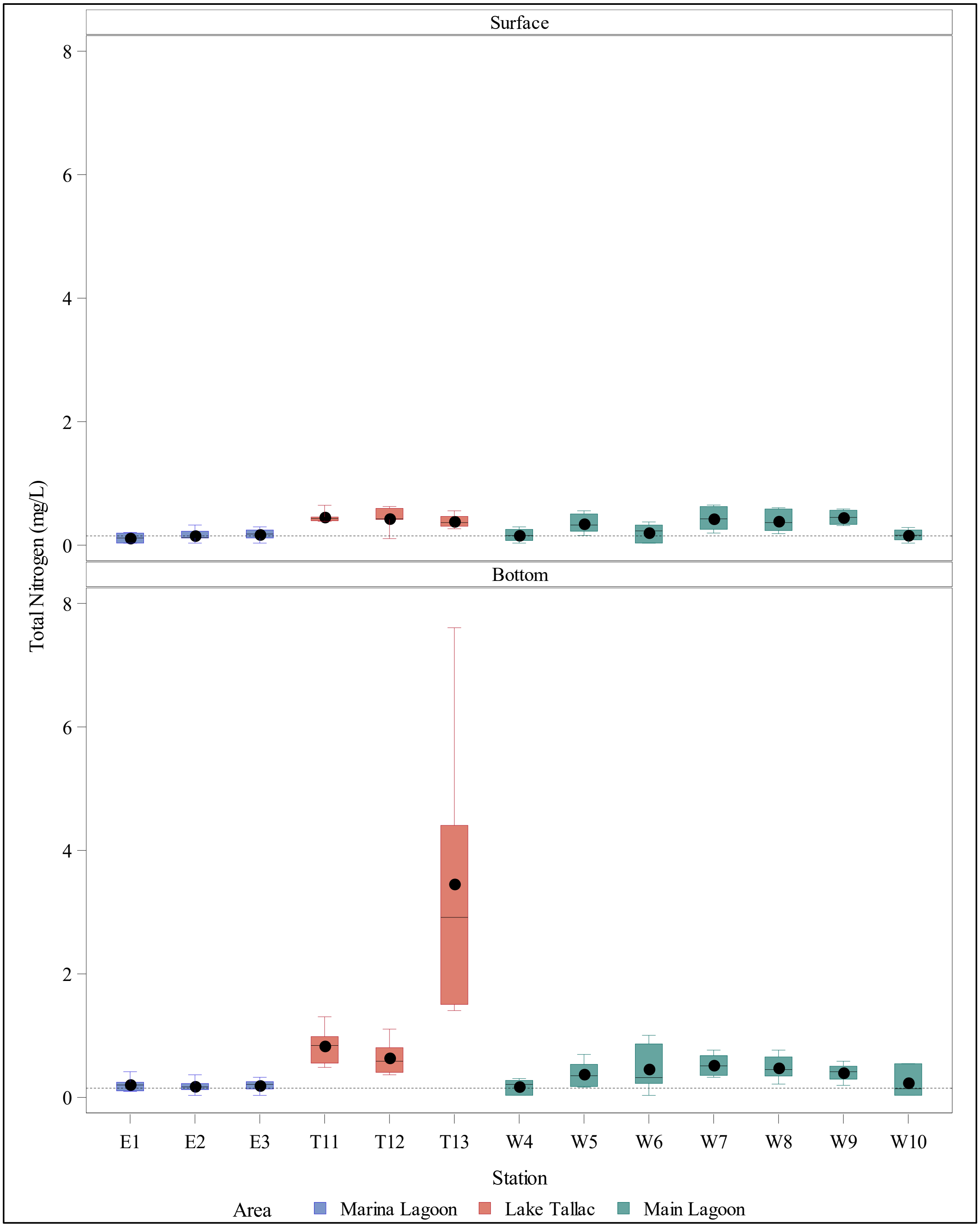

Figure 15. Total nitrogen (mg/L) box-and-whisker plots for near-surface (top) and near-bottom (maximum depth, bottom panel) sample concentrations by station (ot denotes mean, black horizontal line denotes median, and horizontal dashed line indicates 0.15 mg/L maximum criterion).

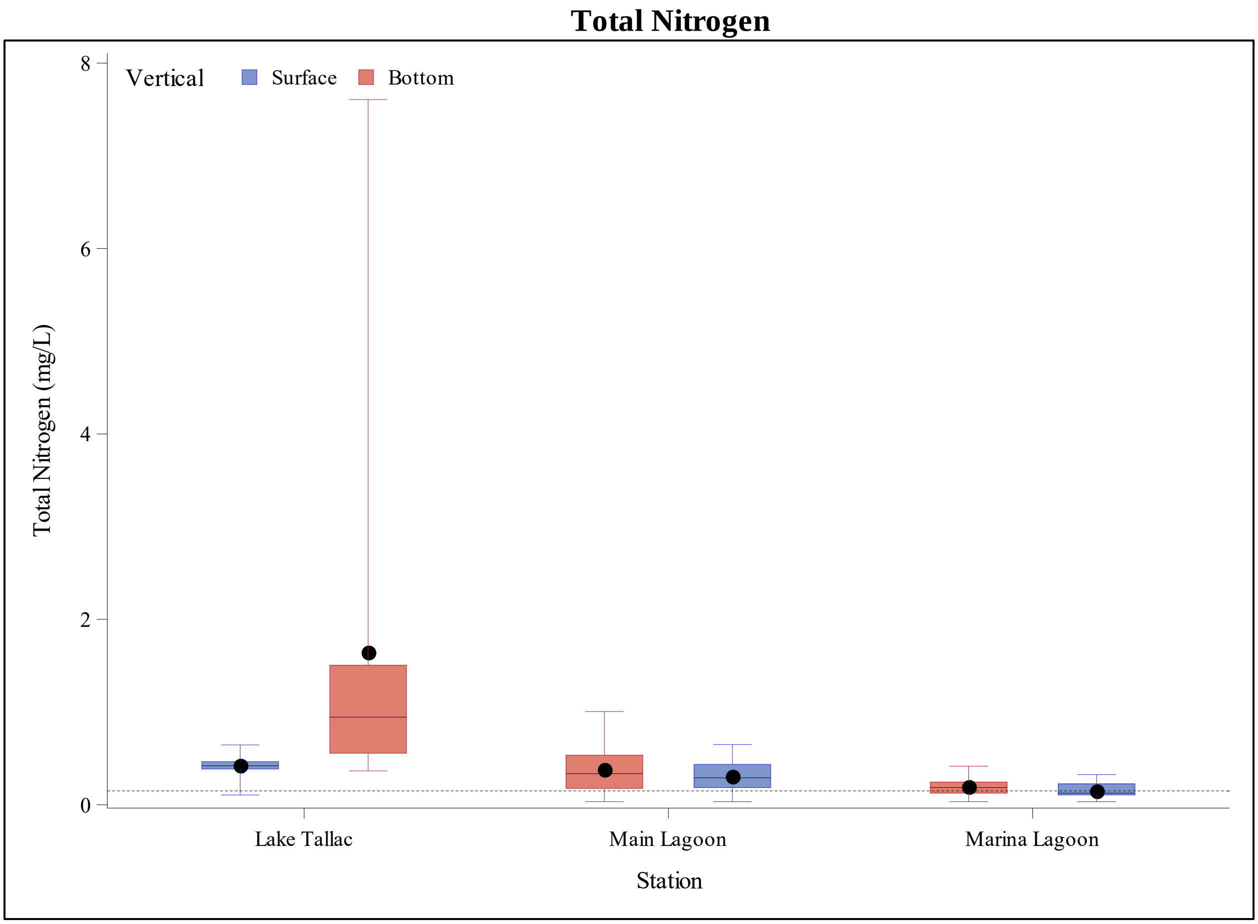

Figure 16. Total nitrogen (mg/L) box-and-whisker plots for sample concentrations by lagoon (dot denotes mean, black horizontal line denotes median, and horizontal dashed line indicates 0.15 mg/L maximum criterion).

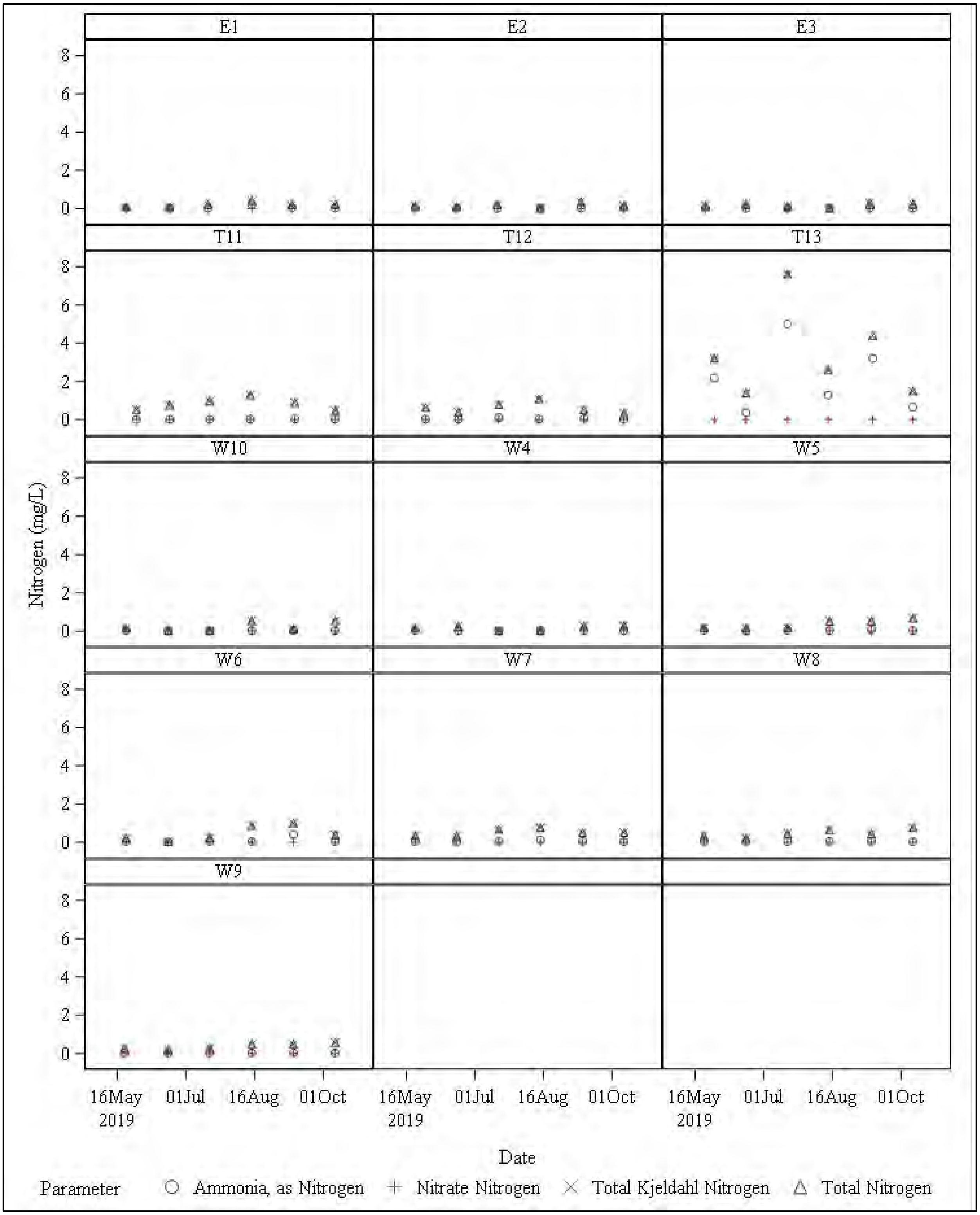

Figure 17. Concentrations of primary nitrogen forms (nitrate, ammonia, TKN; mg/L) and total nitrogen (mg/L) in near-bottom samples from the Tahoe Keys lagoons in 2019.

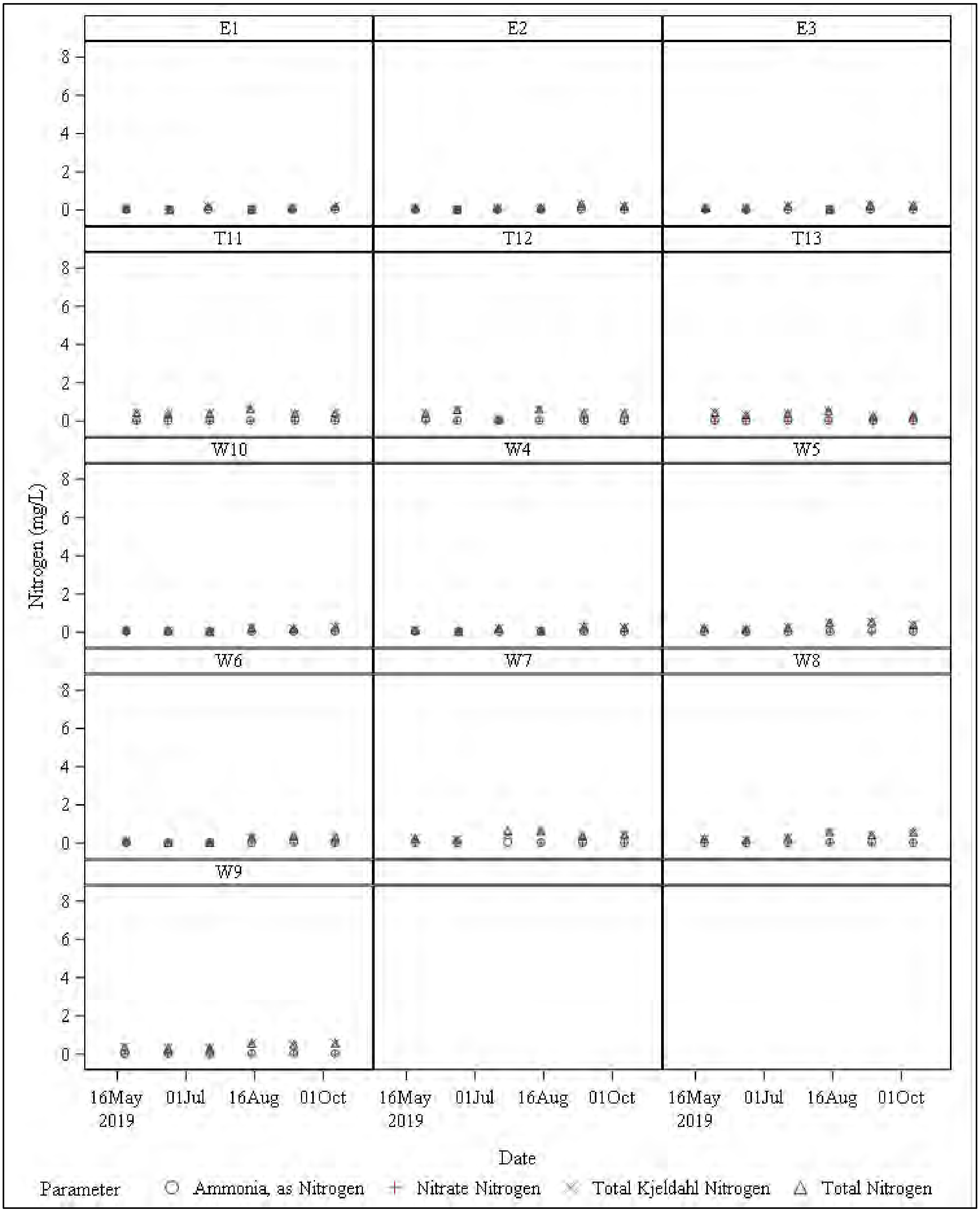

Figure 18. Concentrations of primary nitrogen forms (nitrate, ammonia, TKN; mg/L) and total nitrogen (mg/L) in near-surface samples from the Tahoe Keys lagoons in 2019.

The primary Basin Plan WQO for TP indicates that concentrations should not be above 0.008 mg/L based on an annual average or 90th percentile. For convenience, reference lines delineating this maximum TP criterion are included on the graphics. The reporting sampling period only encompasses six months; as such, the criterion was compared against the 90th percentile for near-surface and near-bottom samples. TP concentrations typically exceeded the 0.008 mg/L reference criterion at both sampling depths with the near-bottom sites reporting higher concentrations than the paired near-surface water samples (Figure 19). Due to low sample size, the 90th percentile and maximum were equivalent (Table 14). The 90th percentile TP concentrations for an individual station by vertical sampling depth were above the 0.008 mg/L criterion indicating that at least 10 percent of samples exceeded the criterion (Table 14). The lowest TP concentrations were observed in the Marina Lagoon where concentrations ranged from 0.006 U to 0.039 mg/L in the near-bottom waters and 0.006 U to 0.035 mg/L in near-surface waters with concentration remaining relatively stable through the sampling period (Table 14, Figure 20). Main Lagoon TP concentrations ranged from 0.006 U to 0.150 mg/L in near-bottom waters and 0.006 U to 0.043 mg/L in near-surface waters (Table 14 and Figure 20). The most variability and greatest TP concentrations were observed in Lake Tallac where concentrations ranged from 0.006 U to 0.290 mg/L in near-bottom waters and 0.006 U to 0.180 mg/L in near-surface waters (Table 14 and Figure 20). Elevated TP concentrations in near-bottom samples were reported at multiple locations (T11, T12, T13, W10 and W9) during the June sampling event. There were only eight detections of orthophosphate from water samples collected at the near-surface; however, near-bottom samples had approximately 25 detections up to 0.16 mg/L. Site T13 in Lake Tallac was consistently higher in orthophosphate in near-bottom samples.

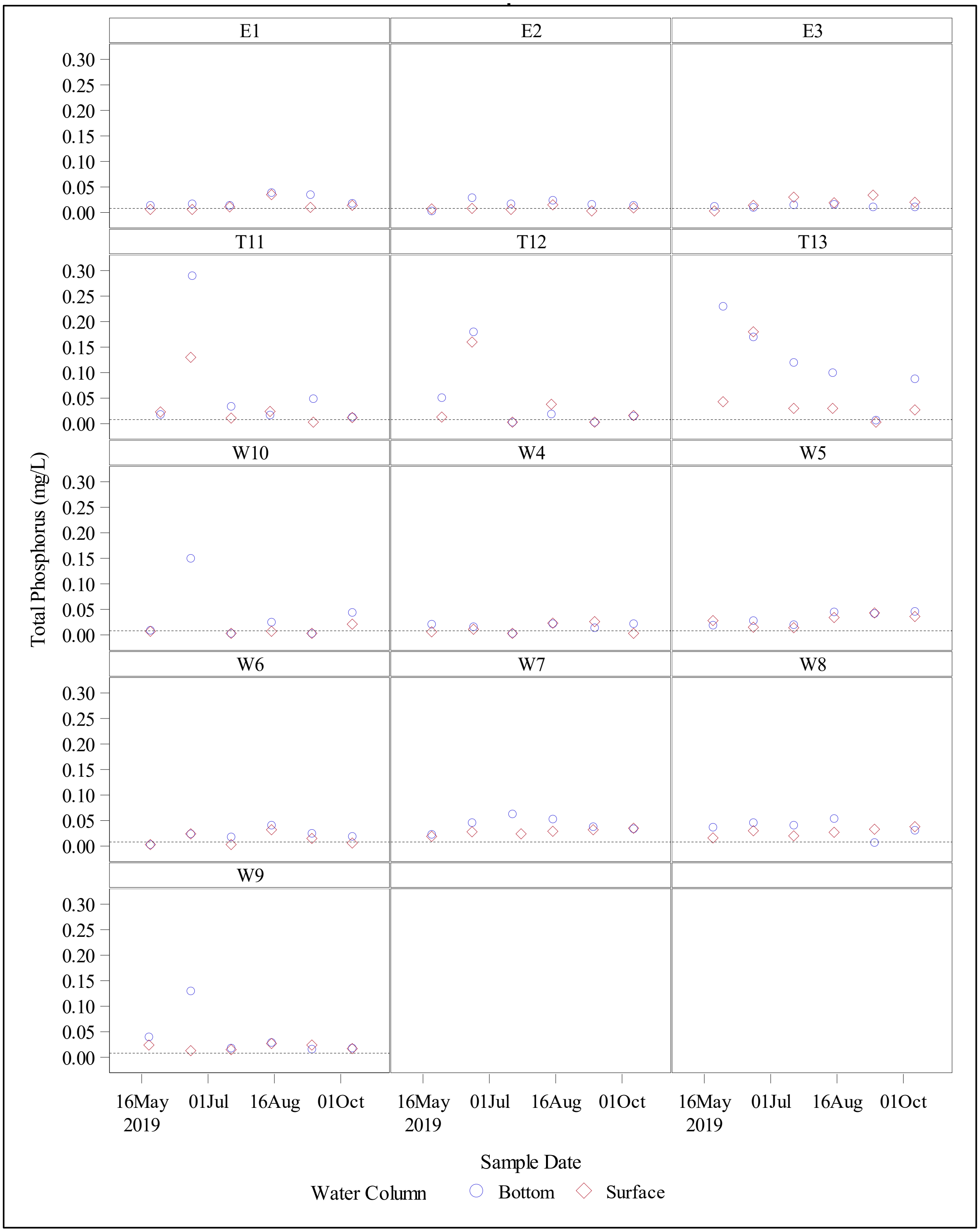

Figure 19. Total phosphorus (mg/L) concentrations in near-surface and near-bottom Tahoe Keys lagoon water samples in 2019 (horizontal dashed line indicates 0.008 mg/L maximum criterion).

Table 14. Total phosphorus (mg/L) summary statistics from near-surface and near-bottom Tahoe Keys lagoons samples in 2019.

Area	Station	Vertical	Sampling Period		# of Samples	Minimum	Mean	90th Percentile/ Maximum*	Standard Deviation
			First	Last					
Lake Tallac	T11	Surface	5/29	10/9	6	0.006 U, HTe	0.034	0.130	0.048
	T11	Bottom	5/29	10/9	6	0.013 J, B, HTe	0.070	0.290	0.109
	T12	Surface	5/29	10/9	6	0.006 U, HTe	0.039	0.160	0.061
	T12	Bottom	5/29	10/9	6	0.006 U, B, HTe	0.045	0.180	0.068
	T13	Surface	5/29	10/9	6	0.006 U, HTe	0.052	0.180	0.064
	T13	Bottom	5/29	10/9	6	0.007 J, HTe	0.119	0.230	0.076
Main Lagoon	W4	Surface	5/22	10/9	6	0.006 U, J, B, HTe	0.012	0.026	0.010
	W4	Bottom	5/22	10/9	6	0.006 U	0.016	0.022	0.007
	W5	Surface	5/22	10/9	6	0.014 J	0.028	0.043 HTe	0.012
	W5	Bottom	5/22	10/9	6	0.019 J, HTe	0.033	0.046 B, HTe	0.013
	W6	Surface	5/22	10/9	6	0.006 U, HTe	0.014	0.032	0.012
	W6	Bottom	5/22	10/9	6	0.006 U, HTe	0.022	0.041	0.012
	W7	Surface	5/22	10/9	6	0.019 J, HTe	0.028	0.035 B, HTe	0.006
	W7	Bottom	5/22	10/9	6	0.023 HTe	0.043	0.063	0.014
	W8	Surface	5/22	10/9	6	0.016 J, HTe	0.027	0.038 B, HTe	0.008
	W8	Bottom	5/22	10/9	6	0.007 J, HTe	0.036	0.054	0.016
	W9	Surface	5/22	10/9	6	0.013	0.020	0.027	0.006
	W9	Bottom	5/22	10/9	6	0.016 J, HTe	0.042	0.130	0.044
	W10	Surface	5/21	10/9	5	0.006 U, HTe	0.008	0.021 B, HTe	0.007
	W10	Bottom	5/21	10/9	6	0.006 U, HTe	0.039	0.150	0.057
Marina Lagoon	E1	Surface	5/22	10/9	6	0.006 J, B, HTe	0.014	0.035	0.011
	E1	Bottom	5/22	10/9	6	0.014 J, HTe	0.023	0.039	0.011
	E2	Surface	5/22	10/9	6	0.006 U, J, HTe	0.008	0.015 J	0.004
	E2	Bottom	5/22	10/9	6	0.006 U, HTe	0.017	0.029	0.009
	E3	Surface	5/23	10/9	6	0.006 U, HTe	0.020	0.034 HTe	0.011
	E3	Bottom	5/23	10/9	6	0.010 J	0.013	0.016 J	0.002

*90th Percentile and Maximum were equivalent due to low sample size
J=The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit
U= The analyte was analyzed, but was not detected above the level of the sample reporting/quantitation limit
B=Rinsate blank 25 percent greater than the reporting limit, sample batch results qualified as potentially bias high
HTe= Holding temperature exceeded for sample based on QAPP guidance

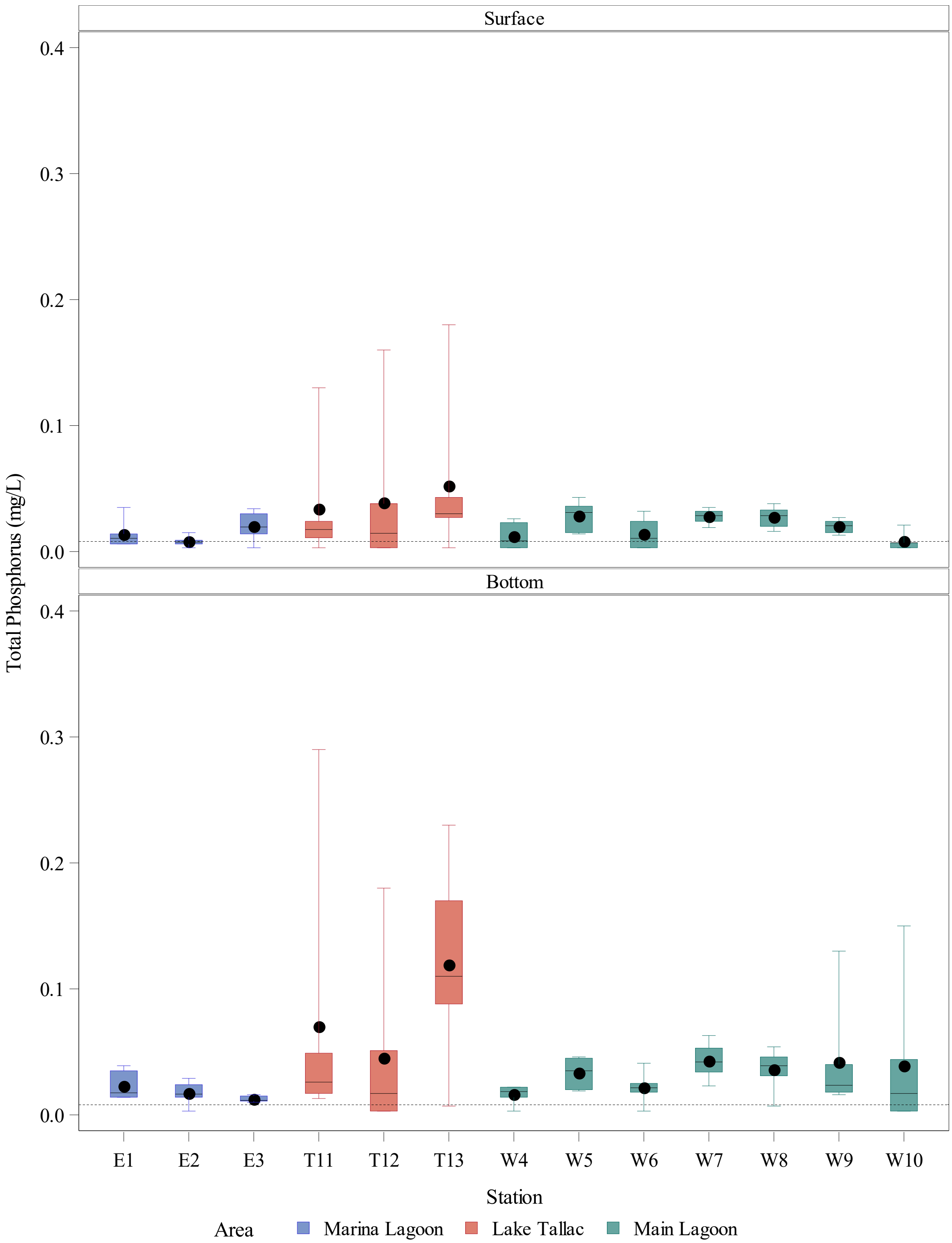

Figure 20. Total phosphorus (mg/L) box-and-whisker plots for near-surface (top) and near-bottom (maximum depth, bottom panel) sample concentrations by station (dot denotes mean, black horizontal line denotes median, horizontal dashed line indicates 0.008 mg/L maximum criterion).

4.3 Sediment Nutrients

As previously mentioned, sediment samples were collected using a petit Ponar, transferred to laboratory provided jars, placed on ice in a cooler, and provided to the laboratory for analysis consistent with the QAPP. For some samples aquatic weeds were caught in the jaws of the sampler preventing complete closure, resulting in additional water that entered the Ponar and washed out some of the sediment in the grab. This was especially problematic in samples collected at W4, E2 and E3. In those samples the water was homogenized together with the sediment, which increased the water content in the sediment and may have diluted concentrations of nutrients. These sample results were flagged “BL”.

In July, samples were analyzed for orthophosphate, total phosphorus, and TKN from nine sites (E1, E2, W4, W5, W6, W7, W10, T12, and T13). In September, three sites (E2, E3, W4) were sampled and analyzed for orthophosphate. Results for orthophosphate and TKN are reported as mg/kg wet weight and results for total phosphorus are reported as mg/kg dry weight, the latter of which were used for the nutrient loading and nutrient cycling conceptual model described in a separate technical memorandum.

Total phosphorus, reported as dry-weight concentrations, was highest at E1 at 2,096 mg/kg and lowest at W10 at 627 mg/kg. On average, TP was 1,737 mg/kg in the Marina Lagoon, 795 mg/kg in the Main Lagoon, and 690 mg/kg in Lake Tallac. Orthophosphate concentrations were at the MDL (0.2 mg/kg) for two sites sampled in July (W7 and W10) and all sites sampled in September (Table 15). The highest concentrations were detected in samples collected from E1, T12, T13, and W6, but only ranging from 0.50 to 0.56 mg/kg-wet weight. Orthophosphate results from W5 were moderate at 0.28 mg/kg wet weight. TKN concentrations were highest at E1 and E2, ranging from 760 to 820 mg/kg-wet weight. The lowest concentration was measured in the sample from T12 at 290 mg/kg. On average, TKN was 790 mg/kg in the Marina Lagoon, 572 mg/kg in the Main Lagoon, and 475 mg/kg in Lake Tallac.

Table 15. Summary of sediment nutrient sample concentrations (mg/kg) from Tahoe Keys, July and September 2019.

Area	Station	Sampling Date	Concentration
Total Phosphorus (mg/kg dry weight)			
Lake Tallac	T12	7/25	738 HTe
	T13	7/25	642 HTe
Main Lagoon	W4	7/24	682 HTe, BL
	W5	7/24	688 HTe
	W6	7/24	1,440 HTe
	W6[d]	7/24	947 HTe
	W7	7/23	789
	W10	7/24	627 HTe
Marina Lagoon	E1	7/24	2,097 HTe, M
	E2	7/24	1,377 HTe, BL
Orthophosphate (mg/kg wet weight)			
Lake Tallac	T12	7/25	0.1 HTe
	T12[d]	7/25	0.2 HTe
	T13	7/25	0.2 HTe
	T13[d]	7/25	0.5 HTe

Area	Station	Sampling Date	Concentration
Main Lagoon	W4	9/18	0.2 HTe, BL
	W4	9/18	0.2 HTe, BL
	W5	7/24	0.3 HTe
	W5[d]	7/24	0.2 HTe
	W6	7/24	0.5 HTe
	W6[d]	7/24	0.2 HTe
	W7	7/23	0.2 HTe
	W7[d]	7/23	0.2 HTe
	W10	7/24	0.2 HTe
Marina Lagoon	E1	7/24	0.6 HTe
	E1[d]	7/24	0.2 HTe
	E2	9/19	0.2 HTe, BL
	E3	9/19	0.2 HTe, BL
Total Kjeldahl Nitrogen (mg/kg wet weight)			
Lake Tallac	T12	7/25	760 HTe
	T13	7/25	820 HTe
Main Lagoon	W4	7/24	510 HTe
	W5	7/24	720 HTe
	W6	7/24	280 HTe
	W6[d]	7/24	450 HTe
	W7	7/23	720
	W10	7/24	460 HTe
Marina Lagoon	E1	7/24	760 HTe
	E2	7/24	820 HTe, BL

HTe = Qualifier indicating holding temperature of 6°C was exceeded.
M = Qualifier indicating the matrix spike/matrix spike duplicate (MS/MSD) values for the analysis of this parameter were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.
BL = Qualifier indicating sample result may be biased low from sediment samples diluted with site water.
[d] Duplicate sample

5 Sediment Elutriate Aluminum

5.1 Hardness and Dissolved Organic Carbon in Overlying Water

In July, the overlying site water was sampled for analysis of hardness and dissolved organic carbon (DOC), and pH was measured with a sonde near the sediment surface monthly for six months, to allow the calculation of site-specific water quality criteria for aluminum. Table 16 provides the DOC and total hardness results as well as the pH range for each sampling site.

Table 16. Dissolved organic carbon (DOC, mg/L), total hardness (mg/L as $CaCO_3$), and minimum and maximum pH measurements from near the sediment surface in the Tahoe Keys lagoons in 2019.

Area	Station	DOC	Total Hardness	pH Range	
Marina Lagoon	E1	1.6 HTe	32 HTe	7.1	8.8
	E2	1.8 HTe	29 HTe	6.7	8.9
	E3	1.6	31	6.7	7.4
Main Lagoon	W4	1.8 HTe	30 HTe	7.2	9.2
	W5	3.1 HTe	37 HTe	6.7	9.2
	W6	2.1 HTe	39 HTe	7.6	8.3
	W7	3.2	47	6.6	7.6
	W8	3.2	43	7.1	9.5

HTe= Holding temperature exceeded for sample based on QAPP guidance

5.2 Elutriate Concentrations of Total Recoverable Aluminum

Samples of sediment and overlying water were collected at three stations in the Marina Lagoon and five stations in the Main Lagoon for elutriate tests of total recoverable aluminum (Table 17, Figure 2). The elutriate test is used to replicate conditions that could occur in the water column during dredging or other sediment disturbance activities. Results from pH measurements and analysis of overlying water samples were used to calculate site-specific acute criterion maximum concentrations (CMC) and chronic criterion continuous concentrations (CCC) for aluminum, for comparisons to the elutriate sample concentrations (Table 17). Because aluminum toxicity increases with higher and lower pH as you move away from neutral pH, criteria were calculated for both the maximum pH and minimum pH measured at the deepest depth at each station during monthly profile measurements.

Using the maximum pH measurements, elutriate samples exceeded both chronic and acute criteria for total recoverable aluminum in samples from one of the three Marina Lagoon stations and three of the five Main Lagoon stations. Using the minimum pH measurements, elutriate samples exceeded both chronic and acute criteria in samples from two of three Marina Lagoon stations and three of five Main Lagoon stations. The chronic criterion was also exceeded at one additional Marina Lagoon station using the minimum pH measurement. By far the highest elutriate aluminum concentration was 12,000 µg/L at E3 toward the back of the Marina Lagoon. Stations where the aluminum elutriate concentrations were below all calculated site-specific criteria were W7 and W8, toward the southwest corner of the Main Lagoon (Figure 2).

Table 17. Aluminum elutriate sample results collected from the Tahoe Keys lagoons compared to calculated site-specific acute and chronic water quality criteria for the protection of aquatic life.

Based on Maximum pH Measurement Above Sediment Surface				
Area	**Site**	**Acute CMC (µg/L)**	**Chronic CCC (µg/L)**	**Sample (µg/L)[1]**
Marina Lagoon	E1*	1,600	1,000	880
	E2*	1,700	1,000	930 HTe, BL
	E3**	1,300	590	12,000 BL
Main Lagoon	W4*	1,400	850	1,900 HTe, BL
	W5*	1,700	1,100	2,500 HTe
	W6*	2,400	1,500	4,000 HTe
	W7	2,100	810	430
	W8*	1,200	760	640
Based on Minimum pH Measurement Above Sediment Surface				
Area	**Site**	**Acute CMC (µg/L)**	**Chronic CCC (µg/L)**	**Sample (µg/L)[1]**
Marina Lagoon	E1	950	410	880
	E2	620	280	930 HTe, BL
	E3**	610	270	12,000 BL
Main Lagoon	W4	1,100	490	1,900 HTe, BL
	W5	910	370	2,500 HTe
	W6	1,700	760	4,000 HTe
	W7	890	360	430
	W8	1,400	520	640

*Criteria for this station were calculated with a pH value that is outside the range for model inputs
**A duplicate sample was collected at this site and the maximum of the two aluminum results was used here
[1]Red = sample value exceeds acute and chronic criteria
Orange = sample value exceeds chronic criterion only
BL = Qualifier indicating sample result may be biased low from sediment samples diluted with site water.
HTe= Holding temperature exceeded for sample based on QAPP guidance

6 Other Chemical Characteristics

6.1 Dissolved Oxygen

To evaluate current conditions, the dissolved oxygen (DO) concentrations of the three lagoons (Lake Tallac, Main Lagoon and Marina Lagoon) were documented using both vertical profiles measured with a YSI MS5 multi-parameter sonde, and continuously recording Onset U26 DO data loggers. There are multiple WQOs specific for DO which are either concentrations (mg/L) or percent saturation. Sample data were compared to the applicable WQO. Vertical profiles were collected in both the morning (AM) and afternoon (PM) at each monitoring station at 1-foot intervals (Figures 21 and 22). Basin Plan WQOs state that dissolved oxygen (DO) should not be depressed below 8.0 mg/L, and also maintain a minimum concentration of 9.5 mg/L as a 7-day average. For comparisons, reference lines delineating the minimum DO criteria were included on the graphs of sample data.

The vertical profiles were consistent with expected DO trends with depth within biologically productive lakes. Higher DO concentrations were observed within near-surface waters in which primary productivity (i.e., photosynthesis) is occurring, whereas lower DO concentrations were measured in the deeper, lower productivity waters where darkness limits photosynthesis and respiration is dominant. Most of the stations also had an elevated zone of DO likely associated with aquatic vegetation. The majority of the Marina Lagoon profiles (<10 feet in water depth) met the minimum DO criterion (8.0 mg/L), as defined by the WQO, in both the morning and afternoon through most of the water column. DO concentrations were generally below 8.0 mg/L at water depths below 10 feet. In the Marina Lagoon, DO concentrations were notably lower throughout the water column in September. There was more variability in the range of DO concentrations both between stations and between sampling events within Lake Tallac and the Main Lagoon. In Lake Tallac, DO concentrations were relatively stable in water depths shallower than about 5 feet during each monitoring event; however, DO declined in water depths greater than 5 feet at all three stations. DO was less than 8.0 mg/L at all depths at two of the Lake Tallac stations during all months except June and July. In the Main Lagoon, water depths were variable between sites yet there was still a distinct decline in DO at generally 10 to 15 feet water depth. All Main Lagoon stations except W9 had DO concentrations below 8.0 mg/L at all depths during September.

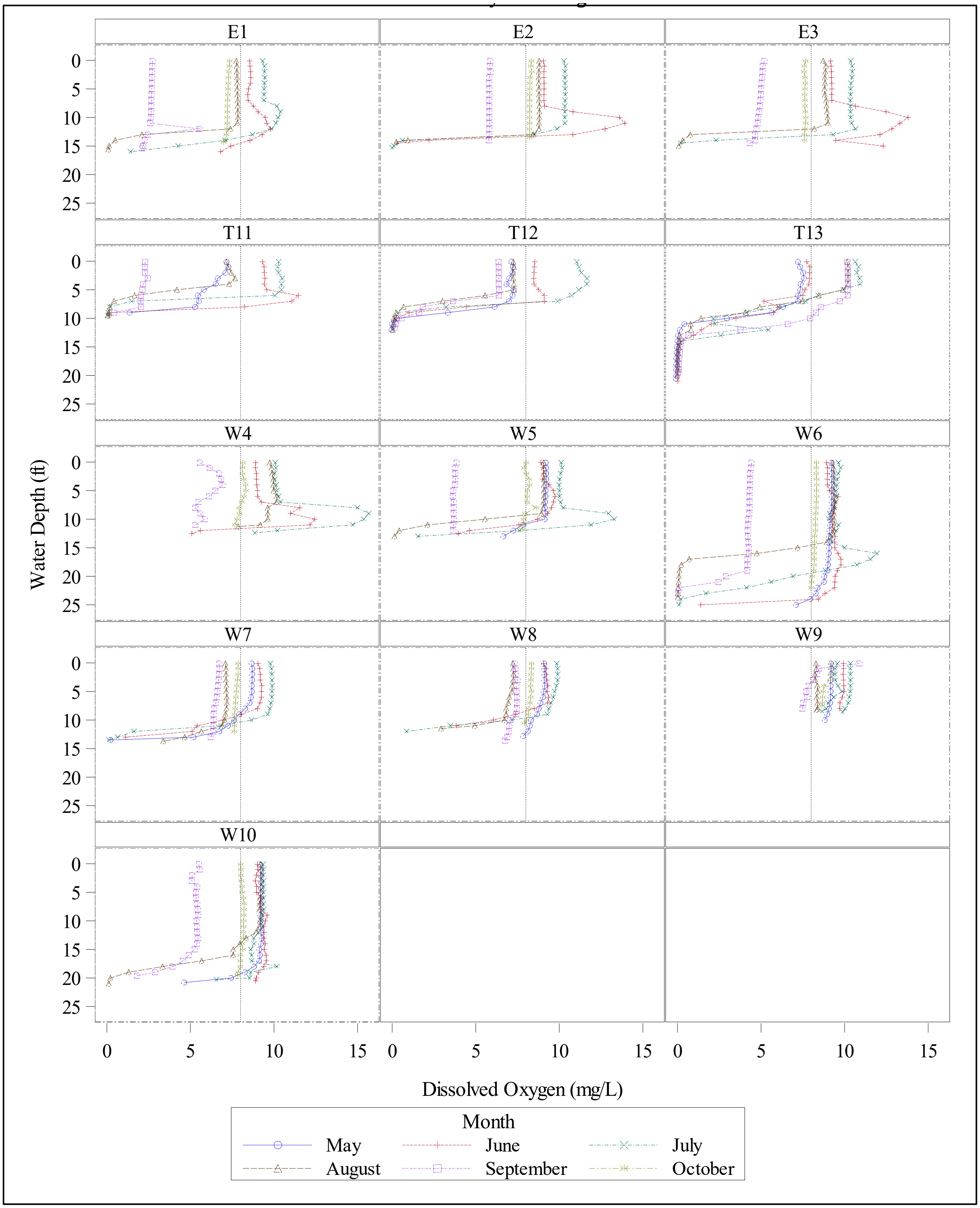

Figure 21. Vertical morning DO (mg/L) profile measurements in the Tahoe Keys lagoons from May to October 2019 (vertical dashed lines indicate the 8.0 mg/L minimum criterion).

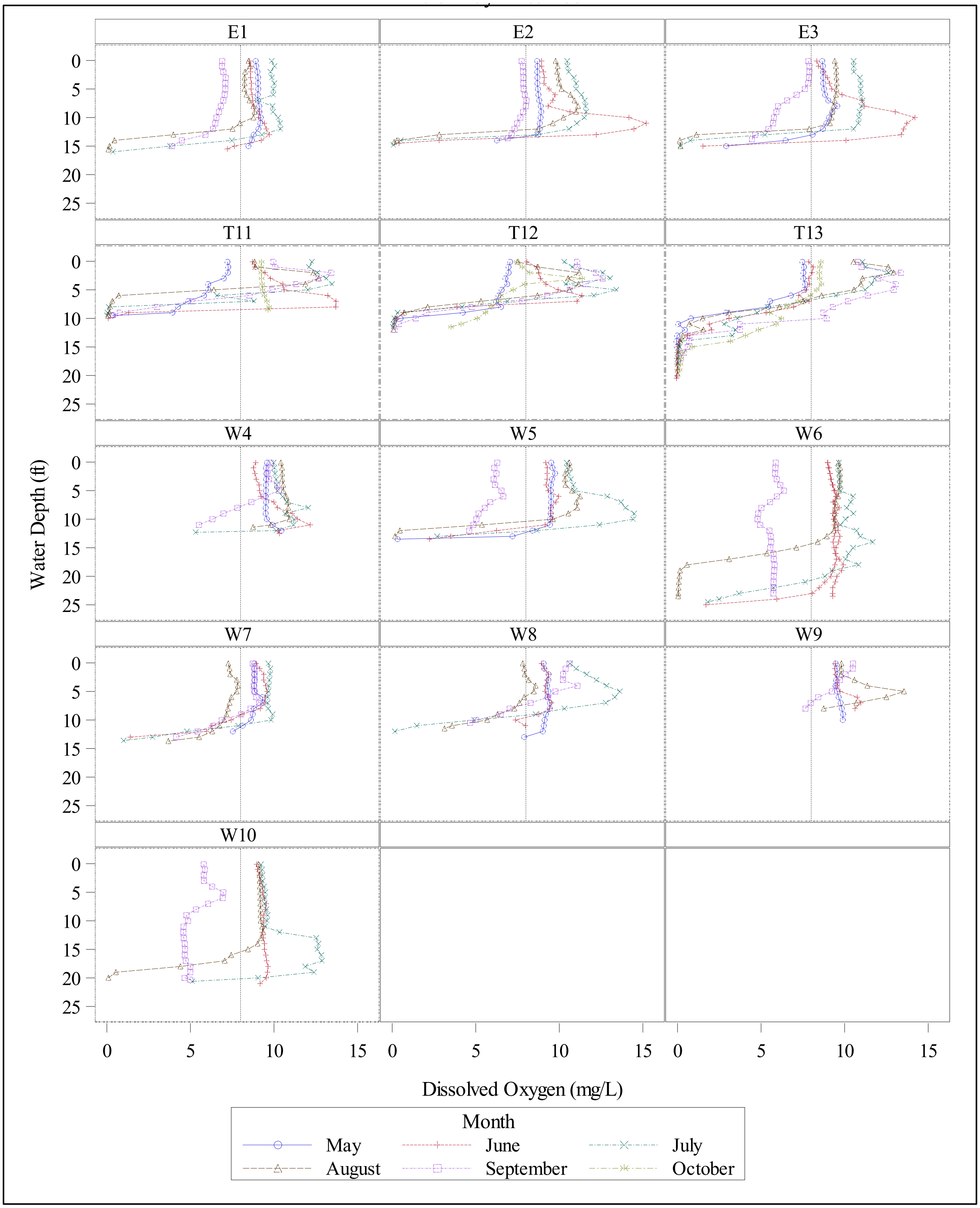

Figure 22. Vertical afternoon DO (mg/L) profile measurements in the Tahoe Keys lagoons from May to October 2019 (vertical dashed lines indicate the 8.0 mg/L minimum criterion).

Onset U26 dissolved oxygen data loggers were deployed at two fixed locations (near-surface and near-bottom) recording data at 15-minute intervals in concentration (mg/L) and percent saturation. The deployment periods for each monitoring station are provided in Table 5. DO concentrations were adjusted for barometric pressure consistent with the manufacturer's procedure. Monthly summary statistics for each location by sampling depth are provided by lagoon in Tables 18 to 20. Minimum and maximum values are provided, but due to the inherent variability in continuous data, the 10th and 90th percentiles are recommended to reduce the influence of anomalous measurements in characterizing DO conditions. In general, DO concentrations were greater in the near-surface waters compared to the paired near-bottom depths (Figures 23 and 24). Extended periods of low, hypoxic (<2.0 mg/L) conditions (period at which insufficient oxygen is available to sustain some biological functions) were observed in the near-bottom waters at many sites (E2, T11, T12, W10, W5 and W6). Daily fluctuations were evident. Elevated saturation (generally >9 mg/L during the warmer months and >11 mg/L at the end of the monitoring season) was apparent in the near-surface waters at stations T11, T12 and W5. As would be expected, diel fluctuations were documented at all locations due to decomposition and respiration of the biota. In addition to the daily minimum WQO criterion (8.0 mg/L), the WQOs include a minimum 7-day average criterion of 9.5 mg/L. The 7-day moving average DO concentrations at the near-surface locations fluctuated around the 9.5 mg/L criterion at all locations (Figure 25). None of the stations maintained 7-day moving average DO concentrations consistently above the criterion. The 7-day average measurements from near-bottom recorders were frequently below 9.5 mg/L, at most locations depressed to anoxic conditions with periodic increases in DO.

Continuous DO saturation was also collected in 15-minute intervals and compared to the WQO that states DO shall not be less than 80 percent saturation (Figure 26). Tables 21 to 23 provide the monthly summary statistics by lagoon for each location by sampling depth. Similar to concentration measurements, minimum and maximum percent saturation values are provided, but due to the inherent variability in continuous data, the 10th and 90th percentiles are recommended to reduce the influence of anomalous measurements in characterizing DO conditions. Observed trends were similar to those reported for DO concentrations where near-surface values were higher than near-bottom concentrations (Figure 27). Super-saturation (>100 percent) values were reported at many sites indicating photosynthetic oxygen production. Mean monthly near-surface DO saturation was consistently above 80 percent at all sites, and peak saturation was observed in July and August. In contrast, near-bottom DO saturation levels were depressed below 80 percent, likely due to decomposition and respiration consuming oxygen and a lack of light to produce oxygen from photosynthesis.

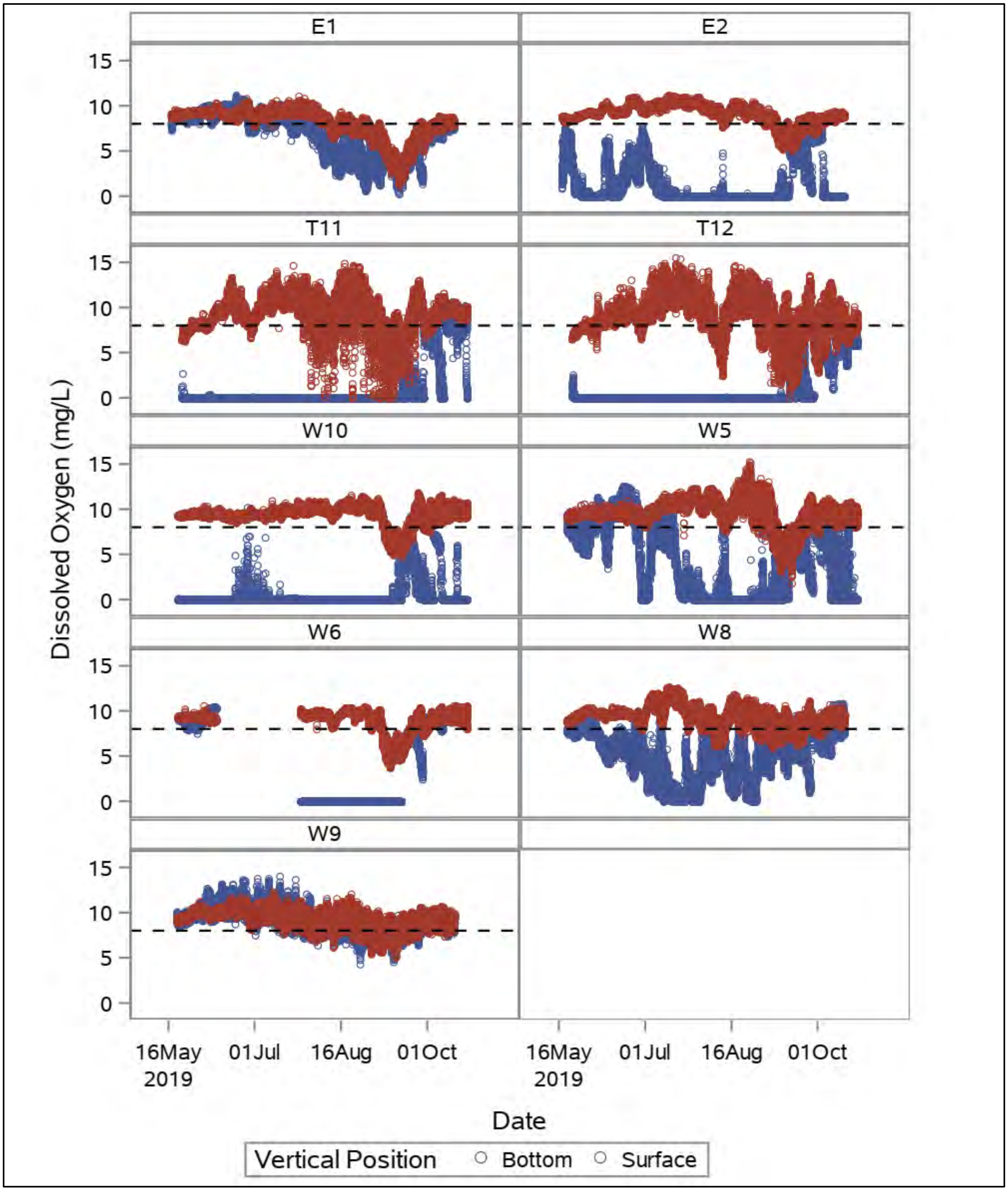

Figure 23. Continuous 15-minute water DO (mg/L) measurements for the near-surface and near-bottom water depths in Tahoe Keys lagoons in 2019 (horizontal black dashed lines indicate minimum [8.0 mg/L] criterion).

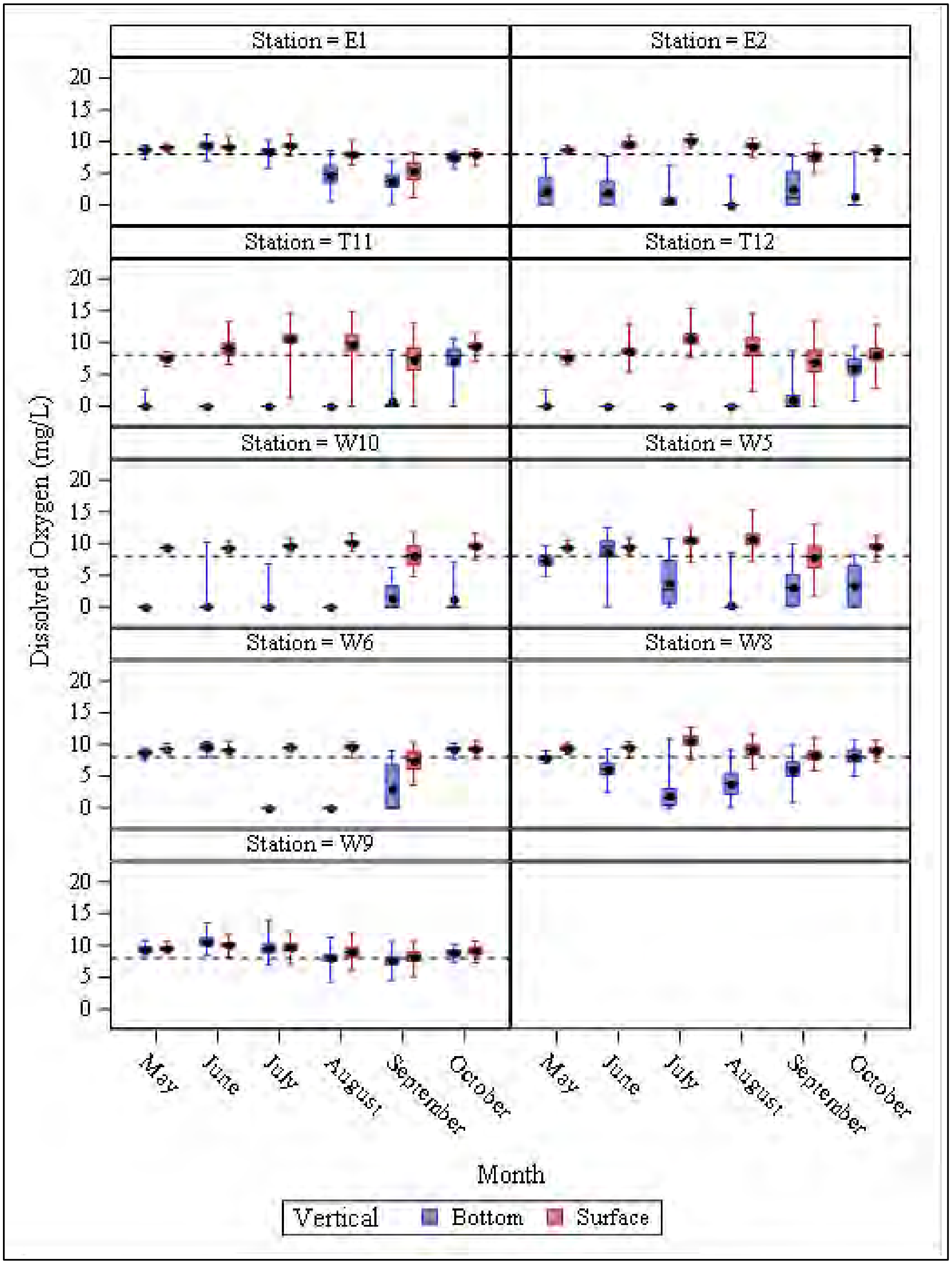

Figure 24. Continuous 15-minute DO (mg/L) measurements monthly box-and-whisker plots for near-surface and near-bottom depths in Tahoe Keys lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal black dashed lines show the minimum criterion [8.0 mg/L]).

Table 18. Monthly DO (mg/L) concentration summary statistics from continuous 15-minute data in Lake Tallac in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
T11	Bottom	May	820	0.0	0.0	0.0	0.0	2.6	0.1
		June	2,876	0.0	0.0	0.0	0.0	0.3	0.0
		July	2,970	0.0	0.0	0.0	0.0	0.0	0.0
		August	2,971	0.0	0.0	0.0	0.0	0.0	0.0
		September	2,876	0.0	0.0	0.9	3.1	8.8	1.9
		October	2,071	0.0	1.7	7.1	9.7	10.6	2.8
	Surface	May	822	6.2	6.8	7.5	8.0	8.5	0.5
		June	2,878	6.6	7.8	9.2	10.7	13.3	1.2
		July	2,973	1.3	9.3	10.6	11.8	14.6	1.1
		August	2,975	0.0	6.9	9.7	12.5	14.9	2.3
		September	2,877	0.0	3.5	7.3	10.4	13.0	2.6
		October	2,073	7.0	8.4	9.4	10.4	11.5	0.8
T12	Bottom	May	823	0.0	0.0	0.1	0.0	2.6	0.3
		June	2,878	0.0	0.0	0.0	0.0	0.0	0.0
		July	2,973	0.0	0.0	0.0	0.0	0.0	0.0
		August	2,975	0.0	0.0	0.0	0.0	0.1	0.0
		September	2,877	0.0	0.0	1.0	3.3	8.7	1.8
		October	2,072	0.9	3.3	6.0	7.8	9.3	1.7
	Surface	May	825	6.4	7.0	7.6	8.0	8.7	0.4
		June	2,879	5.3	7.9	8.7	9.6	13.0	0.8
		July	2,974	7.6	9.2	10.7	12.8	15.5	1.3
		August	2,975	2.4	6.4	9.3	12.4	14.6	2.2
		September	2,878	0.0	3.3	6.9	10.1	13.5	2.5
		October	2,073	2.8	6.4	8.1	10.4	12.7	1.6

Table 19. Monthly DO (mg/L) concentration summary statistics from continuous 15-minute data in the Main Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
W5	Bottom	May	1,086	4.9	5.9	7.3	8.7	9.7	1.1
		June	2,877	0.0	4.4	8.7	11.1	12.5	2.8
		July	2,968	0.0	0.0	3.9	8.7	10.8	3.4
		August	2,973	0.0	0.0	0.3	0.5	8.5	1.0
		September	2,878	0.0	0.0	3.1	6.6	9.9	2.6
		October	2,075	0.0	0.0	3.4	7.6	8.3	3.1
	Surface	May	1,089	8.7	9.1	9.4	9.6	10.5	0.2
		June	2,878	8.3	9.1	9.4	9.8	10.9	0.3
		July	2,974	7.0	9.4	10.5	11.4	12.3	0.8
		August	2,974	7.2	9.1	10.7	12.2	15.3	1.3
		September	2,878	1.8	5.2	7.9	10.6	13.0	2.1
		October	2,075	7.2	8.7	9.5	10.3	11.2	0.6
W6	Bottom	May	1,010	7.4	8.3	8.7	9.2	9.5	0.3
		June	918	8.0	8.8	9.6	10.3	10.4	0.5
		July	613	0.0	0.0	0.0	0.0	0.0	0.0
		August	2,971	0.0	0.0	0.0	0.0	0.0	0.0
		September	2,878	0.0	0.0	3.0	7.9	9.0	3.5
		October	2,081	7.7	8.7	9.2	9.7	10.2	0.4
	Surface	May	1,010	9.0	9.2	9.3	9.4	10.2	0.1
		June	918	8.7	8.8	9.1	9.4	10.5	0.2
		July	614	9.1	9.3	9.5	9.8	10.1	0.2
		August	2,976	8.0	8.8	9.6	10.0	10.4	0.4
		September	2,880	3.6	5.1	7.4	9.5	10.3	1.6
		October	2,080	7.7	8.7	9.3	9.9	10.6	0.5
W8	Bottom	May	1,095	7.0	7.4	7.9	8.4	9.0	0.4
		June	2,876	2.6	4.6	6.2	7.8	9.3	1.2
		July	2,971	0.0	0.0	2.0	4.5	10.9	1.8
		August	2,972	0.0	0.8	3.8	6.6	9.1	2.1
		September	2,876	0.9	3.7	6.1	8.3	10.0	1.7
		October	1,398	5.0	6.2	8.1	9.6	10.8	1.3
	Surface	May	1,096	8.4	8.8	9.4	10.0	10.3	0.4
		June	2,879	7.9	9.0	9.5	9.9	10.4	0.4
		July	2,973	7.7	9.3	10.6	11.8	12.7	0.9
		August	2,974	6.1	7.5	9.2	10.6	11.7	1.2

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
		September	2,879	5.9	7.1	8.3	9.5	11.1	0.9
		October	1,400	7.2	8.3	9.1	9.8	10.6	0.6
W9	Bottom	May	1,092	8.6	8.8	9.4	10.0	10.7	0.5
		June	2,878	8.5	9.4	10.5	11.7	13.6	0.9
		July	2,972	6.9	8.3	9.6	11.1	13.9	1.1
		August	2,970	4.2	7.1	8.0	8.9	11.3	0.7
		September	2,877	4.5	6.6	7.6	8.7	10.5	0.9
		October	1,405	7.4	8.1	8.9	9.5	10.2	0.5
	Surface	May	1,093	8.9	9.1	9.5	10.0	10.6	0.4
		June	2,877	8.1	9.5	10.1	10.8	11.7	0.5
		July	2,971	7.1	8.7	9.7	10.7	12.3	0.8
		August	2,974	6.1	7.7	9.0	10.3	12.0	1.0
		September	2,878	5.0	6.9	8.2	9.4	10.5	1.0
		October	1,404	7.3	8.2	9.2	10.1	10.7	0.7
W10	Bottom	May	1,010	0.0	0.0	0.0	0.0	0.1	0.0
		June	2,876	0.0	0.0	0.1	0.0	10.2	0.6
		July	2,970	0.0	0.0	0.0	0.0	6.8	0.3
		August	2,969	0.0	0.0	0.0	0.0	0.0	0.0
		September	2,873	0.0	0.0	1.5	4.9	6.2	2.0
		October	2,078	0.0	0.0	1.3	6.5	7.2	2.5
	Surface	May	1,011	9.1	9.2	9.3	9.5	9.8	0.1
		June	2,879	8.5	8.9	9.3	9.6	10.3	0.3
		July	2,972	8.7	9.2	9.6	10.0	10.9	0.3
		August	2,973	8.7	9.5	10.1	10.6	11.5	0.4
		September	2,878	4.8	5.9	8.1	10.2	11.8	1.6
		October	2,082	7.4	8.9	9.6	10.5	11.5	0.7

Table 20. Monthly DO (mg/L) concentration summary statistics from continuous 15-minute data from the Main Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
E1	Bottom	May	1,376	7.2	8.4	8.7	9.1	9.4	0.3
		June	2,879	6.9	8.0	9.3	10.3	11.1	0.8
		July	2,973	5.8	7.6	8.5	9.2	10.2	0.6
		August	2,970	0.5	2.6	4.8	6.8	8.6	1.6
		September	2,878	0.2	2.2	3.8	5.6	7.0	1.2
		October	1,391	5.9	6.6	7.5	8.2	8.5	0.6
	Surface	May	1,376	8.6	8.8	9.0	9.3	9.6	0.2
		June	2,879	8.0	8.8	9.2	9.6	10.7	0.3
		July	2,972	7.8	8.9	9.4	9.8	11.0	0.4
		August	2,974	6.3	7.2	8.0	8.8	10.2	0.6
		September	2,878	1.2	3.1	5.3	7.3	8.2	1.6
		October	1,390	6.2	7.2	7.9	8.5	8.8	0.5
E2	Bottom	May	1,370	0.0	0.0	2.3	5.7	7.4	2.3
		June	2,877	0.0	0.0	2.0	5.0	7.7	2.0
		July	2,967	0.0	0.0	0.8	2.8	6.2	1.4
		August	2,971	0.0	0.0	0.0	0.0	4.8	0.2
		September	2,874	0.0	0.0	2.5	6.5	7.7	2.7
		October	1,386	0.0	0.0	1.4	7.2	8.4	2.8
	Surface	May	1,369	8.2	8.4	8.7	9.1	9.3	0.3
		June	2,879	8.8	9.0	9.6	10.3	10.9	0.5
		July	2,973	9.0	9.6	10.1	10.6	11.1	0.4
		August	2,973	7.6	8.6	9.3	10.0	10.5	0.5
		September	2,877	5.0	6.2	7.6	8.7	9.7	0.9
		October	1,388	7.0	8.2	8.6	9.0	9.4	0.4

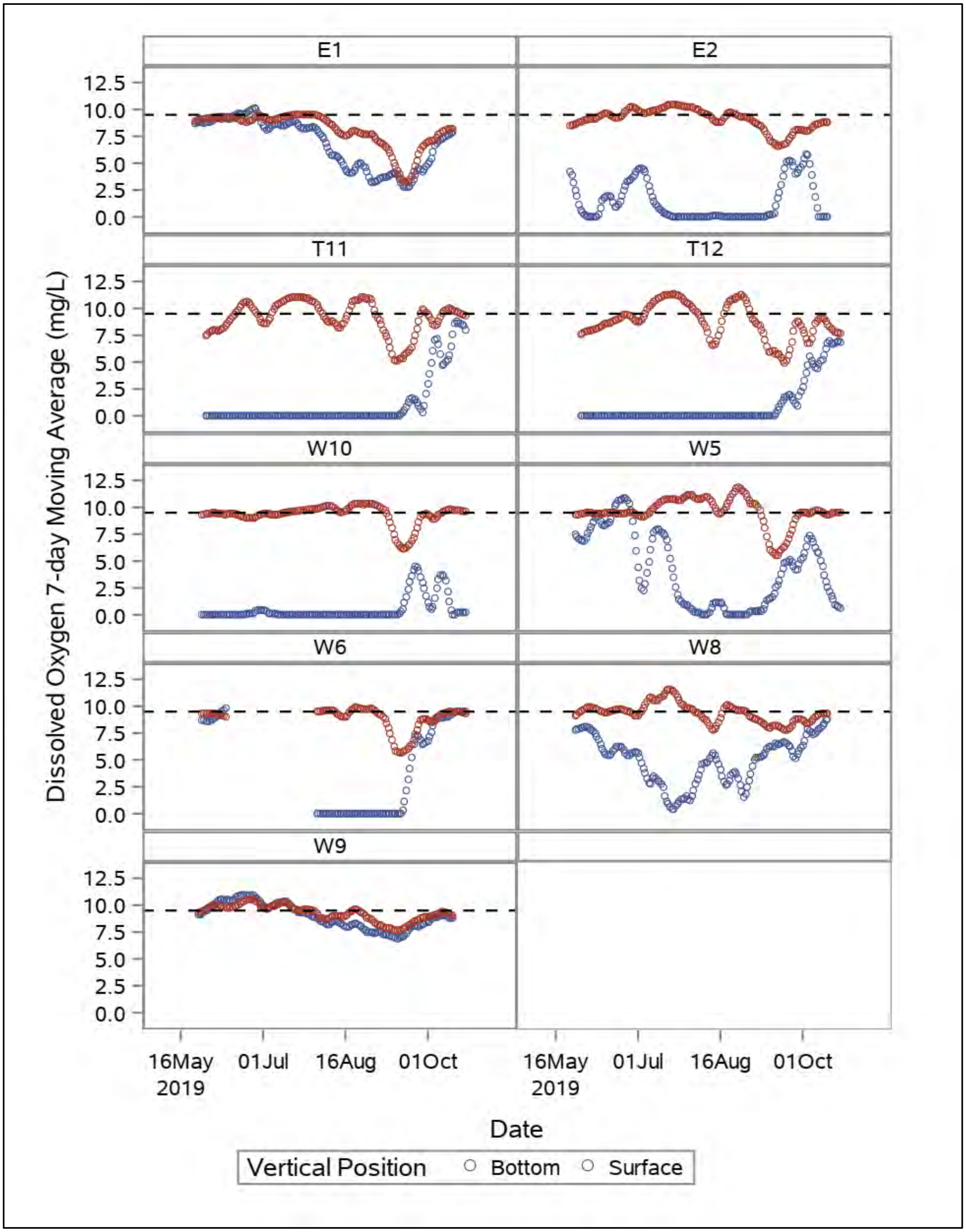

Figure 25. Seven-day moving average DO (mg/L) measurements calculated from continuous 15-minute readings for near-surface and near-bottom water depths in the Tahoe Keys lagoons in 2019 (horizontal black dashed lines indicate the seven-day mean minimum criterion [9.5 mg/L]).

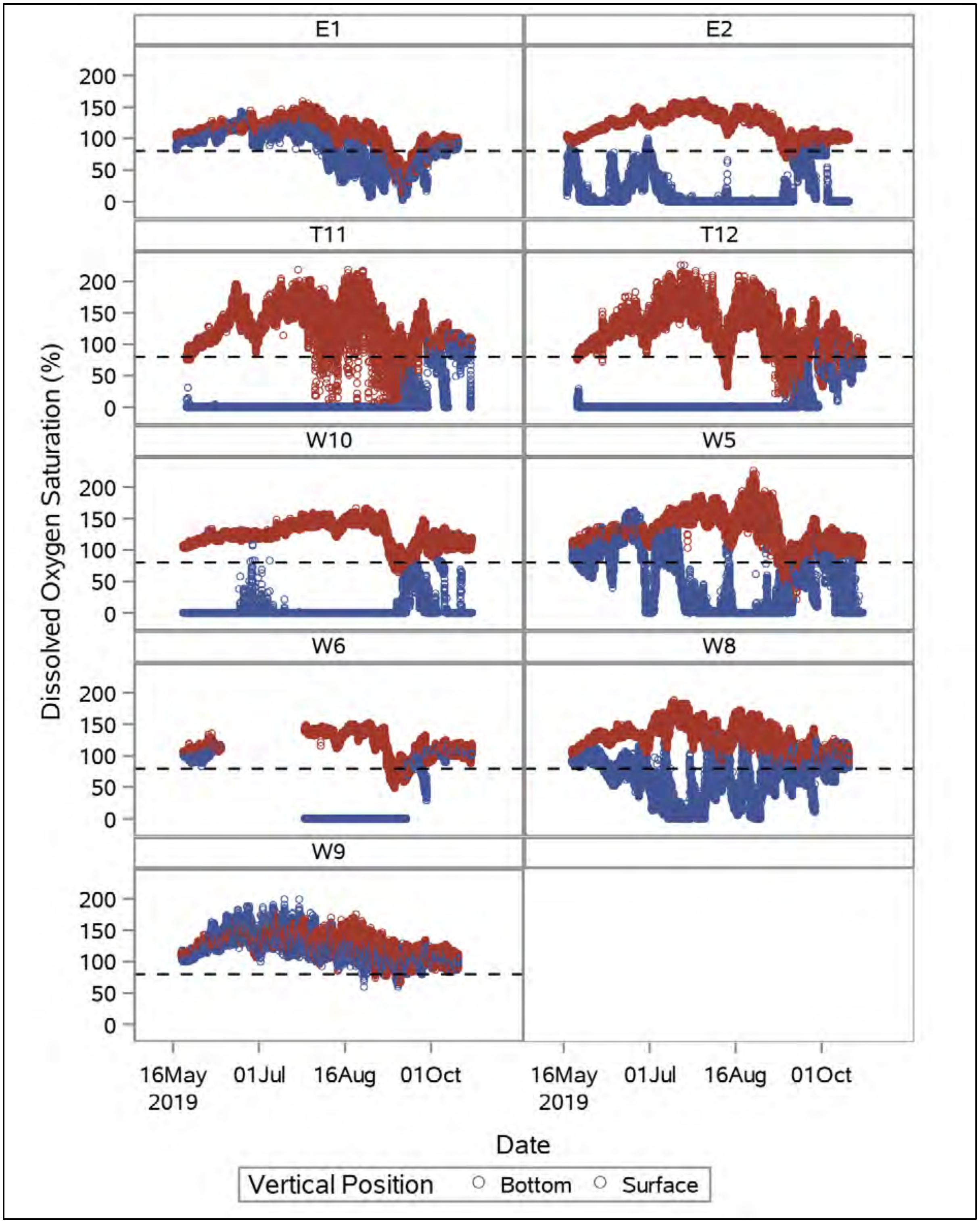

Figure 26. Continuous 15-minute DO (percent saturation) measurements for the near-surface and near-bottom water depths in the Keys lagoons in 2019 (horizontal black dashed lines indicate the percent saturation minimum criterion [80 percent]).

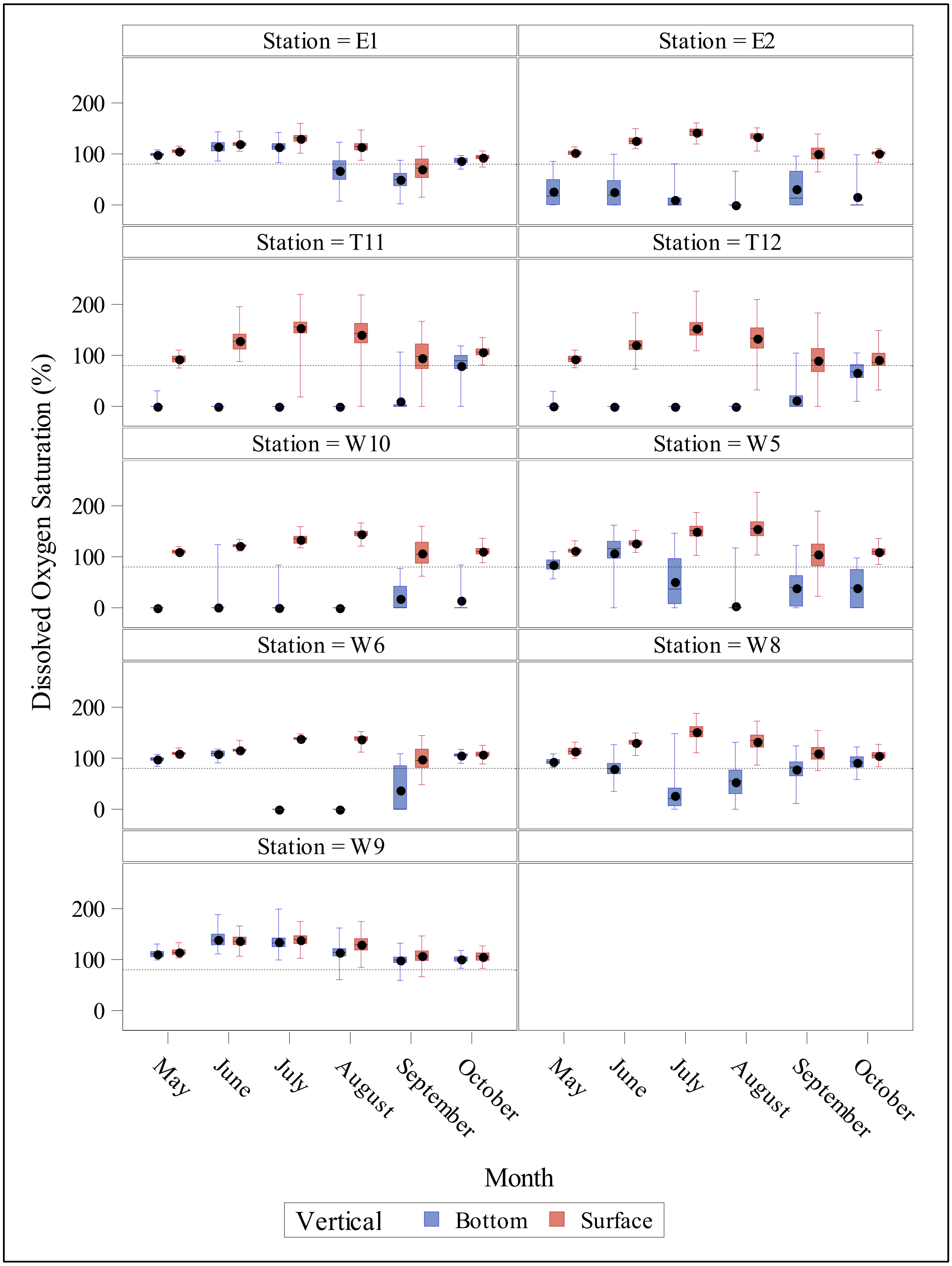

Figure 27. Continuous 15-minute DO (percent saturation) measurements monthly box-and-whisker plots for near-surface and near-bottom depths in the Tahoe Keys lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal black dashed lines indicate the percent saturation minimum criterion [80 percent]).

Table 21. Monthly DO (percent saturation) summary statistics from continuous 15-minute data in Lake Tallac in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
T11	Bottom	May	820	0	0	0	0	30	1
		June	2,876	0	0	0	0	3	0
		July	2,970	0	0	0	0	0	0
		August	2,971	0	0	0	0	0	0
		September	2,876	0	0	10	38	106	23
		October	2,071	0	19	80	108	118	31
	Surface	May	822	75	83	93	102	110	7
		June	2,878	88	105	129	154	195	20
		July	2,973	18	132	154	176	220	18
		August	2,975	0	98	141	184	219	34
		September	2,877	0	45	95	138	167	34
		October	2,073	81	96	107	120	135	10
T12	Bottom	May	823	0	0	1	0	30	3
		June	2,878	0	0	0	0	0	0
		July	2,973	0	0	0	0	0	0
		August	2,975	0	0	0	0	1	0
		September	2,877	0	0	12	41	105	21
		October	2,072	10	38	66	86	105	18
	Surface	May	825	76	85	93	101	110	7
		June	2,879	73	105	121	137	183	13
		July	2,974	109	129	153	184	226	21
		August	2,975	32	91	134	180	209	33
		September	2,878	0	42	90	136	183	35
		October	2,073	32	73	92	119	149	20

Table 22. Monthly DO (percent saturation) summary statistics from continuous 15-minute data in the Main Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
W5	Bottom	May	1,086	57	69	85	101	110	12
		June	2,877	0	54	108	143	162	36
		July	2,968	0	0	51	114	146	45
		August	2,973	0	0	4	7	117	14
		September	2,878	0	0	39	81	123	32
		October	2,075	0	0	39	88	98	36
	Surface	May	1,089	101	106	112	119	131	5
		June	2,878	108	119	127	135	152	6
		July	2,974	103	128	150	168	187	15
		August	2,974	103	129	155	180	226	20
		September	2,878	23	69	105	145	190	30
		October	2,075	85	100	110	121	136	8
W6	Bottom	May	1,010	84	94	98	103	107	4
		June	918	91	101	109	116	118	6
		July	613	0	0	0	0	0	0
		August	2,971	0	0	0	0	0	0
		September	2,878	0	0	38	97	109	43
		October	2,081	90	102	106	110	117	4
	Surface	May	1,010	103	105	110	114	120	3
		June	918	108	112	116	120	135	3
		July	614	132	135	139	142	148	3
		August	2,976	112	125	138	146	152	8
		September	2,880	48	68	98	130	144	23
		October	2,080	89	100	108	115	125	6
W8	Bottom	May	1,095	82	87	94	101	108	5
		June	2,876	35	61	80	98	127	14
		July	2,971	0	0	27	61	148	25
		August	2,972	0	11	54	93	131	30
		September	2,876	11	49	78	103	124	21
		October	1,398	58	71	92	109	122	14
	Surface	May	1,096	99	104	114	125	132	8
		June	2,879	105	120	131	139	149	7
		July	2,973	111	133	152	172	188	14
		August	2,974	87	108	133	155	173	18

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
		September	2,879	76	92	110	131	154	15
		October	1,400	83	96	105	115	127	8
W9	Bottom	May	1,092	99	102	111	120	131	7
		June	2,878	111	123	140	159	188	14
		July	2,972	99	119	135	156	199	14
		August	2,970	61	102	114	127	162	11
		September	2,877	59	88	99	111	132	9
		October	1,405	83	93	101	109	118	6
	Surface	May	1,093	103	107	115	124	133	7
		June	2,877	107	125	137	152	166	10
		July	2,971	103	124	139	153	175	11
		August	2,974	85	111	130	150	175	15
		September	2,878	66	92	108	124	146	13
		October	1,404	83	94	106	119	127	9
W10	Bottom	May	1,010	0	0	0	0	1	0
		June	2,876	0	0	1	0	124	8
		July	2,970	0	0	0	0	84	3
		August	2,969	0	0	0	0	0	0
		September	2,873	0	0	18	61	77	25
		October	2,078	0	0	15	76	84	29
	Surface	May	1,011	103	105	110	115	120	4
		June	2,879	111	118	122	126	134	3
		July	2,972	118	122	134	144	159	8
		August	2,973	121	134	145	153	166	7
		September	2,878	62	77	107	141	160	24
		October	2,082	88	102	111	122	136	8

Table 23. Monthly DO (percent saturation) summary statistics from continuous 15-minute data in the Marina Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
E1	Bottom	May	1,376	82	93	99	103	108	4
		June	2,879	86	98	115	133	144	12
		July	2,973	83	103	114	125	142	8
		August	2,970	7	37	68	96	123	23
		September	2,878	2	29	50	73	88	16
		October	1,391	70	78	87	94	97	6
	Surface	May	1,376	98	100	106	111	115	4
		June	2,879	105	114	120	127	144	5
		July	2,972	101	119	130	141	160	8
		August	2,974	88	102	114	127	147	10
		September	2,878	15	39	71	98	115	22
		October	1,390	74	85	93	100	106	6
E2	Bottom	May	1,370	0	0	27	65	85	26
		June	2,877	0	0	26	63	99	26
		July	2,967	0	0	10	37	81	18
		August	2,971	0	0	0	0	66	2
		September	2,874	0	0	32	80	96	34
		October	1,386	0	0	16	85	98	33
	Surface	May	1,369	94	97	103	110	114	5
		June	2,879	110	115	126	140	150	8
		July	2,973	119	130	143	152	161	8
		August	2,973	106	122	134	144	151	8
		September	2,877	65	82	101	121	139	15
		October	1,388	83	96	101	106	110	4

6.2 Oxidation Reduction Potential

The oxidation reduction potential (ORP or redox potential) is the measure of the ability for a substance to acquire or lose electrons. As it relates to lakes, the redox potential describes the presence of oxidizing conditions, or reducing conditions that allow for phosphorus release from the sediment to the overlying water column. Where nutrients such as phosphorus are limiting to phytoplankton growth, low ORP can result in algae blooms. Redox potential also provides an indication of the ability of organic material (plants or animals) to decompose. Positive values indicate an environment with sufficient electron donors to result in efficient decomposition. Negative values indicate an environment with insufficient electron donors which can result in the accumulation of organic material and/or the release of bound materials. Lower values are typically found near the sediment-water interface where increased oxygen consumption occurs due to decomposition and respiration, and a lack of light for oxygen-producing photosynthesis. The redox potentials at the near-bottom depths associated with each of the monthly vertical profiles (Table 24) were variable by station and sampling event. In Lake Tallac, reducing conditions were present during all profile measurements at the deepest station (T13) and at the other two stations until the final profiles in October. Redox fluctuated between reducing (negative) and oxidizing (positive) conditions at most stations, except at W4 and W9 where oxidizing conditions were present during all or nearly all of the profile measurements. Reducing conditions were present for more of the season toward the back of the Marina Lagoon at E3, compared to E1 closer to the connecting channel, until late September when oxidized conditions were present at all stations.

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Table 24. Oxidation reduction potential measurements (mV) at near-bottom water depths in the Tahoe Keys lagoons in 2019.

Date	Time of Day	Lake Tallac			Main Lagoon							Marina Lagoon		
		T11	T12	T13	W4	W5	W6	W7	W8	W9	W10	E1	E2	E3
5/23	PM	-85.8	-105.1	-72.9	NM	NM	NM	-9.3	-47.2	NM	NM	NM	NM	NM
5/24	AM	-27.2	-65.5	-73.9	NM	73.5	NM	-116.1	-14.6	69.5	-33.3	NM	NM	NM
5/24	PM	NM	NM	NM	63.1	-131.4	NM	NM	NM	82.3	NM	87.8	99.2	-1.5
6/4	PM	NM	NM	NM	NM	NM	-45.9	NM	NM	NM	NM	NM	NM	NM
6/10	PM	-53.3	-23.4	-90.5	NM	156.8	154.9	NM	NM	NM	NM	NM	NM	NM
6/11	AM	-59.3	-35.6	-115.9	NM	88.8	-100.4	142.2	100.0	NM	103.6	NM	NM	NM
6/11	PM	NM	NM	NM	NM	NM	NM	132.7	112.8	100.1	NM	NM	NM	NM
6/17	AM	NM	NM	NM	102.4	NM	NM	NM	NM	36.5	NM	92.7	-123.7	-9.7
6/17	PM	NM	NM	NM	86.1	NM	NM	NM	NM	NM	NM	117.7	-120.4	NM
6/18	PM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-72.8
7/10	AM	NM	NM	NM	NM	117.8	NM	-17.4	173.1	141.7	167.1	NM	NM	NM
7/11	AM	NM	NM	NM	37.4	NM	NM	NM	NM	NM	NM	-59.4	-57.9	-77.5
7/11	PM	NM	NM	NM	NM	125.8	-33.2	-25.4	-17.9	NM	43.2	NM	NM	NM
7/16	AM	-80.5	-43.5	-19.1	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
7/16	PM	NM	NM	NM	-16.3	NM	NM	NM	NM	NM	NM	NM	-136.0	-88.9
7/17	AM	NM	NM	NM	NM	NM	-16.4	NM	NM	125.3	NM	NM	NM	NM
7/17	PM	-60.4	-28.6	-10.1	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
8/6	PM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-106.5	NM
8/8	AM	NM	NM	NM	NM	-188.4	-163.7	104.2	99.3	NM	-98.0	NM	NM	NM
8/8	PM	NM	NM	NM	NM	-127.6	NM	-9.4	116.1	107.2	NM	NM	NM	NM
8/9	AM	NM	NM	NM	91.6	NM	NM	NM	NM	100.8	NM	-152.4	-110.7	-109.7
8/9	PM	NM	NM	NM	90.5	NM	-156.6	NM	NM	NM	-76.3	-140.2	NM	-104.4
8/13	AM	-51.7	-14.8	-69.7	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
8/13	PM	-72.3	NM	-37.6	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
9/11	AM	NM	NM	NM	NM	87.3	-151.2	NM	NM	120.0	83.9	NM	NM	NM

Date	Time of Day	Lake Tallac			Main Lagoon							Marina Lagoon		
		T11	T12	T13	W4	W5	W6	W7	W8	W9	W10	E1	E2	E3
9/12	AM	NM	NM	NM	84.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
9/13	AM	-32.6	-0.9	-97.3	NM	NM	NM	53.2	62.9	NM	NM	NM	NM	NM
9/17	PM	NM	NM	NM	NM	108.0	125.5	NM	NM	NM	103.8	NM	NM	NM
9/18	AM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	76.5	72.3	-37.6
9/24	PM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	101.5	115.9
9/25	PM	-48.9	-23.4	-30.9	99.3	NM	NM	NM	NM	NM	NM	119.0	NM	NM
9/26	PM	NM	NM	NM	NM	NM	NM	-61.7	63.2	89.8	NM	NM	NM	NM
10/2	AM	NM	NM	NM	NM	140.2	124.3	NM	NM	NM	111.1	NM	NM	NM
10/3	AM	NM	NM	NM	112.3	NM	NM	105.1	109.7	100.9	NM	115.8	100.9	88.5
10/3	PM	66.9	44.1	-47.1	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

NM = not measured

6.3 Alkalinity and pH

Near-surface and near-bottom water samples were collected in May, June, and September for measurement of total alkalinity at each of the monitoring sites using a horizontal bottle sampler, transferred to laboratory supplied containers, placed on ice in a cooler, and provided to the laboratory for analysis consistent with the QAPP.

Alkalinity is an indication of the buffering capacity of water, or the ability to neutralize acids and bases and thus maintain a relatively stable pH level. For the protection of aquatic life, alkalinity should be at least 20 mg/L. In general, total alkalinity concentrations were lowest in the Marina Lagoon, averaging 41 mg/L as $CaCO_3$ and 49 mg/L as $CaCO_3$in the Main Lagoon, but with little variation between sites and only slightly higher concentrations in near-bottom samples compared to near-surface samples (Table 25). Total alkalinity increased from May through June and September at nearly all sites and depths. Total alkalinity was consistently higher in Lake Tallac across all months, averaging 59 mg/L as $CaCO_3$, with more pronounced higher near-bottom concentrations compared to concentrations found in the Main and Marina lagoons.

Table 25. Total alkalinity sample concentrations (mg/L as $CaCO_3$) at Tahoe Keys lagoons near-surface and near-bottom water depths in 2019.

Area	Station	Date	Near-Surface	Near-Bottom
Marina Lagoon	E1	5/22	39 HTe	39 HTe
		6/20	41	40
		9/10	45 HTe	45 HTe
	E2	5/22	39 HTe	39 HTe
		6/19	40	40
		9/10	44 HTe	45 HTe
	E3	5/23	39 HTe	39 HTe
		6/19	41	40
		9/10	44 HTe	46 HTe
Lake Tallac	T11	5/29	45	45
		6/19	48	46
		9/12	63 HTe	88 HTe
	T12	5/29[d]	45	45
		6/19	49	62 HTe
		9/12	59 HTe	74
	T13	5/29	45	66
		6/19	49	68 HTe
		9/12	61 HTe	79 HTe
Main Lagoon	W4	5/22	44 HTe	44 HTe
		6/20	44	43
	W5	9/12	45 HTe	44 HTe
		5/22	44 HTe	45

Area	Station	Date	Near-Surface	Near-Bottom
		6/19	44	50 HTe
		9/11	50 HTe	51 HTe
	W6	5/22	44 HTe	44
		6/19	44	42
		9/11	47 HTe	62 HTe
	W7	5/22	54 HTe	55 HTe
		6/19	51	53
		9/11	61 HTe	61 HTe
	W8	5/22	53 HTe	53 HTe
		6/19	52	51
		9/11	61 HTe	61 HTe
	W9	5/21	51 HTe	50 HTe
		6/19	48	49
		9/11	57 HTe	58 HTe
	W10	5/22	44 HTe	44 HTe
		6/19	44	42
		9/11	46 HTe	48 HTe

HTe = Sample analyzed above the accepted holding temperature of 6°C
[d] Duplicate sample result reported

To evaluate current conditions, the pH of the three lagoons was documented using both vertical profiles measured with a YSI multi-parameter sonde, and Onset pH data loggers. Vertical profiles were collected in both the morning and afternoon at each monitoring station at 1-foot intervals (Figures 28 and 29). Basin Plan WQOs require that pH “shall not be depressed below 7.0 nor raised above 8.4”. For comparisons, reference lines showing the specified pH range were included on the graphs of lagoon pH data. Similar to DO, instances in which pH were reported above 8.4 may indicate periods of high primary productivity, while periods below 7.0 may be associated with higher than normal respiration. The pH ranges varied by depth as well as between sampling locations over the monitoring period. Overall, the Main Lagoon sites were more alkaline (higher pH) when compared to the other locations. In general, the pH decreased (became more acidic) with increasing water depth, as would be expected when transitioning from an upper water column having sufficient light to support photosynthesis - to the darker depths of the water column where decomposition and respiration is ongoing but photosynthesis does not occur. There were multiple exceptions in which a mid-column increase in pH was measured. High pH measurements above 8.4 were most common in July and August. Low pH measurements below 7.0 only occurred in the deepest waters, with the lowest measurements recorded in Lake Tallac.

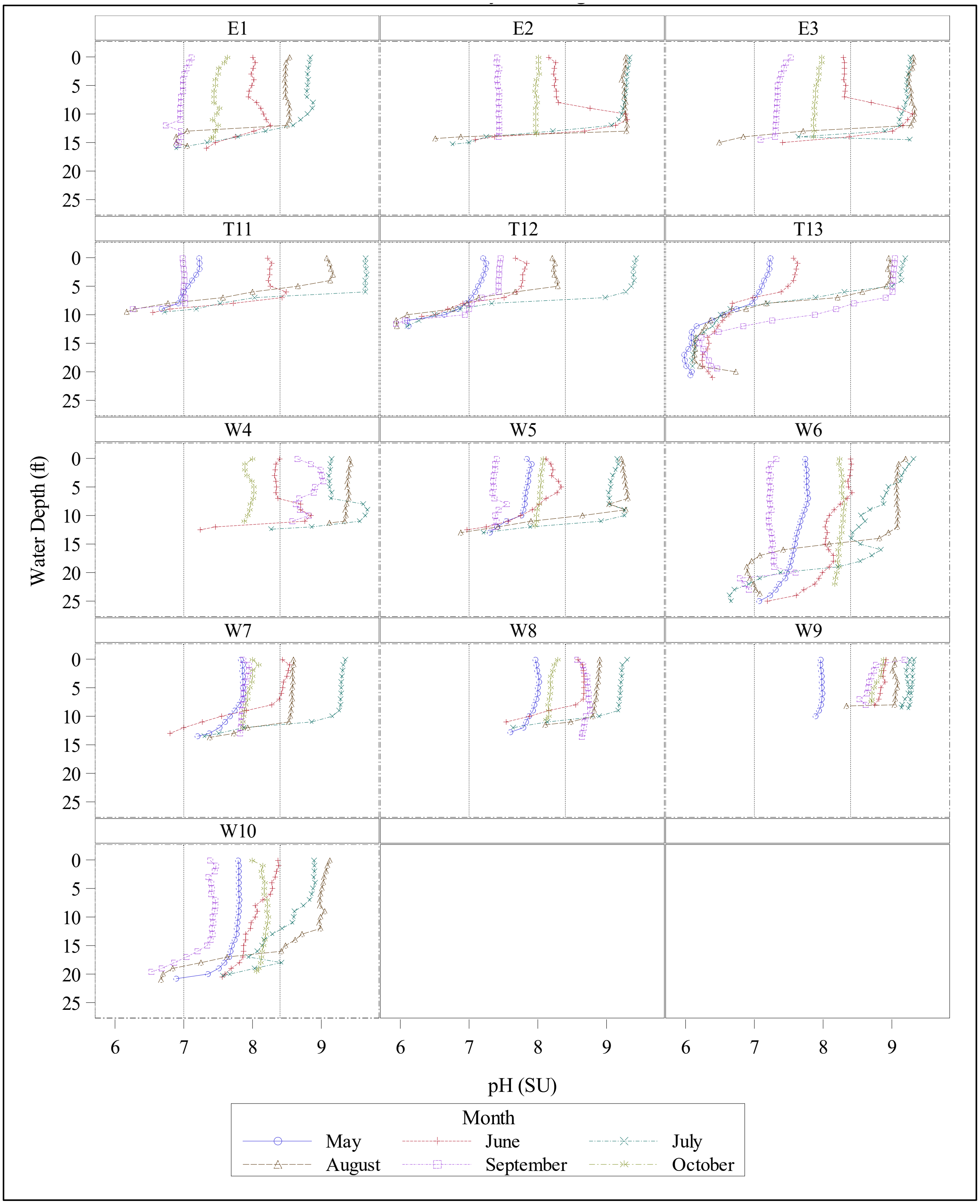


Figure 28. Vertical morning pH profiles in the Tahoe Keys lagoons from May to October 2019 (vertical dash lines show lower [7.0] and upper criteria [8.4]).

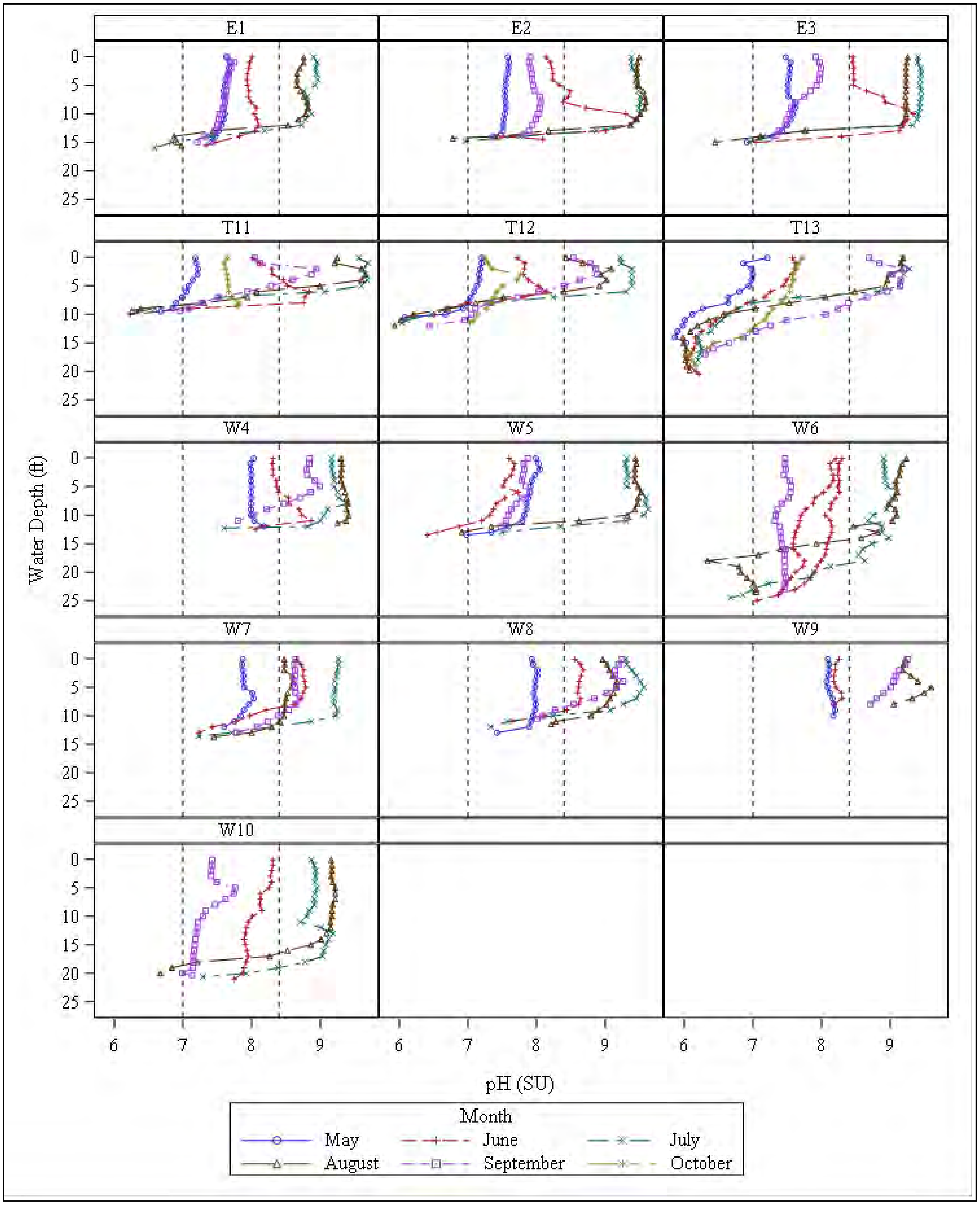


Figure 29. Vertical afternoon pH profiles in the Tahoe Keys lagoons from May to October 2019 (vertical dash lines show lower [7.0] and upper [8.4] criteria).

Onset pH loggers were deployed at two fixed depths (near-surface and near-bottom) to record data at 15-minute intervals. The deployment periods for each monitoring station are provided in Table 2. Typical of freshwater lakes the pH was generally higher in the near-surface waters compared to the near-bottom waters (Figures 30 and 31). Site W9 pH levels were relatively similar comparing the near-surface and near-bottom water depths. Near-surface water pH readings were consistently above the 8.4 maximum criterion at all locations (Figure 31). Near-bottom pH readings were depressed below the 7.0 minimum criterion at several locations (T11, T12 and W10). Daily fluctuations in pH were observed which are likely related to plant respiration and productivity. Monthly summary statistics for each lagoon by location and sampling depth are provided in Tables 26 to 28. Minimum and maximum values are provided, but due to the inherent variability in continuous data, the 10^{th} and 90^{th} percentiles are recommended to reduce the influence of anomalous measurements in characterizing pH conditions. The loss of equipment resulted in a data gap at Site W6 from June 10 to July 25, 2019. Additional data gaps also occurred at stations E1 (near-surface), E2 (near-surface and near-bottom) and W8 (near-surface) due to equipment failing to pass calibration checks. A data gap occurred at station W6 (near-surface) from mid-September through October after rejecting measurements below 3.0, based on comparing data with more normal results from vertical profile measurements.

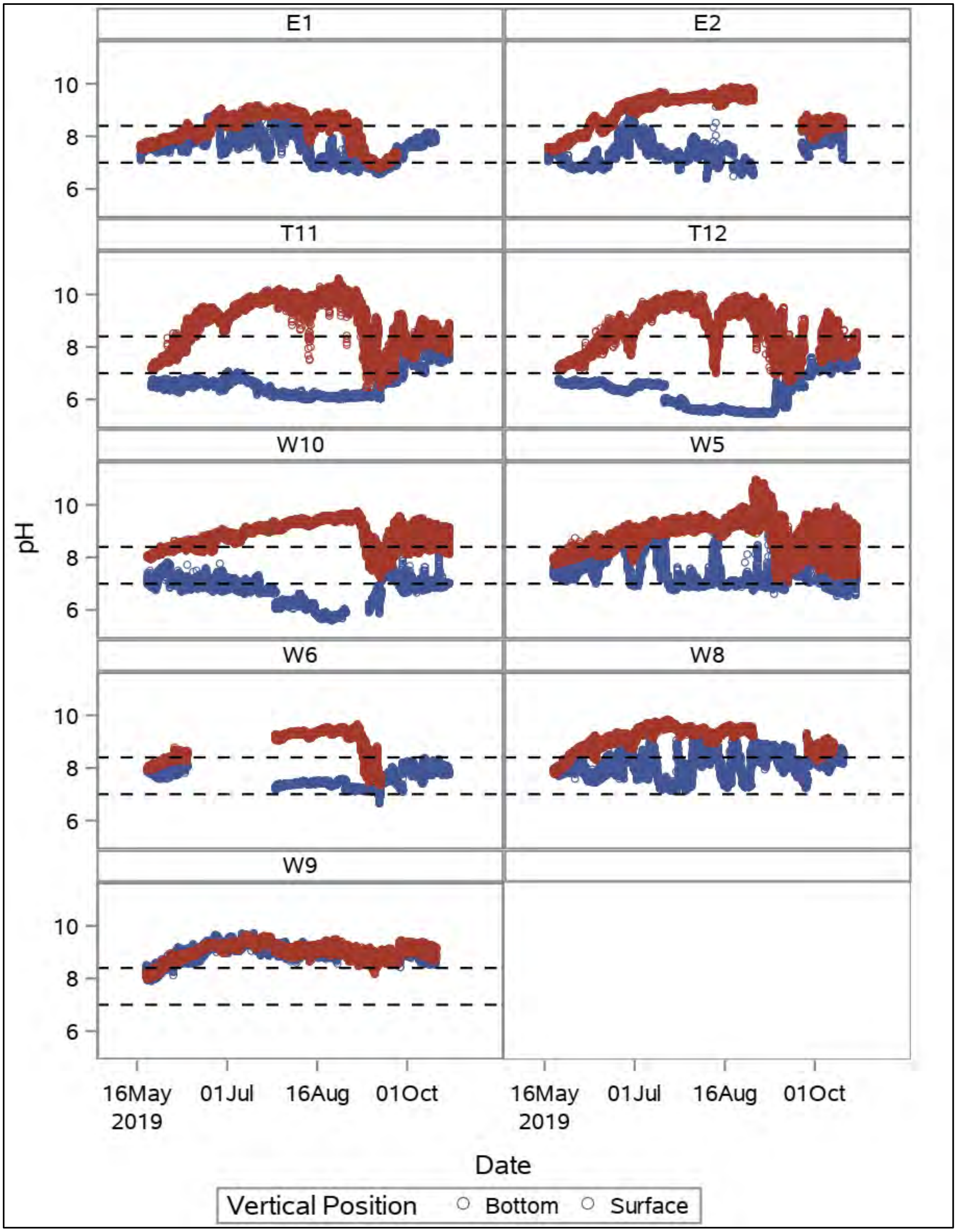


Figure 30. Continuous 15-minute pH measurements for the near-surface and near-bottom water depths in the Tahoe Keys lagoons in 2019 (horizontal dashed lines show lower [7.0] and upper [8.4] criteria).

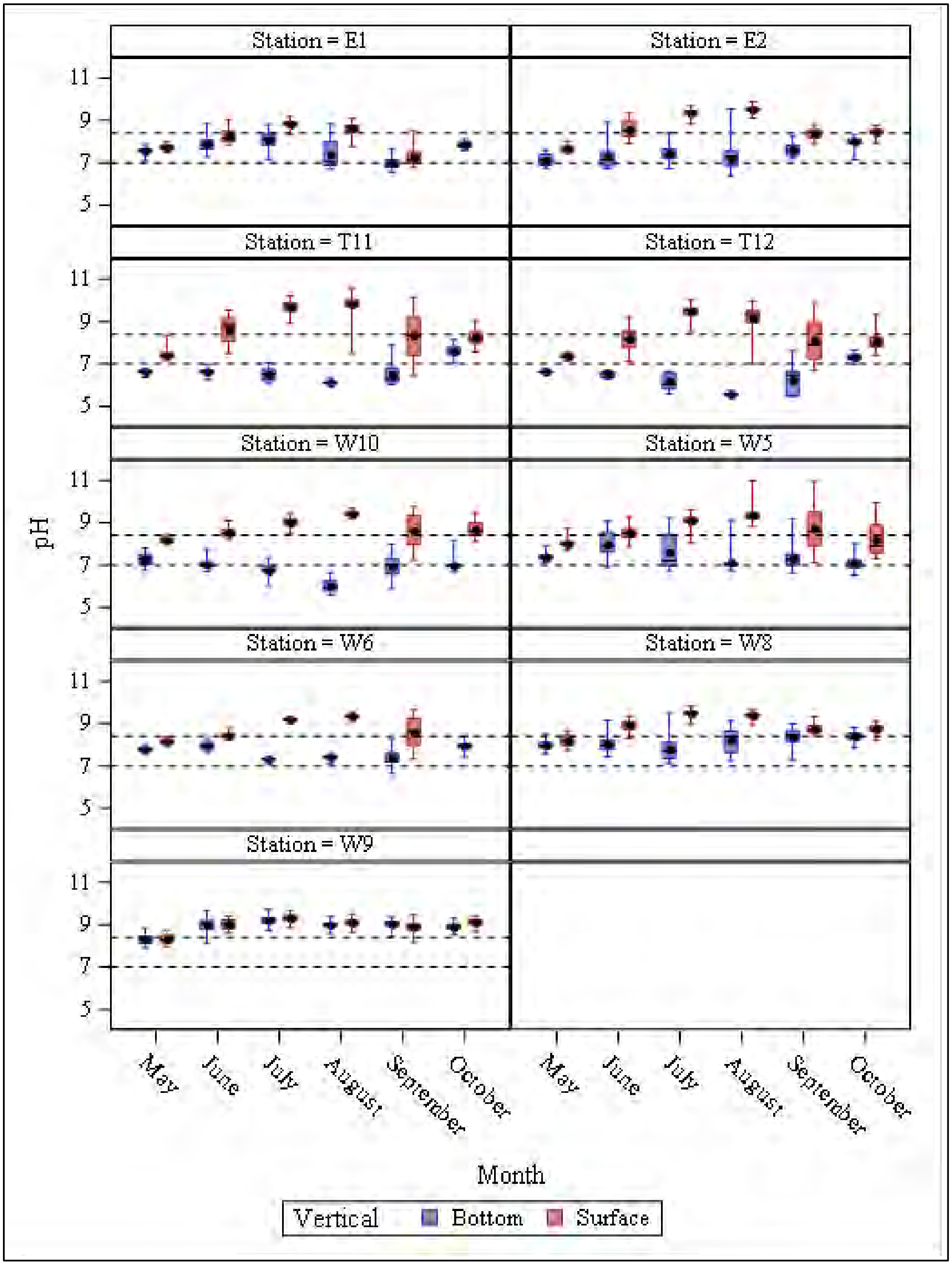


Figure 31. Continuous 15-minute pH monthly box-and-whisker plots for near-surface and near-bottom depths in the Tahoe Keys lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal dashed lines show lower [7.0] and upper [8.4] criteria).

Table 26. Monthly pH summary statistics from continuous 15-minute monitoring data from Lake Tallac in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
T11	Bottom	May	822	6.4	6.5	6.6	6.7	6.8	0.1
		June	2,877	6.3	6.5	6.6	6.8	7.0	0.1
		July	2,970	6.1	6.2	6.5	6.8	7.1	0.3
		August	2,971	6.0	6.1	6.1	6.2	6.3	0.0
		September	2,876	6.0	6.1	6.5	7.1	7.9	0.4
		October	2,069	7.0	7.2	7.6	7.9	8.1	0.3
	Surface	May	822	7.2	7.2	7.4	7.6	8.4	0.1
		June	2,878	7.5	7.7	8.6	9.3	9.5	0.6
		July	2,973	8.9	9.3	9.7	10.0	10.2	0.3
		August	2,974	7.5	9.5	9.8	10.1	10.6	0.3
		September	2,877	6.4	7.1	8.4	9.9	10.1	1.0
		October	2,071	7.6	7.9	8.3	8.7	9.1	0.3
T12	Bottom	May	825	6.5	6.6	6.6	6.7	6.8	0.0
		June	2,877	6.3	6.3	6.5	6.7	6.7	0.1
		July	2,974	5.6	5.6	6.2	6.6	6.6	0.4
		August	2,972	5.5	5.5	5.6	5.6	5.8	0.0
		September	2,877	5.5	5.5	6.2	6.9	7.6	0.6
		October	2,074	7.0	7.2	7.3	7.5	7.6	0.1
	Surface	May	825	7.1	7.3	7.4	7.5	7.6	0.1
		June	2,878	7.1	7.6	8.2	8.7	9.2	0.4
		July	2,975	8.5	9.1	9.5	9.7	10.0	0.3
		August	2,974	7.0	8.4	9.1	9.7	10.0	0.6
		September	2,367	6.7	7.0	8.1	9.3	9.9	0.9
		October	1,821	7.4	7.7	8.1	8.7	9.3	0.4

Table 27. Monthly pH summary statistics from continuous 15-minute monitoring data from the Main Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
W5	Bottom	May	1,087	7.1	7.2	7.4	7.6	7.9	0.2
		June	2,879	6.9	7.2	8.0	8.8	9.1	0.6
		July	2,970	6.7	6.9	7.6	8.8	9.2	0.8
		August	2,972	6.7	6.9	7.1	7.3	9.1	0.4
		September	2,877	6.6	6.9	7.3	7.9	9.2	0.4
		October	2,074	6.5	6.7	7.1	7.4	8.0	0.3
	Surface	May	1,089	7.7	7.9	8.0	8.2	8.7	0.1
		June	2,879	7.8	8.2	8.5	9.0	9.3	0.3
		July	2,973	8.0	8.9	9.1	9.4	9.6	0.2
		August	2,974	8.8	9.1	9.4	9.7	11.0	0.3
		September	2,875	7.1	7.6	8.7	10.2	10.9	1.0
		October	2,074	7.3	7.4	8.2	9.4	10.0	0.7
W6	Bottom	May	1,010	7.6	7.7	7.8	7.9	8.0	0.1
		June	918	7.6	7.8	8.0	8.1	8.3	0.1
		July	613	7.2	7.3	7.3	7.4	7.4	0.0
		August	2,974	7.1	7.4	7.4	7.5	7.6	0.1
		September	2,878	6.7	7.2	7.4	7.8	8.3	0.3
		October	2,081	7.4	7.7	7.9	8.2	8.4	0.2
	Surface	May	1,010	7.9	8.0	8.1	8.3	8.4	0.1
		June	918	8.2	8.3	8.4	8.6	8.8	0.1
		July	614	9.0	9.1	9.2	9.3	9.3	0.1
		August	2,974	9.1	9.3	9.4	9.5	9.6	0.1
		September	1,600	7.4	7.6	8.6	9.4	9.7	0.7
W8	Bottom	May	1,096	7.6	7.8	8.0	8.2	8.5	0.2
		June	2,879	7.4	7.6	8.0	8.7	9.2	0.4
		July	2,972	7.1	7.3	7.8	8.7	9.5	0.5
		August	2,971	7.2	7.4	8.2	8.8	9.1	0.5
		September	2,878	7.3	7.8	8.4	8.8	9.0	0.4
		October	1,398	7.9	8.1	8.4	8.7	8.8	0.2
	Surface	May	1,097	7.8	7.9	8.2	8.6	8.7	0.3
		June	2,879	8.3	8.7	8.9	9.2	9.4	0.2
		July	2,973	9.0	9.3	9.5	9.7	9.8	0.1
		August	2,827	8.9	9.2	9.4	9.5	9.6	0.1

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
		September	418	8.4	8.5	8.8	9.1	9.3	0.2
		October	932	8.2	8.5	8.8	8.9	9.1	0.2
W9	Bottom	May	1,093	7.9	8.0	8.3	8.6	8.9	0.2
		June	2,875	8.1	8.7	9.0	9.3	9.7	0.2
		July	2,972	8.7	9.0	9.2	9.5	9.7	0.2
		August	2,822	8.6	8.9	9.0	9.1	9.4	0.1
		September	421	8.4	8.8	9.0	9.2	9.4	0.1
		October	1,403	8.5	8.7	8.9	9.1	9.3	0.1
	Surface	May	1,094	8.0	8.1	8.3	8.6	8.7	0.2
		June	2,879	8.6	8.7	9.0	9.3	9.4	0.2
		July	2,973	8.9	9.1	9.3	9.5	9.7	0.2
		August	2,974	8.7	8.9	9.1	9.3	9.5	0.1
		September	2,877	8.2	8.7	8.9	9.2	9.5	0.2
		October	1,404	8.7	8.9	9.1	9.3	9.4	0.2
W10	Bottom	May	1,012	6.8	6.9	7.3	7.7	7.8	0.3
		June	2,879	6.7	6.9	7.0	7.3	7.8	0.2
		July	2,970	6.1	6.3	6.7	7.1	7.3	0.3
		August	2,814	5.6	5.8	6.0	6.3	6.6	0.2
		September	1,872	5.9	6.2	6.9	7.4	8.0	0.4
		October	2,082	6.7	6.9	7.0	7.1	8.2	0.2
	Surface	May	1,012	8.0	8.0	8.2	8.3	8.4	0.1
		June	2,879	8.2	8.3	8.5	8.9	9.1	0.2
		July	2,973	8.5	8.7	9.0	9.2	9.4	0.2
		August	2,974	9.2	9.3	9.4	9.5	9.7	0.1
		September	2,876	7.3	7.7	8.6	9.5	9.7	0.7
		October	2,082	8.1	8.3	8.7	9.2	9.5	0.3

Table 28. Monthly pH summary statistics from continuous 15-minute monitoring data from the Marina Lagoon in 2019.

Station	Vertical	Month	# of Measurements	Minimum	10th Percentile	Mean	90th Percentile	Maximum	Standard Deviation
E1	Bottom	May	1,377	7.1	7.4	7.6	7.7	7.9	0.1
		June	2,879	7.3	7.5	7.9	8.6	8.8	0.4
		July	2,973	7.2	7.6	8.1	8.5	8.8	0.3
		August	2,972	6.7	6.8	7.4	8.4	8.8	0.6
		September	2,878	6.6	6.7	7.0	7.5	7.7	0.3
		October	1,392	7.6	7.7	7.8	8.0	8.1	0.1
	Surface	May	1,376	7.5	7.6	7.7	7.9	8.0	0.1
		June	2,878	7.9	7.9	8.3	8.8	9.1	0.3
		July	2,973	8.3	8.6	8.8	9.0	9.2	0.2
		August	2,972	7.8	8.3	8.6	8.9	9.1	0.2
		September	2,357	6.8	6.9	7.3	7.9	8.5	0.4
E2	Bottom	May	1,372	6.8	6.8	7.1	7.5	7.6	0.3
		June	2,879	6.7	6.8	7.3	8.2	8.9	0.5
		July	2,973	6.7	7.1	7.5	7.9	8.4	0.3
		August	2,835	6.4	6.8	7.2	7.6	9.5	0.4
		September	617	7.2	7.3	7.6	8.0	8.3	0.3
		October	1,392	7.2	7.8	8.0	8.2	8.3	0.2
	Surface	May	1,380	7.4	7.5	7.7	7.9	8.0	0.1
		June	2,879	7.9	8.0	8.6	9.2	9.4	0.4
		July	2,973	8.8	9.1	9.4	9.5	9.7	0.2
		August	2,836	9.1	9.4	9.5	9.7	9.9	0.1
		September	617	7.9	8.0	8.4	8.6	8.8	0.2
		October	1,391	7.9	8.3	8.5	8.6	8.8	0.1

7 Biological Characteristics

Phytoplankton ("algae") are free-floating, primary producers which require photosynthesis and nutrients to fuel production. There are a variety of phytoplankton groups including diatoms, cyanobacteria, dinoflagellates and coccolithophores. Algae provide a crucial food source to many small and large aquatic organisms. Factors that impact the ability for light to penetrate the water column can limit phytoplankton production. Oligotrophic (low nutrient) environments also limit phytoplankton growth. In contrast, eutrophic (high nutrient) environments with adequate light availability can lead to the overstimulation of phytoplankton resulting in water quality degradation. Chlorophyll *a* samples and phycocyanin measurements were collected at each of the monitoring sites to characterize the primary productivity of the lagoons.

7.1 Chlorophyll Samples

Chlorophyll *a* (i.e., the pigment in algae chloroplasts) provides a quantitative indicator of phytoplankton abundance. Monthly near-surface samples were collected using a bottle sampler or peristaltic pump and tubing, samples were put on ice, frozen, and delivered to the laboratory for analysis consistent with the QAPP. Chlorophyll *a* and phaeophytin *a* were quantified for each surface water sample. Phaeophytin *a* concentrations indicate the component of algal cells which are dead or undergoing decay and therefore not capable of active photosynthesis. Chlorophyll *a* concentrations were corrected by subtracting phaeophytin *a* concentrations, so the reported chlorophyll *a* results are indicators of only the active phytoplankton cells within the water column. The MDL for chlorophyll *a* was 0.8 mg/L, and Table 29 indicates which samples were "U" flagged as undetected. For the purposes of data analyses, these results were assumed to be one-half the MDL (0.4 mg/L). Table 29 provides summary statistics for the surface water chlorophyll *a* samples by station. The greatest range in chlorophyll *a* concentrations over the sampling period was observed at station W9 in the Main Lagoon, <0.80 to 10.40 µg/L. In May, one sample collected at W9 was "U" flagged. Seven samples collected in July were flagged "C1" for being below the quantification limit and these results are reported as provided by the laboratory, though the values are below the MDL (0.8 mg/L). The same seven samples in July were "J" flagged and should be considered an estimate. Overall, chlorophyll *a* concentrations were higher in the Main Lagoon where they generally increased in the last three sampling months (Figures 32 and 33). In contrast, the Marina Lagoon reported the lowest concentrations ranging from <0.80 to 2.41 µg/L, with little overall variability over the sampling period (Figures 32 and 33). Concentrations in Lake Tallac ranged from 0.66 to 4.12 µg/L, and the highest concentration occurred during the May 2019 sampling event (Figures 32 and 33).

Table 29. Chlorophyll *a* (mg/L) summary statistics from near-surface samples in the Tahoe Keys lagoons in 2019.

Area	Station	Sampling Period First	Sampling Period Last	# of Samples	Minimum	Mean	Maximum	Standard Deviation
Lake Tallac	T11	5/23	10/4	6	0.66 C1, J	1.64	3.73	1.12
	T12	5/23	10/4	6	0.83	1.99	4.12	1.20
	T13	5/23	10/4	6	0.99	2.26	2.91	0.74
Main Lagoon	W4	5/22	10/2	6	0.56 C1, J	2.07	2.87	0.93
	W5	5/22	10/2	6	1.74	4.88	7.31	0.85
	W6	5/22	10/2	6	0.57 C1, J	2.32	4.52	1.97
	W7	5/22	10/3	6	1.94	4.47	8.56	1.44
	W8	5/22	10/3	6	1.79	4.80	8.36	2.41
	W9	5/21	10/3	6	0.80 U	5.49	10.40	2.31
	W10	5/22	10/3	6	0.65 C1, J	1.91	3.26	3.94
Marina Lagoon	E1	5/22	9/10	5	0.66 C1, J	1.36	2.18	0.70
	E2	5/22	10/3	6	0.72 C1, J	1.51	2.41	0.71
	E3	5/23	10/3	6	0.40 C1, J	1.28	1.94	0.64

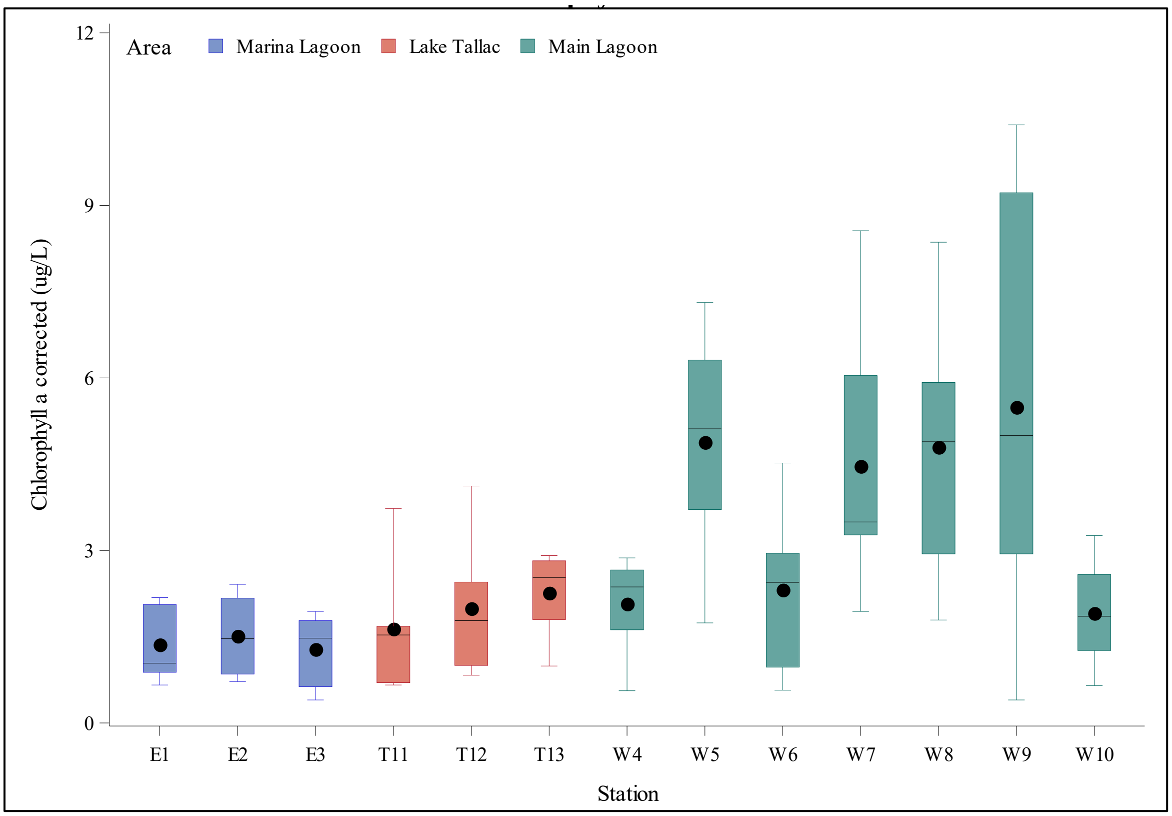
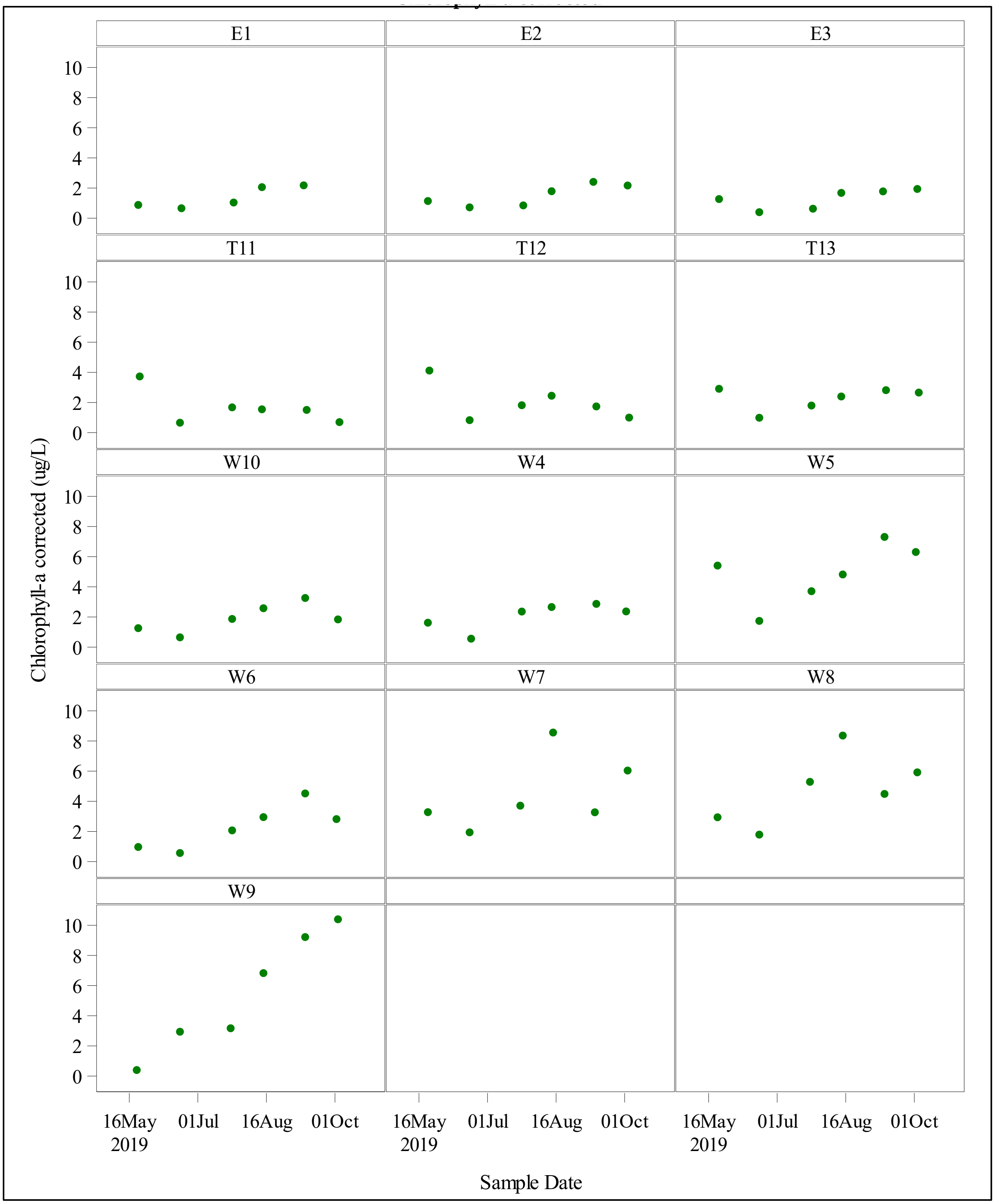


Figure 32. Chlorophyll *a* box-and-whisker plots for near-surface (1-foot below surface) samples collected from the Tahoe Keys lagoons in 2019 (dot denotes mean and black horizontal line denotes median).



Water Column CHLAC

Figure 33. Monthly chlorophyll *a* near-surface sample concentrations from the Tahoe Keys lagoons in 2019.

7.2 Phycocyanin Measurements

Cyanobacteria (blue-green algae) are a specific group of phytoplankton that have unique characteristics. Some species of cyanobacteria are capable of making cyanotoxins that can be harmful to people, animals or the environment. Additionally, many cyanobacteria are able to access nitrogen from the atmosphere (nitrogen-fixation), fueling production if sufficient phosphorus is available in the water column. Phycocyanin is a pigment specific to cyanobacteria that is used as an indicator of harmful algal blooms (HABs). *In-situ* measurements of phycocyanin were taken near the surface (0.1 ft water depth) at the start and end of each vertical profile, and the average of the two readings at each station are provided in Table 30. Overall, concentrations were higher in the morning compared with measurements made in the afternoon. The Marina Lagoon had the lowest values of the three lagoons ranging from 0.00 to 0.27 µg/L in the morning and 0.00 to 0.18 µg/L in the afternoon over the sampling period. The Main Lagoon had the greatest range in values with 0.01 to 1.50 µg/L in the morning and 0.00 to 1.83 µg/L in the afternoon over the sampling period. Within Lake Tallac, phycocyanin concentrations ranged from 0.00 to 0.31 µg/L in the morning and 0.00 to 0.35 µg/L in the afternoon.

Table 30. Near-surface phycocyanin sonde measurements (µg/L) from the Tahoe Keys lagoons in 2019.

Date	Time of Day	Lake Tallac			Main Lagoon							Marina Lagoon		
		T11	T12	T13	W4	W5	W6	W7	W8	W9	W10	E1	E2	E3
5/23	PM	0.35	0.24	0.26	NM	NM	NM	0.24	0.22	NM	NM	NM	NM	NM
5/24	AM	0.21	0.24	0.23	NM	0.24	0.23	0.30	0.20	0.25	0.22	NM	NM	NM
5/24	PM	NM	NM	NM	0.18	0.19	NM	NM	NM	0.15	NM	0.16	0.16	0.16
6/4	PM	NM	NM	NM	NM	NM	0.05	NM	NM	NM	NM	NM	NM	NM
6/10	PM	0.06	0.04	0.05	NM	0.07	0.09	NM	NM	NM	0.08	NM	NM	NM
6/11	AM	0.11	0.09	0.14	NM	0.11	0.12	0.09	0.07	NM	0.13	NM	NM	NM
6/11	PM	NM	NM	NM	NM	NM	NM	0.05	0.04	0.06	NM	NM	NM	NM
6/17	AM	NM	NM	NM	0.10	NM	NM	NM	NM	0.11	NM	0.09	0.09	0.07
6/17	PM	NM	NM	NM	0.03	NM	NM	NM	NM	NM	NM	0.04	0.03	NM
6/18	PM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.02
7/10	AM	NM	NM	NM	NM	0.30	NM	0.51	1.35	0.72	0.15	NM	NM	NM
7/11	AM	NM	NM	NM	0.16	NM	NM	NM	NM	NM	NM	0.27	0.14	0.13
7/11	PM	NM	NM	NM	NM	0.20	0.12	0.46	1.04	NM	0.11	NM	NM	NM
7/16	AM	0.31	0.28	0.24	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
7/16	PM	NM	NM	NM	0.14	NM	NM	NM	NM	NM	NM	0.06	0.06	0.12
7/17	AM	NM	NM	NM	NM	NM	0.22	NM	NM	0.36	NM	NM	NM	NM
7/17	PM	0.10	0.02	0.05	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
8/6	PM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.00	NM
8/8	AM	NM	NM	NM	NM	0.13	0.08	0.28	0.23	NM	0.02	NM	NM	NM
8/8	PM	NM	NM	NM	NM	0.22	NM	0.25	0.04	0.45	NM	NM	NM	NM
8/9	AM	NM	NM	NM	0.01	NM	NM	NM	NM	0.43	NM	0.00	0.02	0.02
8/9	PM	NM	NM	NM	0.00	NM	0.02	NM	NM	NM	0.00	0.01	NM	0.00
8/13	AM	0.01	0.00	0.06	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
8/13	PM	0.00	0.00	0.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

Date	Time of Day	Lake Tallac			Main Lagoon							Marina Lagoon		
		T11	T12	T13	W4	W5	W6	W7	W8	W9	W10	E1	E2	E3
9/11	AM	NM	NM	NM	NM	0.51	0.19	NM	NM	1.50	0.12	NM	NM	NM
9/12	AM	NM	NM	NM	0.08	NM	NM	NM	NM	NM	NM	NM	NM	NM
9/13	AM	0.00	0.00	0.15	NM	NM	NM	0.27	0.32	NM	NM	NM	NM	NM
9/17	PM	NM	NM	NM	NM	0.11	0.07	NM	NM	NM	0.03	NM	NM	NM
9/18	AM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.20	0.09	0.03
9/24	PM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.00	0.01
9/25	PM	0.00	0.00	0.00	0.01	NM	NM	NM	NM	NM	NM	0.18	NM	NM
9/26	PM	NM	NM	NM	NM	NM	NM	0.17	0.24	1.83	NM	NM	NM	NM
10/2	AM	NM	NM	NM	NM	0.34	0.10	NM	NM	NM	0.10	NM	NM	NM
10/3	AM	NM	NM	NM	0.19	NM	NM	0.40	0.54	0.93	NM	0.21	0.10	0.05
10/3	PM	0.01	0.02	0.01	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

Note: Negative values were reported as "0.00".
Values are average of initial and final measurements
NM = not measured

8 Data Quality Review

Field and laboratory measurements collected in 2019 were assessed for quality and usability based on adherence to sample collection methods and quality objectives outlined in the QAPP. The data generated from this effort must be of sufficiently high quality to be considered an accurate representation of conditions in the lagoons, and analytical methods must be sensitive enough to report accurate and repeatable results.

8.1 Field Quality Control Results

The quality of field collected samples and recorded results were evaluated by reviewing calibration logs, field notebooks, water quality data logger files, and laboratory reports. Throughout the 2019 sampling period, field notebooks were maintained to record observations and details on sampling dates, locations, times, and measurement results. Other observations such as environmental conditions and local activities (e.g., weed harvesting) were also recorded. All surface and groundwater samples were collected in laboratory-provided containers and preserved on ice, and in some cases also preserved using acid ampules provided by the laboratory. A chain-of-custody (COC) form was completed for each sampling occasion, indicating the sample ID, location, date and time of collection, number of containers, and specific analyses for each sample container.

Equipment rinsate blanks for surface water sampling were collected in all months except July. Samples were collected by flushing deionized (DI) water through the horizontal bottle sampler three times, or pumping DI water through peristaltic pump tubing, then collecting a sample of the DI water in a laboratory-provided container. Over the sampling period, 41 rinsate blanks were collected with 9.7 percent exceeding the reporting limit. These included TP samples collected in June, ammonia samples collected in August, and TKN samples from October. None of the rinsate results were more than 30 percent of the lowest sample result; however, sample results for these parameters from the same analysis batch were “B” flagged as potentially biased high. Further examination of the results for these parameters measured on the same dates indicated a highly anomalous TP result from W10 collected near the surface, which was rejected as unusable.

A field duplicate of surface water samples was collected from 5 percent of the primary samples, meeting QAPP requirements for field duplicates. All duplicates had a relative percent difference (RPD) of 25 percent or less, except the following: alkalinity from T12 near-surface collected in May, ammonia from T12 near-surface in May and T13 near-bottom in October, total phosphorus at W6 near-bottom and T13 near-bottom in October, and orthophosphate at T13 near-bottom in October. Exceedance of 25 percent between duplicates indicated low precision in the overall sampling and analysis process and/or variability in the sample matrix. These sample results were flagged “P” to indicate potential for poor precision in the primary sample analysis.

A field duplicate of groundwater samples was collected from 8 percent of the primary samples, exceeding QAPP requirements for field duplicate frequency. All duplicate RPDs were less than 25 percent except orthophosphate and TP from P4 collected in September. Concentrations of these parameters in the primary sample were higher than all other sites in September, but not anomalous compared to other sites in other months. These samples were “P” flagged as described above.

8.2 Field Measurements Quality Control

8.2.1 Dissolved Oxygen and pH Data Logger Anomalies

The QAPP indicated that where possible, the Onset HOBO pH, temperature and DO loggers would be secured to dock pilings at two depths (near-surface and near-bottom). When the loggers were initially deployed, they were secured approximately one foot below the water surface and one foot above the sediment; however, water levels increased by roughly one foot between May and June (Figure 4), resulting in the loggers being higher off the bottom for those stations. Because the loggers were attached to floating docks, the near-surface loggers remained at the same level below the water surface. However, following the loss of station W6, all near near-surface loggers were lowered to approximately 18 inches below the surface to reduce visibility and reduce risk of further equipment losses. Water depths were measured with a lead line in July and the depths of deep loggers were adjusted to be sure they were approximately one foot off the sediment surface, and this process was repeated again later in the season as the water level dropped.

Data from the Onset HOBO loggers were downloaded bi-weekly. During downloads, the loggers were cleaned and redeployed – noting in the field notebook the times the units were out of the water. Dissolved oxygen data were post-processed using HOBOware Pro® software to adjust for barometric pressure at 6,225 feet during the deployment period. Data for each logger were compiled into a comprehensive continuous dataset. All data were reviewed based on the calibration records, deployment times, and best professional judgement. Data rejected from further analyses were given a “flag” of “1” in the continuous data sets. Data to be included in analyses were identified with a “flag” of “0”. All data were reviewed at the time surrounding the retrieval and deployment of the sampling equipment to identify any anomalies. Data associated with periods of unsuccessful calibration efforts were rejected and assigned a flag of “1” for omission. Additionally, all data were graphed over the period of record, monthly and daily, to provide a visual inspection of data collected. Best professional judgement was used in isolated instances if dramatic increases or decreases in a parameter were evident which could not be justified from chemical or biological processes. For example, a few near-surface DO readings from zero to 2 mg/L were rejected (assigned a flag of ‘1’) as they occurred within a period of saturation and as such, the sudden depression in DO was considered an unexplained anomaly. As another example, the pH sensor was replaced at the W6 near-surface depth due to a broken electrode on October 2, 2019. The unit was successfully re-calibrated and deployed; however, the reported values were substantially lower (~3 SU) than those at similar locations in the lagoon and were not comparable with the vertical profiles taken over the same period. As such, the pH readings were assigned a flag of “1” to be excluded from further analyses.

8.2.2 Vertical Profiles

The calibration records associated with each sampling event were reviewed to ensure equipment reliability for associated reported values. All data were graphed to perform a visual inspection and assist in identifying any anomalous values. No anomalous values were identified; as such, no data were identified for data exclusion.

8.2.3 Other Measurements

Qualifiers were assigned to some Secchi disk and turbidity measurements. Due to interference from aquatic plants, 16 percent of Secchi disk measurements were "L" qualified (Table 3). Failed calibration of the turbidimeter resulted in 24 percent of turbidity measurements being "C" qualified to indicate these values were estimates (Table 4). All occurrences of "C" flagged data occurred in October during which time the calibration standards were reading 30 percent higher than known standard values. For example, 10.0 NTU standard read 13.0 and the 20.0 NTU standard read 26.0.

8.3 Sample Handling and Holding Time Requirements

After collection, all samples were immediately put into a cooler with frozen ice packs and bagged ice, then transported to the LRWQCB laboratory and placed in a refrigerator until they were re-packed with ice in coolers and transported by courier to the laboratory with chain of custody (COC) forms. Upon receipt, the laboratory noted the temperature, number of containers, date, and time. Samples arrived at the laboratory at or below 6.0°C, except those received in May (7.2°C), July (6.1°C), and September (9.3°C) which were assigned an ESA qualifier of "HTe". In October, the laboratory failed to note the temperature of the sample containers upon arrival; however, ambient water was approximately 12°C at the time of sampling and ice packs were included in the coolers. Samples were refrigerated until being packed on ice in coolers and transported by courier to the laboratory. The laboratory provided verbal communication that the samples arrived on ice. Similar handling was implemented as in previous months when ambient water temperatures were higher and samples arrived within the QAPP specified 6°C maximum temperature.

All samples except orthophosphate were analyzed within acceptable holding times for each of the three months where holding temperatures were exceeded. The orthophosphate samples that exceeded the 48-hour holding time were collected late afternoon on September 10, 2019 from the Marina Lagoon sites (E1, E2, and E3), received by the laboratory on September 12, 2019, analyzed that day, and qualified by the laboratory as "HT". Other samples analyzed outside the QAPP holding times included percent moisture measured from sediment samples collected in July from E3, W7, and W8, and similarly flagged "HT". The near-surface sample collected on July 17, 2019 from W7 was inadvertently excluded from the cooler sent to the laboratory and resampled on July 23, 2019.

8.4 Laboratory Quality Control Results

Data report packages received from the laboratory were reviewed to ensure measurement quality objectives (MQOs) were met for internal laboratory quality control and field collected samples. Duplicate sample analyses were performed on at least 10 percent of samples, and method blanks (matrix dependent), laboratory control samples (LCS), matrix spikes (MS), and matrix spike duplicates (MSD) were analyzed as part of the routinely performed analytical methods. Laboratory duplicates, LCS, MS, and MSD analyses were used to estimate the precision and accuracy resulting from the combination of the analytical procedure and matrix interferences. Laboratory blanks were used to measure the response of the analytical system at a theoretical concentration of zero, and to check for laboratory contamination.

All water and sediment analytical data were considered valid unless (1) the laboratory identified analytical problems that required the results to be qualified, (2) there were known issues in data collection that were identified in the field notes or calibration forms, or (3) best professional judgement determined anomalous results were not reliable. Laboratory data qualifiers used in this report are described in Table 31.

Table 31. Data qualifiers assigned by the laboratory and the ESA Project Quality Assurance Manager.

Data Qualifier	Description
B	Rinsate blank 25 percent greater than the reporting limit, sample batch results qualified as potentially bias high
BH	Qualifier specific to sediment moisture content; results potentially biased high due to excess water in the petit Ponar
BL	Qualifier specific to sediment; results potentially biased low due excess water in the petit Ponar sampler
C1	Qualifier specific to chlorophyll *a* and phaeophytin *a* results; the reported concentration for this analyte is below the quantification limit
E	Results should be considered an estimate. The sample matrix had the potential to interfere with analysis due to particulate matter being present in the sample
HT	Sample analyzed beyond the accepted holding time
HTe	Holding temperature exceeded for sample based on QAPP guidance
J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit
U	The analyte was analyzed for, but was not detected above the level of the sample reporting/quantitation limit
M	The matrix spike/matrix spike duplicate (MS/MSD) values for the analysis of this parameter were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate
P	Primary field sample and duplicate were outside the RPD of 25 percent; precision is considered poor
QD	The sample duplicate or matrix spike duplicate analysis demonstrated sample imprecision. The reported result should be considered an estimate
R	Sample result rejected as unusable
S	Surrogate recovery was outside of laboratory acceptance limits due to matrix interference. The associated blank and LCS surrogate recovery were within acceptance limits
SC	Spike recovery not calculated. Sample concentration >4X the spike amount; therefore, the spike could not be adequately recovered

Shaded qualifiers indicate those assigned by the Project Quality Assurance Manager

8.4.1 Surface water Nutrients and Conventional Water Quality Indicators

A summary of laboratory qualifiers by parameter for surface water samples is provided in Table 32. Only parameters with qualifiers are presented, and includes:

- Initial reporting limits provided by the laboratory did not provide sufficient resolution given the low concentrations of some parameters (e.g., ammonia, total phosphorus), therefore concentrations below the practical quantitation limit (PQL) were reported and "J" flagged after the May sampling event. The laboratory used this qualifier to indicate analytical results that were between the laboratory MDL and the laboratory PQL and considered estimated concentrations. The May report was also subsequently amended to include “J” flagged data. Results of 88 percent of surface water samples analyzed for ammonia were “J” flagged.

- More than 92 percent of the nitrate- and nitrite-nitrogen samples were “U” flagged as not detected above the reported sample/quantitation limit, and 10 of those samples were also flagged “HT” in July and September as being outside the holding time.
- Over 70 percent of the orthophosphate samples were “U” flagged, two were flagged “E” as being an estimates that likely contained particulate material.
- Three sample results were rejected: nitrate- and nitrite-nitrogen samples from near the surface at W7 in July due to anomalously high results in combination with holding time exceedance (“HT” flag), one TP from near the surface at W10 in June which was anomalously high and associated with a rinsate blank that reported to be 0.15 mg/L.

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Table 32. Summary of surface water sample data qualifiers assigned by the laboratory or ESA Project Quality Assurance Manager.

Parameter	Total Samples	No. Samples Rejected	Qualifier												
			B	**HTe**	**U**	**E**	**HT**	**J**	**P**	**M**	**M**	**P**	**QD**	**SC**	**C1**
Ammonia	156		32	72				141				1			
Chlorophyll *a*	77				1			8							8
Phaeophytin *a*	77				1			4							4
DOC	8			5											
Nitrate Nitrogen	156		6	72	153		11	2							
Nitrite Nitrogen	156		6	72	156		11			1					
Orthophosphate	156		6	72	119	2	6	30				1			
TKN	156		32	72	15			32		5	1		1	1	
TP	156	1	37	72	19			62	1	2		1			
Total Alkalinity	78	1										1			

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8.4.2 Groundwater Nutrients

A summary of groundwater data qualifiers by the laboratory and the ESA Project Quality Assurance Manager by parameter is provided in Table 33, and includes:

- Nearly half of the nitrate-nitrogen samples were "U" flagged and all but one nitrite-nitrogen sample was "U" flagged.
- One nitrate-nitrogen sample was "M" flagged for the MS/MSD analysis being outside acceptance criteria.
- Orthophosphate data were flagged for a number of qualifiers, including "U", "E", "J", "M". Two of the "E" flagged samples were rejected because their concentrations exceeded TP concentrations in the same sample water.
- Of the TP samples, they were "U" and "J" flagged in limited instances.
- All samples collected in July were flagged by the Project Quality Assurance Manager as "HTe" for exceeding the QAPP holding temperature of 6°C.

Table 33. Summary of groundwater sample data qualifiers assigned by the laboratory or ESA Project Quality Assurance Manager.

Parameter	Total Samples	No. Samples Rejected	Qualifier						
			HTe	U	E	J	M	P	SC
Nitrate Nitrogen	14		4	6			1		
Nitrite Nitrogen	14		4	14			1		
Orthophosphate	13	2	3	2	3	2	1	1	
TKN	14		4			2			1
TP	14		4	1		3		1	

8.4.3 Sediment Nutrients, Aluminum Elutriate Samples and Sediment Physical Characteristics

A summary of sediment data qualifiers by the laboratory and the Project Quality Assurance Manager by parameter is provided in Table 34, and includes:

- Four sediment samples analyzed for percent moisture were flagged "BH" due to increased water in the petit Ponar resulting and potentially biased high results.
- One sample was flagged "BL" due to increased water content that likely biased low the resulting organic matter content.
- Four samples were flagged "HT" for exceeding holding time criteria for percent moisture as determined by Standard Method 2540, which states holding times shall not exceed 7 days. Samples collected in July were analyzed on day 8 following collection.
- Numerous samples were flagged "HTe" for exceeding the holding temperature criteria of 6°C for all parameters listed in Table 34.
- One instance of sediment phosphorus was "M" flagged for the MS/MSD analysis being outside acceptance criteria.
- No sediment data were rejected as unusable.

Table 34. Summary of sample data qualifiers for sediment nutrients, sediment physical characteristics, and sediment elutriate aluminum assigned by the laboratory or ESA Project Quality Assurance Manager.

Parameter	Total Samples	Qualifier				
		BH	BL	HT	HTe	M
Aluminum	9				6	
Organic Matter	2		1		1	
Percent Moisture	14	4		4	4	
Orthophosphate	18				18	
TKN	10				9	
TP	10				9	1

8.5 Data Quality Objectives and Data Quality Assessment

All laboratory data underwent a quality assurance review by laboratory staff to compare quality control sample results to the acceptance criteria specified in the standard operating procedure for each analytical method. Appropriate qualifiers were then assigned to results that did not meet acceptance criteria and, if acceptable according to the method, the samples were re-analyzed. Data qualifiers were described in a case narrative included with each data package.

Upon receipt of the verified data from laboratories, the Project Quality Assurance Manager evaluated the data for project use by comparing the results of QC samples with MQOs for bias, precision, and accuracy. Data were also reviewed for outliers or abnormalities and double-checked as necessary against field notes, previous data trends or supporting raw data.

Overall precision was estimated by calculating the RPD between results for field duplicates. Instances of RPDs above 25 percent were not used to reject data; however, in two instances, the sample collected as a duplicate was used in place of the primary sample: samples collected in May at T12 and analyzed for alkalinity and bicarbonate, as these exceeded other primary samples by more than half and were considered anomalous. The primary samples were "R" flagged.

Analytical bias was within acceptable limits as laboratory QC limits were met for blanks, MS and MSD samples, and LCS. Sampling bias was evaluated by verifying that the correct sampling and handling procedures were used, and by confirming that results for field blank analyses were less than reporting limits. As previously mentioned, field rinsate blanks were not collected for one sample event due to miscommunication with the laboratory in ordering an adequate number of bottles.

Quality assurance review of field measurements consisted of graphing results to identify outliers and abnormalities, and comparing results between data loggers and sondes for temperature, DO, and pH. As described in Section 8.2.1, anomalous data were omitted by incorporating calibration records, deployment times, and best professional judgement.

There were a total of 1,300 surface water, groundwater, and sediment samples analyzed by the laboratory for nutrients and other chemical and physical characteristics. Of those, four samples were fully rejected from further analysis, or 0.3 percent (i.e., one surface water TP, one primary surface water alkalinity rejected and the duplicate used instead, and two orthophosphate groundwater samples).

The goal of the baseline water quality project was to provide scientifically valid data characterizing existing water and sediment quality in the Tahoe Keys lagoons, including compliance with numerical and narrative WQOs from the Basin Plan, and provide other information needed to develop a conceptual model of nutrient loading and nutrient cycling in the lagoons. Information from this project will be used to evaluate the potential effects from aquatic weed control alternatives, and help inform a complete anti-degradation analysis. Based on a thorough review of the project data, the ESA Project Quality Assurance Manager concluded that baseline water quality results were of sufficient quality to meet the project goal and support water quality evaluations, and specific project data quality objectives described in the QAPP were met except the collection of baseline herbicide chemical concentrations which was postponed.

9 Literature Cited

California Regional Water Quality Control Board. 1995. Water Quality Control Plan for the Lahontan Region. State of California. Regional Water Quality Control Board. Lahontan Region.

Environmental Science Associates (ESA). 2019. Quality Assurance Project Plan: Baseline Water Quality in Tahoe Keys Lagoons. Prepared for Tahoe Regional Planning Agency. Available: https://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml.

Appendix F

Tahoe Keys Nutrient Loading and Nutrient Cycling Conceptual Model

Technical Memorandum

date January 16, 2020

to Jim Good, ESA Project Manager

cc Jeremy Pratt, TRC Project Manager

from David Tomasko, Ph.D.

subject Tahoe Keys Nutrient Loading and Nutrient Cycling Conceptual Model

Background

As shown in Section 4.2, and consistent with prior reports from Sierra Ecosystems Associates (2017) the water quality in Tahoe Keys is enriched with total nitrogen (TN) and total phosphorus (TP) to levels substantially higher than the water quality objectives (WQOs) of 0.150 and 0.008 mg/L for TN and TP, respectively, outlined in the Water Quality Control Plan for the Lahontan Region (Basin Plan). In addition to these numerical criteria, the Basin Plan states that "waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect the water for beneficial uses." These numerical and narrative WQOs were based on historical high water quality documented in Lake Tahoe in the late 1960s and early 1970s. Annual average values for TN and TP in the Tahoe Keys exceeded their relevant WQOs for each year from 2007 to 2013 (SEA 2017a). In 2016, even the minimum values recorded for TN and TP exceeded relevant WQOs for the Marina Lagoon, the Main Lagoon and Lake Tallac. Clearly, the Tahoe Keys lagoons should be considered "enriched" with nutrients, at least in terms of the relevant Basin Plan criteria. The Basin Plan states that water quality objectives may be exceeded due to natural causes in a few water bodies within the Lake Tahoe Basin, and the Regional Board will assess compliance with the objectives on a case-by-case basis in such circumstances.

With the lagoons' water quality already exceeding Basin Plan criteria, any activities that could potentially increase nutrient concentrations in the water column should be evaluated for potential adverse effects on beneficial uses. Of particular relevance, Wang et al. (2018) documented the initiation of a cyanobacteria bloom in a Chinese lake, upon the seasonal die-off of luxuriant meadows of curlyleaf pondweed (*Potamogeton crispus)*. The authors speculated that the nutrient content of the *P. crispus* meadows became available for fueling phytoplankton growth upon remineralization of the phosphorus within the macrophyte biomass (Wang et al. 2018). Similarly, the annual average water column chlorophyll-a concentration in Florida's Lake Tarpon did not correlate with external stormwater loads, but did correlate (in a positive direction) with the amount of invasive aquatic species treated by herbicides in a given year (Atkins and ESA 2016). In the first example, the lake in China exhibited a phytoplankton bloom in response to the release of phosphorus from submerged aquatic vegetation, or SAV, (Wang et al. 2018) while in the second example, algal blooms in Lake Tarpon were related to the release of nitrogen from SAV (Atkins and ESA 2016).

Nutrients and Chlorophyll in the Tahoe Keys Lagoons During the 2019 Growing Season

The 2019 data collected and analyzed by ESA is displayed in detail in Section 4 of the report "Draft Summary of Results: Baseline Water Quality in Tahoe Keys Lagoons." For the purposes of this nutrient cycling conceptual model, Table 1 summarizes the most relevant data for model development and determining the nutrient of greatest concern. Results shown are for TN, TP and Chlorophyll-a (Chl-a).

Table 1 – Summary of nutrient and chlorophyll-a data from the Marina Lagoon, the Main Lagoon, and Lake Tallac.

Lagoon	Depth	TN average (mg/L)	TP average (mg/L)	TN:TP	Chl-a average (µg/L)
Marina	Surface	0.15	0.014	10.8	1.39
	Bottom	0.20	0.018	11.2	
	Combined	0.17	0.016	11.0	
Main	Surface	0.31	0.020	15.4	3.71
	Bottom	0.38	0.033	11.6	
	Combined	0.34	0.027	13.0	
Tallac	Surface	0.43	0.042	10.2	2.66
	Bottom	1.65	0.078	21.1	
	Combined	1.04	0.060	17.3	

Chang et al. (1992) concluded that the waters of Lake Tahoe had shifted over time to become increasingly phosphorus limited, due in part to enrichment of nitrogen via atmospheric deposition.

To further investigate the issue of nutrient limitation, the waters of the Marina Lagoon, the Main Lagoon and Lake Tallac were all examined by comparing concentrations of chlorophyll-a (as a potential statistically significant dependent variable) against both TN and TP, as independent variables. In all cases, the data sets failed tests for normality and/or homogeneity of variance. Consequently, non-parametric statistical analyses were performed, using both Pearson's and Spearman's tests. Where a line and equation are shown in Figures 1 to 6, there is a mathematical relationship between a nutrient and chlorophyll-a, derived from linear regression, but only for those data sets where statistical significance ($p < 0.05$) was determined using non-parametric analyses.

Results for the Marina Lagoon are shown in Figures 1 and 2, while results from the Main Lagoon are displayed in Figures 3 and 4, and results from Lake Tallac are shown in Figures 5 and 6.

Figure 1 – Relationship between TP (mg/L) and Chl-a (µg/L) in the near-surface waters of the Marina Lagoon in 2019 (data from ESA).

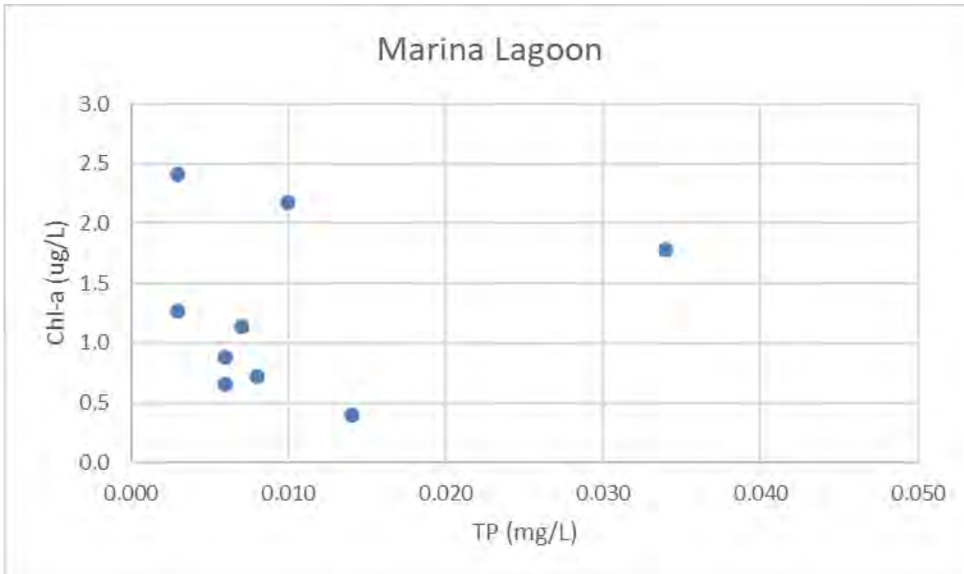
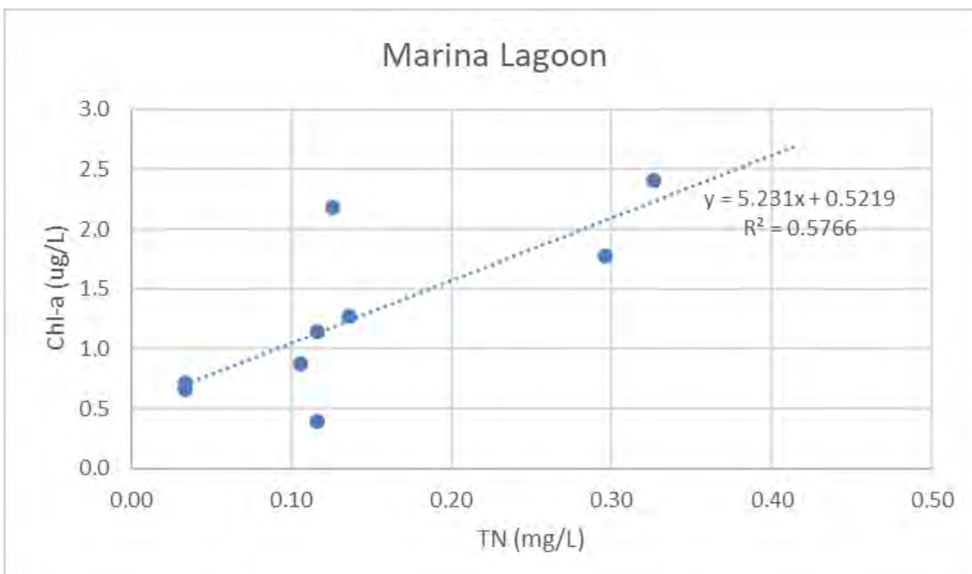


Figure 2 – Relationship between TN (mg/L) and Chl-a (µg/L) in the near-surface waters of the Marina Lagoon in 2019 (data from ESA).



The results shown in Figures 1 and 2 show that nitrogen is likely the limiting nutrient in the Marina Lagoon, as it, rather than phosphorus, varied in a positive and statistically significant manner with chlorophyll-a. Over 50 years ago, the nitrogen to phosphorus ratio of 16:1 (by moles) was established as a value suggestive of shift from nitrogen limitation (below 16) to co-limitation or phosphorus limitation (above 16). This so-called Redfield ratio (Redfield 1958) is on a molar basis. After conversion to a weight-based ratio, nitrogen-limitation would be expected with TN:TP ratios (by weight) below 7.2. For the open waters of Lake Tahoe, Chang et al. (1992) concluded that the lake's average TN:TP ratio (by moles) was 54:1, and phytoplankton was determined by manipulative experimentation to be limited by phosphorus. A 54:1 molar ratio converts to a weight-based TN:TP ratio of 24.4 to 1. Consequently, for the Tahoe Keys lagoons, weight based TN:TP ratios of less than 7.2 suggest nitrogen limitation, values higher than 24.4 indicate phosphorus limitation, and values between 7.2 and 24.4 indicate potential co-limitation by nitrogen and phosphorus. The TN:TP ratio of surface waters in the Marina Lagoon averaged 10.8, a value indicating co-limitation, while there was no statistically significant relationship between TP and chlorophyll-a, indicating a stronger influence of nitrogen than phosphorus

Figure 3 – Relationship between TP (mg/L) and Chl-a (µg/L) in the surface waters of the Main Lagoon in 2019 (data from ESA).

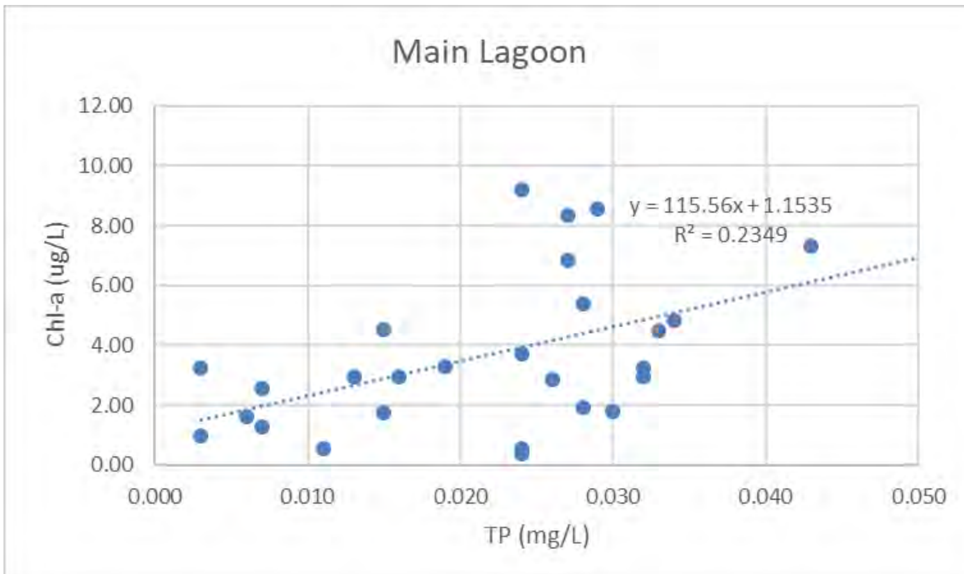
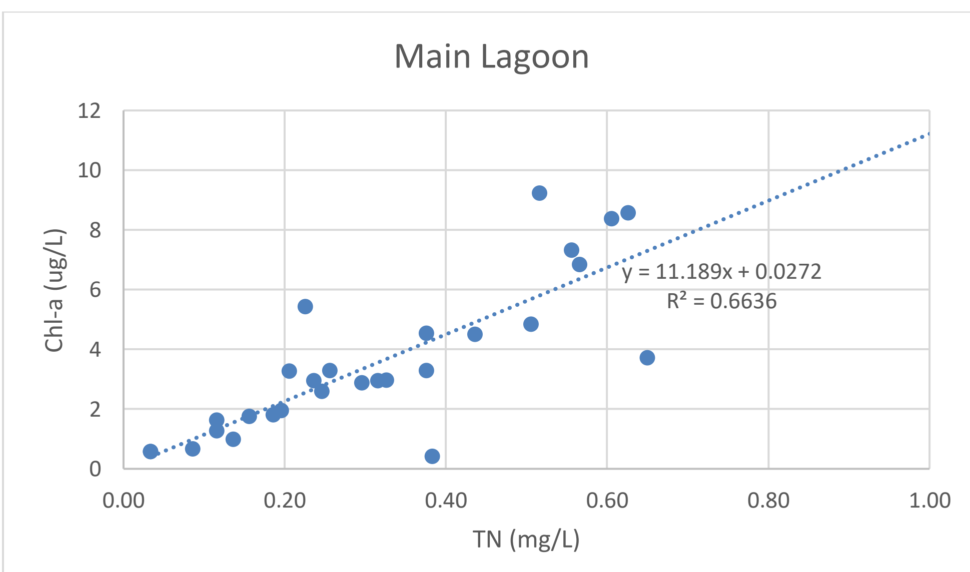


Figure 4 – Relationship between TN (mg/L) and Chl-a (µg/L) in the surface waters of the Main Lagoon in 2019 (data from ESA).



For the Main Lagoon, the results shown in Figures 3 and 4 suggest that there are statistically significant relationships between both nutrients and phytoplankton abundance, which is consistent with the average TN:TP ratio of 15.4. However, the better statistical fit between TN and Chl-a, compared to that of TP and Chl-a, suggests that nitrogen is the more ecologically relevant nutrient (i.e., limiting to algal productivity) in the Main Lagoon.

Figure 5 – Relationship between TP (mg/L) and Chl-a (µg/L) in the surface waters of Lake Tallac in 2019 (data from ESA).

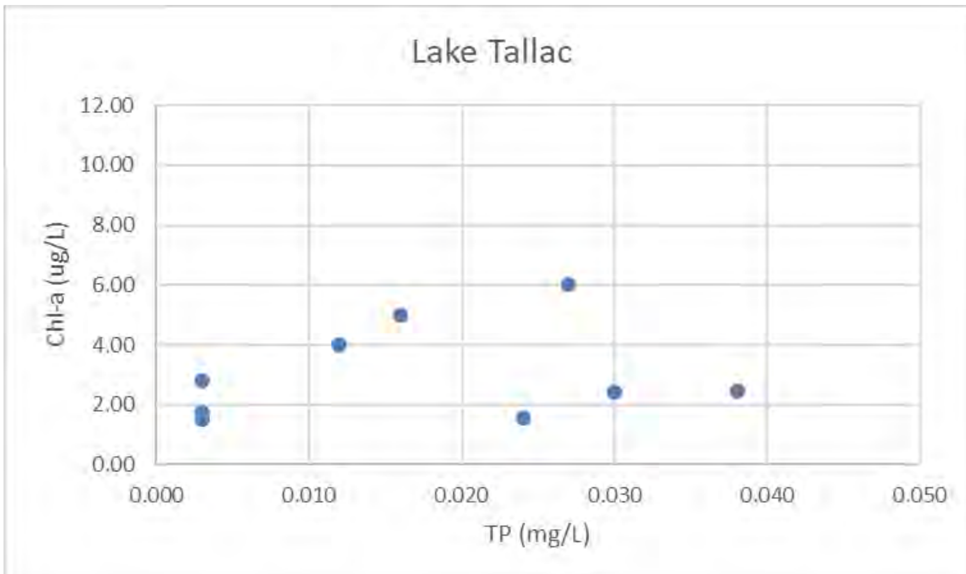
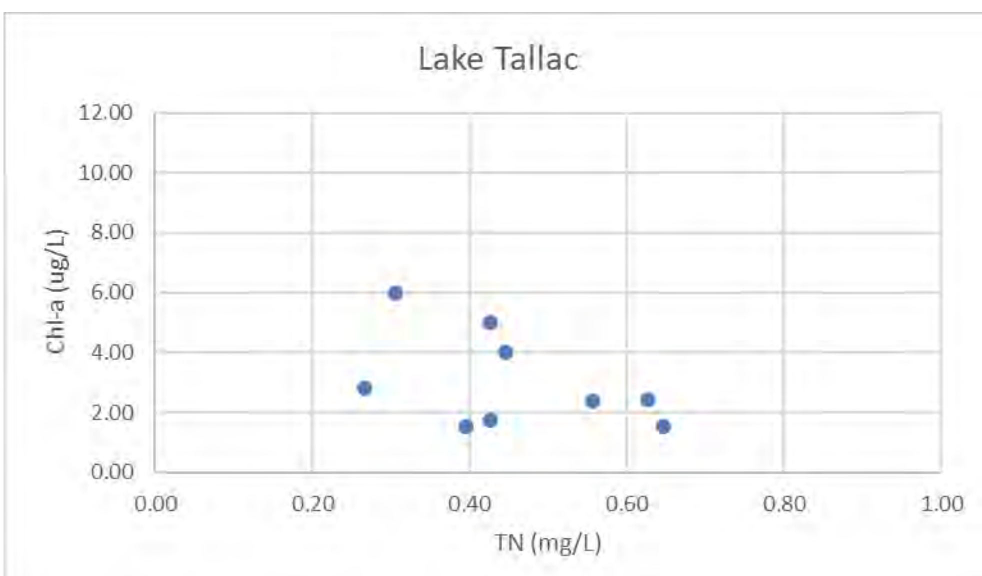


Figure 6 – Relationship between TN (mg/L) and Chl-a (µg/L) in the surface waters of Lake Tallac in 2019 (data from ESA).



In contrast to both the Marina and Main Lagoons, the results displayed in Figures 5 and 6 do not suggest that there is a statistically significant (or obvious) relationship between nutrient levels and phytoplankton biomass in Lake Tallac. Perhaps because of a more direct connection to adjacent wetlands and the abundance of tannins in the water, Lake Tallac may be less sensitive to nutrient supply, at least for phytoplankton, than the Marina and Main Lagoons. Prior work in locations as disparate as Florida, Minnesota, the UK and the Islamic Republic of Iran have shown that wetland-associated compounds such as tannic acids, fulvic acids and humic acids moderate the response of phytoplankton to nutrient levels (i.e., Tomasko et al. 2016 and references within). Lake Tallac's extensive wetland fringe may contribute a degree of protection from the impacts of nutrients, in terms of phytoplankton blooms and cyanobacteria blooms, that is not available in the Marina and Main Lagoons.

With this background, ESA set about developing a nutrient loading model that was focused on estimating the nutrient loads and nutrient pools associated with the Tahoe Keys lagoons. In her Master of Science thesis, Walter (2000) focused on phosphorus dynamics and nutrient uptake studies for the macrophytes in the Tahoe Keys lagoons. Considering the TN:TP ratios and the results displayed in Figures 1 through 6, the nutrient loading model described here focuses on both nitrogen and phosphorus as nutrients of concern, in terms of the potential for adverse impacts to water quality. This memorandum thus summarizes the approach, assumptions, and algorithms involved in the development of both nitrogen and phosphorus loading estimates, and the results from the analyses conducted for this effort.

<u>Model Components</u>

The nutrient loading model is comprised of several different components. The individual components include the following:

- Estimating the mass of TP and TN in the water column in the Marina Lagoon, Main Lagoon and Lake Tallac
- Estimating the mass of TP and TN contained within the Submerged Aquatic Vegetation (SAV) within the Marina Lagoon, Main Lagoon, and Lake Tallac
- Estimating the amount of TP and TN that would be expected to enter the water column after decomposition of the SAV
- Estimating the amount of TP and TN likely to enter Lake Tallac and the Main Lagoon from groundwater inflow from portions of the watershed at higher elevations
- Estimating the amount of TP likely to enter the water column via sediment fluxes (no similar estimates could be derived for TN fluxes from bottom sediments from existing data)
- Estimating the amount of TP and TN likely to enter the Main and Marina Lagoons and Lake Tallac from stormwater runoff
- Estimating the amount of TP and TN likely to enter the Marina and Main Lagoons during times when lake levels are rising, and
- Estimating the amount of TP and TN likely to enter all three lagoons from wet and dry atmospheric deposition

The model components listed above focus on different sources for nutrients that could be added to the water column. There are also unquantified processes through which nutrients, both dissolved and particulate, "leave" the water column, such as water leaving the lagoons during periods of lower lake levels (as opposed to lake rise) as well as the settling out of sediment-bound phosphorous and nitrogen, or the process of denitrification. However, the nutrient loading model quantifies sources of nutrient loads over which control is possible, and the unquantified processes were implicity included in our findings by the use of water column and sediment nutrient data collected in 2019.

The data sources for assumptions and algorithms used in the rate coefficients and/or state variables are cited for each loading source in the following sections.

Lagoon Water Quality

The assumptions required to estimate the amount of TP and TN in the water column are listed below in Tables 2 and 3, respectively. Estimates of the size of the waterbodies came from LaPlante (2018) and SEA (2018) while depth estimates for the Marina and Main Lagoons came from SEA (2018). Depth estimates for Main and Marina Lagoons were also applied for Lake Taillac, in the absence of site-specific information.

Table 2 – Assumptions and estimates of the amount of TP in the water column for the Marina and Main Lagoons and Lake Tallac.

System	Size (acres)	Size (m2)	Mean depth (ft)	Mean depth (m)	Volume (m3)	Volume (L)	2019 mean mg TP/L (surface and bottom)	Mean TP mass in water -2019 (kg TP)
Marina lagoon	32	129,504	12	3.66	473,985	473,984,640	0.016	7.6
Main lagoon	110	445,170	12	3.66	1,629,322	1,629,322,200	0.027	44.0
Lake Tallac	30	121,410	12	3.66	444,361	444,360,600	0.060	26.7

Size estimates from LaPlante (2008). Depth estimates from SEA (2018) and 2019 mean TP values from ESA (2019).

Table 3 – Assumptions and estimates of the amount of TN in the water column for the Marina and Main Lagoons and Lake Tallac.

System	Size (acres)	Size (m2)	Mean depth (ft)	Mean depth (m)	Volume (m3)	Volume (L)	May to July 2019 average TN (mg/L)	Mean TN mass in water -2019 (kg TN)
Marina lagoon	32	129,504	12	3.66	473,985	473,984,640	0.170	80.6
Main lagoon	110	445,170	12	3.66	1,629,322	1,629,322,200	0.340	554.0
Lake Tallac	30	121,410	12	3.66	444,361	444,360,600	1.040	462.1

Size estimates from LaPlante (2008). Depth estimates from SEA (2018) and 2019 mean TP values from ESA (2019).

Submerged Aquatic Vegetation (SAV) Phosphorus and Nitrogen Content

To estimate the amounts of TP and TN contained within the SAV within the three lagoons, local data sources were combined with data from the wider scientific literature. The assumptions required to estimate the amount of TP and TN that could reasonably be expected to be contained within the SAV in the Marina Lagoon, the Main Lagoon and Lake Tallac are displayed in Tables 4 and 5.

Table 4– Assumptions used to estimate the amount of TP contained within the SAV in the Marina and Main Lagoons and Lake Tallac.

Species	Common name	Biomass (g dw / m2)				P content (% dry wt)		P contnent (g/m2)			System wide SAV P content (kg) using mean values		
		Low	Mid	High	Average	Literature-derived minimum	Measured	Low end	High end	Average	Marina lagoon	Main lagoon	Lake Tallac
Myriophyllum spicatum	Eursasian watermilfoil	74	166-349	763	338	0.130	0.392	0.096	2.990	1.325	136	501	145
Potamogeton crispus	Curly leaf pondweed	50	122-190	798	310	0.130	0.320	0.065	2.550	0.992	101	375	108
Myriophyllum spicatum	Eursasian watermilfoil	peak biomass in bloom conditions			763	0.130	0.280			2.136	219	808	233
Mean value											**152**	**562**	**162**

Biomass estimates for *M. spicatum* are from Johnson et al. (2000) and references therein. Biomass estimates for *P. crispus* are from Woolf and Madsen (2003) and references therein. Phosphorus content estimates are from Nichols and Keeney (1970), Bole and Allan (1978), Barko and Smart (1979), Theibaut (2008) and Wang et al. (2018). Tahoe Keys-specific *M. spicatum* phosphorus content of 0.28 (% dry weight) is from Walter (2000). The relative abundance (% of bottom area) with SAV was estimated at 79, 85 and 90 %, respectively, for Marina Lagoon, Main Lagoon and Lake Tallac, respectively (SEA, 2017b).

Table 5– Assumptions used to estimate the amount of TN contained within the SAV in the Marina and Main Lagoons and Lake Tallac.

Species	Common name	Biomass (g dw / m2)				N content (% dry wt)		N contnent (g/m2)			System wide SAV N content (kg) using mean values		
		Low	Mid	High	Average	Literature-derived minimum	Literature	Low end	High end	Average	Marina lagoon	Main lagoon	Lake Tallac
Myriophyllum spicatum	Eursasian watermilfoil	74	166-349	763	338	ND	1.620	0.096	2.990	5.476	560	2,072	598
Potamogeton crispus	Curly leaf pondweed	50	122-190	798	310	ND	1.620	0.065	2.550	5.022	514	1,900	549
Myriophyllum spicatum	Eursasian watermilfoil	peak biomass in bloom conditions			763	ND	1.620			12.361	1,265	4,677	1,351
Mean value											**780**	**2,883**	**833**

Biomass estimates for *M. spicatum* are from Johnson et al. (2000) and references therein. Biomass estimates for *P. crispus* are from Woolf and Madsen (2003) and references therein. Nitrogen content estimates for *M. spicatum* and *P. crispus* are from Walter (2000). Estimates of the relative abundance (% of bottom area) with SAV was estimated at 77, 85 and 90 %, respectively, for Marina Lagoon, Main Lagoon and Lake Tallac, respectively (SEA, 2017b).

When the results from the water column and the SAV are combined, it is clear that the majority of TP in the three lagoons is contained within the SAV, rather than the water column itself (Figures 7 to 9).

Figure 7 – Percentage of TP content in the water column and SAV in the Marina Lagoon.

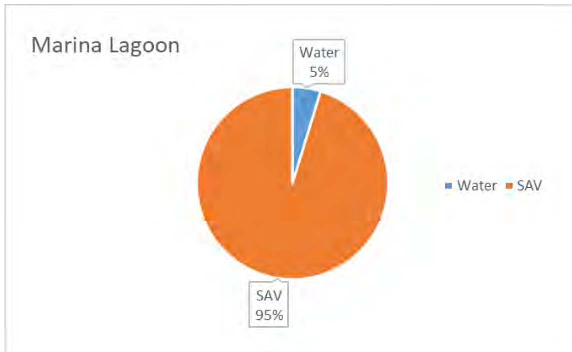


Figure 8 – Percentage of TP content in the water column and SAV in the Main Lagoon.

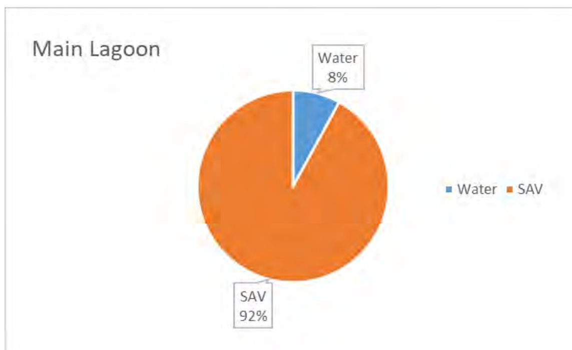
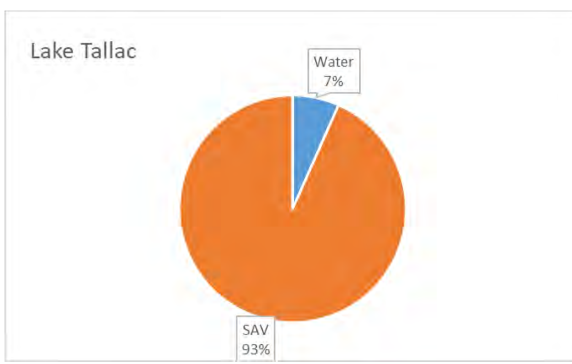


Figure 9 – Percentage of TP content in the water column and SAV in Lake Tallac.



Similar to the results for TP, it is also clear that the majority of TN in the three lagoons is contained within the SAV, rather than the water column itself (Figures 10 to 12). However, the percentage of TN in the water column ranged as high as 36% in Lake Tallac.

Figure 10 – Percentage of TN content in the water column and SAV in the Marina Lagoon.

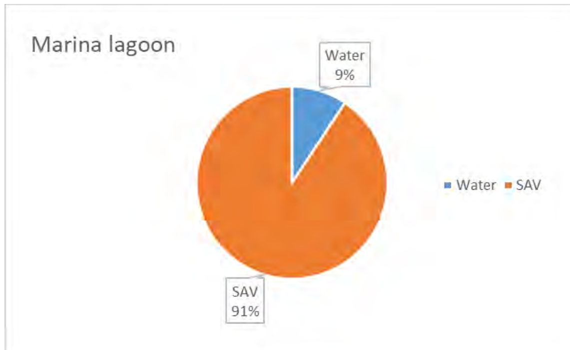


Figure 11– Percentage of TN content in the water column and SAV in the Main Lagoon.

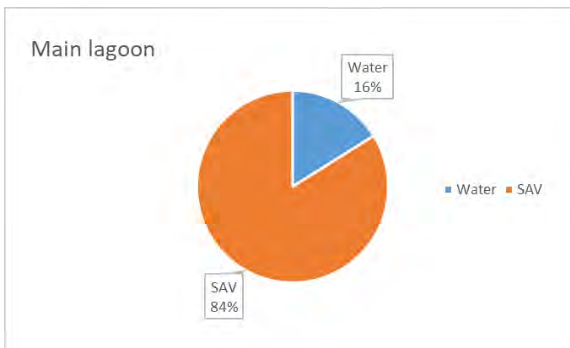
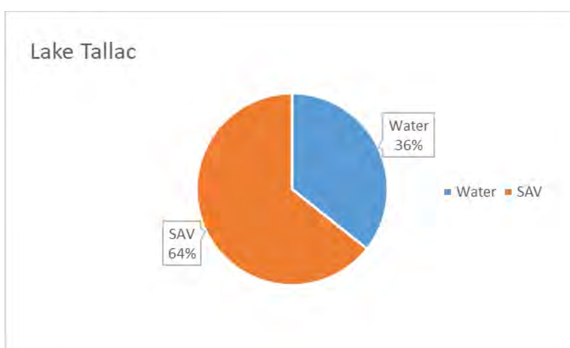


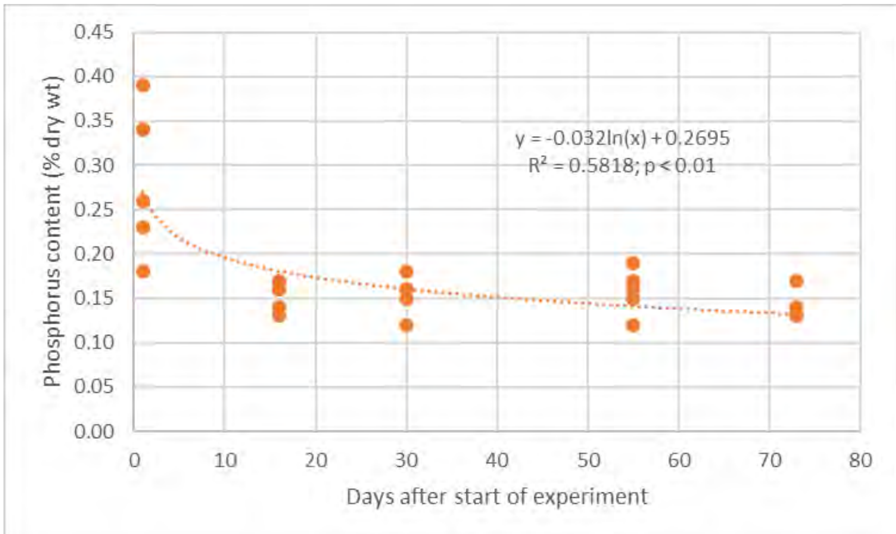
Figure 12 – Percentage of TN content in the water column and SAV in Lake Tallac.



Based on the assumptions listed above, it appears that the majority of the TP and TN in the Tahoe Keys lagoons is contained within the SAV community, rather than in the water column itself. These results suggest that care should be taken in terms of SAV management, lest the nutrient contents of treated SAV become available to the water column in such a manner as to initiate a phytoplankton and/or harmful algal bloom (HAB).

The rate at which TP is released from decomposing SAV was estimated using the results from a MS thesis conducted by Walter (2000). In her thesis, Walter (2000) determined the TP content of decomposing *M. spicatum* collected from the Tahoe Keys lagoons. The amount of TP not found in the decomposing vegetation was assumed to be the amount of TP that is at least temporarily available in the water column for phytoplankton uptake (Figure 13).

Figure 13 – Phosphorus content of decomposing M. spicatum. Data from Walter (2000).



The results displayed above suggest that over the course of ca. 70 days, approximately 49% of the TP content of SAV in the Tahoe Keys lagoons becomes available to the water column via remineralization. The majority of the 49% of TP that is released into the water column occurs in the first 20 days.

For TN, there are no locally-derived SAV remineralization estimates. Instead, a literature-derived value of 57% of TN is expected to become available over a 20 to 40-day timeframe (Jewell 1971) a value similar to the locally-measured value used for TP.

Assuming the release rates of 49% for TP for the biomass of SAV quantified above gives rise to TP loads of 74, 275 and 79 kg for the Marina Lagoon, the Main Lagoon, and Lake Tallac, respectively. Assuming a release rate of 57% for TN for the biomass of SAV quantified above gives rise to TN loads of 444, 1,643 and 475 kg for the Marina Lagoon, the Main Lagoon, and Lake Tallac, respectively. For the purposes of this model, it is assumed that the majority of the TP and TN made available via SAV decomposition would become available during the first 20 to 40 days.

Groundwater TP and TN Loads

The amounts of TP and TN loaded to the Marina and Main Lagoons were estimated based on information contained within tables from preliminary draft EIR/EIS Chapter 3.3.3. The volume of groundwater inflow into Lake Tallac and the Main Lagoon was modeled for the period of May to October of 2019. (There are no available estimates of groundwater loads to the Marina Lagoon in that Chapter or the reviewed literature.) Groundwater inflows are available for Lake Tallac from areas south of Lake Tallac, as well as inflows to the Main Lagoon from both Lake Tallac (below Venice Road) as well as via Pope Marsh. The monthly groundwater exchange estimates for 2019 from Chapter 3.3.3 were summed, and then converted from acre-feet to liters. The quantity of groundwater inflow was then multiplied by average TP and TN values for ESA groundwater sampling sites P2, P3, P4, and P5 for inflows into Lake Tallac, as well as groundwater flows from Lake Tallac into the Main Lagoon. For groundwater flows from Pope Marsh into the Main Lagoon, volumes were multiplied by the average TP and TN values from sites P1 and P2.

Sediment Phosphorus Release

The development of a sediment phosphorus release estimate involves a number of steps: 1) determining the TP content of the sediments, 2) developing a hypothetical TP-release estimate from the sediments based on the TP content of the sediments, and 3) developing a system-wide internal TP release estimate based on the hypothetical TP-release estimate, modified to reflect the relative oxygen content of the bottom waters of the three lagoons.

The sediment TP content of samples from the three lagoons are shown in Table 6.

Table 6 – Sediment phosphorus content (in various units) for the Marina Lagoon (stations E1 and E2), the Main Lagoon (stations W4 to W7 and W10) and Lake Tallac (stations T12 and T13).

Site	mg TP/ kg	mg TP/ g	mgT P / kg dry wt	mg TP/ g dry wt	TP - % dry wt
E1	260.0	0.260	2,097	2.10	0.210
E2	73.0	0.073	1,377	1.38	0.138
Mean	**166.5**	**0.167**	**1,737**	**1.74**	**0.174**
W4	92.0	0.092	681	0.68	0.068
W5	97.0	0.097	688	0.69	0.069
W6	160.0	0.160	947	0.95	0.095
W7	82.0	0.082	788	0.79	0.079
W10	59.0	0.059	628	0.63	0.063
Mean	**98.0**	**0.098**	**746**	**0.75**	**0.075**
T12	110.0	0.110	738	0.74	0.074
T13	79.0	0.079	642	0.64	0.064
Mean	**94.5**	**0.095**	**690**	**0.69**	**0.069**

The results displayed above suggest that the TP content of the Marina Lagoon is more than twice as high as the sediment TP content in both the Main Lagoon and Lake Tallac, which are similar to each other. The sediment TP contents found in the three lagoons do not appear to be particularly enriched from anthropogenic sources, as a study of sediment TP content from 50 lakes in the Sierra Nevada found an average of 1.45 mg TP / gdw (Homyak et al. 2014) a value higher than the average for the Main Lagoon and Lake Tallac, and less than 20% lower than the average value for the Main Lagoon sites.

The sediment TP contents were used to develop hypothetical TP-release estimates, using the empirically-derived relationship between sediment TP content and laboratory-based TP release estimates derived by Nürnberg (1994).

The equation derived by Nürnberg (1994) produces estimates of TP release rate (RR) based on the following equation:

$$RR = -4.3 + 3.88(TP_{sed})$$

This equation allows for the derivation of TP release from sediments from a direct laboratory estimate, based only on the sediment TP content (TPsed) of sediments.

The RR was then further modified to develop an internal TP load estimate (L) based on the following equation:

$$L = RR \text{ x } AF$$

Where:

L = areal internal TP load (mg TP/m^2/yr),

RR = Release Rate (mg TP/m^2/day), and

AF = Anoxia Factor, which is the sum of all time and space occurrences of bottom water anoxia divided by the area of the water body (days/yr).

$$AF = \frac{\sum_i^n Ti \; x \; Ai}{Ao}$$

Where:

AF = anoxia factor (days/yr),

Ti = number of occurrences of bottom water anoxia,

Ai = spatial extent (percent of area) with bottom water hypoxia, and

Ao = total area of waterbody.

The data used to develop AF estimates for the three lagoons are summarized below in Table 7.

Table 7 - Summary of data used to develop anoxia factor (AF) value used to determine the internal TP load estimate for the Marina and Main Lagoons and Lake Tallac.

Station	% Frequency of hypoxia (based on 4 or 5 months of monthly sampling)	Hypoxic duration (days/yr)
E1	0	0
E2	20	73
E3	20	73
W4	0	0
W5	0	0
W6	20	73
W7	25	91
W8	25	91
W9	0	0
W10	0	0
T11	60	219
T12	80	292
T13	100	365

These results, which are from the period of May to July of 2019, are consistent with the time period over which SAV treatment via herbicides and/or at least the initial phases of UV-C light treatments are anticipated to occur. These estimates of bottom water hypoxia during the spring to summer months were used to determine an average AF for each of the three lagoons, which was then applied to the RR estimates for each lagoon, to develop internal P load estimates for each Tahoe Keys Lagoon (Table 8).

Table 8 – Estimates of annual internal TP load (kg P / yr) for the Marina and Main Lagoons and Lake Tallac.

System	Size (acres)	Size (m2)	Sum t*a	AF (days/yr)	Sediment TP (mg/g dry wt)	RR (mg/m2/d)	Internal TP Load (mg/m^2/yr)	Annual Internal Load (kg TP/yr)
Marina Lagoon	32	129,504	6,302,528	49	1.737	2.44	118.73	15.38
Main Lagoon	110	445,170	16,248,705	37	0.746	-1.40	-51.24	-22.81
Lake Tallac	30	121,410	35,451,720	292	0.690	-1.62	-473.86	-57.53

Based on the equations listed in Nürnberg (1994) the results displayed above suggest that the sediments are only a source of TP flux into the water column in the Marina Lagoon. In the Main Lagoon and Lake Tallac, sediment TP contents are low enough that the sediments in those two locations are not expected to be a net source of TP into the water column. These results are in-line with the results from Homyak et al. (2014) who derived an average sediment TP content of 1.45 mg TP/gdw from 50 lakes in the Sierra Nevada; the average values for the Main Lagoon and Lake Tallac were 48 and 52 percent lower than that value, respectively. Even though the bottom waters of Lake Tallac, especially at station T13, were often or regularly anoxic, the low sediment TP content resulted in those sediments not being determined to be a substantial source of TP flux into the water column. It should also be taken into account that sediment samples were collected in July of 2019, prior to the system-wide senescence of SAV that occurs in the fall. Sediment TP values could be higher after SAV senescence than was found during the season of active SAV growth.

Stormwater Loads

Estimates of the amount of TP and TN loaded into the Tahoe Keys were developed for the Main Lagoon, based on combining results from (1) a water budget developed for the Tahoe Keys Lagoons for the Final Lake Tahoe TMDL report (CRWQCB and NDEP 2010) with (2) results from the stormwater sampling effort conducted in November 2018 (data from SEA). The water budgets which are based on rainfall and runoff, have not been changed from those listed in CRWQCB (2014). However, the TMDL did not separate out the watersheds of the Tahoe Lagoon system into the three waterbodies, and it appears that the value of 372 acres for "watershed" includes areas that do not drain to either the Main or Marina Lagoons, and does not include the entire watershed for Lake Tallac. For these estimates, GIS was used to derive an estimate of the watersheds of the Main and Marina Lagoons of 210 and 68 acres, respectively, and the ratio between those two watersheds was applied to apportion the stormwater loads shown as "TK precipitation" between the Main and Marina Lagoons. A 600-acre watershed was assumed for Lake Tallac (A. Kopania, personal communication) and the runoff volume shown as "Upland Precipitation" was used as the volume of stormwater runoff coming into Lake Tallac. Those stormwater runoff volumes were then multiplied by the average TP and TN values recorded by SEA (2018) in their November 2018 stormwater sampling effort, 0.157 and 0.610 mg/L, respectively.

The assumptions required to develop an estimate of stormwater loads to the Tahoe Keys Lagoons are listed in Table 9 and 10, respectively, for TP and TN.

Table 9 – Summary of water budget values (CRWQCB 2014) and nutrient content (data from SEA 2018) used to develop stormwater TP load estimates for the Tahoe Keys Lagoons.

	Source/Cause	Area (acres)	Annual avg. (ft)	Runoff factor	Volume (acre-ft)	Portion of total (%)	Volume (L)	TP load (kg/yr)	TP load Main Lagoon (kg/yr)	TP load Marina Lagoon (kg/yr)
Inflows	TK precipitation - 1	372	1.7	0.4	254	45	313,303,920	49.03	37.04	11.99
	Upland precipitation - 2	600	1.7	0.5	510		629,074,800	98.45		
	Lake level rise - 3	100	2.5	NA	250	45	308,370,000	4.63		
	Irrigation runoff - 4	82	6.7	NA	54	10	66,607,920	10.42	7.87	2.55

Table 10 – Summary of water budget values (CRWQCB 2014) and nutrient content (data from SEA 2018) used to develop stormwater TN load estimates for the Tahoe Keys Lagoons.

	Source/Cause	Area (acres)	Annual avg. (ft)	Runoff factor	Volume (acre-ft)	Volume (L)	TN load (kg/yr)	TN load Main Lagoon (kg/yr)	TN Load Marina Lagoon (kg/yr)
Inflows	TK precipitation - 1	278	1.7	0.4	254	313,303,920	191.12	144.37	46.75
	Upland precipitation - 2	600	1.7	0.5	510	629,074,800	383.74		
	Lake level rise - 3	100	2.5	NA	250	308,370,000	74.01		
	Irrigation runoff - 4	82	6.7	NA	54	66,607,920	40.63	30.69	9.94

The terminology used in this table is consistent with that in the Lake Tahoe TMDL (CRWQCB 2014), although the values used have been modified, for reasons outlined above and below.

1. The term “precipitation” refers to the total amount of annual precipitation at South Lake Tahoe. That depth of water was then multiplied by the runoff factors used by CRWQCB (2014) and runoff volumes calculated based on estimates of the watershed size for the Marina and Main Lagoon watersheds. These volumes of water were then multiplied by storm-event average TP and TN sample concentrations of 0.157 and 0.610 mg/L, respectively, as reported by SEA (2018). Based on GIS, it was determined that the watershed for the Main and Marina Lagoons are approximately 210 and 68 acres, respectively.
2. The term “upland precipitation” refers to stormwater runoff that enters Lake Tallac. The 600-acre estimate for Lake Tallac’s watershed is from A. Kopania (personal communication 12/2019). This watershed size was then used, in conjunction with estimates of rainfall and the runoff coefficient to derive runoff volumes loaded to Lake Tallac from its watershed. That volume of water was then multiplied by the TP and TN concentrations used for the Marina and Main Lagoon stormwater to estimate nutrient loads to Lake Tallac from its watershed.
3. Lake level rise refers to the average annual increase in water level in Lake Tahoe over the period of 2003-2009. The height of lake increase was combined with the acreage of the Marina and Main Lagoons to estimate a volume of water entering those two waterbodies from the lake, and that volume was multiplied by Lake Tahoe Water Quality Objectives of 0.008 mg TP/L and 0.150 mg TN/L (CRWQCB and NDEP 2010) to derive a load to the Marina and Main Lagoons from lake rise.
4. Irrigation runoff accounts for that amount of runoff generated by landscape irrigation in the residential Main Lagoon watershed. As was done for stormwater runoff, the amount of irrigation runoff volume was apportioned as a function of the ratio between the watersheds of the Marina and Main lagoons. That volume of water was then multiplied by the stormwater event sampling average TP and TN concentrations of 0.157 and 0.610 mg/L, respectively, reported by SEA (2018).

Atmospheric Deposition

Estimates of the amount of TP loaded to the Marina Lagoon, Main Lagoon and Lake Tallac from the atmosphere were based on the Lake Tahoe TMDL (CRWCQB and NDEP 2010). The data used for estimating both wet and dry atmospheric deposition to the Main Lagoon, Marina Lagoon and Lake Tallac are listed below for TP (Table 11 and TN (Table 12).

Table 11 – Summary of values used to develop TP load estimates from atmospheric deposition to Tahoe Keys lagoons.

Wet plus dry deposition		Atmospheric load to Marina Lagoon		Atmospheric load to Main Lagoon		Atmospheric load to Lake Tallac	
kg P/acre/yr	g/acre/yr	acres	kg TP/yr	acres	kg TP/yr	acres	kg TP/yr
0.057	57	32	1.82	110	6.27	30	1.71

Table 12 – Summary of values used to develop TN load estimates from atmospheric deposition to Tahoe Keys lagoons.

Wet plus dry deposition		Atmospheric load to Marina Lagoon		Atmospheric load to Main Lagoon		Atmospheric load to Lake Tallac	
kg N / acre / yr	g/acre/yr	acres	kg TN / yr	acres	kg TN / yr	acres	kg TN / yr
1.78	1,780	32	57.0	110	195.8	30	53.4

Differences in the amount of atmospheric deposition displayed above are entirely due to differences in the amount of open water in the three lagoons, as the rates simply reflect a single estimate for area-normalized wet and dry deposition applied to different size waterbodies.

<u>Comparison of Load Estimates</u>

Figures 14 to 16 summarize the sources of TP loads to the Marina Lagoon, the Main Lagoon, and Lake Tallac, respectively.

Figure 14 – Estimates of TP loads from stormwater runoff and irrigation, sediment flux, lake level rise, atmospheric deposition, and SAV decomposition for the Marina Lagoon.

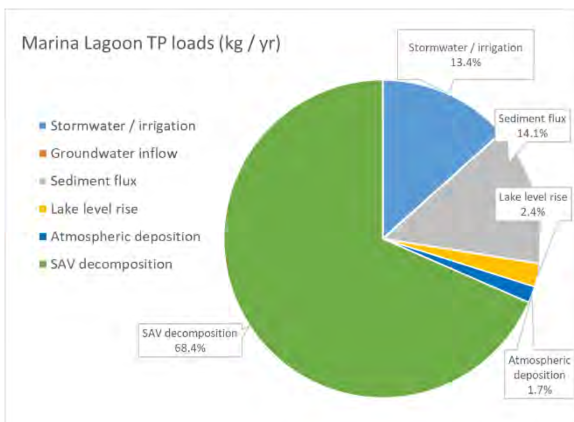


Figure 15 – Estimates of TP loads from stormwater runoff and irrigation, groundwater inflow, sediment flux, lake level rise, atmospheric deposition, and SAV decomposition for the Main Lagoon.

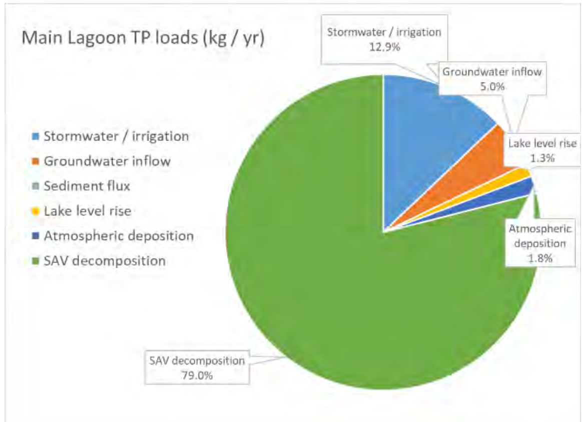
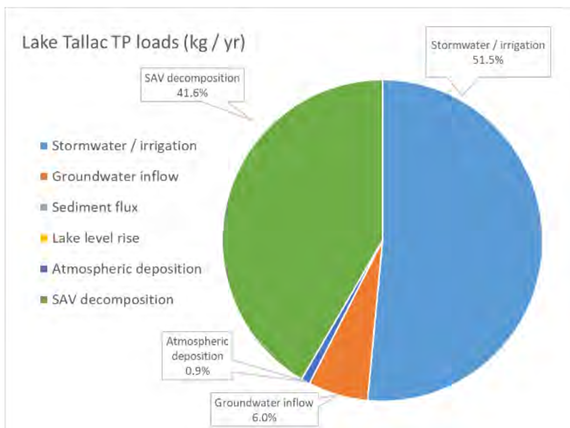


Figure 16 – Estimates of TP loads from stormwater runoff and irrigation, groundwater inflow, sediment flux, lake level rise, atmospheric deposition, and SAV decomposition for Lake Tallac.



The three lagoons differ from each other in terms of the sources of TP loads. The Marina Lagoon is the only one to show a load from sediment fluxes, because it was the only waterbody to have sufficiently high sediment TP contents, in addition to sufficient spatial and temporal distribution of bottom water hypoxia. However, the dominant TP load to the Marina Lagoon appears to be SAV decomposition. The Main Lagoon's dominant source for TP loads was SAV decomposition, followed by stormwater/irrigation runoff. In Lake Tallac, the much larger watershed influence, compared to the restricted watersheds of the Marina and Main Lagoons, results in stormwater runoff being the primary source of TP loads. The TP load associated with SAV decomposition is the second largest source for Lake Tallac, followed by groundwater inflows.

It should be kept in mind that the basis for the high loads of TP from SAV decomposition is because the majority of TP in the three lagoons was associated with SAV, rather than dissolved or suspended forms of phosphorus in the water column. It should also be noted that the TP content of the SAV is originally from sediment sources, as both native and nuisance plants mostly take up nutrients from their roots, which are in the sediments (with the exception of coontail). As such, the sediment release from SAV decomposition represents a process through which native and nuisance SAV take up sediment TP for growth, but then release approximately half of that TP into the water column during decomposition.

Figures 17 to 19 summarize the sources of TN loads to the Marina Lagoon, the Main Lagoon, and Lake Tallac, respectively.

Figure 17 – Estimates of TN loads from stormwater runoff and irrigation, groundwater inflow, lake level rise, atmospheric deposition, and SAV decomposition for the Marina Lagoon.

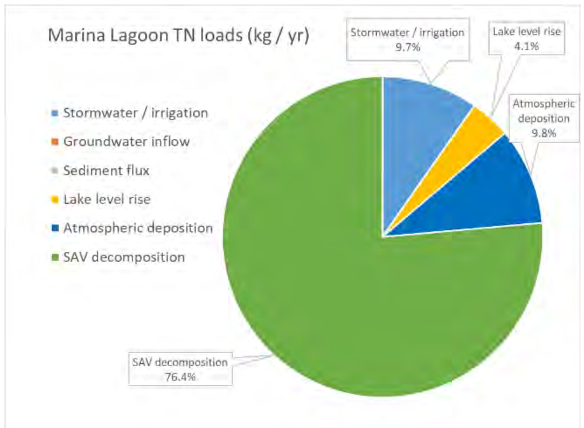


Figure 18 – Estimates of TN loads from stormwater runoff and irrigation, groundwater inflow, lake level rise, atmospheric deposition, and SAV decomposition for the Main Lagoon.

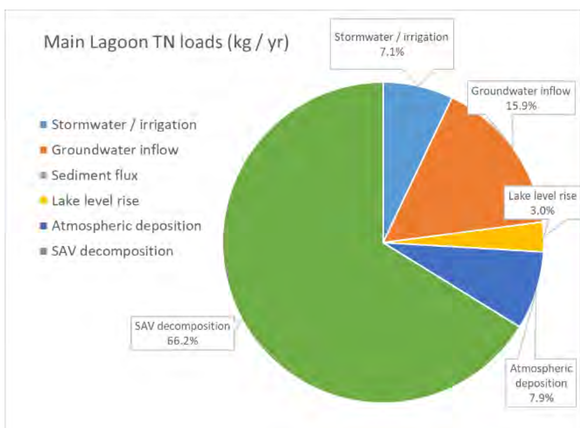
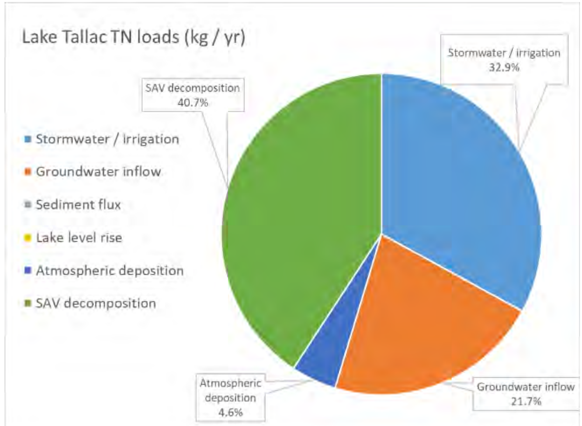


Figure 19 – Estimates of TN loads from stormwater runoff and irrigation, groundwater inflow, lake level rise, atmospheric deposition, and SAV decomposition for Lake Tallac.



The three lagoons differ from each other in terms of the sources of TN loads. As was found for TP, the dominant TN loads to the Marina and Main Lagoons appears to be SAV decomposition. In Lake Tallac, the much larger watershed influence, compared to the restricted watersheds of the Marina and Main Lagoons, results in stormwater runoff being the most significant source of TN loads. Groundwater inflows appear to be the second most important source of TN loads to Lake Tallac, followed by SAV decomposition.

Also as was found for TP, the basis for the high loads of TN from SAV decomposition is due to the finding that the majority of TN in the three lagoons was associated with SAV, rather than dissolved or suspended forms of nitrogen in the water column. It should also be remembered that the TN content of the SAV is from sediment sources, as both native and nuisance plants mostly take up nutrients from their roots, which are in the sediments (with the exception of coontail). As such, the sediment release from SAV decomposition represents a process through which native and nuisance SAV take up sediment nitrogen for growth, but then release approximately 60% of that TN into the water column during decomposition.

<u>Water Quality Responses to SAV Management Strategies</u>

The results displayed here suggest that special attention should be paid to the timing of treatment of nuisance SAV, whether via herbicide applications or UV treatment or any other activity. While the results from Walter (2000) suggest gradual release with perhaps only half of the TP content of SAV available to the water column in the first 70 days, most of that first half of TP release takes place within the first 20 days. Prior work by Wang et al. (2018) and Atkins and ESA (2016) suggest that overly ambitious efforts to eradicate nuisance SAV can bring about the unwanted side effect of creating a pulse of nutrients that can fuel nuisance algal blooms, including cyanobacteria.

A careful and informed effort to control nuisance SAV that takes into account the balance between SAV growth cycles, water temperature, and the availability of TP from all sources would be appropriate to optimize the effectiveness of implemented SAV control efforts, while concurrently minimizing the potential for adverse impacts to water quality that could give rise to nuisance algal blooms.

In an attempt to predict the water quality impacts of various SAV eradication scenarios, the results of water quality from the 2019 ESA sampling efforts were used, in comparison with the estimates of TP and TN that would be expected to be released into the water column upon SAV decomposition. The resultant water quality values for TP and TN were then compared to prior water quality guidance produced for the Bridgeport Reservoir, in Mono County (Warden and Payne 2004). The TMDL for the Bridgeport Reservoir provides guidance levels for springtime TP and peak chlorophyll-a values for oligotrophic, mesotrophic and eutrophic conditions. These nutrient categories are meant to protect resources dependent upon the maintenance of adequate water quality, and to reduce the likelihood of nuisance or Harmful Algal Blooms (HABs) such as those associated with cyanobacteria (aka blue-green algae). For TP, the guidance for springtime values translate to (after conversion to similar units) ranges of less than 0.02, 0.02 to 0.42, and greater than 0.42 mg TP/L for oligotrophic, mesotrophic and eutrophic conditions, respectively. For peak chlorophyll-a values, Warden and Payne (2004) suggest values of less than 2, 2 to 9, and greater than 9 µg Chl-a/L for oligotrophic, mesotrophic and eutrophic conditions, respectively. No guidance criteria for TN were developed by Warden and Payne (2004).

For the aquatic weed control methods test project, no methods testing is planned in the Marina Lagoon. Therefore, attention is focused here on determining the potential nutrient uplift associated with tests planned in the following areas: 1) east Main Lagoon, 2) west Main Lagoon, and 3) Lake Tallac. It is expected that a variety of methods would be tested for SAV management, mostly starting in spring of 2021. Herbicide application testing is expected to occur over a few weeks between early May and mid-June of 2021, with treatments in each test area completed in one or two days. Treatment with UV-C light is expected to occur in <2 ac test areas from June to October of 2021, with treatment of each site taking less than one week and treatments likely repeated in the second half of the growing season. Both techniques are expected to result in the die-off of SAV *in situ*, with nutrient release into the water column occurring more rapidly in those areas with herbicide application than in those test areas with UV-C light treatment. In the following year, 2022, additional and follow-up treatments with UV-C light might occur sometime during the months of June to October, if warranted. Herbicide applications would not occur in 2022. Additional anticipated SAV management techniques include the use of Laminar-Flow Aeration (LFA) and suction dredging. LFA was installed in April 2018 at one 6-acre site in the Main Lagoon, and two additional smaller test areas have been proposed for the methods test, one each in the Main Lagoon and Lake Tallac. Suction dredging, if used, would be conducted in Main Lagoon sites in the summer to fall of 2021.

The responses of water quality that are discussed below are related to those SAV management actions that have the potential to arise with the death and decomposition of SAV that would occur *in situ* with the use of herbicides and/or UV-C light treatments. These two techniques differ from the use of LFA and suction dredging, as they would result in the pool of SAV-containing nutrients being retained in the lagoons, with potential impacts to water quality and/or algal bloom initiation due to nutrient release from decomposing plant biomass.

In contrast, suction dredging could – if done appropriately – remove the mass of nutrients from plants and bottom sediments, which differs from the results of the actions undertaken with herbicide application and/or UV-C light treatment. In their review of more than a dozen completed sediment removal projects, Cooke et al. (2005) concluded that such projects had “mixed results” in terms of water quality improvement, while being several times more expensive than chemical methods for nutrient inactivation. Cooke et al. (2005) suggested that sediment removal for SAV control could be effective, but only if the resulting water depth was below the depth limit at which SAV could achieve sufficient light for growth and reproduction. For suction dredging to be able to permanently reduce the problem of nuisance SAV, results of a review of lake management projects suggests that the newly dredged lake bottom would have to exceed the deepest depth to which SAV grows in the Tahoe Keys, otherwise such an approach may only bring about a temporary reduction in SAV biomass, if the projects reviewed by Cooke et al. (2005) reflect conditions that are locally applicable. In a study conducted in Lake Tahoe (Hackley et al. 1996) it was found that water column nutrient concentrations could stay elevated above background concentrations for at least two weeks after the completion of sediment dredging (Figure 4-4b). The authors of that study found that, on average, less than 5% of the TP and TN in sediments was inorganic and/or biologically available, the nutrient forms that are readily available for phytoplankton uptake. The authors also found that "A majority of the marina sediments were shown to stimulate algal growth when added to Lake Tahoe water as a 1 % solution of elutriate test supernatant…" which suggests that very low concentrations of sediment porewater had the ability bring about adverse impacts to the lake's open waters, even with very thorough mixing. In addition, it was found that newly exposed sediments (below the dredged bottom) could potentially be a source of inorganic nitrogen loads to the water column over "a long period" (Hackley et al. 1996).

The use of LFA is fairly similar to the well-known lake management technique of artificial circulation. In their review of international lake management projects, Cooke et al. (2005) examined the responses of more than 50 lakes to artificial aeration, and found generally positive water quality responses. The positive responses of water quality to artificial aeration were almost universally associated with the introduction of oxygen into formerly hypoxic or anoxic waters along the lake bottom. However, none of the more than 50 lakes studied by Cooke et al. (2005) used artificial aeration as a primary technique for SAV control, and SAV responses to the use of techniques such as LFA was not quantified in the studies reviewed by Cooke et al. (2005). There may be no known benefit to the use of LFA to reduce nutrient loads from decomposing SAV, because the process may not actually reduce SAV growth.

Related to the SAV management techniques discussed above, the following portion of this Technical Memo focuses on the potential impacts to water quality associated with the use of herbicides and/or UV-C light as SAV management techniques. It is anticipated that herbicide application as a SAV management actions would be restricted to the spring to summer period, and so water quality data were restricted to those values of TP and TN collected in the months of May to July, 2019. Water quality stations were then separated into those stations representative of areas where SAV management actions would take place (in 2021) for the east vs. west sides of the Main Lagoon, and for the east side of Lake Tallac. If UV-C light treatments would extend into later months, these estimates of TP and TN uplift are still relevant, as water quality did not change substantially between July and October 2019, in part because the vast majority of TP and TN is in the SAV biomass, not the water column itself.

The expected uplift in TP and TN concentrations from the decomposition of SAV biomass was estimated based on an assumed peak SAV biomass of 324 gdw/m^2 for 2021 conditions, and the following scenarios were examined: 5, 10, 20, 40 and 100% of peak biomass treated, and TP and TN contents left to remineralize into the water column. For follow-up activities in the year 2022, it was assumed that SAV management was capable of reducing biomass by 75%, so that peak biomass was then reduced to 81 gdw/m^2. As was done for 2021, the following scenarios were examined: 5, 10, 20, 40 and 100% of peak biomass treated, and TP and TN contents left to remineralize into the water column.

The increases in TP and TN were then converted to expectations of increased concentrations of Chl-a in the Main Lagoon, based on the TP vs. Chl-a and TN vs. Chl-a equations displayed in Figures 3 and 4. As there was no statistically significant relationship between nutrients and Chl-a for Lake Tallac, uplift in nutrient concentrations is not a reliable indicator of algal productivity and Chl-a predictions were not made for Lake Tallac.

Results from the expected responses of TP and Chl-a to SAV treatment scenarios for 2021 and 2022 are displayed in Tables 13 and 14, respectively.

Table 13 – Expectations of TP increase, and Chl-a responses for year 2021 SAV treatment scenarios, with expectation of peak SAV biomass of 324 gdw/m^{w}.

System	Peak biomass treated (%)	TP uplift (mg/L)	May-July 2019 avg TP (mg/L)	Predicted Chl-a (µg/L)	Expected TP with treatment(mg/L)	Predicted Chl-a (µg/L)
East Main Lagoon	5	0.005	0.019	3.35	0.024	3.93
East Main Lagoon	10	0.010	0.019	3.35	0.029	4.50
East Main Lagoon	20	0.019	0.019	3.35	0.038	5.54
East Main Lagoon	40	0.038	0.019	3.35	0.057	7.74
East Main Lagoon	100	0.096	0.019	3.35	0.115	14.44
West Main Lagoon	5	0.005	0.021	3.58	0.026	4.16
West Main Lagoon	10	0.010	0.021	3.58	0.031	4.74
West Main Lagoon	20	0.019	0.021	3.58	0.040	5.78
West Main Lagoon	40	0.038	0.021	3.58	0.059	7.97
West Main Lagoon	100	0.103	0.021	3.58	0.124	15.48
East Lake Tallac	5	0.005	0.055	ND	0.060	ND
East Lake Tallac	10	0.011	0.055	ND	0.066	ND
East Lake Tallac	20	0.022	0.055	ND	0.077	ND
East Lake Tallac	40	0.044	0.055	ND	0.099	ND
East Lake Tallac	100	0.109	0.055	ND	0.164	ND

When applicable, results are color-coded as light blue (oligotrophic), yellow (mesotrophic) and orange (eutrophic) conditions, based on guidance within Warden and Payne (2004). ND = not determined.

Table 14 – Expectations of TP increase, and Chl-a responses for year 2021 SAV treatment scenarios, with expectation of peak SAV biomass of 81 gdw/m^{w}.

System	Peak biomass treated (%)	TP uplift (mg/L)	May-July 2019 avg TP (mg/L)	Predicted Chl-a (µg/L)	Expected TP with treatment(mg/L)	Predicted Chl-a (µg/L)
East Main Lagoon	5	0.001	0.019	3.35	0.020	3.46
East Main Lagoon	10	0.002	0.019	3.35	0.021	3.58
East Main Lagoon	20	0.005	0.019	3.35	0.024	3.93
East Main Lagoon	40	0.010	0.019	3.35	0.029	4.50
East Main Lagoon	100	0.024	0.019	3.35	0.043	6.12
West Main Lagoon	5	0.001	0.021	3.58	0.022	3.70
West Main Lagoon	10	0.002	0.021	3.58	0.023	3.81
West Main Lagoon	20	0.005	0.021	3.58	0.026	4.16
West Main Lagoon	40	0.010	0.021	3.58	0.031	4.74
West Main Lagoon	100	0.026	0.021	3.58	0.047	6.58
East Lake Tallac	5	0.001	0.055	ND	0.056	ND
East Lake Tallac	10	0.003	0.055	ND	0.058	ND
East Lake Tallac	20	0.005	0.055	ND	0.060	ND
East Lake Tallac	40	0.011	0.055	ND	0.066	ND
East Lake Tallac	100	0.027	0.055	ND	0.082	ND

When applicable, results are color-coded as light blue (oligotrophic), yellow (mesotrophic) and orange (eutrophic) conditions, based on guidance within Warden and Payne (2004). ND = not determined.

For TP, the most likely results of any of the SAV treatment scenarios for both 2021 and 2022 would be that TP and Chl-a values would increase from baseline conditions (as of 2019) but would fall within the category of mesotrophic water quality conditions The exceptions are for the East and West Main Lagoon, where TP and Chl-a values could trend up into the eutrophic range if biomass reached 40 to 100% of peak values prior to either herbicide application or the use of UV-C light treatments (Table 14) For Lake Tallac, existing (2019) TP concentrations are already high enough to be categorized as eutrophic. However, as there are no clear relationships between nutrients and Chl-a in Lake Tallac, the ecological consequences of such a condition are unclear.

Results for TN are displayed for 2021 and 2022 scenarios in Tables 15 and 16, respectively.

Table 15 – Expectations of TN increase, and Chl-a responses for year 2020 SAV treatment scenarios, with expectation of peak SAV biomass of 324 gdw/m^{w}.

System	Peak biomass treated (%)	TN uplift (mg/L)	May-July 2019 avg TN (mg/L)	Predicted Chl-a (µg/L)	Expected TN with treatment(mg/L)	Predicted Chl-a (µg/L)
East Main Lagoon	5	0.032	0.220	2.49	0.252	2.85
East Main Lagoon	10	0.065	0.220	2.49	0.285	3.22
East Main Lagoon	20	0.129	0.220	2.49	0.349	3.93
East Main Lagoon	40	0.258	0.220	2.49	0.478	5.38
East Main Lagoon	100	0.646	0.220	2.49	0.866	9.72
West Main Lagoon	5	0.035	0.320	3.61	0.355	4.00
West Main Lagoon	10	0.067	0.320	3.61	0.387	4.36
West Main Lagoon	20	0.139	0.320	3.61	0.459	5.16
West Main Lagoon	40	0.278	0.320	3.61	0.598	6.72
West Main Lagoon	100	0.695	0.320	3.61	1.015	11.38
East Lake Tallac	5	0.037	0.420	ND	0.457	ND
East Lake Tallac	10	0.074	0.420	ND	0.494	ND
East Lake Tallac	20	0.147	0.420	ND	0.567	ND
East Lake Tallac	40	0.294	0.420	ND	0.714	ND
East Lake Tallac	100	0.736	0.420	ND	1.156	ND

When applicable, results are color-coded as light blue (oligotrophic), yellow (mesotrophic) and orange (eutrophic) conditions, based on guidance within Warden and Payne (2004). ND = not determined.

Table 16 – Expectations of TN increase, and Chl-a responses for year 2021 SAV treatment scenarios, with expectation of peak SAV biomass of 81 gdw/m^{w}.

System	Peak biomass treated (%)	TN uplift (mg/L)	May-July 2019 avg TN (mg/L)	Predicted Chl-a (µg/L)	Expected TN with treatment(mg/L)	Predicted Chl-a (µg/L)
East Main Lagoon	5	0.008	0.220	2.49	0.228	2.58
East Main Lagoon	10	0.016	0.220	2.49	0.236	2.67
East Main Lagoon	20	0.032	0.220	2.49	0.252	2.85
East Main Lagoon	40	0.065	0.220	2.49	0.285	3.22
East Main Lagoon	100	0.161	0.220	2.49	0.381	4.29
West Main Lagoon	5	0.009	0.320	3.61	0.329	3.71
West Main Lagoon	10	0.017	0.320	3.61	0.337	3.80
West Main Lagoon	20	0.035	0.320	3.61	0.355	4.00
West Main Lagoon	40	0.069	0.320	3.61	0.389	4.38
West Main Lagoon	100	0.174	0.320	3.61	0.494	5.55
East Lake Tallac	5	0.009	0.420	ND	0.429	ND
East Lake Tallac	10	0.018	0.420	ND	0.438	ND
East Lake Tallac	20	0.037	0.420	ND	0.457	ND
East Lake Tallac	40	0.074	0.420	ND	0.494	ND
East Lake Tallac	100	0.184	0.420	ND	0.604	ND

When applicable, results are color-coded as light blue (oligotrophic), yellow (mesotrophic) and orange (eutrophic) conditions, based on guidance within Warden and Payne (2004). ND = not determined.

While Warden and Payne (2004) do not provide guidance criteria for TN, the expected TN concentrations are converted into expected values for Chl-a, for which guidance criteria exist. As was found for TP, the most likely scenarios for 2021 and 2022 SAV management scenarios is that in the Main Lagoon, Chl-a concentrations would result in values consistent with mesotrophic water quality conditions, although eutrophic conditions could occur in 2021 if biomass reached 100% in the West Main Lagoon prior to herbicide or UV-C light treatments were applied.

Conclusions

The results shown in Tables 14 and 16 suggest that water quality in the Main Lagoon is likely to remain in its existing range of mesotrophic water quality conditions, unless SAV control mechanisms that leave plant biomass to decompose in the lagoon are undertaken late enough in the growing season that biomass exceeds 40% of estimated peak values of 324 gdw/m^2 (130 gdw/m^2). Based on expectations of release of nutrients from decomposing SAV, applications of herbicides or the use of UV-C light treatments would have less of an impact to water quality when SAV biomass is lower than it would be at peak conditions. The waters of the Main Lagoon appear to be more sensitive to nutrient supply than the waters of Lake Tallac, perhaps due to the moderating effect of tannins from its natural wetland shoreline (see Tomasko et al. 2016, and references within). While caution is warranted, and SAV management techniques should still be applied as early in the growing season as is possible, while still being effective, water quality concerns in Lake Tallac might be less than they are in the Main Lagoon, after the application of *in situ* SAV management techniques that leave biomass behind to decompose in the waterways.

If the initial management actions are capable of reducing SAV biomass by the targeted value of 75%, results shown in Tables 15 and 17 suggest that water quality concerns would be reduced, as the quantities of nutrients that would be released into the water column via decomposition would be lower than in the initial treatment.

The impacts to water quality of sediment removal and/or the use of LFA cannot be estimated with the same confidence, compared to SAV management via herbicide application and/or UV-C light treatment. In a literature review of dozens of lake management projects conducted worldwide, the conclusion of Cooke et al. (2005) was that sediment removal projects are typically the most expensive approach to water quality management, while also have a very mixed track record of success. If SAV management was the purpose of a sediment removal project, success is only assured if the project results in the waterbody having a resultant water depth that is deeper than the deepest depth that the target SAV species would grow, which would require more sediment removal than might be practical in the Main Lagoon and/or Lake Tallac. The need for caution for any sediment removal projects is borne out by the results shown in Hackney et al. (1996) which focused on actual water quality responses of waters in the Lake Tahoe basin, during and after various dredging projects.

While Cooke et al. (2005) did not specifically review LFA as a lake management technique, LFA has much in common with a variety of artificial aeration and/or artificial circulation techniques. Of the dozens of circulation enhancement projects reviewed by Cooke et al. (2005) none of them had SAV management as their stated basis for implementation; an absence of potentially relevant information was found in terms of the effectiveness of LFA as an SAV management technique from the literature reviewed for this report.

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Appendix G

2019 Fish and Benthic Macroinvertebrate Surveys in Tahoe Keys Lagoons

2019 FISH AND BENTHIC MACROINVERTEBRATE SURVEYS IN TAHOE KEYS LAGOONS

Final Report

Prepared for

Tahoe Regional Planning Agency

April 2020

ESA

Draft

2019 FISH AND BENTHIC MACROINVERTEBRATE SURVEYS IN TAHOE KEYS LAGOONS

Draft Report

Prepared for **April 2020**

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CHAPTER 1
Introduction

Surveys to comprehensively describe the fish and benthic macroinvertebrate (BMI) species assemblages in the Tahoe Keys Lagoons were conducted in June and October of 2019 (**Figure 1**). The purpose of these surveys was to support the evaluation of the Tahoe Keys Lagoons Restoration Program (TKLRP) alternatives in an Environmental Impact Report and Environmental Impact Statement (EIR/EIS) and Antidegradation Analysis (AA), under contract to the Tahoe Regional Planning Agency (TRPA). This report describes the survey methods and results from the 2019 BMI and fish surveys. This report also provides a brief description of prior BMI and fish surveys in the Tahoe Keys Lagoons, along with basic comparisons of results between the 2019 and prior surveys.

SOURCE: DigitalGlobe, 2018

Tahoe Keys Lagoons Restoration Program EIR/EIS, D180990

Figure 1
Tahoe Keys Lagoons Restoration Project Area

CHAPTER 2
Methods

The Tahoe Keys Lagoons consist of three man-made embayments connected to the southern end of Lake Tahoe: Main Lagoon (108 acres), Marina Lagoon (32 acres), and Lake Tallac (30 acres) For all fish and BMI surveys, the lagoons were sub-divided into approximately 17-acre sites to produce six sites in the Main Lagoon and two sites each in the Marina Lagoon and Lake Tallac (**Figure 2**). Each site was further divided into five evenly distributed sampling locations. Transects and sampling locations within the Marina Lagoon avoided marina property. At two of the five sampling locations within each site, the following water quality parameters were measured with multi-sensor sondes: turbidity, water temperature, conductivity, pH, and dissolved oxygen. A detailed description of survey methods is provided in **Appendix A, Baseline Study Plan** (ESA 2019).

SOURCE: NAIP, 2016; BMI, 2019; ESA, 2019

Tahoe Keys Lagoon

Figure 2
BMI and Fish Studies Survey Areas

2.1 Benthic Macroinvertebrate (BMI) Assemblage Surveys

Methods for BMI surveys were consistent with those described in **Appendix A**, with the exception of the number of sampling locations within each site. In the 2019 surveys, there were five sampling locations in each site rather than seven (**Figure 3**).

Collected BMI samples were shipped to a laboratory for taxonomic analysis. Taxa were identified to family or species and used to determine the following metrics: species richness, BMI community tolerance/intolerance, and functional feeding groups. Species richness is defined as the number of different species present. BMI community tolerance/intolerance metrics evaluate the sensitivity of species to disturbed habitat using a 0 – 1 scale, where 0 is very sensitive (intolerant) to disturbed habitat and 10 is very tolerant to disturbed habitat. Functional feeding groups were used to analyze the BMI community on behavioral feeding mechanisms rather than taxonomic group. This method of analysis avoids the relatively non-informative necessity to classify the majority of aquatic insect taxa as omnivores and it establishes linkages to basic aquatic food resource categories, coarse particulate organic matter (CPOM), and fine particulate organic matter (FPOM), which require different adaptations for their exploitation.

SOURCE: NAIP, 2016; BMI, 2019; ESA, 2019

Tahoe Keys Lagoon

Figure 3
BMI Nearshore and Mid-Channel Sampling Locations

2.1.1 Nearshore Sampling

Nearshore samples were collected off the bow of a boat using a 500-µm mesh D-frame sweep net. Samples were collected within three meters of the shoreline at depths no greater than two meters. Samples were collected following an adaptation of the Standard Operating Procedures for Collection of Macroinvertebrates, Benthic Algae, and Associated Physical Habitat Data in California Depressional Wetlands (California SWAMP 2015). The sampling location was approached slowly via boat with the collector on the bow holding the sweep net in hand. Once the sampling location was reached, the collector held the net in front of themselves at arms' length with the net handle perpendicular to themselves and the opening of the net facing the right. The net was then plunged into the water quickly until it reached the lake bottom. The net was then swept to the right while gently rubbing the lake bottom in an undulating motion that covered a swath about a meter long, quickly turned 180 degrees and swept to the left in the same undulating motion. After completing the sweeping motions, the net was quickly raised out of the water and the contents were emptied into a clean bucket of water. Once emptied, the net was rinsed over the bucket with a squeeze bottle filled with clean water to ensure the collection of any remaining BMI in the net. Subsequent nearshore samples collected within each site were added to the same bucket to form a composite sample for each nearshore site.

Each nearshore composite sample was elutriated using a 500-µm mesh sieve. The contents were deposited into one-liter sample bottles, labeled, and covered with 90% denatured alcohol to preserve the samples before being shipped off for analysis. The collected nearshore samples were then shipped to Jon Lee Consulting for taxonomic analysis. Jon Lee is a taxonomist located in Eureka, California that specializes in freshwater macroinvertebrate taxonomy as it relates to biological assessment.

2.1.2 Mid-channel Sampling

Mid-channel samples were collected from the bow of a boat with a petite Ponar grab sampler[1] at the deepest point of the channel cross-section. The sampling location was approached slowly via boat with the collector on the bow with the Ponar sampler secured to the boat with a rope. Once the sampling location was reached, the collector slowly lowered the Ponar sampler into the water until the unit was fully submerged. Once fully submerged, the Ponar sampler was released and allowed to quickly sink to the lake bottom. Once the Ponar sampler reached the lake bottom, the collector retrieved the sample by pulling in the rope and raising the Ponar sampler out of the water and onto the deck of the boat. Once on-board the boat, the contents of the Ponar sampler were emptied into a clean bucket and the Ponar sampler was rinsed over the bucket with a squeeze bottle filled with clean water to ensure the collection of any remaining BMI in the Ponar sampler. Subsequent mid-channel samples collected within each site were added to the same bucket to form a composite sample for each mid-channel site.

Each mid-channel composite sample was elutriated using a 250-µm mesh sieve. Many of the mid-channel composite samples were too large to fit into a one-liter sample bottle, as a result the

[1] A petite Ponar grab sampler is used to take sediment samples. The petite size (15 pounds) allows the Ponar sampler to be easily carried and deploy by hand rather than with the use of heavy machinery.

composite samples were not bottled in their entirety. To collect a representative mid-channel composite sample, the contents of the bucket were stirred thoroughly prior to elutriation, and the sample was elutriated in small batches until a single one-liter sample bottle was filled. Once filled, the sample bottle was labeled and covered with 90% denatured alcohol to preserve the samples before being shipped off for analysis. The collected mid-channel samples were then shipped to Jon Lee Consulting for taxonomic analysis.

2.2 Fish Assemblage Surveys

Methods for fish assemblage surveys were consistent with those described in Appendix A, with the exception of the number of electrofishing transects within each site. In the 2019 surveys, there were five electrofishing transects in each site rather than six.

To comprehensively assess the fish assemblage while providing continuity with past methods, the 2019 surveys used electrofishing and added minnow trapping to target native minnows, and otter trawling to target the deepest habitat units in the lagoons.

All captured fish were briefly held in a live well until they were individually identified to species, counted, total length measured (mm), weighed (g), and released. Data summaries were prepared by survey sites and gear types.

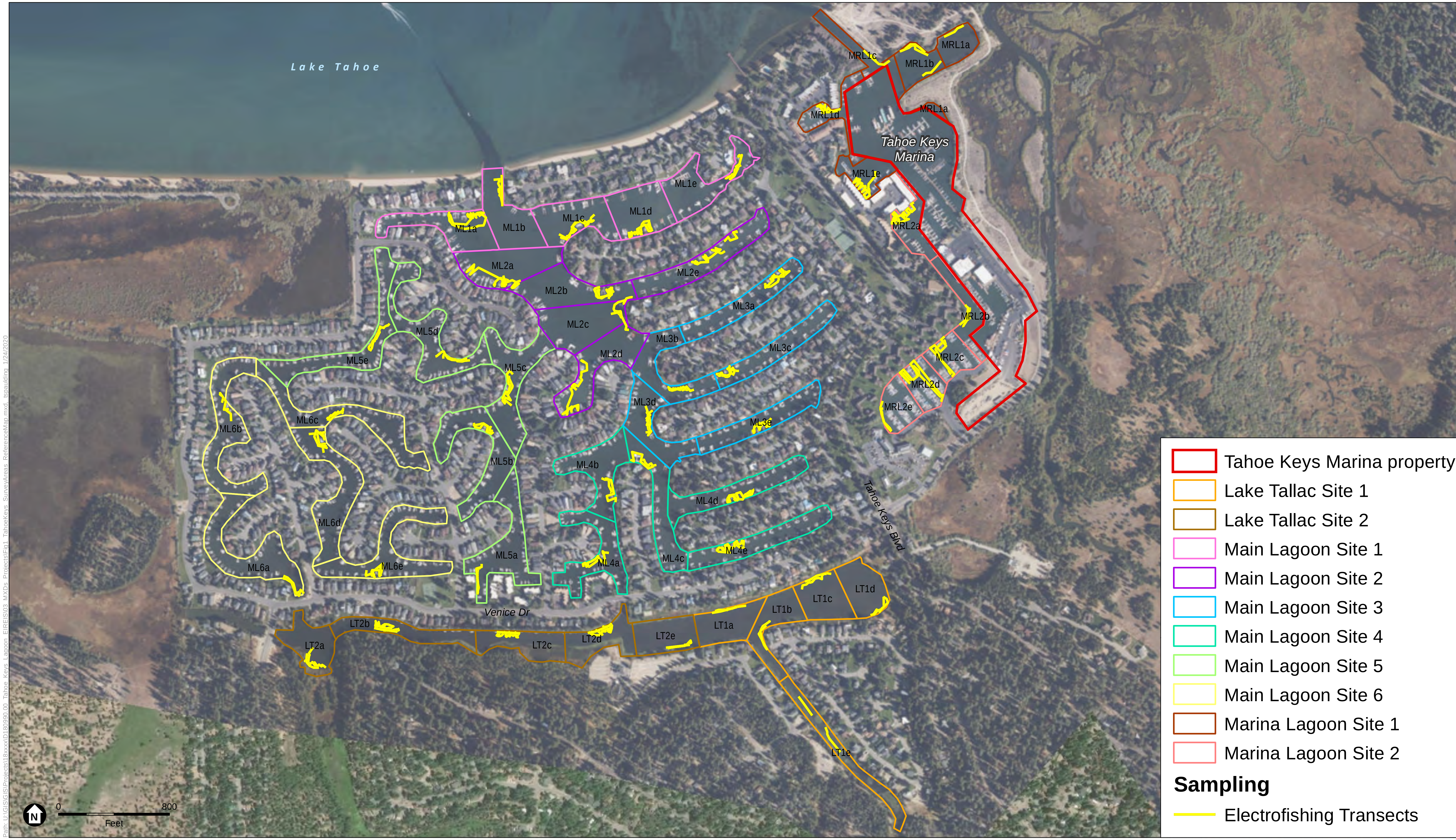
2.2.1 Boat Electrofishing

Boat electrofishing survey methods were consistent with those described in the Baseline Study Plan (ESA 2019) with the exception of the number of electrofishing transects within each site. In the 2019 surveys, there were five electrofishing transects in each site rather than six.

Within each site, five 50-meter electrofishing transects were sampled, one per sampling location. Transects were identified in the field as areas of minimal conflict; areas with few watercraft and humans. Once a potential transect location was identified, it was measured using ArcCollector on an iPad prior to sampling (**Figure 4**). All captured fish were briefly held in a live well until they were individually identified to species, counted, measured, weighed, and released.

Electrofishing was performed using a Smith-Root Generator-Powered Pulsator (GPP) set to Pulsed DC with a duty cycle of 60, high range power, and 40-65% power. These settings resulted in an electric current in the range of 4 to 8.5 amps while electrofishing. These settings were adjusted depending on the conductivity of the water and observed fish response to the electrical field to ensure high capture efficiency while minimizing injury to all fish species.

In 2019, electrofishing was complicated by aquatic vegetation. On numerous occasions fish were observed swimming down into vegetation where they could not be seen and therefore were not caught.



SOURCE: NAIP, 2016; BMI, 2019; ESA, 2019

Tahoe Keys Lagoon

Figure 4
Boat Electrofishing Transects

2.2.2 Otter Trawling

Otter trawling survey methods were consistent with those described in the Baseline Study Plan: Fisheries and Benthic Macroinvertebrates in Tahoe Keys Lagoons (ESA 2019). The net head line dimensions of the otter trawl were 12 feet wide by 3 feet high. Otter trawl sampling was conducted only in ML1 and ML2 due to presence of deep water habitat and the ability to safely navigate a deep water trawl (**Figure 5**).

All captured fish were briefly held in a live well until they were individually identified to species, counted, measured, weighed, and released.

During the 2019 sampling, otter trawling was hindered by wind and submerged aquatic vegetation. High winds severely limited the navigability of the boat while trawling resulting in a few trawling transects that were shorter than the target length of 400-500 meters. Additionally, a few trawls were loaded with debris and little or no fish. It is possible that aquatic vegetation filled the net early in trawl and reduced the effectiveness of the trawl.

SOURCE: NAIP, 2016; BMI, 2019; ESA, 2019

Tahoe Keys Lagoon

Figure 5
Otter Trawl Transects

2.2.3 Minnow Trapping

Minnow trapping survey methods were consistent with those described in the Baseline Study Plan (ESA 2019).

Minnow trap dimensions were 9 inch by 16.5 inch, double entrance opening of 1 inch with ¼ inch mesh galvanized steel wire. Minnow traps were set within 10 feet of the shoreline and allowed to fish for one night. The minnow traps were submerged in a variety of habitats including submerged vegetation, emergent vegetation, boulder structures, and boat docks. Traps were deployed and retrieved by one 4-person crew using a boat; two trap tenders, one data collector, and the boat operator. Locations of minnow traps are shown in **Figure 6**.

SOURCE: NAIP, 2016; BMI, 2019; ESA, 2019

Tahoe Keys Lagoon

Figure 6
Minnow Trap Locations

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CHAPTER 3
Results

3.1 BMI Assemblage

In the 2019 BMI surveys, a total of 73 distinct taxa were identified from 33 families among the ten survey areas. **Appendix B** lists the taxa and counts from the 2019 BMI survey areas. Copepods in the Cyclopidae family were the dominant benthic taxa among the Marina Lagoon, Main Lagoon, and Lake Tallac. Ostracoda (seed shrimp), Chironomidae (midge), Eurycercidae, and Glossiphoniidae (leeches) were also dominant organisms among survey areas. Data summaries for BMI taxa collected at each site are provided in **Appendix B**. Data summaries for water quality data collected at each site are provided in **Appendix C**.

3.1.1 Richness and Composition/Diversity Metrics

Taxonomic richness for all taxa was calculated as the total number of species represented in the benthic macroinvertebrate community at each site during 2019 BMI surveys. Taxonomic richness for all taxa was highest in ML4 and MRL1 with a total of 58 and 57 species identified in ML4 and MRL1, respectively. ML6 had the lowest taxonomic richness with 42 species identified (**Table 1**).

EPT taxa richness was also calculated to evaluate quality of habitat. Generally used in a stream setting, habitat quality is considered high if there is a high EPT species richness. EPT taxa richness includes benthic aquatic macroinvertebrats in the Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) families. EPT taxa richness was highest in ML1, ML4, and ML5 (values of 6, 5, and 5 respectively). ML6 had the lowest EPT taxa richness, with 1 EPT species present (Table 1).

3.1.2 Tolerance/Intolerance Metrics

The macroinvertebrate Index of Biotic Integrity (IBI) was used to estimate the overall tolerance of the BMI community to disturbed or degraded habitat conditions. BMI species are assigned a tolerance number from 0 to 10 indicating that group's known sensitivity to disturbance; 0 being most sensitive and 10 being most tolerant (Lunde and Resh 2011). In the 2019 BMI surveys, there was little variability in IBI values across all survey areas. Values ranged from 7.24 to 7.59 (Table 1). These IBI tolerance values suggest the BMI community with the 2019 survey areas has a high tolerance of degraded water quality. In addition to high IBI tolerance values, 4 out of 73 species observed were intolerant (tolerance values <5). The 2019 results were similar to a study conducted in 2016 concluding the community was comprised of tolerant taxon (Sierra Ecosystem Associates 2017).

TABLE 1
BMI INDICATOR VALUES BY SURVEY AREA

Metric	Main Lagoon						Marina Lagoon		Lake Tallac	
	ML1	ML2	ML3	ML4	ML5	ML6	MRL1	MRL2	LT1	LT2
Richness										
Taxa Richness	46	50	48	58	47	42	57	47	52	50
EPT Taxa Richness	5	4	4	6	3	1	5	2	4	4
Composition/Diversity										
Percent Dominant Taxa	35.4	35.3	18.1	34.0	22.9	54.7	18.5	31.6	22.2	44.7
Dominant Taxa	*Cyclopidae spp*	*Cyclopidae spp*	*Chironomidae spp*	*Cyclopidae spp*	*Cyclopidae spp*	*Cyclopidae spp*	*Ostracoda spp*	*Cyclopidae spp*	*Cyclopidae spp*	*Cyclopidae spp*
Tolerance/Intolerance										
Hilsenhoff Biotic Index (HBI)	7.59	7.41	7.28	7.49	7.47	7.55	7.27	7.53	7.24	7.28
Functional Feeding Groups										
Percent Scrapers	1%	1%	1%	1%	1%	1%	2%	1%	4%	2%
Percent Predators	4%	5%	4%	5%	6%	3%	8%	5%	10%	4%
Percent Collector-Filterers	7%	6%	15%	10%	9%	9%	8%	14%	16%	6%
Percent Collector-Gatherer	88%	86%	79%	83%	82%	86%	81%	80%	69%	87%
Other*	1%	2%	1%	1%	2%	1%	1%	<1%	<1%	<1%

NOTE:
* Other includes macrophyte herbivores, omnivores, parasites, and piercer herbivores FFGs

3.1.3 Functional Feeding Groups (FFG)

BMI taxa were grouped into FFGs based on mouth morphology, rather than taxonomic group, because mouth morphology determines and limits feeding behavior. Major freshwater FFGs include: Scrapers, Predators, Collector-filterers, and Collector- Gatherers. Other FFGs include macrophyte herbivores, herbivores, omnivores, parasites, and piercer herbivores. (Jonsson and Malmqvist 2003). During the 2019 BMI surveys, Collector- Gatherer was the dominant FFG among all survey areas (Table 1).

3.2 Fish Assemblage

In the 2019 fish surveys, 13 fish species were caught across all gear types; five native and cold water species and eight nonnative species. A total of 1,731 individual fish were caught across all gear types; 53 individuals were native and cold water species and 1,678 were nonnative (**Table 2)**. Data summaries for fish species collected at each site are provided in **Appendix D**.

TABLE 2
2019 FISH SURVEY RESULTS

Common Name	Scientific Name	Origin	Electrofish	Otter Trawl	Minnow Trap
Black Bullhead	*Ameiurus melas*	Nonnative	4	-	-
Black Crappie	*Pomoxis nigromaculatus*	Nonnative	45	6	-
Bluegill	*Lepomis macrochirus*	Nonnative	787	108	6
Brown Bullhead	*Ameiurus nebulosus*	Nonnative	197	5	-
Golden Shiner	*Notemigonus crysoleucas*	Nonnative	7	-	-
Goldfish	*Carassius auratus*	Nonnative	99	-	-
Lahontan Redside*	*Richardsonius egregius*	Native	4	2	-
Largemouth Bass	*Micropterus salmoides*	Nonnative	407	6	-
Mountain Sucker*	*Catostomus platyrhynchus*	Native	1	-	-
Rainbow Trout*	*Oncorhynchus mykiss*	Nonnative	4	-	-
Spotted Bass	*Micropterus punctulatus*	Nonnative	-	1	-
Tahoe Sucker*	*Catostomus tahoensis*	Native	35	1	-
Tui Chub*	*Gila bicolor*	Native	6	-	-
Total			**1,596**	**129**	**6**

NOTES:
* Native and cold water species

3.2.1 Boat Electrofishing

During the 2019 boat electrofishing surveys, 1,596 individual fish were caught across all sites surveyed. Catch per unit effort (CPUE) is used as an index for relative abundance. CPUE was calculated as the number of individual fish caught per hour of electrofishing. Time spent electrofishing was recorded in the field as the number of seconds an electric current was applied to the water.

Bluegill had the highest CPUE across all sites. Largemouth Bass had the second highest CPUE across all sites, followed by Brown Bullhead. Of the native and cold water species caught, Tahoe Sucker had the highest CPUE across all sites. The Main Lagoon had the highest CPUE of all individuals caught, follow by Lake Tallac. The Marina Lagoon had the lowest CPUE for individuals caught (**Figure 7**). CPUE and species composition are presented in **Table 3**.

In 2015, a boat electrofishing effort was conducted to remove warm water fish from the Tahoe Keys Main Lagoon and Marina Lagoon (Chandra et al. 2015). 2015 efforts did not sample Lake Tallac. For comparison, 2019 catch only includes fish caught in the Main Lagoon and Marina Lagoon. Total shock time was 62.8 hours and 4.5 hours in 2015 and 2019 respectively.

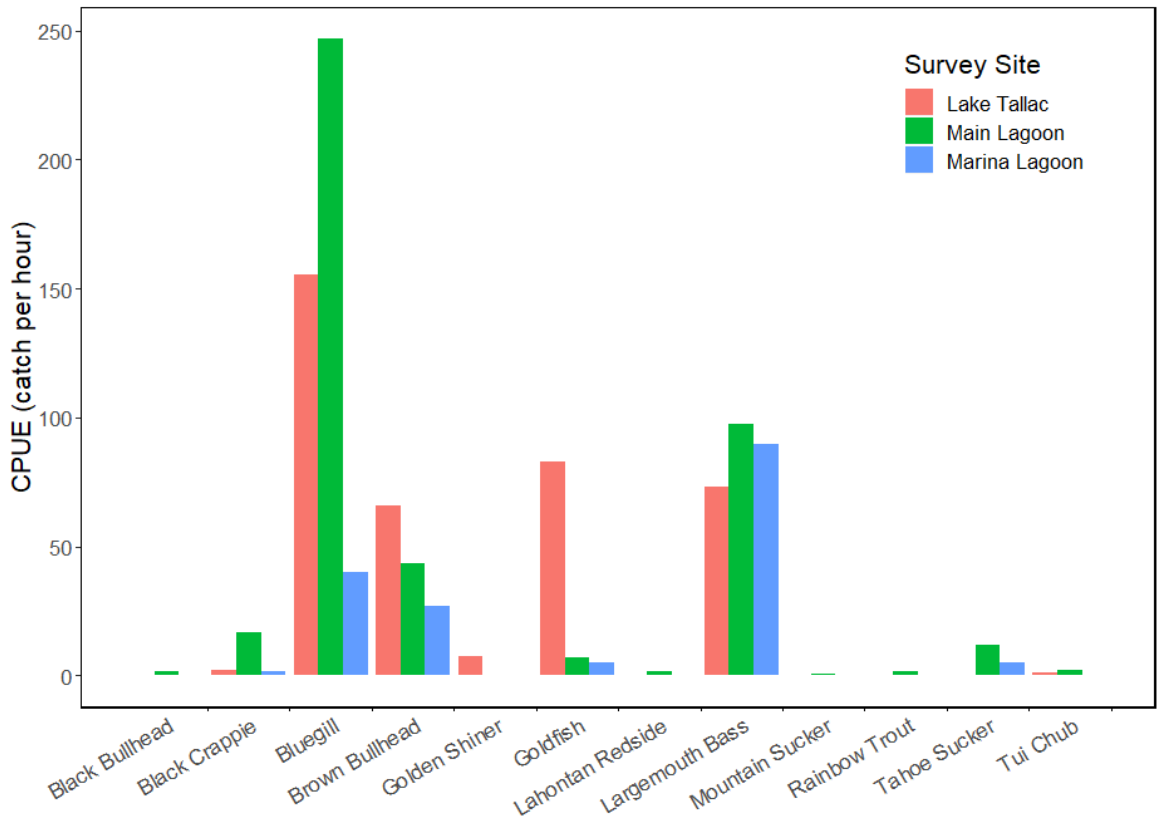

Figure 7
Boat Electrofishing Catch Per Hour By Site

TABLE 3
2019 BOAT ELECTROFISHING CATCH PER HOUR BY SITE

Common Name	Lake Tallac	Main Lagoon	Marina Lagoon	All Sites
Black Bullhead	0	1.65	0	0.89
Black Crappie	2.19	16.90	1.74	10.03
Bluegill	155.29	246.87	40.11	175.37
Brown Bullhead	65.61	43.69	27.03	43.90
Golden Shiner	7.66	0	0	1.56
Goldfish	83.11	7.01	5.23	22.06
Lahontan Redside*	0	1.65	0	0.891
Largemouth Bass	73.27	97.68	89.80	90.69
Mountain Sucker*	0	0.41	0	0.22
Rainbow Trout*	0	1.65	0	0.89
Tahoe Sucker*	0	11.95	5.23	7.80
Tui Chub*	1.09	2.06	0	1.34
Total	**388.21**	**431.51**	**169.15**	**355.63**

NOTES:

* Native and cold water species

Bluegill and Largemouth Bass had the highest CPUE in 2015 and 2019. Brown Trout, Golden Shiner, and Mountain Whitefish were caught in the Main Lagoon and Marina Lagoon in 2015 but not 2019. Black Bullhead and Mountain Sucker were two species caught in 2019 efforts that were not caught during 2015. 2015 surveys caught more Tahoe Sucker and Tui Chub per unit of effort than 2019 surveys. Tahoe Sucker was the most abundant native, coldwater species caught in 2019. A species list and CPUE comparison is presented in **Table 4** and **Figure 8**.

TABLE 4
BOAT ELECTROFISHING CATCH PER HOUR IN 2015 AND 2019

	2015	2019**
Black Bullhead	-	0.89
Black Crappie	2.01	9.58
Bluegill	73.15	143.72
Brown Bullhead	26.73	30.53
Brown Trout*	0.10	-
Golden Shiner	0.19	-
Goldfish	0.13	5.13
Lahontan Redside*	0.13	0.89
Largemouth Bass	73.56	75.76
Mountain Sucker*	-	0.22
Mountain Whitefish*	0.10	-
Rainbow Trout*	0.59	0.89
Tahoe Sucker*	13.49	7.80
Tui Chub*	12.92	1.11
Total	**203.08**	**276.53**

NOTES:
* Native and cold water species
** Only includes individuals caught in the Main Lagoon and Marina Lagoon

3.2.2 Otter Trawling

During the 2019 otter trawling surveys, 129 individual fish were caught across 17 trawling events. CPUE was used as an index for relative abundance. CPUE was calculated as the total number of individual fish caught per number of trawls. Bluegill made up the majority of the otter trawl catch, followed by other nonnative, warm water species. Three individual native fish were caught during otter trawl surveys, Table 5 Otter trawling has not been conducted in prior survey efforts in the Tahoe Keys, therefore there is no comparison data.

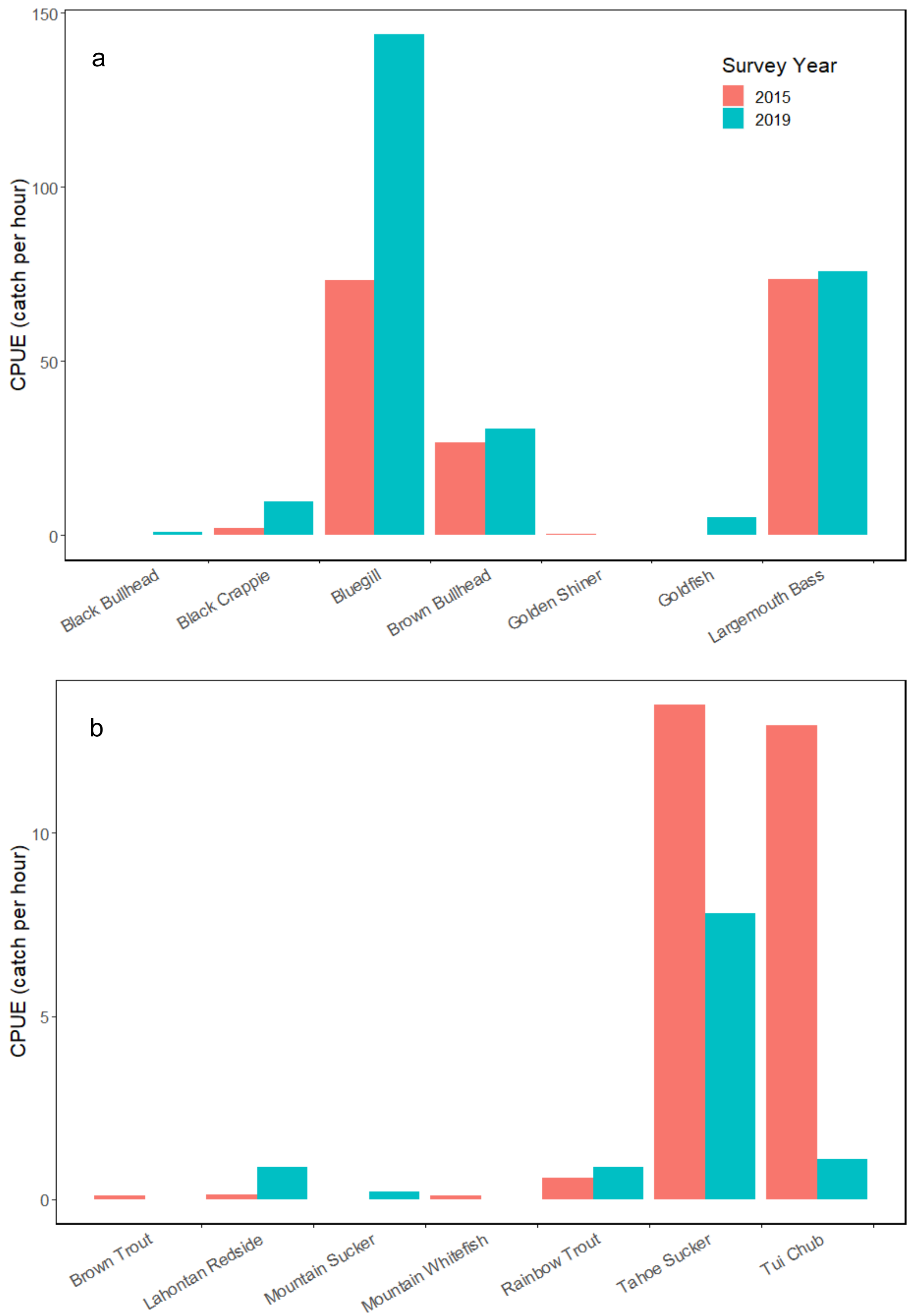

Figure 8
Boat Electrofishing Catch Per Hour a) Non-native Species b) Native and Cold Water Species

TABLE 5

2019 OTTER TRAWL CATCH PER TRAWL

Species	CPUE
Black Crappie	0.35
Bluegill	6.35
Brown Bullhead	0.29
Lahontan Redside*	0.12
Largemouth Bass	0.35
Spotted Bass	0.06
Tahoe Sucker*	0.06
Total	**7.59**

NOTES:
* Native species

3.2.3 Minnow Trapping

During the 2019 minnow trapping surveys, a total of 100 individual minnow traps were set and 6 Bluegill were caught. No other species were caught. Minnow trapping has not been conducted in prior surveys in Tahoe Keys, therefore there is no comparison data.

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CHAPTER 4
Discussion

The 2019 BMI and fish surveys were conducted to characterize the aquatic community of Tahoe Keys lagoons and Lake Tallac.

Results from the 2019 BMI surveys indicate that the BMI taxa currently present in the Tahoe Keys are representative of a community that is tolerant to degraded conditions. The benthic environment consists of static (i.e., non-flowing) water conditions, sediment with high organic content, and degraded water quality (e.g., low DO) at the sediment interface due to the decomposition of invasive plant material, all of which limit existing taxa to those that have high tolerance levels.

Results from the 2019 fish surveys indicate the fish community is dominated by nonnative, warm water species and a low abundance of native, cold water species in the Tahoe Keys lagoons and Lake Tallac. The observed species assemblage can be partially explained by existing habitat conditions. Static, shallow, warm water conditions with abundant invasive submerged aquatic vegetation creates favorable habitat conditions for nonnatives such has Largemouth Bass, Bluegill, and catfish, and unfavorable conditions for native species. Furthermore, Tahoe Keys consists of dead-end embayments lacking any upstream habitat, and as a result, is not a migratory corridor for native species. In addition to unfavorable habitat conditions for native species, the presence of nonnative predatory species such as Largemouth Bass and catfish likely further limits the presence of natives.

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CHAPTER 5
References

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Appendix A
Baseline Study Plan

Baseline Study Plan: Fisheries and Benthic Macroinvertebrates in Tahoe Keys Lagoons

Prepared for:
Tahoe Regional Planning Association

June 2019

Prepared by:
Environmental Science Associates

Draft

Baseline Study Plan: Fisheries and Benthic Macroinvertebrates in Tahoe Keys Lagoons

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Tahoe Regional Planning Association

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Background

The Tahoe Keys Lagoons consists of three man-made embayments connected to the southern end of Lake Tahoe: Main Lagoon (aka West Lagoon), Marina Lagoon (aka East Lagoon), and Lake Tallac (Table 1, Figure 1). The Tahoe Keys Lagoons Restoration Project (TKLRP) aims to reduce and control the abundant growth of non-native and nuisance aquatic plants currently infesting the lagoons. The TKLRP proponents are monitoring a variety of physical and biological parameters to provide information on the development of project technologies, and independent scientists are collecting baseline information on water quality and biological resources under contract to the Tahoe Regional Planning Agency. In 2019, surveys will be carried out to comprehensively describe the fish and benthic macroinvertebrate species assemblages in the Tahoe Keys Lagoons. Descriptions of these assemblages will provide baseline biological data for use in evaluating environmental impacts of alternatives proposed for the TKLRP.

Table 1: Tahoe Keys Lagoons Areas and Volumes

	Area (ha)	Volume (m^3)
Main Lagoon	45	1,357,000
Marina Lagoon	13	395,000
Lake Tallac	12	370,000

Figure 1: Tahoe Keys Lagoons Restoration Project Area

Benthic Macroinvertebrate (BMI) assemblage surveys

The design of BMI assemblage surveys was based on the Lake Tahoe Nearshore Evaluation and Monitoring Framework (Heyvaert 2013), the California Surface Water Ambient Monitoring Program (SWAMP) protocol for depressional wetlands (SWAMP 2015), the US Environmental Protection Agency (EPA) protocol for lakes (US EPA 1997a), and the most recent BMI assemblage surveys in the Tahoe Keys Lagoons (Sierra Ecosystem Associates et al. 2017).

BMI surveys will be conducted in the early summer (e.g., late June) and again in the fall (e.g., October). For each survey, the lagoons will be sub-divided into approximately 7-hectare sites to produce six sites in the Main Lagoon and two sites each in the Marina Lagoon and Lake Tallac (Figure 2). Within each site, seven sampling locations will be distributed at evenly spaced intervals along the shoreline. Figure 2 shows examples of roughly evenly distributed locations and transects within site W6. Transects and sampling locations within the Marina Lagoon will avoid marina property. At two of the seven sampling locations within each site, the following water quality parameters will be measured with multi-sensor sondes: turbidity, water temperature, conductivity, pH, and dissolved oxygen.

Figure 2: Fish and BMI Sampling Sites, Trawl Transects, and Example Locations for Minnow Traps, BMI Sampling, and Electrofishing Transects

At all seven sampling locations, one nearshore BMI sample and one mid-channel BMI sample will be collected. Nearshore samples will be collected with a 500-µm mesh D-frame sweep net at ≤ 1-meter depth. Mid-channel samples will be collected from a boat with a petite Ponar grab sampler at the deepest point of the channel cross-section. Within each site, samples will be composited into one nearshore composite sample and one mid-channel composite sample. BMI sampling will be conducted by a 4-person crew using a boat.

Nearshore composite samples will be elutriated with a 500-µm mesh sieve. Mid-channel composite samples will be elutriated with a 250-µm mesh sieve. Elutriated samples will be preserved with 95% ethanol. This protocol will produce 10 nearshore and 10 mid-channel composite samples in each season's survey, for a total of 40 composite samples.

Before shipping BMI composite samples to a taxonomy laboratory, ethanol will be drained from the containers using sheer nylons as a sieve. Taxonomic identification and enumeration will be conducted with 600-count subsampling and Level 2 Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) standard taxonomic effort (STE). A total of 4 samples (10% of project total) will be independently identified and enumerated by two separate laboratories for quality control.

Complications: The abundance of aquatic vegetation in the Tahoe Keys Lagoons is likely to complicate BMI surveys by filling the nearshore sweep net and obstructing mid-channel sediment grabs. For nearshore samples this will require additional elutriation time in the field to remove invertebrates from collected vegetation. For mid-channel samples this will require additional time in the field to locate unobstructed sampling points and to offset and repeat failed Ponar grabs.

Fish assemblage surveys

The design of fish assemblage surveys was based on the Lake Tahoe Nearshore Evaluation and Monitoring Framework (Heyvaert 2013), the US EPA protocol for lakes (US EPA 1997b), the US EPA protocol for non-wadeable rivers (US EPA 2018), and the most recent fish surveys in the Tahoe Keys Lagoons (Chandra et al. 2009; Ngai et al. 2010; Chandra et al. 2015). The Tahoe Keys Lagoons fish assemblage is currently dominated by non-native warmwater fish, e.g. 87% of all fish captured in the most recent survey (Chandra et al. 2015), but methods (electrofishing near shore) have targeted these fish and their habitat. To comprehensively assess the fish assemblage while providing continuity with past data, the present surveys will use electrofishing but add minnow trapping to target native minnows and otter trawling to target the deepest habitat. Fish surveys will be conducted in the early summer (e.g., late June) and again in the fall (e.g., October). The sub-division of the lagoons into 10 sites for BMI surveys will also be used for fish surveys.

Within each site, six 50-meter electrofishing transects will be distributed at evenly spaced intervals along the shoreline. At two of the six transects, the following water quality parameters will be measured with multi-sensor sondes: turbidity, water temperature, conductivity, pH, and dissolved oxygen. At all six transects, fish will be sampled by electrofishing the full 50-meter transect at a depth of ≤ 3 meters. Electrofishing will be conducted by a 4-person crew using an electrofishing boat. Electrofishing settings will be adjusted as needed based on environmental conditions and observed fish response to the electrical field to ensure high capture efficiency while avoiding or minimizing injury and/or mortality to all fish species. Settings will typically start at 10% of range, 30 Hz, 100 volts.

Electrofishing will not affect boat or dock anti-corrosion systems (Y. Smith, personal communication, April 30, 2019) but does present a hazard for non-target organisms (including humans) in the water near the boat. The boat will discontinue electrofishing if any human is in the water within 30 meters of the boat (USFWS 2016). Aquatic mammals and birds generally move away from an electrofishing boat before they are affected by its electrical field, but the crew will actively look for non-target wildlife and discontinue electrofishing if they are in the water within 10 meters of the boat.

Within each site, five minnow trap locations will be distributed at evenly spaced intervals along the shoreline and a single minnow trap will be deployed at each location for one night. Minnow traps will be baited with dog food and submerged underneath structures such as boat docks. Traps will be deployed and retrieved by two 2-person crews using boats.

Finally, the two Main Lagoon sites near the entry channel include the deepest habitat in the Tahoe Keys Lagoons (up to 6 meters) and these sites will also be sampled by otter trawling. Five bottom trawls of approximately 400-500 meters each will be conducted within the two sites. Otter trawling will be conducted by a 4-person crew using a boat.

All captured fish will be briefly held in a live well (electrofishing, trawling) or bucket until they are individually identified to species, counted, measured, weighed, and released.

Complications: The abundance of aquatic vegetation in the Tahoe Keys Lagoons is likely to complicate fish surveys by filling the otter trawl net. This will require shortening trawl lengths to remove collected vegetation, increasing the time required to sample the target sites. The abundance of people in the Tahoe Keys Lagoons is likely to complicate fish surveys by interrupting electrofishing for safety reasons. This will require additional time in the field to wait for safe conditions or relocate to unoccupied transects.

Proposed schedule

June

- 17-21: Fish surveys – two days of electrofishing and minnow trapping, one day of trawling and minnow trapping.
- 24-28: BMI surveys – four days of sampling and processing for shipment.

October

- 7-11: Fish surveys – two days of electrofishing and minnow trapping, one day of trawling and minnow trapping.
- 14-18: BMI surveys – four days of sampling and processing for shipment.

Technical memorandum

The results of the 2019 BMI and fish surveys will be described in a technical memorandum. The memorandum will document the survey methods used and the summarize results in tables and figures. Brief descriptions of prior BMI and fish surveys in the Tahoe Keys Lagoons will also be included, along with basic comparisons of results between the current and prior surveys. The memorandum will also include a map showing the BMI sampling locations and fish survey sites.

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Appendix B
BMI Taxa Data Summaries

APPENDIX B

BMI Taxa Data Summaries

Class/Order/Family	Taxon Identification	Main Lagoon						Marina Lagoon		Lake Tallac	
		ML1	ML2	ML3	ML4	ML5	ML6	MRL1	MRL2	LT1	LT2
Hydrozoa	*Hydridae Hydra*	17	20	9	6	30	15	2	0	6	0
Turbellaria	*Hydridae spp*	17	18	5	4	36	10	6	6	24	14
Bivalvia	*Sphaeriidae spp*	4	9	33	17	2	2	11	32		1
Bivalvia	*Sphaeriidae Pisidum*	5	8	21	25	11	1	6	3	8	1
Gastropoda	*Valvatidae Valvata*	0	0	0	1	1	0	0	0	0	0
Gastropoda	*Lymnaeidae Lymnaea*	0	0	0	0	0	0	0	1	0	0
Gastropoda	*Physidae Physa*	2	2	4	3	5	2	11	2	14	14
Gastropoda	*Planorbidae spp*	0	0	0	0	6	0	14	2	0	0
Gastropoda	*Planorbidae Gyraulus*	13	20	7	4	6	20	10	2	72	21
Gastropoda	*Planorbidae Menetus*	1	5	2	5	5	3	3	0	4	11
Hirudinea	*Erpobdellidae spp*	0	0	0	0	1	0	0	0	0	0
Hirudinea	*Glossiphoniidae Helobdella*	0	0	0	0	0	0	0	0	0	1
Oligochaeta	*Glossiphoniidae spp*	55	190	71	99	142	156	60	80	366	146
Arachnida	*Subclass: Acari spp*	0	0	0	1	2	0	0	0	0	0
Arachnida	*Hygrobatidae Hygrobates*	0	0	0	0	0	0	1	0	0	0
Arachnida	*Lebertiidae Lebertia*	0	0	0	0	1	0	0	1	0	0
Arachnida	*Limnesiidae Limnesia*	6	2	0	1	1	1	3	1	2	0
Arachnida	*Mideopsidae Mideopsis*	3	4	7	14	5	3	19	8	0	0
Arachnida	*Pionidae Forelia*	0	1	1	1	0	1	0	0	2	1
Arachnida	*Pionidae Piona*	0	1	0	0	0	0	3	5	0	1
Arachnida	*Sperchontidae Sperchonopsis*	0	0	0	1	0	0	0	0	0	0
Arachnida	*Unionicolidae Neumania*	0	0	0	0	0	0	2	0	0	0
Arachnida	*Oribatida spp*	0	0	0	0	0	1	0	0	0	0
Arachnida	*Oribatida Hydrozetes*	2	5	6	2	7	3	6	1	10	0
Ostracoda	*Ostracoda spp*	268	264	183	334	435	117	317	297	26	29
Amphipoda	*Crangonyctidae Crangonyx*	3	59	1	0	2	61	17	12	4	4
Amphipoda	*Gammaridae Gammarus*	0	0	0	0	0	0	0	0	0	1
Amphipoda	*Hyalellidae Hyalella*	132	171	129	133	195	36	144	43	36	76

Diplostraca	*Bosminidae Bosmina*	2	3	5	4	0	1	0	0	16	2
Diplostraca	*Chydoridae spp*	0	1	0	0	0	0	0	0	0	0
Diplostraca	*Chydoridae Alona*	22	42	37	39	33	7	0	2	0	0
Diplostraca	*Chydoridae Camptocercus*	4	1	0	0	1	9	0	1	8	0
Diplostraca	*Chydoridae Chydorus*	0	0	0	0	0	0	0	0	202	1
Diplostraca	*Chydoridae Graptoleberis testudinaria*	0	0	0	0	0	0	0	1	62	0
Diplostraca	*Chydoridae Kurzia*	0	2	0	0	0	0	0	11	42	3
Diplostraca	*Chydoridae Leydigia*	0	0	0	0	0	0	0	0	2	0
Diplostraca	*Daphniidae Ceriodaphnia*	1	0	0	1	0	0	0	0	0	0
Diplostraca	*Daphniidae Daphnia*	2	6	29	5	0	32	0	1	0	20
Diplostraca	*Daphniidae Moinodaphnia*	0	3	0	0	0	0	0	11	2	0
Diplostraca	*Daphniidae Simocephalus*	97	81	42	138	181	141	66	82	100	32
Diplostraca	*Eurycercidae Eurycercus*	255	207	193	188	285	208	92	101	36	34
Diplostraca	*Ilyocryptidae Ilyocryptus*	6	5	9	20	3	5	1	0	0	3
Diplostraca	*Sididae Sida*	18	19	23	28	10	10	5	33	38	36
Copepoda - Calanoida	*Calanoida spp*	1	0	0	0	0	0	0	3	0	0
Copepoda - Calanoida	*Diaptomidae spp*	0	0	3	3	1	8	0	0	4	2
Copepoda - Calanoida	*Temoridae spp*	0	1	0	1	0	0	1	0	0	0
Copepoda - Cyclopodia	*Cyclopidae spp*	722	849	281	915	648	1,310	292	524	538	952
Harpacticoida	*Harpacticoida spp*	45	73	37	38	185	0	40	10	8	1
Ephemeroptera	*Baetidae Callibaetis*	1	0	0	1	0	0	0	0	4	2
Ephemeroptera	*Caenidae Caenis*	0	0	0	0	0	0	4	1	174	84
Trichoptera	*Hydroptilidae Agraylea*	6	11	3	3	17	0	1	0	0	0
Trichoptera	*Hydroptilidae Hydroptila*	2	4	4	1	2	0	0	0	0	0
Trichoptera	*Hydroptilidae Oxyethira*	8	27	7	22	34	17	9	4	10	3
Trichoptera	*Leptoceridae Mystacides*	0	2	0	2	0	0	1	0	0	0
Trichoptera	*Leptoceridae Oecetis*	4	0	10	9	0	0	4	0	16	2
Odonata	*Aeshnidae Anax*	0	0	0	0	0	0	0	0	0	1
Odonata	*Libellulidae Leucorrhinia*	0	0	0	0	0	0	0	0	0	1
Odonata	*Coenagrionidae spp*	6	5	12	23	52	14	23	2	110	30
Odonata	*Odonata Ischnura*	0	2	1	0	0	1	0	0	0	0
Hemiptera	*Notonectidae Notonecta*	0	0	0	0	0	1	0	0	0	0
Coleoptera	*Haliplidae Peltodytes*	0	0	0	0	2	0	0	0	0	0

Diptera-Ceratopogonidae	*Ceratopogonidae spp*	0	0	0	0	0	0	1	0	0	0
Diptera-Ceratopogonidae	*Bezzia/Palpomyia*	3	4	12	5	9	5	30	8	16	20
Diptera-Ceratopogonidae	*Dasyhelea*	0	0	0	0	0	0	0	0	0	5
Diptera-Ceratopogonidae	*Probezzia*	0	3	1	5	1	0	2	0	2	0
Diptera - Chrionomidae	*Chironomidae spp*	203	125	307	364	236	64	277	165	0	338
Diptera - Chrionomidae	*Chironomus spp*	2	3	0	6	2	0	7	8	8	1
Diptera - Chrionomidae	*Cladopelma spp*	0	0	3	10	0	0	0	0	6	0
Diptera - Chrionomidae	*Cryptochironomus spp*	0	0	0	1	0	0	3	0	2	0
Diptera - Chrionomidae	*Dicrotendipes spp*	21	5	47	20	18	15	25	6	62	6
Diptera - Chrionomidae	*Microtendipes pedellus*	0	0	0	0	0	0	1	0	10	0
Diptera - Chrionomidae	*Parachironomus spp*	10	43	5	41	36	23	23	52	34	17
Diptera - Chrionomidae	*Phaenopsectra spp*	0	0	2	1	0	0	4	5	8	2
Diptera - Chrionomidae	*Polypedilum spp*	0	0	4	1	0	0	3	1	8	16
Diptera - Chrionomidae	*Pseudochironomus spp*	0	6	4	5	10	7	8	6	4	4
Diptera - Chrionomidae	*Cladotanytarsus spp*	0	0	1	0	0	0	1	0	0	0
Diptera - Chrionomidae	*Micropsectra spp*	0	0	0	0	1	0	4	2	2	0
Diptera - Chrionomidae	*Micropsectra/Tanytarsus spp*	7	0	17	14	0	2	23	41	50	0
Diptera - Chrionomidae	*Paratanytarsus spp*	5	19	66	21	37	19	22	14	140	22
Diptera - Chrionomidae	*Stempellina spp*	2	0	0	0	0	0	1	0	0	0
Diptera - Chrionomidae	*Tanytarsus spp*	0	0	0	2	0	0	9	11	30	4
Diptera - Orthocladiinae	*Orthocladiinae spp*	18	18	17	32	37	7	30	7	0	10
Diptera - Orthocladiinae	*Corynoneura spp*	2	1	0	2	7	4	10	0	14	12
Diptera - Orthocladiinae	*Cricotopus spp*	6	17	7	11	33	17	17	0	12	99
Diptera - Orthocladiinae	*Psectrocladius spp*	14	15	7	11	8	12	23	28	26	14
Diptera - Tanypdinae	*Tanypdinae spp*	2	4	17	19	4	2	9	0	0	20
Diptera - Tanypdinae	*Clinotanypus spp*	0	0	0	0	0	0	0	0	2	0
Diptera - Tanypdinae	*Procladius spp*	0	0	2	3	0	0	1	0	6	3
Diptera - Tanypdinae	*Tanypus spp*	0	0	0	1	0	0	0	0	0	0
Diptera - Tanypdinae	*Ablabesmyia spp*	8	20	2	14	43	23	3	18	26	5
Diptera - Tanypdinae	*Guttipelopia spp*	4	1	2	7	0	0	1	1	14	4
Diptera - Tanypdinae	*Labrundinia spp*	0	0	0	0	0	0	2	0	0	0
Ephydridae	*Ephydridae spp*	0	0	0	0	0	0	0	1	0	0
	Total Count	**2,037**	**2,407**	**1,698**	**2,688**	**2,829**	**2,396**	**1,714**	**1,657**	**2,428**	**2,132**

Appendix C
Water Quality Data Summaries

Appendix C
Water Quality Data Summaries

Site	ML1	ML1	ML1	ML1	ML1	ML1
Location	E	E	D	D	C	C
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	8:35 AM	8:35 AM	8:35 AM	8:35 AM	8:35 AM	8:35 AM
Time_Departure	9:07 AM	9:07 AM	9:07 AM	9:07 AM	9:07 AM	9:07 AM
Time_First_Sample	8:38 AM	8:38 AM	8:38 AM	8:38 AM	8:38 AM	8:38 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	na	na	na	na	na	na
Submerged_Algae_percent	na	na	na	na	na	na
Submerged_Other_percent	na	na	na	na	na	na
Surface_Algae_percent	na	na	na	na	na	na
Surface_Other_percent	na	na	na	na	na	na
Location_Sample_Time	8:42 AM	8:38 AM	8:42 AM	8:45 AM	8:54 AM	8:52 AM
Location_Depth_feet	4	18.5	5	13.5	3	21.5
Location_Distance_from_Shore_feet	5.5	na	5.5	na	3	na
Location_Comments	Bouldery, SAV	na	Bouldery, SAV	na	Rocky substrate	na
Turbidity_NTU1	na	1.81	na	na	na	na
Turbidity_NTU2	na	1.86	na	na	na	na
Water_Temp_degC	na	19.4	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	100.7	na	na	na	na
DO_mg*L-1	na	9.27	na	na	na	na
Notes	na	na	na	na	na	na

Site	ML1	ML1	ML1	ML1	ML2	ML2
Location	B	B	A	A	A	A
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Midchannel	Nearshore
Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	8:35 AM	8:35 AM	8:35 AM	8:35 AM	9:19 AM	9:19 AM
Time_Departure	9:07 AM	9:07 AM	9:07 AM	9:07 AM	9:58 AM	9:58 AM
Time_First_Sample	8:38 AM	8:38 AM	8:38 AM	8:38 AM	9:27 AM	9:27 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	na	na	na	na	3	3
Submerged_Algae_percent	na	na	na	na	97	97
Submerged_Other_percent	na	na	na	na	0	0
Surface_Algae_percent	na	na	na	na	0	0
Surface_Other_percent	na	na	na	na	0	0
Location_Sample_Time	8:59 AM	8:57 AM	9:04 AM	9:02 AM	9:27 AM	9:32 AM
Location_Depth_feet	5.5	22.5	5	9	10	2.8
Location_Distance_from_Shore_feet	4	na	4	na	na	6
Location_Comments	SAV substrate	na	90% SAV, 10% rock	na	na	Sandy substrate
Turbidity_NTU1	na	na	3.68	na	2.37	na
Turbidity_NTU2	na	na	2.43	na	2.01	na
Water_Temp_degC	na	na	19.2	na	19.4	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	93.2	na	94.3	na
DO_mg*L-1	na	na	8.63	na	8.72	na
Notes	na	na	na	na	na	na

Site	ML2	ML2	ML2	ML2	ML2	ML2
Location	B	B	E	E	C	C
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	9:19 AM	9:19 AM	9:19 AM	9:19 AM	9:19 AM	9:19 AM
Time_Departure	9:58 AM	9:58 AM	9:58 AM	9:58 AM	9:58 AM	9:58 AM
Time_First_Sample	9:27 AM	9:27 AM	9:27 AM	9:27 AM	9:27 AM	9:27 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	3	3	3	3	3	3
Submerged_Algae_percent	97	97	97	97	97	97
Submerged_Other_percent	0	0	0	0	0	0
Surface_Algae_percent	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0
Location_Sample_Time	9:33 AM	9:36 AM	9:42 AM	9:44 AM	9:48 AM	9:51 AM
Location_Depth_feet	26.5	5.5	13.5	5	22	3.5
Location_Distance_from_Shore_feet	na	4	na	6	na	1
Location_Comments	na	All SAV substrate	na	Boulder, SAV, and some sand	na	Sandy and SAV
Turbidity_NTU1	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na
Notes	na	na	na	na	na	na

Site	ML2	ML2	ML3	ML3	ML3	ML3
Location	D	D	A	A	B	B
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	9:19 AM	9:19 AM	10:34 AM	10:34 AM	10:34 AM	10:34 AM
Time_Departure	9:58 AM	9:58 AM	11:05 AM	11:05 AM	11:05 AM	11:05 AM
Time_First_Sample	9:27 AM	9:27 AM	10:36 AM	10:36 AM	10:36 AM	10:36 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	3	3	na	na	na	na
Submerged_Algae_percent	97	97	na	na	na	na
Submerged_Other_percent	0	0	na	na	na	na
Surface_Algae_percent	0	0	na	na	na	na
Surface_Other_percent	0	0	na	na	na	na
Location_Sample_Time	9:55 AM	9:57 AM	10:36 AM	10:37 AM	10:43 AM	10:45 AM
Location_Depth_feet	14	5	13.5	3	15	1.8
Location_Distance_from_Shore_feet	na	1	na	5	na	4
Location_Comments	na	Sandy substrate; some SAV	Sandy substrate	Sandy/silty, SAV	sand	Sandy substrate with cobble and algae
Turbidity_NTU1	3.10	na	2.48	na	na	na
Turbidity_NTU2	2.28	na	3.16	na	na	na
Water_Temp_degC	19.6	na	20.0	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	94.5	na	98.5	na	na	na
DO_mg*L-1	8.68	na	8.94	na	na	na
Notes	na	na	na	na	na	na

Site	ML3	ML3	ML3	ML3	ML3	ML3
Location	C	C	D	D	E	E
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Nearshore	Midchannel
Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	10:34 AM	10:34 AM	10:34 AM	10:34 AM	10:34 AM	10:34 AM
Time_Departure	11:05 AM	11:05 AM	11:05 AM	11:05 AM	11:05 AM	11:05 AM
Time_First_Sample	10:36 AM	10:36 AM	10:36 AM	10:36 AM	10:36 AM	10:36 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	na	na	na	na	na	na
Submerged_Algae_percent	na	na	na	na	na	na
Submerged_Other_percent	na	na	na	na	na	na
Surface_Algae_percent	na	na	na	na	na	na
Surface_Other_percent	na	na	na	na	na	na
Location_Sample_Time	10:49 AM	10:51 AM	10:58 AM	10:59 AM	11:04 AM	11:03 AM
Location_Depth_feet	15	1.6	9	2.5	2.3	16
Location_Distance_from_Shore_feet	na	0.5	na	3	3	na
Location_Comments	mud, silt	SAV, sandy, silt	SAV, mud	Sand and gravel	Rocky substrate	na
Turbidity_NTU1	na	na	na	na	na	3.49
Turbidity_NTU2	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	20.3
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	na	na	100.6
DO_mg*L-1	na	na	na	na	na	9.09
Notes	na	na	na	na	na	na

Site	ML4	ML4	ML4	ML4	ML4	ML4
Location	E	C	C	D	D	B
Location_Method	Midchannel	Midchannel	Nearshore	Nearshore	Midchannel	Nearshore
Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019
Time_Arrival	9:15 AM	9:15 AM	9:15 AM	9:15 AM	9:15 AM	9:15 AM
Time_Departure	10:32 AM	10:32 AM	10:32 AM	10:32 AM	10:32 AM	10:32 AM
Time_First_Sample	9:19 AM	9:19 AM	9:19 AM	9:19 AM	9:19 AM	9:19 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	5	5	5	5	5	5
Submerged_Algae_percent	95	95	95	95	95	95
Submerged_Other_percent	0	0	0	0	0	0
Surface_Algae_percent	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0
Location_Sample_Time	9:45 AM	9:56 AM	9:57 AM	10:00 AM	10:05 AM	10:12 AM
Location_Depth_feet	17	11	2.2	1.4	16.5	1.8
Location_Distance_from_Shore_feet	na	na	3	3.5	na	5.5
Location_Comments	na	na	Samples taken off bow of boat with D-frame kick net	Samples taken off bow of boat with D-frame kick net	na	Samples taken off bow of boat with D-frame kick net
Turbidity_NTU1	na	na	na	2.93	na	na
Turbidity_NTU2	na	na	na	na	na	na
Water_Temp_degC	na	na	na	19.7	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	100.5	na	na
DO_mg*L-1	na	na	na	9.18	na	na
Notes	na	na	na	na	na	na

Site	ML4	ML4	ML4	ML5	ML5	ML5
Location	B	A	A	A	A	B
Location_Method	Midchannel	Nearshore	Midchannel	Midchannel	Nearshore	Nearshore
Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019
Time_Arrival	9:15 AM	9:15 AM	9:15 AM	10:55 AM	10:55 AM	10:55 AM
Time_Departure	10:32 AM	10:32 AM	10:32 AM	11:38 AM	11:38 AM	11:38 AM
Time_First_Sample	9:19 AM	9:19 AM	9:19 AM	11:05 AM	11:05 AM	11:05 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	5	5	5	na	na	na
Submerged_Algae_percent	95	95	95	na	na	na
Submerged_Other_percent	0	0	0	na	na	na
Surface_Algae_percent	0	0	0	na	na	na
Surface_Other_percent	0	0	0	na	na	na
Location_Sample_Time	10:16 AM	10:26 AM	10:31 AM	11:05 AM	11:10 AM	11:16 AM
Location_Depth_feet	11	3.5	11.5	13.5	5.5	2.4
Location_Distance_from_Shore_feet	na	7	na	na	1	6
Location_Comments	na	Samples taken off bow of boat with D-frame kick net	na	na	A long sheet pile break wall; sandy substrate	na
Turbidity_NTU1	na	na	5.91	2.81	na	na
Turbidity_NTU2	na	na	na	3.00	na	na
Water_Temp_degC	na	na	20.1	19.7	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	98.2	104.5	na	na
DO_mg*L-1	na	na	8.91	9.56	na	na
Notes	na	na	na	na	na	na

Site	ML5	ML5	ML5	ML5	ML5	ML5
Location	B	C	C	D	D	E
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Midchannel
Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019
Time_Arrival	10:55 AM	10:55 AM	10:55 AM	10:55 AM	10:55 AM	10:55 AM
Time_Departure	11:38 AM	11:38 AM	11:38 AM	11:38 AM	11:38 AM	11:38 AM
Time_First_Sample	11:05 AM	11:05 AM	11:05 AM	11:05 AM	11:05 AM	11:05 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	na	na	na	na	na	na
Submerged_Algae_percent	na	na	na	na	na	na
Submerged_Other_percent	na	na	na	na	na	na
Surface_Algae_percent	na	na	na	na	na	na
Surface_Other_percent	na	na	na	na	na	na
Location_Sample_Time	11:19 AM	na	11:22 AM	11:27 AM	11:31 AM	11:35 AM
Location_Depth_feet	11.5	3.5	12	4.5	15	13.5
Location_Distance_from_Shore_feet	na	5	na	7	na	na
Location_Comments	na	Bouldery substrate with SAV (water milfoil)	na	Rocky, vegetated substrate	na	na
Turbidity_NTU1	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na
Notes	na	na	na	na	na	na

Site	ML5	ML6	ML6	ML6	ML6	ML6
Location	E	E	E	D	D	C
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019
Time_Arrival	10:55 AM	11:43 AM	11:43 AM	11:43 AM	11:43 AM	11:43 AM
Time_Departure	11:38 AM	1:00 PM	1:00 PM	1:00 PM	1:00 PM	1:00 PM
Time_First_Sample	11:05 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	na	5	5	5	5	5
Submerged_Algae_percent	na	95	95	95	95	95
Submerged_Other_percent	na	0	0	0	0	0
Surface_Algae_percent	na	0	0	0	0	0
Surface_Other_percent	na	0	0	0	0	0
Location_Sample_Time	11:38 AM	11:54 AM	na	12:03 PM	na	12:31 PM
Location_Depth_feet	1.3	14.5	2.5	18	1.6	14.5
Location_Distance_from_Shore_feet	3	na	3	na	4	na
Location_Comments	Boulder substrate	na	Rocky, vegetated substrate	na	Boulder substrate	na
Turbidity_NTU1	7.90	6.33	na	na	na	na
Turbidity_NTU2	3.48	3.32	na	na	na	na
Water_Temp_degC	20.7	21.3	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	111.9	113.2	na	na	na	na
DO_mg*L-1	10.04	10.04	na	na	na	na
Notes	na	na	na	na	na	na

Site	ML6	ML6	ML6	ML6	ML6	LT1
Location	C	B	B	A	A	A
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/19/2019
Time_Arrival	11:43 AM	11:43 AM	11:43 AM	11:43 AM	11:43 AM	10:11 AM
Time_Departure	1:00 PM	1:00 PM	1:00 PM	1:00 PM	1:00 PM	11:21 AM
Time_First_Sample	11:54 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM	10:28 AM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	N. Dunkley
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	K. Berridge
Crew_Other2	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	C. Reyes
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	M. Silva
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	5	5	5	5	5	5
Submerged_Algae_percent	95	95	95	95	95	45
Submerged_Other_percent	0	0	0	0	0	45
Surface_Algae_percent	0	0	0	0	0	5
Surface_Other_percent	0	0	0	0	0	0
Location_Sample_Time	na	12:45 PM	na	1:07 PM	na	10:28 AM
Location_Depth_feet	4	15.5	2.1	16.5	0.9	9.5
Location_Distance_from_Shore_feet	6	na	4	na	2.5	na
Location_Comments	Rocky substrate	na	Rocky substrate	na	Rocky substrate	na
Turbidity_NTU1	na	5.47	na	na	na	1.62
Turbidity_NTU2	na	3.07	na	na	na	2.23
Water_Temp_degC	na	21.3	na	na	na	22.6
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	112.3	na	na	na	na
DO_mg*L-1	na	9.89	na	na	na	na
Notes	na	na	na	na	na	YSI not working - DO readings not stabilizing

Site	LT1	LT1	LT1	LT1	LT1	LT1
Location	A	E	E	B	B	C
Location_Method	Nearshore	Nearshore	Midchannel	Midchannel	Nearshore	Midchannel
Date	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019
Time_Arrival	10:11 AM	10:11 AM	10:11 AM	10:11 AM	10:11 AM	10:11 AM
Time_Departure	11:21 AM	11:21 AM	11:21 AM	11:21 AM	11:21 AM	11:21 AM
Time_First_Sample	10:28 AM	10:28 AM	10:28 AM	10:28 AM	10:28 AM	10:28 AM
Crew_Recorder	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	5	5	5	5	5	5
Submerged_Algae_percent	45	45	45	45	45	45
Submerged_Other_percent	45	45	45	45	45	45
Surface_Algae_percent	5	5	5	5	5	5
Surface_Other_percent	0	0	0	0	0	0
Location_Sample_Time	10:31 AM	10:47 AM	10:50 AM	10:55 AM	10:59 AM	11:02 AM
Location_Depth_feet	1.4	1.3	5	11	1.4	9.5
Location_Distance_from_Shore_feet	5	2	na	na	5.5	na
Location_Comments	na	Silty substrate, SAV and emergent vegetation	na	na	Sand; SAV and emergent; muddy	Silt, algae, and SAV
Turbidity_NTU1	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na
Notes	na	na	na	na	na	na

Site	LT1	LT1	LT1	LT2	LT2	LT2
Location	C	D	D	A	A	B
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019
Time_Arrival	10:11 AM	10:11 AM	10:11 AM	8:58 AM	8:58 AM	8:58 AM
Time_Departure	11:21 AM	11:21 AM	11:21 AM	10:10 AM	10:10 AM	10:10 AM
Time_First_Sample	10:28 AM	10:28 AM	10:28 AM	9:00 AM	9:00 AM	9:00 AM
Crew_Recorder	N. Dunkley	N. Dunkley	N. Dunkley	N.Dunkley	N.Dunkley	N.Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	5	5	5	7	7	7
Submerged_Algae_percent	45	45	45	44	44	44
Submerged_Other_percent	45	45	45	44	44	44
Surface_Algae_percent	5	5	5	0	0	0
Surface_Other_percent	0	0	0	5	5	5
Location_Sample_Time	11:05 AM	11:10 AM	11:15 AM	9:00 AM	9:06 AM	9:18 AM
Location_Depth_feet	2.5	10	1.7	20.5	3.2	8
Location_Distance_from_Shore_feet	6	na	5.5	na	1.7	na
Location_Comments	50% SAV, 50% sand; some floating vegetation as well	na	na	na	Substrate = SAV (myriophyllum)	na
Turbidity_NTU1	na	na	3.48	2.82	na	na
Turbidity_NTU2	na	na	1.97	2.09	na	na
Water_Temp_degC	na	na	23.7	21.7	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na
Notes	na	na	YSI not working - DO readings not stabilizing	YSI not working - readings would not stabilize	na	na

Site	LT2	LT2	LT2	LT2	LT2	LT2
Location	B	C	C	D	D	E
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019
Time_Arrival	8:58 AM	8:58 AM	8:58 AM	8:58 AM	8:58 AM	8:58 AM
Time_Departure	10:10 AM	10:10 AM	10:10 AM	10:10 AM	10:10 AM	10:10 AM
Time_First_Sample	9:00 AM	9:00 AM	9:00 AM	9:00 AM	9:00 AM	9:00 AM
Crew_Recorder	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	7	7	7	7	7	7
Submerged_Algae_percent	44	44	44	44	44	44
Submerged_Other_percent	44	44	44	44	44	44
Surface_Algae_percent	0	0	0	0	0	0
Surface_Other_percent	5	5	5	5	5	5
Location_Sample_Time	9:22 AM	9:32 AM	9:34 AM	9:41 AM	9:44 AM	9:51 AM
Location_Depth_feet	2.8	20.5	3	6	1.3	15.5
Location_Distance_from_Shore_feet	4.5	na	4	na	0.5	na
Location_Comments	silty & SAV	na	rocky, silty, and SAV	A lot of submerged aquatic vegetation present	All SAV; floating aquatic vegetation present as well (lily pads)	SAV, silt, algae
Turbidity_NTU1	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na
Notes	na	na	na	na	na	

Site	LT2	MRL1	MRL1	MRL1	MRL1	MRL1
Location	E	E	E	D	D	C
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	6/19/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	8:58 AM	2:08 PM	2:08 PM	2:08 PM	2:08 PM	2:08 PM
Time_Departure	10:10 AM	3:30 PM	3:30 PM	3:30 PM	3:30 PM	3:30 PM
Time_First_Sample	9:00 AM	2:26 PM	2:26 PM	2:26 PM	2:26 PM	2:26 PM
Crew_Recorder	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	7	3	3	3	3	3
Submerged_Algae_percent	44	48.5	48.5	48.5	48.5	48.5
Submerged_Other_percent	44	48.5	48.5	48.5	48.5	48.5
Surface_Algae_percent	0	0	0	0	0	0
Surface_Other_percent	5	0	0	0	0	0
Location_Sample_Time	9:59 AM	2:26 PM	2:32 PM	2:39 PM	2:42 PM	2:51 PM
Location_Depth_feet	2.7	13	4	16	3.5	14
Location_Distance_from_Shore_feet	1.8	na	4	na	5	na
Location_Comments	All SAV and floating vegetation	na	Sandy bottom with SAV	na	Overhanging vegetation; sandy bottom; boulders on shore	na
Turbidity_NTU1	4.26	1.96	na	na	na	na
Turbidity_NTU2	2.22	1.54	na	na	na	na
Water_Temp_degC	22.9	20.6	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	99.0	na	na	na	na
DO_mg*L-1	na	8.89	na	na	na	na
Notes	YSI not working - readings would not stabilize	na	na	na	na	na

Site	MRL1	MRL1	MRL1	MRL1	MRL1	MRL2
Location	C	B	B	A	A	E
Location_Method	Nearshore	Nearshore	Midchannel	Midchannel	Nearshore	Midchannel
Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	2:08 PM	2:08 PM	2:08 PM	2:08 PM	2:08 PM	1:22 PM
Time_Departure	3:30 PM	3:30 PM	3:30 PM	3:30 PM	3:30 PM	2:02 PM
Time_First_Sample	2:26 PM	2:26 PM	2:26 PM	2:26 PM	2:26 PM	1:27 PM
Crew_Recorder	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	3	3	3	3	3	0
Submerged_Algae_percent	48.5	48.5	48.5	48.5	48.5	50
Submerged_Other_percent	48.5	48.5	48.5	48.5	48.5	50
Surface_Algae_percent	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0
Location_Sample_Time	2:54 PM	2:57 PM	3:00 PM	3:04 PM	3:06 PM	1:27 PM
Location_Depth_feet	2.5	2	13	7	4.5	14
Location_Distance_from_Shore_feet	3	4	na	na	8	na
Location_Comments	Sandy with SAV	Sandy bottom; woody debris present	na	na	All SAV	na
Turbidity_NTU1	na	na	na	na	2.54	1.67
Turbidity_NTU2	na	na	na	na	2.87	1.59
Water_Temp_degC	na	na	na	na	20.5	21.0
Conductivity_µS*cm-1	na	na	na	na	na	na
pH	na	na	na	na	na	na
DO_percent	na	na	na	na	125.3	100.1
DO_mg*L-1	na	na	na	na	11.33	8.93
Notes	na	na	na	na	na	For Marina Lagoon: mostly sandy bottom; significantly less naturalized - no rocks, no trees; all sheet pile

Site	MRL2	MRL2	MRL2	MRL2	MRL2	MRL2	MRL2
Location	E	D	D	C	C	B	B
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Time_Arrival	1:22 PM	1:22 PM	1:22 PM	1:22 PM	1:22 PM	1:22 PM	1:22 PM
Time_Departure	2:02 PM	2:02 PM	2:02 PM	2:02 PM	2:02 PM	2:02 PM	2:02 PM
Time_First_Sample	1:27 PM	1:27 PM	1:27 PM	1:27 PM	1:27 PM	1:27 PM	1:27 PM
Crew_Recorder	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley	N.Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
GPS_Device1	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9	iPAD #9
GPS_Device2	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance	Lowe Lowrance
Emergent_Vegetation_percent	0	0	0	0	0	0	0
Submerged_Algae_percent	50	50	50	50	50	50	50
Submerged_Other_percent	50	50	50	50	50	50	50
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	1:28 PM	1:31 PM	1:34 PM	1:39 PM	1:43 PM	1:47 PM	1:51 PM
Location_Depth_feet	7.5	10.5	10	11	9	16	5
Location_Distance_from_Shore_feet	0	na	0	na	0	na	0
Location_Comments	Scrape on sheet piles (submerged, on shore)	na	wall scrape	na	Sheet pile wall scrape	No vegetation on grab	Scraped log along sheet pile
Turbidity_NTU1	na	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na	na
Notes	na	na	na	na	na	na	na

Site	MRL2	MRL2	ML6	ML6	ML6	ML6	ML6
Location	A	A	A	A	B	B	C
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	6/18/2019	6/18/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Time_Arrival	1:22 PM	1:22 PM	11:09 AM	11:09 AM	11:09 AM	11:09 AM	11:09 AM
Time_Departure	2:02 PM	2:02 PM	11:53 AM	11:53 AM	11:53 AM	11:53 AM	11:53 AM
Time_First_Sample	1:27 PM	1:27 PM	11:09 AM	11:09 AM	11:09 AM	11:09 AM	11:09 AM
Crew_Recorder	N.Dunkley	N.Dunkley	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	M. Silva	M. Silva	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD #9	iPAD #9	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	Lowe Lowrance	Lowe Lowrance	na	na	na	na	na
Emergent_Vegetation_percent	0	0	2	2	2	2	2
Submerged_Algae_percent	50	50	0	0	0	0	0
Submerged_Other_percent	50	50	98	98	98	98	98
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	1:55 PM	1:58 PM	11:09 AM	11:13 AM	11:19 AM	11:22 AM	11:31 AM
Location_Depth_feet	19	4	15	2	15	1.5	13.5
Location_Distance_from_Shore_feet	na	na	100	2	80	3	50
Location_Comments	na	Sandy substrate	mud	Rock; sweep of bottom	mud	Rock; sweep of bottom	mud
Turbidity_NTU1	na	4.29	4.04	na	na	na	na
Turbidity_NTU2	na	1.54	na	na	na	na	na
Water_Temp_degC	na	19.9	10.7	na	na	na	na
Conductivity_µS*cm-1	na	na	138.7	na	na	na	na
pH	na	na	7.72	na	na	na	na
DO_percent	na	96.8	71.5	na	na	na	na
DO_mg*L-1	na	8.81	7.93	na	na	na	na
Notes	na		surface algae bloom	na	na	na	na

Site	ML6	ML6	ML6	ML6	ML6	ML5	ML5
Location	C	D	D	E	E	A	A
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Time_Arrival	11:09 AM	11:09 AM	11:09 AM	11:09 AM	11:09 AM	12:05 PM	12:05 PM
Time_Departure	11:53 AM	11:53 AM	11:53 AM	11:53 AM	11:53 AM	12:50 PM	12:50 PM
Time_First_Sample	11:09 AM	11:09 AM	11:09 AM	11:09 AM	11:09 AM	12:07 PM	12:07 PM
Crew_Recorder	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	2	2	2	2	2	0	0
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	98	98	98	98	98	70	70
Surface_Algae_percent	0	0	0	0	0	30	30
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	11:33 AM	11:43 AM	11:40 AM	11:50 AM	11:52 AM	12:43 PM	12:45 PM
Location_Depth_feet	3	17.5	3	14	4	12	4
Location_Distance_from_Shore_feet	2	75	2	40	4	50	3
Location_Comments	Sand; sweep of bottom	mud	Rock; sweep of bottom	mud	Sand; sweep of bottom	mud	Sand; sweep of bottom
Turbidity_NTU1	na	na	na	na	na	8.65	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	10.9	na
Conductivity_µS*cm-1	na	na	na	na	na	131.8	na
pH	na	na	na	na	na	8.31	na
DO_percent	na	na	na	na	na	82.2	na
DO_mg*L-1	na	na	na	na	na	9.09	na
Notes	na	na	na	na	na	na	na

Site	ML5	ML5	ML5	ML5	ML5	ML5	ML5
Location	B	B	C	C	D	D	E
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Time_Arrival	12:05 PM	12:05 PM	12:05 PM	12:05 PM	12:05 PM	12:05 PM	12:05 PM
Time_Departure	12:50 PM	12:50 PM	12:50 PM	12:50 PM	12:50 PM	12:50 PM	12:50 PM
Time_First_Sample	12:07 PM	12:07 PM	12:07 PM	12:07 PM	12:07 PM	12:07 PM	12:07 PM
Crew_Recorder	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	0	0	0	0	0	0	0
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	70	70	70	70	70	70	70
Surface_Algae_percent	30	30	30	30	30	30	30
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	12:35 PM	12:37 PM	12:32 PM	12:31 PM	12:24 PM	12:29 PM	12:12 PM
Location_Depth_feet	11	2	10	2	14	3.5	10
Location_Distance_from_Shore_feet	30	2	50	2	50	3	45
Location_Comments	mud	Rock; sweep of bottom	mud	Rock; sweep of bottom	Mud	Sand; sweep of bottom	mud
Turbidity_NTU1	na	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na	na
Notes	na	na	na	na	na	na	na

Site	ML5	MRL2	MRL2	MRL2	MRL2	MRL2	MRL2
Location	E	E	E	D	D	C	C
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Time_Arrival	12:05 PM	8:38 AM	8:38 AM	8:38 AM	8:38 AM	8:38 AM	8:38 AM
Time_Departure	12:50 PM	9:30 AM	9:30 AM	9:30 AM	9:30 AM	9:30 AM	9:30 AM
Time_First_Sample	12:07 PM	8:49 AM	8:49 AM	8:49 AM	8:49 AM	8:49 AM	8:49 AM
Crew_Recorder	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	0	0	0	0	0	0	0
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	70	100	100	100	100	100	100
Surface_Algae_percent	30	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	12:13 PM	8:49 AM	8:54 AM	9:01 AM	9:05 AM	9:09 AM	9:12 AM
Location_Depth_feet	2	16	15	15	15	16	5
Location_Distance_from_Shore_feet	3	100	1	100	1	125	1
Location_Comments	Sand; sweep of bottom	mud	Sweep through vegetation tips	mud	Sweep through vegetation tips	mud	Sand; sweep along bottom
Turbidity_NTU1	na	2.54	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	11.3	na	na	na	na	na
Conductivity_µS*cm-1	na	19.3	na	na	na	na	na
pH	na	7.57	na	na	na	na	na
DO_percent	na	82.9	na	na	na	na	na
DO_mg*L-1	na	9.08	na	na	na	na	na
Notes	na	na	na	na	na	na	na

Site	MRL2	MRL2	MRL2	MRL2	MRL1	MRL1	MRL1
Location	B	B	A	A	E	E	D
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel
Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Time_Arrival	8:38 AM	8:38 AM	8:38 AM	8:38 AM	9:50 AM	9:50 AM	9:50 AM
Time_Departure	9:30 AM	9:30 AM	9:30 AM	9:30 AM	10:25 AM	10:25 AM	10:25 AM
Time_First_Sample	8:49 AM	8:49 AM	8:49 AM	8:49 AM	9:50 AM	9:50 AM	9:50 AM
Crew_Recorder	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	0	0	0	0	5	5	5
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	100	100	100	100	95	95	95
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	9:15 AM	9:18 AM	9:25 AM	9:29 AM	9:50 AM	9:55 AM	10:01 AM
Location_Depth_feet	16	7	18	4	11	3	16
Location_Distance_from_Shore_feet	60	1	100	1	150	1	40
Location_Comments	mud	Sweep through vegetation	mud	Sand; sweep along bottom	mud	Sand; sweep of bottom	mud
Turbidity_NTU1	na	na	na	na	2.47	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	11.1	na	na
Conductivity_µS*cm-1	na	na	na	na	97.8	na	na
pH	na	na	na	na	8.03	na	na
DO_percent	na	na	na	na	82.9	na	na
DO_mg*L-1	na	na	na	na	9.12	na	na
Notes	na	na	na	na	na	na	na

Site	MRL1	MRL1	MRL1	MRL1	MRL1	MRL1	MRL1
Location	D	C	C	B	B	A	A
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Time_Arrival	9:50 AM	9:50 AM	9:50 AM	9:50 AM	9:50 AM	9:50 AM	9:50 AM
Time_Departure	10:25 AM	10:25 AM	10:25 AM	10:25 AM	10:25 AM	10:25 AM	10:25 AM
Time_First_Sample	9:50 AM	9:50 AM	9:50 AM	9:50 AM	9:50 AM	9:50 AM	9:50 AM
Crew_Recorder	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	5	5	5	5	5	5	5
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	95	95	95	95	95	95	95
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	10:05 AM	10:10 AM	10:12 AM	10:16 AM	10:17 AM	10:21 AM	10:25 AM
Location_Depth_feet	4	13	3	9	2	10	1
Location_Distance_from_Shore_feet	1	50	4	75	4	70	2
Location_Comments	Sand; sweep of bottom	mud	Sand; sweep of bottom	mud	Sand; sweep of bottom	mud	Rock; sweep of bottom
Turbidity_NTU1	na	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na	na
Notes	na	na	na	na	na	na	na

Site	ML1	ML1	ML1	ML1	ML1	ML1	ML1
Location	A	A	B	B	C	C	D
Location_Method	Midchannel	Nearshore	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019
Time_Arrival	2:21 PM	2:21 PM	2:21 PM	2:21 PM	2:21 PM	2:21 PM	2:21 PM
Time_Departure	3:00 PM	3:00 PM	3:00 PM	3:00 PM	3:00 PM	3:00 PM	3:00 PM
Time_First_Sample	2:25 PM	2:25 PM	2:25 PM	2:25 PM	2:25 PM	2:25 PM	2:25 PM
Crew_Recorder	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	0	0	0	0	0	0	0
Submerged_Algae_percent	5	5	5	5	5	5	5
Submerged_Other_percent	95	95	95	95	95	95	95
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	2:25 PM	2:26 PM	2:32 PM	2:35 PM	2:38 PM	2:39 PM	2:43 PM
Location_Depth_feet	10	1.8	3.5	25.5	4.5	22	4
Location_Distance_from_Shore_feet	70	5	2	200	3	60	5
Location_Comments	muddy	rocky	rocky with algae	muddy	sandy	muddy	sandy
Turbidity_NTU1	3.08	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	12.1	na	na	na	na	na	na
Conductivity_µS*cm-1	103.7	na	na	na	na	na	na
pH	8.41	na	na	na	na	na	na
DO_percent	90.4	na	na	na	na	na	na
DO_mg*L-1	9.79	na	na	na	na	na	na
Notes	Trouble with deploying ponar - too much vegetation could be blocking ponar from substrate	Turtle seen: N 38*56.155' W 120*00.926'; sunny with slight breeze	na	na	na	na	na

Site	ML1	ML1	ML1	ML2	ML2	ML2	ML2
Location	D	E	E	D	D	C	C
Location_Method	Midchannel	Midchannel	Nearshore	Midchannel	Nearshore	Nearshore	Midchannel
Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019
Time_Arrival	2:21 PM	2:21 PM	2:21 PM	1:35 PM	1:35 PM	1:35 PM	1:35 PM
Time_Departure	3:00 PM	3:00 PM	3:00 PM	2:13 PM	2:13 PM	2:13 PM	2:13 PM
Time_First_Sample	2:25 PM	2:25 PM	2:25 PM	1:35 PM	1:35 PM	1:35 PM	1:35 PM
Crew_Recorder	N. Dunkley	N. Dunkley	N. Dunkley	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	0	0	0	10	10	10	10
Submerged_Algae_percent	5	5	5	5	5	5	5
Submerged_Other_percent	95	95	95	85	85	85	85
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	2:47 PM	2:52 PM	2:54 PM	1:35 PM	1:41 PM	1:47 PM	1:50 PM
Location_Depth_feet	22	20	4	14.5	4	3.25	22
Location_Distance_from_Shore_feet	200	70	5	40	0	1	250
Location_Comments	muddy	Muddy; multiple attempts at Ponar (x4)	sandy	mud	sand; scraped along bottom along sheetpile	mud/rock	mud
Turbidity_NTU1	na	na	na	3.47	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	12.4	na	na	na
Conductivity_µS*cm-1	na	na	na	112.4	na	na	na
pH	na	na	na	8.25	na	na	na
DO_percent	na	na	na	89.3	na	na	na
DO_mg*L-1	na	na	na	9.5	na	na	na
Notes	na	na	na	na	na	na	na

Site	ML2	ML2	ML2	ML2	ML2	ML2	ML3
Location	E	E	B	B	A	A	E
Location_Method	Midchannel	Nearshore	Nearshore	Midchannel	Nearshore	Midchannel	Midchannel
Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019
Time_Arrival	1:35 PM	1:35 PM	1:35 PM	1:35 PM	1:35 PM	1:35 PM	12:00 PM
Time_Departure	2:13 PM	2:13 PM	2:13 PM	2:13 PM	2:13 PM	2:13 PM	12:40 PM
Time_First_Sample	1:35 PM	1:35 PM	1:35 PM	1:35 PM	1:35 PM	1:35 PM	12:00 PM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	10	10	10	10	10	10	10
Submerged_Algae_percent	5	5	5	5	5	5	0
Submerged_Other_percent	85	85	85	85	85	85	90
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	1:53 PM	1:55 PM	2:00 PM	2:02 PM	2:06 PM	2:10 PM	12:00 PM
Location_Depth_feet	16	4	1.8	25	1	12	15
Location_Distance_from_Shore_feet	40	3	2	150	3	80	50
Location_Comments	mud	rock	rock	mud	rock	mud	mud
Turbidity_NTU1	na	na	na	na	na	na	3.1
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na	11.4
Conductivity_µS*cm-1	na	na	na	na	na	na	118.8
pH	na	na	na	na	na	na	7.81
DO_percent	na	na	na	na	na	na	79.1
DO_mg*L-1	na	na	na	na	na	na	8.63
Notes	na	na	na	na	na	na	na

Site	ML3	ML3	ML3	ML3	ML3	ML3	ML3
Location	E	D	D	C	C	B	B
Location_Method	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Nearshore	Midchannel
Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019
Time_Arrival	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM
Time_Departure	12:40 PM	12:40 PM	12:40 PM	12:40 PM	12:40 PM	12:40 PM	12:40 PM
Time_First_Sample	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	10	10	10	10	10	10	10
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	90	90	90	90	90	90	90
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	12:04 PM	12:11 PM	12:13 PM	12:18 PM	12:25 PM	12:31 PM	12:34 PM
Location_Depth_feet	1.8	13	1.8	15	1	0.8	15
Location_Distance_from_Shore_feet	1	50	2.5	50	2	1	50
Location_Comments	rock	mud	sand	mud	sand	rock	mud
Turbidity_NTU1	na	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na	na
Notes	na	na	na	na	na	na	na

Site	ML3	ML3	ML4	ML4	ML4	ML4	ML4
Location	A	A	E	E	C	C	D
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Nearshore	Midchannel	Nearshore
Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019
Time_Arrival	12:00 PM	12:00 PM	11:04 AM	11:04 AM	11:04 AM	11:04 AM	11:04 AM
Time_Departure	12:40 PM	12:40 PM	11:45 AM	11:45 AM	11:45 AM	11:45 AM	11:45 AM
Time_First_Sample	12:00 PM	12:00 PM	11:04 AM	11:04 AM	11:04 AM	11:04 AM	11:04 AM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	10	10	5	5	5	5	5
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	90	90	95	95	95	95	95
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	0	0
Location_Sample_Time	12:38 PM	12:40 PM	11:04 AM	11:13 AM	11:17 AM	11:20 AM	11:26 AM
Location_Depth_feet	14.5	2.5	16	1.5	2	10	1.5
Location_Distance_from_Shore_feet	40	4	40	3	2	80	4
Location_Comments	mud	sand	mud	rock	sand	mud	sand
Turbidity_NTU1	na	na	2.84	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	11.0	na	na	na	na
Conductivity_µS*cm-1	na	na	118.4	na	na	na	na
pH	na	na	7.65	na	na	na	na
DO_percent	na	na	72.8	na	na	na	na
DO_mg*L-1	na	na	8.02	na	na	na	na
Notes	na	na	na	na	na	na	na

Site	ML4	ML4	ML4	ML4	ML4	LT2	LT2
Location	D	B	B	A	A	A	A
Location_Method	Midchannel	Nearshore	Midchannel	Midchannel	Nearshore	Midchannel	Nearshore
Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/16/2019	10/16/2019
Time_Arrival	11:04 AM	11:04 AM	11:04 AM	11:04 AM	11:04 AM	10:30 AM	10:30 AM
Time_Departure	11:45 AM	11:45 AM	11:45 AM	11:45 AM	11:45 AM	11:25 AM	11:25 AM
Time_First_Sample	11:04 AM	11:04 AM	11:04 AM	11:04 AM	11:04 AM	10:36 AM	10:36 AM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	5	5	5	5	5	20	20
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	95	95	95	95	95	55	55
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	0	0	0	0	0	25	25
Location_Sample_Time	11:28 AM	11:36 AM	11:38 AM	11:42 AM	11:44 AM	10:36 AM	10:40 AM
Location_Depth_feet	16	1.2	11	10	1.5	19.5	1.5
Location_Distance_from_Shore_feet	70	1	70	100	2	70	15
Location_Comments	mud	mud	mud	mud	mud	mud	silt
Turbidity_NTU1	na	na	na	na	na	3.57	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	9.1	na
Conductivity_µS*cm-1	na	na	na	na	na	318.0	na
pH	na	na	na	na	na	7.28	na
DO_percent	na	na	na	na	na	72.7	na
DO_mg*L-1	na	na	na	na	na	8.38	na
Notes	na	na	na	na	na	na	na

Site	LT2	LT2	LT2	LT2	LT2	LT2	LT2
Location	B	B	C	C	D	D	E
Location_Method	Midchannel	Nearshore	Midchannel	Nearshore	Nearshore	Midchannel	Nearshore
Date	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019
Time_Arrival	10:30 AM	10:30 AM	10:30 AM	10:30 AM	10:30 AM	10:30 AM	10:30 AM
Time_Departure	11:25 AM	11:25 AM	11:25 AM	11:25 AM	11:25 AM	11:25 AM	11:25 AM
Time_First_Sample	10:36 AM	10:36 AM	10:36 AM	10:36 AM	10:36 AM	10:36 AM	10:36 AM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na
Emergent_Vegetation_percent	20	20	20	20	20	20	20
Submerged_Algae_percent	0	0	0	0	0	0	0
Submerged_Other_percent	55	55	55	55	55	55	55
Surface_Algae_percent	0	0	0	0	0	0	0
Surface_Other_percent	25	25	25	25	25	25	25
Location_Sample_Time	10:47 AM	10:54 AM	10:58 AM	11:00 AM	11:07 AM	11:15 AM	11:18 AM
Location_Depth_feet	12.5	2.8	20	0.8	0.5	7.5	1.2
Location_Distance_from_Shore_feet	30	3	50	1.2	0.5	30	5
Location_Comments	mud	Sand; very vegetated	mud	mud	sand	mud	silt
Turbidity_NTU1	na	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na
Water_Temp_degC	na	na	na	na	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na	na
Notes	na	na	na	na	na	na	na

Site	LT2	LT1	LT1	LT1	LT1	LT1	LT1	LT1	LT1
Location	E	A	A	E	E	B	B	C	C
Location_Method	Midchannel	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore	Midchannel	Nearshore
Date	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019
Time_Arrival	10:30 AM	11:45 AM	11:45 AM	11:45 AM	11:45 AM	11:45 AM	11:45 AM	11:45 AM	11:45 AM
Time_Departure	11:25 AM	12:40 PM	12:40 PM	12:40 PM	12:40 PM	12:40 PM	12:40 PM	12:40 PM	12:40 PM
Time_First_Sample	10:36 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM	11:54 AM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD	iPAD
GPS_Device2	na	na	na	na	na	na	na	na	na
Emergent_Vegetation_percent	20	20	20	20	20	20	20	20	20
Submerged_Algae_percent	0	0	0	0	0	0	0	0	0
Submerged_Other_percent	55	55	55	55	55	55	55	55	55
Surface_Algae_percent	0	0	0	0	0	0	0	0	0
Surface_Other_percent	25	25	25	25	25	25	25	25	25
Location_Sample_Time	11:22 AM	11:54 AM	11:56 AM	12:00 PM	12:09 PM	12:15 PM	12:17 PM	12:18 PM	12:22 PM
Location_Depth_feet	18	12	1.2	8.5	1.8	11	0.8	8	1.8
Location_Distance_from_Shore_feet	100	50	2	20	3	30	2	100	3
Location_Comments	mud	mud	mud	mud	silt	mud	mud	mud	silt
Turbidity_NTU1	na	3.74	na	na	na	na	na	na	na
Turbidity_NTU2	na	na	na	na	na	na	na	na	na
Water_Temp_degC	na	10.1	na	na	na	na	na	na	na
Conductivity_µS*cm-1	na	297.0	na	na	na	na	na	na	na
pH	na	7.49	na	na	na	na	na	na	na
DO_percent	na	81.1	na	na	na	na	na	na	na
DO_mg*L-1	na	9.13	na	na	na	na	na	na	na
Notes	na	na	na	na	Site location changed due to heavy vegetation making it unaccessible for boat	na	na	na	na

Site	LT1	LT1
Location	D	D
Location_Method	Midchannel	Nearshore
Date	10/16/2019	10/16/2019
Time_Arrival	11:45 AM	11:45 AM
Time_Departure	12:40 PM	12:40 PM
Time_First_Sample	11:54 AM	11:54 AM
Crew_Recorder	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding
GPS_Device1	iPAD	iPAD
GPS_Device2	na	na
Emergent_Vegetation_percent	20	20
Submerged_Algae_percent	0	0
Submerged_Other_percent	55	55
Surface_Algae_percent	0	0
Surface_Other_percent	25	25
Location_Sample_Time	12:25 PM	12:27 PM
Location_Depth_feet	11	1.2
Location_Distance_from_Shore_feet	60	3
Location_Comments	mud	sand
Turbidity_NTU1	na	na
Turbidity_NTU2	na	na
Water_Temp_degC	na	na
Conductivity_µS*cm-1	na	na
pH	na	na
DO_percent	na	na
DO_mg*L-1	na	na
Notes	na	na

Appendix D

Fish Assemblage Data Summaries

APPENDIX D
Fish Assemblage Data Summaries

Boat Electrofishing Events

Site	ML6	ML6	ML6	ML6	ML6	ML5	ML5	ML5	ML5	ML5
Location	D	E	C	B	A	C	B	A	E	D
Date	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/25/2019
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Crew_Other1	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Crew_Other2	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Amps	4	4	4	4	4	6	6	6	6	6
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	65	65	65	65	65	55	55	55	55	55
Power_range	na	na	na	na	na	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60
Start_Time	12:01 PM	11:40 AM	11:18 AM	11:01 AM	10:41 AM	1:04 PM	1:20 PM	1:35 PM	12:21 PM	12:45 PM
End_Time	12:10 PM	11:44 AM	11:22 AM	11:07 AM	10:46 AM	1:08 PM	1:24 PM	1:38 PM	na	12:48 PM
Duration_seconds	122	173	100	272	107	198	149	110	170	100
Distance_meters	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	4.03	na	na	na	4.08	na	na	4.14	na	na
Water_Temp_degC	21.5	na	na	na	20.5	na	na	20.8	21.0	na
Conductivity_µS*cm-1	111.6	na	na	na	112.5	na	na	92.7	106.3	na
pH	na	na	na	na	na	na	na	na	na	na
DO_percent	105.8	na	na	na	97.4	na	na	115.1	108.9	na
DO_mg*L-1	9.40	na	na	na	8.76	na	na	10.32	9.72	na
Notes	na	na	na	Several fish observed shocked but not fully knocked out in water offshore in 8-13' depth. Most fish captured in water <4' along shore.	Shocked center channel, 80 m of shoreline	Distance shocked = center channel length	Many fish (mostly bluegill) shocked but lodged in between rocks/boulders and not captured	na	Increased power for this site. Forgot to record end time.	na

Boat Electrofishing Events

Site	ML4	ML4	ML4	ML4	ML4	MRL2	MRL2	MRL2	MRL2	MRL2	MRL1
Location	E	D	C	B	A	D	E	B	C	A	E
Date	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/25/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019
Crew_Recorder	M. Silva	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other1	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Crew_Other2	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other3	C. Reyes	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Amps	6	6	5	5	5	5	5	5	4	5	5
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	55	55	55	55	55	55	55	60	80	60	60
Power_range	High	High	High	High	High	High	High	High	Low	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60	60
Start_Time	2:08 PM	2:29 PM	2:50 PM	3:30 PM	3:07 PM	8:56 AM	8:41 AM	9:22 AM	9:11 AM	9:36 AM	9:56 AM
End_Time	2:14 PM	2:36 PM	2:58 PM	3:39 PM	3:15 PM	9:03 AM	8:47 AM	9:24 AM	9:18 AM	9:42 AM	10:03 AM
Duration_seconds	145	224	186	237	250	145	225	118	179	155	222
Distance_meters	50	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	3.94	na	na	3.55	na	na	2.38	na	na	4.5	2.75
Water_Temp_degC	21.3	na	na	19.5	na	na	18.6	na	na	18.3	18.1
Conductivity_µS*cm-1	96.2	na	na	90.2	na	na	91.6	na	na	85.3	81.6
pH	na	na	na	na	na	na	na	na	na	na	na
DO_percent	109.9	na	na	103.1	na	na	115.0	na	na	100.1	92.9
DO_mg*L-1	9.78	na	na	9.48	na	na	10.76	na	na	9.41	8.78
Notes	na	na	na	na	na	10-15' deep; Fish observed, but too deep to catch.	8-10' depth; fish observed but too deep to catch.	6-8' depth	At 43 seconds, settings changed to 60% power/high range. 10-16' depth; fish observed but too deep to catch.	na	na

Boat Electrofishing Events

Site	MRL1	MRL1	MRL1	MRL1	ML3	ML3	ML3	ML3	ML3	ML2
Location	D	C	B	A	D	E	B	C	A	E
Date	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019
Crew_Recorder	C. Reyes	C. Reyes	C. Reyes	C. Reyes	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Crew_Other2	A. Lopez	A. Lopez	A. Lopez	A. Lopez	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Amps	5	5	4	4	4	5	4	4	5	4.5
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	60	na	60	60	60	60	60	60	60	60
Power_range	High	na	High	High	High	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60
Start_Time	10:14 AM	10:33 AM	10:50 AM	11:08 AM	12:12 PM	11:58 AM	12:38 PM	12:24 PM	12:58 PM	1:48 PM
End_Time	10:21 AM	10:37 AM	10:56 AM	11:12 AM	12:16 PM	12:03 PM	12:42 PM	12:31 PM	1:03 PM	1:56 PM
Duration_seconds	168	144	211	150	128	105	140	168	169	129
Distance_meters	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	na	na	na	2.61	na	2.57	na	na	2.1	2.55
Water_Temp_degC	na	na	na	18.5	na	19.3	na	na	19.0	19.4
Conductivity_µS*cm-1	na	na	na	82.2	na	92.4	na	na	87.4	78.4
pH	na	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	88.2	na	100.6	na	na	98.9	103.7
DO_mg*L-1	na	na	na	8.29	na	9.30	na	na	9.16	9.55
Notes	na	na	Water quality captured in MRL1a; Efishing site in MRL1b due to public - not safe to efish MRL1a	na	na	na	na	na	na	na

Boat Electrofishing Events

Site	ML2	ML2	ML2	ML2	ML1	ML1	ML1	ML1	ML1	LT2	LT2
Location	D	C	B	A	E	D	C	B	A	B	A
Date	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/26/2019	6/27/2019	6/27/2019
Crew_Recorder	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Amps	4.5	4.5	4.5	na	4.5	4.5	4	4	4.5	8	6
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	60	60	60	60	60	60	60	60	60	40	20
Power_range	High	High	High	High	High	High	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60	60
Start_Time	2:06 PM	2:23 PM	2:40 PM	2:58 PM	4:14 PM	4:27 PM	4:45 PM	3:57 PM	3:15 PM	9:28 AM	9:03 AM
End_Time	2:11 PM	2:30 PM	2:46 PM	3:03 PM	4:19 PM	4:33 PM	4:50 PM	4:00 PM	3:25 PM	9:34 AM	9:10 AM
Duration_seconds	162	137	137	105	137	142	140	82	170	186	232
Distance_meters	50	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	na	na	na	1.87	na	1.8	na	na	2.04	na	2.99
Water_Temp_degC	na	na	na	19.0	na	19.3	na	na	18.8	na	17.7
Conductivity_µS*cm-1	na	na	na	81.7	na	82.6	na	na	85.2	na	260.0
pH	na	na	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	94.0	na	96.6	na	na	96.0	na	91.9
DO_mg*L-1	na	na	na	8.74	na	8.93	na	na	8.95	na	8.75
Notes	na	na	na	na	na	na	na	na	na	Switched to 40% high range	Switched to 20% high range

Boat Electrofishing Events

Site	LT2	LT2	LT2	LT1	LT1	LT1	LT1	LT1	ML1	ML1	ML1
Location	D	C	E	A	B	E	D	C	A	B	C
Date	6/27/2019	6/27/2019	6/27/2019	6/27/2019	6/27/2019	6/27/2019	6/27/2019	6/27/2019	10/8/2019	10/8/2019	10/8/2019
Crew_Recorder	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	C. Reyes	C. Reyes	C. Reyes
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Turner	C. Turner	C. Turner
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	R. Fuller	R. Fuller	R. Fuller
Amps	8	8	8	8	8	8.5	8	8	4	5	5
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	60	60	60	60	60	60	60	60	75	75	75
Power_range	Low	Low	Low	Low	Low	Low	Low	Low	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60	60
Start_Time	10:07 AM	9:47 AM	10:25 AM	10:37 AM	11:15 AM	10:56 AM	11:45 AM	11:25 AM	11:41 AM	11:34 AM	11:55 AM
End_Time	10:15 AM	9:54 AM	10:27 AM	10:41 AM	11:18 AM	10:59 AM	11:48 AM	11:28 AM	11:46 AM	11:37 AM	12:03 PM
Duration_seconds	280	175	110	160	148	116	99	140	120	98	163
Distance_meters	50	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	na	na	3.41	na	na	3.38	3.12	na	na	2.41	na
Water_Temp_degC	na	na	19.2	na	na	17.1	20.5	na	na	13.4	na
Conductivity_µS*cm-1	na	na	232.0	na	na	260.0	223.0	na	na	92.1	na
pH	na	na	na	na	na	na	na	na	na	8.55	na
DO_percent	na	na	87.4	na	na	85.1	91.0	na	na	88.3	na
DO_mg*L-1	na	na	8.08	na	na	8.18	8.23	na	na	9.23	na
Notes	Heavy lily pad cover, difficult to shock and net fish	Switched to 60% low range	na	na	na	na	na	na	na	Rainbow trout found by bubble curtain	na

Boat Electrofishing Events

Site	ML1	ML1	ML2	ML2	ML2	ML2	ML2	ML3	ML3	ML3
Location	D	E	A	B	D	C	E	A	B	C
Date	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/7/2019	10/7/2019	10/7/2019
Crew_Recorder	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other2	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other3	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Amps	5	5	5	5	5	5	4	5	4	4
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	75	75	75	75	75	75	75	55	55	55
Power_range	High	High	High	High	High	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60
Start_Time	12:15 PM	12:31 PM	1:18 PM	1:42 PM	2:35 PM	1:57 PM	2:18 PM	3:32 PM	3:13 PM	2:57 PM
End_Time	12:21 PM	12:36 PM	1:28 PM	1:48 PM	2:45 PM	2:07 PM	2:23 PM	3:38 PM	3:17 PM	3:01 PM
Duration_seconds	162	120	179	137	170	137	93	124	124	101
Distance_meters	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	na	3.72	3.86	na	2.50	na	na	4.37	na	na
Water_Temp_degC	na	13.9	14.3	na	13.9	na	na	14.7	na	na
Conductivity_µS*cm-1	na	95.8	94.3	na	98.8	na	na	102.3	na	na
pH	na	7.89	8.68	na	8.75	na	na	8.48	na	na
DO_percent	na	79.2	91.8	na	93.6	na	na	92	na	na
DO_mg*L-1	na	8.15	9.40	na	9.65	na	na	9.34	na	na
Notes	na	na	Survey section divided into two parts	na	na	na	na	na	na	na

Boat Electrofishing Events

Site	ML3	ML3	MRL1	MRL1	MRL1	MRL1	MRL1	MRL2	MRL2	MRL2
Location	D	E	A	B	C	D	E	A	B	C
Date	10/7/2019	10/7/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019
Crew_Recorder	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other2	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other3	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Amps	4	5	6	6	7	7	7	7	7	7
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	55	55	75	75	75	75	75	75	75	75
Power_range	High	High	High	High	High	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60
Start_Time	2:45 PM	2:34 PM	10:50 AM	10:35 AM	10:26 AM	10:13 AM	9:51 AM	9:32 AM	9:21 AM	9:13 AM
End_Time	2:50 PM	2:39 PM	10:57 AM	10:41 AM	10:31 AM	10:19 AM	10:01 AM	9:41 AM	9:25 AM	9:17 AM
Duration_seconds	131	120	195	162	150	153	234	152	108	104
Distance_meters	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	na	3.70	3.68	na	na	na	3.32	2.96	na	na
Water_Temp_degC	na	13.9	13.0	na	na	na	12.7	12.6	na	na
Conductivity_µS*cm-1	na	103.5	93.0	na	na	na	93.9	97.5	na	na
pH	na	8.17	9.40	na	na	na	8.51	7.98	na	na
DO_percent	na	85.9	107.7	na	na	na	86.1	76.7	na	na
DO_mg*L-1	na	8.94	11.37	na	na	na	9.15	8.16	na	na
Notes	na	na	Very dense submerged aquatic vegetation; Water quality measured out on the lake on 10/8/2019 at 12 ft deep - Turbidity: 1.42 NTU, pH: 8.20, DO: 83.5%, 8.55mg/L, Temp: 57.8 deg F, Conductivity: 86.4 µS*cm-1	na	na	Surface algae bloom near boat docks; Unknown sucker had damaged mouth - photo taken on C. Turner's phone	na	Surface algae bloom and submerged aquatic vegetation created very poor in-water visibility	na	Shocked only at sheet pile. 3 non-adjacent lengths; No fish caught

Boat Electrofishing Events

Site	MRL2	MRL2	ML4	ML4	ML4	ML4	ML4	ML5	ML5	ML5
Location	D	E	A	B	C	D	E	A	B	C
Date	10/8/2019	10/8/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019
Crew_Recorder	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other2	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other3	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Amps	7	7	4	4	4	6	6	6	6	6
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	75	75	55	55	55	55	55	55	55	55
Power_range	High	High	High	High	High	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60
Start_Time	8:59 AM	8:49 AM	1:16 PM	12:58 PM	12:44 PM	12:29 PM	12:12 PM	11:49 AM	11:34 AM	11:25 AM
End_Time	9:06 AM	8:53 AM	1:20 PM	1:03 PM	12:51 PM	12:35 PM	12:18 PM	11:52 AM	11:40 AM	11:31 AM
Duration_seconds	138	1016	92	168	181	148	157	111	159	157
Distance_meters	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	na	4.36	6.55	na	na	na	3.67	6.60	na	na
Water_Temp_degC	na	12.5	12.9	na	na	na	13.7	13.1	na	na
Conductivity_µS*cm-1	na	104.6	105.6	na	na	na	109.8	101.5	na	na
pH	na	8.18	8.06	na	na	na	7.77	9.31	na	na
DO_percent	na	83.4	86.0	na	na	na	78.4	100.2	na	na
DO_mg*L-1	na	8.89	9.13	na	na	na	8.30	10.54	na	na
Notes	Shocked only at sheet pile walls, 3 non-adjacent lengths	na	Shocked along a sheet pile	na	na	na	na	Shocked along sheet pile wall; surface algae present	na	na

Boat Electrofishing Events

Site	ML5	ML5	ML6	ML6	ML6	ML6	ML6	LT2	LT2	LT2
Location	D	E	E	A	B	C	D	A	B	C
Date	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/7/2019	10/9/2019	10/9/2019	10/9/2019
Crew_Recorder	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other2	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other3	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Amps	6	6	8	8	8	8	8	7	6	6
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	55	55	55	55	55	55	55	30	30	30
Power_range	High	High	High	High	High	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60	60	60	60
Start_Time	11:10 AM	10:55 AM	10:20 AM	9:10 AM	9:38 AM	9:54 AM	10:02 AM	8:50 AM	9:05 AM	9:16 AM
End_Time	11:19 AM	11:02 AM	10:26 AM	9:20 AM	9:45 AM	9:59 AM	10:10 AM	8:56 AM	9:10 AM	9:23 AM
Duration_seconds	154	173	123	202	148	70	119	206	135	145
Distance_meters	50	50	50	50	50	50	50	50	50	50
Turbidity_NTU	na	6.36	4.20	7.05	na	na	na	3.12	na	na
Water_Temp_degC	na	12.6	12.6	11.9	na	na	na	10.4	na	na
Conductivity_μS*cm-1	na	127.3	135.6	1456.6	na	na	na	320.0	na	na
pH	na	8.62	8.24	7.20	na	na	na	7.49	na	na
DO_percent	na	84.0	83.9	77.6	na	na	na	89.9	na	na
DO_mg*L-1	na	8.92	8.94	8.39	na	na	na	10.03	na	na
Notes	Surface algae bloom, poor in-water visibility	Thick submerged aquatic vegetation and surface algae bloom; 3 bluegill not measured	na	na	Surface algae bloom impaired in-water visibility	Surface algae bloom	na	na	na	na

Boat Electrofishing Events

Site	LT2	LT2	LT1	LT1	LT1	LT1	LT1
Location	D	E	A	C	D	B	E
Date	10/9/2019	10/9/2019	10/9/2019	10/9/2019	10/9/2019	10/9/2019	10/9/2019
Crew_Recorder	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez	A. Lopez
Crew_Other1	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other2	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other3	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller	R. Fuller
Amps	6	6	6	5	5	6	6
Current_type	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC	Pulsed DC
Power_percent	30	30	30	30	30	30	30
Power_range	High	High	High	High	High	High	High
Duty_Cycle	60	60	60	60	60	60	60
Start_Time	9:34 AM	9:53 AM	10:06 AM	10:57 AM	11:17 AM	10:43 AM	10:32 AM
End_Time	9:41 AM	9:58 AM	10:13 AM	11:05 AM	11:23 AM	10:48 AM	10:36 AM
Duration_seconds	189	164	191	204	130	170	112
Distance_meters	50	50	50	50	50	50	50
Turbidity_NTU	na	4.23	5.0	na	2.68	na	3.93
Water_Temp_degC	na	11.4	52.9	na	12.4	na	10.3
Conductivity_µS*cm-1	na	302.0	288.0	na	280.0	na	273.0
pH	na	7.52	8.08	na	8.50	na	7.47
DO_percent	na	81.1	95.5	na	101.4	na	73.3
DO_mg*L-1	na	8.84	10.39	na	10.80	na	8.25
Notes	One Bullfrog	na	na	na	na	na	na

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML6	D	6/25/2019	Bluegill	163	100.6
ML6	D	6/25/2019	Bluegill	150	75.4
ML6	D	6/25/2019	Bluegill	83	12.5
ML6	D	6/25/2019	Bluegill	169	97.3
ML6	D	6/25/2019	Bluegill	121	32.3
ML6	D	6/25/2019	Largemouth Bass	311	385.7
ML6	E	6/25/2019	Bluegill	151	67.6
ML6	E	6/25/2019	Bluegill	157	78.8
ML6	E	6/25/2019	Bluegill	134	52.2
ML6	E	6/25/2019	Bluegill	168	103.0
ML6	E	6/25/2019	Bluegill	135	52.2
ML6	E	6/25/2019	Bluegill	79	9.8
ML6	E	6/25/2019	Bluegill	161	91.3
ML6	E	6/25/2019	Bluegill	164	87.5
ML6	E	6/25/2019	Bluegill	185	168.4
ML6	E	6/25/2019	Bluegill	143	59.6
ML6	E	6/25/2019	Bluegill	na	na
ML6	E	6/25/2019	Goldfish	222	217.7
ML6	E	6/25/2019	Largemouth Bass	168	53.8
ML6	E	6/25/2019	Brown Bullhead	272	254.7
ML6	C	6/25/2019	Largemouth Bass	246	185.4
ML6	C	6/25/2019	Largemouth Bass	122	18.3
ML6	C	6/25/2019	Largemouth Bass	163	50.4
ML6	C	6/25/2019	Largemouth Bass	112	15.3
ML6	C	6/25/2019	Bluegill	151	70.2
ML6	C	6/25/2019	Bluegill	150	65.6
ML6	B	6/25/2019	Largemouth Bass	116	17.4
ML6	B	6/25/2019	Largemouth Bass	104	15.3
ML6	B	6/25/2019	Largemouth Bass	163	47.2
ML6	B	6/25/2019	Bluegill	156	71.8
ML6	B	6/25/2019	Bluegill	157	78.5
ML6	B	6/25/2019	Bluegill	82	12.4
ML6	B	6/25/2019	Bluegill	154	75.4
ML6	B	6/25/2019	Bluegill	154	82.5
ML6	B	6/25/2019	Bluegill	165	94.4
ML6	B	6/25/2019	Bluegill	127	39.3
ML6	B	6/25/2019	Tahoe Sucker	293	228.2
ML6	B	6/25/2019	Brown Bullhead	203	119.6
ML6	A	6/25/2019	Largemouth Bass	235	226.5
ML6	A	6/25/2019	Largemouth Bass	148	41.7
ML6	A	6/25/2019	Largemouth Bass	109	16.9
ML6	A	6/25/2019	Bluegill	132	48.2
ML6	A	6/25/2019	Bluegill	168	110.2
ML6	A	6/25/2019	Bluegill	150	92.3

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML6	A	6/25/2019	Bluegill	136	64.5
ML6	A	6/25/2019	Bluegill	146	79.1
ML6	A	6/25/2019	Bluegill	151	85.3
ML6	A	6/25/2019	Bluegill	84	13.9
ML6	A	6/25/2019	Brown Bullhead	195	94.5
ML6	A	6/25/2019	Brown Bullhead	274	251.1
ML5	C	6/25/2019	Bluegill	137	47.2
ML5	C	6/25/2019	Bluegill	137	43.6
ML5	C	6/25/2019	Bluegill	112	26.5
ML5	C	6/25/2019	Largemouth Bass	148	32.3
ML5	C	6/25/2019	Largemouth Bass	355	537.9
ML5	C	6/25/2019	Largemouth Bass	162	45.7
ML5	C	6/25/2019	Largemouth Bass	498	2200.0
ML5	C	6/25/2019	Brown Bullhead	193	106.9
ML5	C	6/25/2019	Brown Bullhead	162	64.8
ML5	C	6/25/2019	Brown Bullhead	187	91.8
ML5	C	6/25/2019	Brown Bullhead	194	102.7
ML5	C	6/25/2019	Tahoe Sucker	197	85.5
ML5	B	6/25/2019	Bluegill	140	41.4
ML5	B	6/25/2019	Largemouth Bass	111	15.2
ML5	B	6/25/2019	Largemouth Bass	284	287.1
ML5	B	6/25/2019	Largemouth Bass	480	2100.0
ML5	B	6/25/2019	Tahoe Sucker	149	34.3
ML5	B	6/25/2019	Tahoe Sucker	241	147.9
ML5	B	6/25/2019	Black Crappie	129	25.7
ML5	A	6/25/2019	Largemouth Bass	104	10.6
ML5	A	6/25/2019	Largemouth Bass	103	10.9
ML5	A	6/25/2019	Largemouth Bass	152	40.8
ML5	A	6/25/2019	Largemouth Bass	424	1200.0
ML5	A	6/25/2019	Bluegill	119	29.0
ML5	A	6/25/2019	Bluegill	127	36.1
ML5	A	6/25/2019	Tahoe Sucker	250	168.6
ML5	A	6/25/2019	Tahoe Sucker	316	414.2
ML5	A	6/25/2019	Tahoe Sucker	301	262.4
ML5	E	6/25/2019	Bluegill	127	40.9
ML5	E	6/25/2019	Bluegill	159	85.5
ML5	E	6/25/2019	Bluegill	155	75.5
ML5	E	6/25/2019	Bluegill	150	71.7
ML5	E	6/25/2019	Bluegill	158	81.2
ML5	E	6/25/2019	Bluegill	150	70.8
ML5	E	6/25/2019	Bluegill	163	93.2
ML5	E	6/25/2019	Bluegill	148	66.7
ML5	E	6/25/2019	Bluegill	147	62.3
ML5	E	6/25/2019	Bluegill	151	67.5

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML5	E	6/25/2019	Bluegill	na	na
ML5	E	6/25/2019	Bluegill	na	na
ML5	E	6/25/2019	Bluegill	na	na
ML5	E	6/25/2019	Largemouth Bass	189	76.4
ML5	E	6/25/2019	Largemouth Bass	125	22.6
ML5	E	6/25/2019	Largemouth Bass	426	1200.0
ML5	E	6/25/2019	Largemouth Bass	223	187.2
ML5	E	6/25/2019	Tahoe Sucker	311	347.9
ML5	E	6/25/2019	Tahoe Sucker	245	163.2
ML5	E	6/25/2019	Brown Bullhead	207	150.3
ML5	D	6/25/2019	Largemouth Bass	122	18.6
ML5	D	6/25/2019	Largemouth Bass	134	22.9
ML5	D	6/25/2019	Largemouth Bass	140	30.3
ML5	D	6/25/2019	Largemouth Bass	148	32.6
ML5	D	6/25/2019	Largemouth Bass	101	10.6
ML5	D	6/25/2019	Bluegill	86	10.8
ML5	D	6/25/2019	Bluegill	124	34.2
ML5	D	6/25/2019	Bluegill	61	3.6
ML5	D	6/25/2019	Tahoe Sucker	198	87.9
ML5	D	6/25/2019	Goldfish	304	620.7
ML4	E	6/25/2019	Bluegill	167	110.2
ML4	E	6/25/2019	Bluegill	145	55.7
ML4	E	6/25/2019	Bluegill	136	43.6
ML4	E	6/25/2019	Bluegill	111	21.8
ML4	E	6/25/2019	Bluegill	77	6.6
ML4	E	6/25/2019	Bluegill	147	65.1
ML4	E	6/25/2019	Bluegill	121	28.9
ML4	E	6/25/2019	Bluegill	156	71.2
ML4	E	6/25/2019	Bluegill	109	24.0
ML4	E	6/25/2019	Bluegill	119	30.6
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na
ML4	E	6/25/2019	Bluegill	na	na

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML4	E	6/25/2019	Largemouth Bass	182	77.4
ML4	E	6/25/2019	Largemouth Bass	191	85.4
ML4	E	6/25/2019	Largemouth Bass	169	55.4
ML4	E	6/25/2019	Largemouth Bass	321	464.1
ML4	E	6/25/2019	Largemouth Bass	282	315.2
ML4	E	6/25/2019	Largemouth Bass	460	1400.0
ML4	E	6/25/2019	Brown Bullhead	296	391.5
ML4	D	6/25/2019	Bluegill	178	127.5
ML4	D	6/25/2019	Bluegill	151	63.0
ML4	D	6/25/2019	Bluegill	164	87.6
ML4	D	6/25/2019	Bluegill	162	68.8
ML4	D	6/25/2019	Bluegill	160	84.0
ML4	D	6/25/2019	Bluegill	116	25.8
ML4	D	6/25/2019	Bluegill	159	75.2
ML4	D	6/25/2019	Bluegill	169	90.1
ML4	D	6/25/2019	Bluegill	161	68.1
ML4	D	6/25/2019	Bluegill	162	92.7
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na
ML4	D	6/25/2019	Bluegill	na	na

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML4	D	6/25/2019	Tahoe Sucker	312	319.9
ML4	D	6/25/2019	Brown Bullhead	190	98.6
ML4	D	6/25/2019	Largemouth Bass	319	445.8
ML4	D	6/25/2019	Largemouth Bass	350	596.6
ML4	D	6/25/2019	Largemouth Bass	425	1200.0
ML4	C	6/25/2019	Largemouth Bass	198	105.4
ML4	C	6/25/2019	Largemouth Bass	144	33.5
ML4	C	6/25/2019	Brown Bullhead	172	63.6
ML4	C	6/25/2019	Bluegill	126	37.7
ML4	C	6/25/2019	Bluegill	138	54.8
ML4	C	6/25/2019	Bluegill	124	34.5
ML4	C	6/25/2019	Bluegill	140	50.7
ML4	C	6/25/2019	Bluegill	126	40.2
ML4	C	6/25/2019	Bluegill	129	38.4
ML4	C	6/25/2019	Bluegill	145	54.2
ML4	C	6/25/2019	Bluegill	65	6.0
ML4	C	6/25/2019	Bluegill	143	56.6
ML4	C	6/25/2019	Bluegill	146	58.9
ML4	C	6/25/2019	Bluegill	na	na
ML4	C	6/25/2019	Bluegill	na	na
ML4	C	6/25/2019	Bluegill	na	na
ML4	C	6/25/2019	Tahoe Sucker	208	93.7
ML4	B	6/25/2019	Bluegill	130	38.3
ML4	B	6/25/2019	Bluegill	145	60.1
ML4	B	6/25/2019	Bluegill	170	93.2
ML4	B	6/25/2019	Bluegill	139	48.2
ML4	B	6/25/2019	Bluegill	123	33.3
ML4	B	6/25/2019	Bluegill	132	47.4
ML4	B	6/25/2019	Bluegill	150	59.1
ML4	B	6/25/2019	Bluegill	114	27.5
ML4	B	6/25/2019	Bluegill	154	68.5
ML4	B	6/25/2019	Bluegill	163	87.1
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Bluegill	na	na
ML4	B	6/25/2019	Largemouth Bass	138	21.7
ML4	B	6/25/2019	Largemouth Bass	280	315.9
ML4	B	6/25/2019	Largemouth Bass	115	15.7
ML4	B	6/25/2019	Largemouth Bass	116	12.2
ML4	B	6/25/2019	Largemouth Bass	490	2400.0
ML4	B	6/25/2019	Tahoe Sucker	271	202.5
ML4	A	6/25/2019	Bluegill	144	56.0
ML4	A	6/25/2019	Bluegill	135	42.1
ML4	A	6/25/2019	Bluegill	143	53.1
ML4	A	6/25/2019	Largemouth Bass	158	39.5
ML4	A	6/25/2019	Largemouth Bass	204	104.6
ML4	A	6/25/2019	Largemouth Bass	214	121.7
ML4	A	6/25/2019	Largemouth Bass	119	15.2
ML4	A	6/25/2019	Largemouth Bass	106	12.2
ML4	A	6/25/2019	Largemouth Bass	362	784.5
ML4	A	6/25/2019	Brown Bullhead	158	55.0
ML4	A	6/25/2019	Brown Bullhead	195	98.2
ML4	A	6/25/2019	Brown Bullhead	185	84.3
ML4	A	6/25/2019	Brown Bullhead	204	105.9
ML4	A	6/25/2019	Brown Bullhead	198	113.6
ML4	A	6/25/2019	Brown Bullhead	172	63.4
ML4	A	6/25/2019	Brown Bullhead	209	139.4
ML4	A	6/25/2019	Brown Bullhead	161	56.9
ML4	A	6/25/2019	Brown Bullhead	320	487.4
ML4	A	6/25/2019	Brown Bullhead	194	112.5
ML4	A	6/25/2019	Brown Bullhead	na	na
ML4	A	6/25/2019	Goldfish	245	306.1
ML4	A	6/25/2019	Goldfish	249	343.3
MRL2	D	6/26/2019	Largemouth Bass	341	616.7
MRL2	D	6/26/2019	Largemouth Bass	252	233.6
MRL2	D	6/26/2019	Largemouth Bass	322	535.3
MRL2	D	6/26/2019	Largemouth Bass	377	792.8
MRL2	E	6/26/2019	Bluegill	170	110.7
MRL2	E	6/26/2019	Bluegill	176	128.3
MRL2	E	6/26/2019	Bluegill	150	68.0
MRL2	E	6/26/2019	Bluegill	146	60.5
MRL2	E	6/26/2019	Bluegill	172	113.2

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
MRL2	E	6/26/2019	Bluegill	167	114.2
MRL2	E	6/26/2019	Bluegill	168	105.9
MRL2	E	6/26/2019	Largemouth Bass	345	609.1
MRL2	E	6/26/2019	Largemouth Bass	299	370.5
MRL2	E	6/26/2019	Largemouth Bass	230	156.5
MRL2	E	6/26/2019	Largemouth Bass	237	194.1
MRL2	E	6/26/2019	Largemouth Bass	254	234.4
MRL2	E	6/26/2019	Largemouth Bass	329	582.5
MRL2	E	6/26/2019	Largemouth Bass	380	945.2
MRL2	E	6/26/2019	Largemouth Bass	401	983.5
MRL2	B	6/26/2019	Largemouth Bass	292	334.8
MRL2	B	6/26/2019	Largemouth Bass	239	207.1
MRL2	B	6/26/2019	Largemouth Bass	315	514.2
MRL2	B	6/26/2019	Largemouth Bass	257	242.3
MRL2	B	6/26/2019	Largemouth Bass	263	258.4
MRL2	C	6/26/2019	Largemouth Bass	393	976.4
MRL2	C	6/26/2019	Largemouth Bass	368	703.8
MRL2	A	6/26/2019	Goldfish	185	133.9
MRL2	A	6/26/2019	Goldfish	235	262.4
MRL2	A	6/26/2019	Tahoe Sucker	219	121.9
MRL2	A	6/26/2019	Tahoe Sucker	229	143.6
MRL2	A	6/26/2019	Largemouth Bass	285	335.6
MRL2	A	6/26/2019	Largemouth Bass	390	1000.0
MRL2	A	6/26/2019	Largemouth Bass	409	1100.0
MRL2	A	6/26/2019	Bluegill	124	28.9
MRL2	A	6/26/2019	Bluegill	85	7.9
MRL2	A	6/26/2019	Bluegill	146	57.3
MRL2	A	6/26/2019	Bluegill	129	40.4
MRL2	A	6/26/2019	Bluegill	124	37.6
MRL2	A	6/26/2019	Brown Bullhead	153	51.3
MRL2	A	6/26/2019	Brown Bullhead	170	61.8
MRL2	A	6/26/2019	Brown Bullhead	163	64.1
MRL2	A	6/26/2019	Brown Bullhead	147	42.0
MRL2	A	6/26/2019	Brown Bullhead	180	83.2
MRL2	A	6/26/2019	Brown Bullhead	318	497.9
MRL1	E	6/26/2019	Bluegill	95	11.6
MRL1	E	6/26/2019	Bluegill	140	53.2
MRL1	E	6/26/2019	Bluegill	100	17.7
MRL1	E	6/26/2019	Bluegill	118	25.2
MRL1	E	6/26/2019	Bluegill	100	19.3
MRL1	E	6/26/2019	Brown Bullhead	159	55.0
MRL1	E	6/26/2019	Brown Bullhead	178	76.4
MRL1	E	6/26/2019	Brown Bullhead	311	424.7
MRL1	E	6/26/2019	Brown Bullhead	270	306.7

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
MRL1	E	6/26/2019	Brown Bullhead	189	100.8
MRL1	E	6/26/2019	Largemouth Bass	199	114.4
MRL1	E	6/26/2019	Largemouth Bass	239	201.7
MRL1	E	6/26/2019	Largemouth Bass	304	405.4
MRL1	E	6/26/2019	Largemouth Bass	418	1300.0
MRL1	E	6/26/2019	Largemouth Bass	334	597.8
MRL1	E	6/26/2019	Largemouth Bass	383	1018.3
MRL1	E	6/26/2019	Largemouth Bass	372	722.0
MRL1	E	6/26/2019	Tahoe Sucker	180	73.7
MRL1	E	6/26/2019	Tahoe Sucker	150	37.5
MRL1	E	6/26/2019	Goldfish	225	233.5
MRL1	E	6/26/2019	Goldfish	219	235.2
MRL1	D	6/26/2019	Bluegill	128	34.0
MRL1	D	6/26/2019	Largemouth Bass	309	404.1
MRL1	D	6/26/2019	Largemouth Bass	234	202.3
MRL1	D	6/26/2019	Largemouth Bass	291	351.7
MRL1	D	6/26/2019	Largemouth Bass	264	259.8
MRL1	D	6/26/2019	Goldfish	199	178.1
MRL1	D	6/26/2019	Goldfish	209	195.8
MRL1	D	6/26/2019	Brown Bullhead	155	44.2
MRL1	D	6/26/2019	Brown Bullhead	168	73.7
MRL1	D	6/26/2019	Brown Bullhead	192	99.5
MRL1	D	6/26/2019	Brown Bullhead	246	223.1
MRL1	C	6/26/2019	Largemouth Bass	254	230.9
MRL1	C	6/26/2019	Largemouth Bass	364	703.5
MRL1	C	6/26/2019	Largemouth Bass	363	738.4
MRL1	C	6/26/2019	Largemouth Bass	300	455.7
MRL1	C	6/26/2019	Largemouth Bass	425	1215.5
MRL1	C	6/26/2019	Largemouth Bass	297	269.7
MRL1	C	6/26/2019	Largemouth Bass	261	266.7
MRL1	C	6/26/2019	Largemouth Bass	292	346.0
MRL1	C	6/26/2019	Largemouth Bass	314	542.8
MRL1	C	6/26/2019	Bluegill	62	1.5
MRL1	B	6/26/2019	Largemouth Bass	308	432.5
MRL1	B	6/26/2019	Largemouth Bass	336	723.5
MRL1	B	6/26/2019	Largemouth Bass	425	1400.0
MRL1	B	6/26/2019	Largemouth Bass	366	764.5
MRL1	B	6/26/2019	Largemouth Bass	315	512.5
MRL1	B	6/26/2019	Largemouth Bass	284	305.2
MRL1	B	6/26/2019	Largemouth Bass	187	113.7
MRL1	B	6/26/2019	Largemouth Bass	244	225.8
MRL1	B	6/26/2019	Largemouth Bass	346	575.9
MRL1	B	6/26/2019	Largemouth Bass	391	907.7
MRL1	B	6/26/2019	Bluegill	115	28.7

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
MRL1	B	6/26/2019	Bluegill	110	20.5
MRL1	B	6/26/2019	Brown Bullhead	303	381.3
MRL1	B	6/26/2019	Tahoe Sucker	132	24.3
MRL1	A	6/26/2019	Bluegill	114	22.7
MRL1	A	6/26/2019	Bluegill	103	14.2
MRL1	A	6/26/2019	Bluegill	192	96.6
MRL1	A	6/26/2019	Bluegill	98	13.7
MRL1	A	6/26/2019	Bluegill	155	64.8
MRL1	A	6/26/2019	Bluegill	117	27.2
MRL1	A	6/26/2019	Bluegill	94	14.4
MRL1	A	6/26/2019	Brown Bullhead	158	51.8
MRL1	A	6/26/2019	Brown Bullhead	185	89.5
MRL1	A	6/26/2019	Largemouth Bass	370	747.8
MRL1	A	6/26/2019	Largemouth Bass	384	1018.2
MRL1	A	6/26/2019	Largemouth Bass	450	1600.0
MRL1	A	6/26/2019	Largemouth Bass	294	421.7
MRL1	A	6/26/2019	Largemouth Bass	121	17.3
MRL1	A	6/26/2019	NOT RECORDED	70	3.3
ML3	D	6/26/2019	Bluegill	149	64.9
ML3	D	6/26/2019	Bluegill	57	3.5
ML3	D	6/26/2019	Bluegill	166	98.9
ML3	D	6/26/2019	Bluegill	135	36.1
ML3	D	6/26/2019	Bluegill	132	41.9
ML3	D	6/26/2019	Bluegill	101	18.1
ML3	D	6/26/2019	Bluegill	146	65.9
ML3	D	6/26/2019	Bluegill	154	68.2
ML3	D	6/26/2019	Bluegill	160	75.0
ML3	D	6/26/2019	Bluegill	152	73.2
ML3	D	6/26/2019	Bluegill	na	na
ML3	D	6/26/2019	Bluegill	na	na
ML3	D	6/26/2019	Bluegill	na	na
ML3	D	6/26/2019	Bluegill	na	na
ML3	D	6/26/2019	Bluegill	na	na
ML3	D	6/26/2019	Largemouth Bass	185	87.8
ML3	D	6/26/2019	Largemouth Bass	192	81.9
ML3	D	6/26/2019	Largemouth Bass	202	110.0
ML3	D	6/26/2019	Largemouth Bass	120	19.5
ML3	E	6/26/2019	Largemouth Bass	137	30.7
ML3	E	6/26/2019	Largemouth Bass	162	45.6
ML3	E	6/26/2019	Largemouth Bass	120	17.4
ML3	E	6/26/2019	Largemouth Bass	370	786.0
ML3	E	6/26/2019	Largemouth Bass	308	329.0
ML3	E	6/26/2019	Bluegill	127	34.5
ML3	E	6/26/2019	Bluegill	116	30.1

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML3	E	6/26/2019	Bluegill	106	22.0
ML3	E	6/26/2019	Bluegill	148	72.0
ML3	E	6/26/2019	Bluegill	166	86.7
ML3	E	6/26/2019	Bluegill	137	48.9
ML3	E	6/26/2019	Bluegill	132	47.1
ML3	E	6/26/2019	Bluegill	137	48.5
ML3	E	6/26/2019	Bluegill	157	76.2
ML3	E	6/26/2019	Bluegill	71	6.7
ML3	E	6/26/2019	Brown Bullhead	315	480.0
ML3	B	6/26/2019	Largemouth Bass	150	36.5
ML3	B	6/26/2019	Largemouth Bass	129	28.5
ML3	B	6/26/2019	Bluegill	116	28.1
ML3	B	6/26/2019	Bluegill	136	46.6
ML3	B	6/26/2019	Bluegill	61	3.8
ML3	B	6/26/2019	Bluegill	73	5.2
ML3	B	6/26/2019	Bluegill	77	6.4
ML3	B	6/26/2019	Bluegill	135	48.1
ML3	B	6/26/2019	Bluegill	61	3.7
ML3	B	6/26/2019	Bluegill	120	32.4
ML3	B	6/26/2019	Bluegill	64	3.8
ML3	B	6/26/2019	Brown Bullhead	202	125.3
ML3	B	6/26/2019	Brown Bullhead	197	105.4
ML3	B	6/26/2019	Brown Bullhead	200	105.4
ML3	B	6/26/2019	Brown Bullhead	262	191.6
ML3	B	6/26/2019	Brown Bullhead	200	123.1
ML3	B	6/26/2019	Brown Bullhead	141	37.7
ML3	B	6/26/2019	Brown Bullhead	192	94.4
ML3	B	6/26/2019	Brown Bullhead	206	128.7
ML3	B	6/26/2019	Brown Bullhead	223	157.4
ML3	B	6/26/2019	Tahoe Sucker	162	43.3
ML3	C	6/26/2019	Largemouth Bass	155	40.2
ML3	C	6/26/2019	Largemouth Bass	133	25.2
ML3	C	6/26/2019	Largemouth Bass	119	16.7
ML3	C	6/26/2019	Largemouth Bass	192	82.4
ML3	C	6/26/2019	Largemouth Bass	341	485.0
ML3	C	6/26/2019	Largemouth Bass	123	20.7
ML3	C	6/26/2019	Bluegill	66	5.5
ML3	C	6/26/2019	Bluegill	170	97.2
ML3	C	6/26/2019	Bluegill	131	40.6
ML3	C	6/26/2019	Bluegill	166	87.2
ML3	C	6/26/2019	Bluegill	166	95.5
ML3	C	6/26/2019	Bluegill	159	84.8
ML3	C	6/26/2019	Bluegill	161	83.4
ML3	C	6/26/2019	Bluegill	131	42.9

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML3	C	6/26/2019	Bluegill	55	2.8
ML3	C	6/26/2019	Bluegill	134	44.5
ML3	C	6/26/2019	Bluegill	na	na
ML3	C	6/26/2019	Bluegill	na	na
ML3	C	6/26/2019	Bluegill	na	na
ML3	C	6/26/2019	Bluegill	na	na
ML3	C	6/26/2019	Bluegill	na	na
ML3	C	6/26/2019	Bluegill	na	na
ML3	C	6/26/2019	Bluegill	na	na
ML3	C	6/26/2019	Bluegill	na	na
ML3	A	6/26/2019	Largemouth Bass	152	32.9
ML3	A	6/26/2019	Largemouth Bass	146	29.9
ML3	A	6/26/2019	Largemouth Bass	165	52.0
ML3	A	6/26/2019	Largemouth Bass	141	30.6
ML3	A	6/26/2019	Largemouth Bass	175	62.8
ML3	A	6/26/2019	Largemouth Bass	151	37.9
ML3	A	6/26/2019	Largemouth Bass	148	37.1
ML3	A	6/26/2019	Largemouth Bass	150	33.5
ML3	A	6/26/2019	Brown Bullhead	190	92.6
ML3	A	6/26/2019	Brown Bullhead	180	76.7
ML3	A	6/26/2019	Brown Bullhead	163	62.6
ML3	A	6/26/2019	Brown Bullhead	133	33.8
ML3	A	6/26/2019	Brown Bullhead	135	33.2
ML3	A	6/26/2019	Brown Bullhead	236	160.0
ML3	A	6/26/2019	Brown Bullhead	187	97.8
ML3	A	6/26/2019	Brown Bullhead	200	118.3
ML3	A	6/26/2019	Brown Bullhead	150	49.9
ML3	A	6/26/2019	Brown Bullhead	156	56.2
ML3	A	6/26/2019	Bluegill	71	5.4
ML3	A	6/26/2019	Bluegill	127	36.1
ML3	A	6/26/2019	Bluegill	116	27.2
ML3	A	6/26/2019	Bluegill	61	7.5
ML3	A	6/26/2019	Tui Chub	131	23.0
ML3	A	6/26/2019	Mountain Sucker	296	231.0
ML3	A	6/26/2019	Tahoe Sucker	196	86.0
ML2	E	6/26/2019	Largemouth Bass	153	41.2
ML2	E	6/26/2019	Largemouth Bass	102	10.1
ML2	E	6/26/2019	Largemouth Bass	247	190.2
ML2	E	6/26/2019	Largemouth Bass	162	53.0
ML2	E	6/26/2019	Largemouth Bass	112	13.2
ML2	E	6/26/2019	Largemouth Bass	364	603.3
ML2	E	6/26/2019	Bluegill	141	41.6
ML2	E	6/26/2019	Bluegill	130	43.1
ML2	E	6/26/2019	Bluegill	126	34.0

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML2	E	6/26/2019	Brown Bullhead	155	49.9
ML2	D	6/26/2019	Largemouth Bass	155	41.0
ML2	D	6/26/2019	Bluegill	150	75.3
ML2	D	6/26/2019	Bluegill	173	112.0
ML2	D	6/26/2019	Bluegill	142	553.3
ML2	D	6/26/2019	Bluegill	145	51.2
ML2	D	6/26/2019	Bluegill	171	98.7
ML2	D	6/26/2019	Bluegill	165	92.5
ML2	D	6/26/2019	Bluegill	65	5.5
ML2	D	6/26/2019	Black Crappie	336	616.0
ML2	D	6/26/2019	Tahoe Sucker	335	432.0
ML2	C	6/26/2019	Largemouth Bass	260	246.2
ML2	C	6/26/2019	Largemouth Bass	161	44.0
ML2	C	6/26/2019	Largemouth Bass	229	159.0
ML2	C	6/26/2019	Largemouth Bass	192	97.1
ML2	C	6/26/2019	Largemouth Bass	120	18.5
ML2	C	6/26/2019	Largemouth Bass	162	58.1
ML2	C	6/26/2019	Largemouth Bass	422	1300.0
ML2	C	6/26/2019	Brown Bullhead	177	84.2
ML2	C	6/26/2019	Brown Bullhead	157	59.3
ML2	C	6/26/2019	Brown Bullhead	173	72.1
ML2	C	6/26/2019	Brown Bullhead	202	105.6
ML2	C	6/26/2019	Brown Bullhead	144	38.1
ML2	C	6/26/2019	Brown Bullhead	195	113.5
ML2	C	6/26/2019	Bluegill	175	130.0
ML2	C	6/26/2019	Bluegill	81	9.1
ML2	C	6/26/2019	Bluegill	61	4.0
ML2	C	6/26/2019	Bluegill	65	4.7
ML2	C	6/26/2019	Bluegill	117	31.9
ML2	C	6/26/2019	Tahoe Sucker	272	213.2
ML2	C	6/26/2019	Tahoe Sucker	296	262.0
ML2	C	6/26/2019	Tahoe Sucker	214	104.6
ML2	B	6/26/2019	Largemouth Bass	318	415.7
ML2	B	6/26/2019	Largemouth Bass	170	54.3
ML2	B	6/26/2019	Largemouth Bass	135	23.9
ML2	B	6/26/2019	Bluegill	125	33.9
ML2	B	6/26/2019	Bluegill	106	24.6
ML2	B	6/26/2019	Bluegill	160	86.0
ML2	B	6/26/2019	Bluegill	150	61.3
ML2	B	6/26/2019	Bluegill	129	38.2
ML2	B	6/26/2019	Bluegill	139	45.7
ML2	B	6/26/2019	Bluegill	140	51.8
ML2	B	6/26/2019	Bluegill	136	42.6
ML2	B	6/26/2019	Bluegill	126	34.5

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML2	B	6/26/2019	Bluegill	66	5.2
ML2	B	6/26/2019	Bluegill	na	na
ML2	B	6/26/2019	Bluegill	na	na
ML2	B	6/26/2019	Bluegill	na	na
ML2	B	6/26/2019	Brown Bullhead	152	52.0
ML2	B	6/26/2019	Brown Bullhead	190	98.3
ML2	B	6/26/2019	Brown Bullhead	186	86.7
ML2	B	6/26/2019	Brown Bullhead	210	139.0
ML2	B	6/26/2019	Brown Bullhead	186	89.2
ML2	B	6/26/2019	Brown Bullhead	151	51.0
ML2	B	6/26/2019	Tahoe Sucker	176	58.2
ML2	A	6/26/2019	Largemouth Bass	164	54.0
ML2	A	6/26/2019	Largemouth Bass	445	1600.0
ML2	A	6/26/2019	Largemouth Bass	388	943.0
ML2	A	6/26/2019	Largemouth Bass	226	169.8
ML2	A	6/26/2019	Largemouth Bass	301	394.0
ML2	A	6/26/2019	Bluegill	132	49.2
ML2	A	6/26/2019	Bluegill	145	56.3
ML2	A	6/26/2019	Bluegill	135	39.9
ML1	E	6/26/2019	Bluegill	135	43.7
ML1	E	6/26/2019	Bluegill	117	25.3
ML1	E	6/26/2019	Bluegill	119	25.8
ML1	E	6/26/2019	Bluegill	126	35.7
ML1	E	6/26/2019	Bluegill	122	31.1
ML1	E	6/26/2019	Bluegill	141	52.0
ML1	E	6/26/2019	Bluegill	139	56.7
ML1	E	6/26/2019	Bluegill	114	24.2
ML1	E	6/26/2019	Bluegill	127	36.4
ML1	E	6/26/2019	Bluegill	119	27.2
ML1	E	6/26/2019	Bluegill	na	na
ML1	E	6/26/2019	Largemouth Bass	267	292.5
ML1	E	6/26/2019	Largemouth Bass	125	18.5
ML1	E	6/26/2019	Largemouth Bass	108	13.1
ML1	E	6/26/2019	Largemouth Bass	449	1800.0
ML1	E	6/26/2019	Brown Bullhead	148	40.5
ML1	D	6/26/2019	Largemouth Bass	175	66.6
ML1	D	6/26/2019	Largemouth Bass	95	8.8
ML1	D	6/26/2019	Bluegill	109	23.2
ML1	D	6/26/2019	Bluegill	130	43.7
ML1	D	6/26/2019	Bluegill	192	174.4
ML1	D	6/26/2019	Bluegill	127	33.7
ML1	D	6/26/2019	Bluegill	139	53.2
ML1	D	6/26/2019	Bluegill	122	30.1
ML1	D	6/26/2019	Bluegill	69	6.0

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML1	D	6/26/2019	Bluegill	54	2.2
ML1	D	6/26/2019	Bluegill	67	5.2
ML1	D	6/26/2019	Brown Bullhead	204	102.2
ML1	D	6/26/2019	Brown Bullhead	230	181.9
ML1	D	6/26/2019	Brown Bullhead	151	39.7
ML1	D	6/26/2019	Brown Bullhead	210	119.5
ML1	D	6/26/2019	Brown Bullhead	142	40.1
ML1	D	6/26/2019	Brown Bullhead	185	82.4
ML1	D	6/26/2019	Brown Bullhead	127	22.5
ML1	D	6/26/2019	Brown Bullhead	146	43.4
ML1	D	6/26/2019	Brown Bullhead	137	32.7
ML1	D	6/26/2019	Brown Bullhead	131	31.0
ML1	D	6/26/2019	Brown Bullhead	na	na
ML1	D	6/26/2019	Goldfish	152	72.5
ML1	D	6/26/2019	Lahontan Redside	81	5.5
ML1	C	6/26/2019	Largemouth Bass	152	39.9
ML1	C	6/26/2019	Largemouth Bass	168	61.4
ML1	C	6/26/2019	Largemouth Bass	91	10.6
ML1	C	6/26/2019	Largemouth Bass	156	43.5
ML1	C	6/26/2019	Largemouth Bass	154	51.7
ML1	C	6/26/2019	Largemouth Bass	160	48.6
ML1	C	6/26/2019	Largemouth Bass	178	66.4
ML1	C	6/26/2019	Largemouth Bass	87	10.7
ML1	C	6/26/2019	Largemouth Bass	148	31.5
ML1	C	6/26/2019	Largemouth Bass	133	29.2
ML1	C	6/26/2019	Bluegill	106	24.3
ML1	C	6/26/2019	Bluegill	121	35.2
ML1	C	6/26/2019	Bluegill	130	35.2
ML1	C	6/26/2019	Tahoe Sucker	218	112.0
ML1	C	6/26/2019	Tahoe Sucker	159	44.7
ML1	C	6/26/2019	Brown Bullhead	171	69.2
ML1	C	6/26/2019	Brown Bullhead	160	55.7
ML1	C	6/26/2019	Lahontan Redside	87	na
ML1	B	6/26/2019	Bluegill	150	72.1
ML1	B	6/26/2019	Bluegill	162	84.1
ML1	B	6/26/2019	Bluegill	151	68.2
ML1	B	6/26/2019	Bluegill	150	59.3
ML1	B	6/26/2019	Rainbow Trout	226	98.6
ML1	A	6/26/2019	Largemouth Bass	155	44.2
ML1	A	6/26/2019	Largemouth Bass	235	175.8
ML1	A	6/26/2019	Largemouth Bass	251	217.2
ML1	A	6/26/2019	Largemouth Bass	165	60.0
ML1	A	6/26/2019	Largemouth Bass	174	69.1
ML1	A	6/26/2019	Largemouth Bass	157	45.5

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML1	A	6/26/2019	Largemouth Bass	189	92.7
ML1	A	6/26/2019	Largemouth Bass	187	99.2
ML1	A	6/26/2019	Largemouth Bass	165	61.2
ML1	A	6/26/2019	Largemouth Bass	200	124.8
ML1	A	6/26/2019	Largemouth Bass	na	na
ML1	A	6/26/2019	Largemouth Bass	na	na
ML1	A	6/26/2019	Bluegill	93	13.9
ML1	A	6/26/2019	Bluegill	135	47.4
ML1	A	6/26/2019	Bluegill	124	35.6
ML1	A	6/26/2019	Bluegill	121	36.0
ML1	A	6/26/2019	Bluegill	135	49.8
ML1	A	6/26/2019	Brown Bullhead	180	86.3
ML1	A	6/26/2019	Brown Bullhead	191	102.7
ML1	A	6/26/2019	Brown Bullhead	196	105.3
ML1	A	6/26/2019	Lahontan Redside	66	4.1
ML1	A	6/26/2019	Tahoe Sucker	238	141.7
ML1	A	6/26/2019	Tahoe Sucker	166	53.1
ML1	A	6/26/2019	Tahoe Sucker	221	122.2
ML1	A	6/26/2019	Goldfish	160	81.8
LT2	B	6/27/2019	Goldfish	180	102.7
LT2	B	6/27/2019	Goldfish	163	82.8
LT2	B	6/27/2019	Goldfish	165	85.1
LT2	B	6/27/2019	Goldfish	155	67.4
LT2	B	6/27/2019	Bluegill	146	53.3
LT2	B	6/27/2019	Bluegill	75	6.2
LT2	B	6/27/2019	Bluegill	87	9.1
LT2	B	6/27/2019	Bluegill	85	10.1
LT2	B	6/27/2019	Bluegill	74	7.4
LT2	B	6/27/2019	Bluegill	66	5.1
LT2	B	6/27/2019	Bluegill	141	47.2
LT2	B	6/27/2019	Bluegill	111	21.5
LT2	B	6/27/2019	Bluegill	87	11.4
LT2	B	6/27/2019	Brown Bullhead	130	27.7
LT2	B	6/27/2019	Brown Bullhead	260	222.8
LT2	B	6/27/2019	Brown Bullhead	135	28.3
LT2	A	6/27/2019	Goldfish	165	88.7
LT2	A	6/27/2019	Goldfish	161	73.6
LT2	A	6/27/2019	Goldfish	140	51.7
LT2	A	6/27/2019	Goldfish	115	28.0
LT2	A	6/27/2019	Goldfish	154	68.9
LT2	A	6/27/2019	Goldfish	151	66.3
LT2	A	6/27/2019	Goldfish	134	42.6
LT2	A	6/27/2019	Goldfish	137	45.1
LT2	A	6/27/2019	Goldfish	157	67.6

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT2	A	6/27/2019	Goldfish	133	38.3
LT2	A	6/27/2019	Goldfish	na	na
LT2	A	6/27/2019	Goldfish	na	na
LT2	A	6/27/2019	Largemouth Bass	240	165.5
LT2	A	6/27/2019	Largemouth Bass	147	31.5
LT2	A	6/27/2019	Largemouth Bass	142	29.9
LT2	A	6/27/2019	Largemouth Bass	91	7.9
LT2	A	6/27/2019	Largemouth Bass	87	7.5
LT2	A	6/27/2019	Largemouth Bass	115	15.3
LT2	A	6/27/2019	Largemouth Bass	240	158.3
LT2	A	6/27/2019	Largemouth Bass	162	51.7
LT2	A	6/27/2019	Largemouth Bass	233	167.7
LT2	A	6/27/2019	Largemouth Bass	185	61.6
LT2	A	6/27/2019	Largemouth Bass	na	na
LT2	A	6/27/2019	Largemouth Bass	na	na
LT2	A	6/27/2019	Largemouth Bass	na	na
LT2	A	6/27/2019	Largemouth Bass	na	na
LT2	A	6/27/2019	Brown Bullhead	150	44.8
LT2	A	6/27/2019	Brown Bullhead	140	35.5
LT2	A	6/27/2019	Brown Bullhead	125	22.8
LT2	A	6/27/2019	Brown Bullhead	92	7.4
LT2	A	6/27/2019	Bluegill	115	25.2
LT2	A	6/27/2019	Bluegill	125	32.3
LT2	A	6/27/2019	Bluegill	82	8.2
LT2	A	6/27/2019	Bluegill	109	19.8
LT2	A	6/27/2019	Bluegill	117	27.9
LT2	A	6/27/2019	Bluegill	85	10.6
LT2	A	6/27/2019	Bluegill	87	10.3
LT2	A	6/27/2019	Bluegill	133	na
LT2	A	6/27/2019	Bluegill	80	9.4
LT2	A	6/27/2019	Bluegill	140	49.2
LT2	A	6/27/2019	Bluegill	na	na
LT2	A	6/27/2019	Bluegill	na	na
LT2	D	6/27/2019	Largemouth Bass	300	437.3
LT2	D	6/27/2019	Largemouth Bass	342	603.2
LT2	D	6/27/2019	Largemouth Bass	315	442.7
LT2	D	6/27/2019	Largemouth Bass	173	46.6
LT2	D	6/27/2019	Largemouth Bass	340	536.1
LT2	D	6/27/2019	Bluegill	105	18.2
LT2	D	6/27/2019	Bluegill	66	5.4
LT2	D	6/27/2019	Bluegill	116	26.2
LT2	D	6/27/2019	Brown Bullhead	140	38.2
LT2	D	6/27/2019	Brown Bullhead	185	87.8
LT2	D	6/27/2019	Goldfish	185	114.1

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT2	D	6/27/2019	Goldfish	153	65.9
LT2	D	6/27/2019	Goldfish	147	50.9
LT2	C	6/27/2019	Largemouth Bass	462	1800.0
LT2	C	6/27/2019	Largemouth Bass	390	875.1
LT2	C	6/27/2019	Largemouth Bass	415	1074.8
LT2	C	6/27/2019	Largemouth Bass	180	64.0
LT2	C	6/27/2019	Largemouth Bass	290	295.8
LT2	C	6/27/2019	Largemouth Bass	325	503.9
LT2	C	6/27/2019	Largemouth Bass	375	808.7
LT2	C	6/27/2019	Goldfish	174	87.9
LT2	C	6/27/2019	Goldfish	140	46.9
LT2	C	6/27/2019	Bluegill	76	7.7
LT2	C	6/27/2019	Bluegill	144	54.9
LT2	C	6/27/2019	Bluegill	131	38.7
LT2	C	6/27/2019	Bluegill	144	53.1
LT2	C	6/27/2019	Bluegill	151	56.2
LT2	C	6/27/2019	Bluegill	120	27.0
LT2	C	6/27/2019	Golden Shiner	176	51.1
LT2	C	6/27/2019	Golden Shiner	195	78.7
LT2	C	6/27/2019	Golden Shiner	186	57.6
LT2	E	6/27/2019	Largemouth Bass	351	645.8
LT2	E	6/27/2019	Largemouth Bass	420	1100.0
LT2	E	6/27/2019	Largemouth Bass	296	352.4
LT2	E	6/27/2019	Largemouth Bass	420	1224.7
LT2	E	6/27/2019	Bluegill	137	46.6
LT2	E	6/27/2019	Goldfish	171	93.5
LT1	A	6/27/2019	Largemouth Bass	161	49.7
LT1	A	6/27/2019	Largemouth Bass	105	7.8
LT1	A	6/27/2019	Largemouth Bass	395	983.7
LT1	A	6/27/2019	Brown Bullhead	161	61.7
LT1	A	6/27/2019	Brown Bullhead	155	45.4
LT1	A	6/27/2019	Brown Bullhead	154	41.8
LT1	A	6/27/2019	Goldfish	165	89.1
LT1	A	6/27/2019	Goldfish	151	69.9
LT1	A	6/27/2019	Goldfish	149	61.1
LT1	A	6/27/2019	Goldfish	125	30.4
LT1	A	6/27/2019	Goldfish	183	110.7
LT1	A	6/27/2019	Bluegill	95	8.0
LT1	A	6/27/2019	Bluegill	121	31.9
LT1	B	6/27/2019	Largemouth Bass	225	156.1
LT1	B	6/27/2019	Largemouth Bass	268	295.4
LT1	B	6/27/2019	Bluegill	147	65.2
LT1	B	6/27/2019	Bluegill	79	8.0
LT1	B	6/27/2019	Goldfish	193	138.6

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT1	B	6/27/2019	Goldfish	170	97.2
LT1	B	6/27/2019	Goldfish	246	317.5
LT1	B	6/27/2019	Goldfish	167	na
LT1	B	6/27/2019	Brown Bullhead	151	44.4
LT1	E	6/27/2019	Largemouth Bass	196	89.6
LT1	E	6/27/2019	Largemouth Bass	249	179.7
LT1	E	6/27/2019	Largemouth Bass	265	223.0
LT1	E	6/27/2019	Golden Shiner	210	105.7
LT1	E	6/27/2019	Tui Chub	251	146.3
LT1	E	6/27/2019	Goldfish	141	51.8
LT1	E	6/27/2019	Goldfish	139	51.4
LT1	D	6/27/2019	Goldfish	295	900.0
LT1	D	6/27/2019	Goldfish	157	72.4
LT1	D	6/27/2019	Largemouth Bass	438	1400.0
LT1	D	6/27/2019	Largemouth Bass	421	1400.0
LT1	D	6/27/2019	Brown Bullhead	150	43.7
LT1	D	6/27/2019	Brown Bullhead	137	33.0
LT1	D	6/27/2019	Bluegill	171	87.4
LT1	D	6/27/2019	Bluegill	72	6.3
LT1	D	6/27/2019	Golden Shiner	177	58.1
LT1	D	6/27/2019	Golden Shiner	132	24.5
LT1	C	6/27/2019	Brown Bullhead	140	37.3
LT1	C	6/27/2019	Brown Bullhead	140	33.9
LT1	C	6/27/2019	Brown Bullhead	140	34.5
LT1	C	6/27/2019	Brown Bullhead	147	40.4
LT1	C	6/27/2019	Brown Bullhead	155	48.8
LT1	C	6/27/2019	Brown Bullhead	140	33.4
LT1	C	6/27/2019	Bluegill	147	52.4
LT1	C	6/27/2019	Goldfish	176	115.1
LT1	C	6/27/2019	Goldfish	170	86.7
LT1	C	6/27/2019	Goldfish	171	82.9
LT1	C	6/27/2019	Goldfish	175	88.2
LT1	C	6/27/2019	Goldfish	155	145.0
LT1	C	6/27/2019	Largemouth Bass	315	420.7
ML1	A	10/8/2019	Bluegill	142	5035.0
ML1	A	10/8/2019	Bluegill	140	51.5
ML1	A	10/8/2019	Bluegill	147	60.5
ML1	A	10/8/2019	Bluegill	156	70.5
ML1	A	10/8/2019	Bluegill	132	47.0
ML1	A	10/8/2019	Bluegill	130	39.5
ML1	A	10/8/2019	Bluegill	105	23.5
ML1	A	10/8/2019	Bluegill	144	52.0
ML1	A	10/8/2019	Bluegill	150	56.5
ML1	A	10/8/2019	Bluegill	27	0.8

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML1	A	10/8/2019	Bluegill	na	na
ML1	A	10/8/2019	Brown Bullhead	207	128.5
ML1	A	10/8/2019	Brown Bullhead	189	91.5
ML1	A	10/8/2019	Brown Bullhead	162	50.5
ML1	A	10/8/2019	Largemouth Bass	190	101.5
ML1	A	10/8/2019	Largemouth Bass	49	3.0
ML1	A	10/8/2019	Largemouth Bass	55	3.0
ML1	A	10/8/2019	Largemouth Bass	57	3.0
ML1	A	10/8/2019	Largemouth Bass	53	2.5
ML1	B	10/8/2019	Rainbow Trout	230	100.5
ML1	C	10/8/2019	Largemouth Bass	270	292.6
ML1	C	10/8/2019	Largemouth Bass	93	11.9
ML1	C	10/8/2019	Largemouth Bass	204	113.5
ML1	C	10/8/2019	Largemouth Bass	370	740.0
ML1	C	10/8/2019	Largemouth Bass	165	60.3
ML1	C	10/8/2019	Bluegill	160	71.5
ML1	C	10/8/2019	Bluegill	140	51.0
ML1	C	10/8/2019	Bluegill	150	60.3
ML1	C	10/8/2019	Bluegill	142	53.7
ML1	C	10/8/2019	Bluegill	129	39.5
ML1	C	10/8/2019	Bluegill	126	38.7
ML1	C	10/8/2019	Bluegill	139	48.2
ML1	C	10/8/2019	Bluegill	132	38.5
ML1	C	10/8/2019	Bluegill	128	335.3
ML1	C	10/8/2019	Bluegill	132	45.7
ML1	C	10/8/2019	Bluegill	na	na
ML1	C	10/8/2019	Black Crappie	207	112.5
ML1	C	10/8/2019	Black Crappie	296	514.0
ML1	C	10/8/2019	Black Crappie	328	663.0
ML1	C	10/8/2019	Black Crappie	266	359.5
ML1	C	10/8/2019	Black Crappie	258	331.7
ML1	C	10/8/2019	Black Crappie	227	198.5
ML1	C	10/8/2019	Black Crappie	245	280.5
ML1	C	10/8/2019	Black Crappie	313	594.0
ML1	C	10/8/2019	Black Crappie	200	110.0
ML1	C	10/8/2019	Black Crappie	250	287.5
ML1	C	10/8/2019	Black Crappie	na	na
ML1	C	10/8/2019	Black Crappie	na	na
ML1	C	10/8/2019	Black Crappie	na	na
ML1	C	10/8/2019	Black Crappie	na	na
ML1	C	10/8/2019	Tahoe Sucker	255	186.5
ML1	D	10/8/2019	Bluegill	135	45.8
ML1	D	10/8/2019	Bluegill	140	51.9
ML1	D	10/8/2019	Bluegill	128	39.7

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML1	D	10/8/2019	Bluegill	170	97.4
ML1	D	10/8/2019	Bluegill	158	77.3
ML1	D	10/8/2019	Bluegill	127	43.5
ML1	D	10/8/2019	Bluegill	130	44.4
ML1	D	10/8/2019	Bluegill	142	56.3
ML1	D	10/8/2019	Bluegill	130	41.2
ML1	D	10/8/2019	Bluegill	135	49.5
ML1	D	10/8/2019	Bluegill	na	na
ML1	D	10/8/2019	Bluegill	na	na
ML1	D	10/8/2019	Bluegill	na	na
ML1	D	10/8/2019	Bluegill	na	na
ML1	D	10/8/2019	Bluegill	na	na
ML1	D	10/8/2019	Bluegill	na	na
ML1	D	10/8/2019	Bluegill	na	na
ML1	D	10/8/2019	Largemouth Bass	338	582.3
ML1	D	10/8/2019	Largemouth Bass	278	375.4
ML1	D	10/8/2019	Largemouth Bass	135	24.1
ML1	D	10/8/2019	Largemouth Bass	57	2.5
ML1	D	10/8/2019	Brown Bullhead	192	91.1
ML1	D	10/8/2019	Tui Chub	155	39.3
ML1	E	10/8/2019	Bluegill	150	58.2
ML1	E	10/8/2019	Bluegill	149	58.6
ML1	E	10/8/2019	Bluegill	155	62.8
ML1	E	10/8/2019	Bluegill	118	31.3
ML1	E	10/8/2019	Bluegill	148	54.5
ML1	E	10/8/2019	Bluegill	154	59.9
ML1	E	10/8/2019	Bluegill	133	40.6
ML1	E	10/8/2019	Bluegill	131	39.8
ML1	E	10/8/2019	Bluegill	131	39.7
ML1	E	10/8/2019	Largemouth Bass	121	18.5
ML1	E	10/8/2019	Largemouth Bass	128	23.5
ML1	E	10/8/2019	Largemouth Bass	331	589.0
ML1	E	10/8/2019	Largemouth Bass	125	21.3
ML1	E	10/8/2019	Largemouth Bass	61	4.7
ML1	E	10/8/2019	Largemouth Bass	60	4.3
ML1	E	10/8/2019	Rainbow Trout	402	602.0
ML2	A	10/8/2019	Bluegill	130	38.4
ML2	A	10/8/2019	Bluegill	128	37.0
ML2	A	10/8/2019	Bluegill	135	44.0
ML2	A	10/8/2019	Bluegill	128	35.0
ML2	A	10/8/2019	Bluegill	140	47.0
ML2	A	10/8/2019	Bluegill	133	40.0
ML2	A	10/8/2019	Bluegill	142	47.0
ML2	A	10/8/2019	Bluegill	155	68.0

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML2	A	10/8/2019	Bluegill	135	37.3
ML2	A	10/8/2019	Bluegill	119	28.0
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Bluegill	na	na
ML2	A	10/8/2019	Largemouth Bass	197	92.0
ML2	A	10/8/2019	Largemouth Bass	242	198.0
ML2	A	10/8/2019	Largemouth Bass	172	53.5
ML2	A	10/8/2019	Largemouth Bass	183	72.0
ML2	A	10/8/2019	Black Crappie	290	411.1
ML2	A	10/8/2019	Black Crappie	282	398.5
ML2	A	10/8/2019	Black Crappie	373	926.0
ML2	A	10/8/2019	Black Crappie	330	555.0
ML2	A	10/8/2019	Black Crappie	292	472.0
ML2	A	10/8/2019	Black Crappie	295	440.0
ML2	A	10/8/2019	Black Crappie	283	420.0
ML2	A	10/8/2019	Black Crappie	294	460.0
ML2	A	10/8/2019	Black Crappie	327	645.0
ML2	A	10/8/2019	Black Crappie	230	208.0
ML2	A	10/8/2019	Black Crappie	na	na
ML2	A	10/8/2019	Black Crappie	na	na
ML2	A	10/8/2019	Black Crappie	na	na
ML2	A	10/8/2019	Brown Bullhead	245	192.0
ML2	A	10/8/2019	Brown Bullhead	279	270.0
ML2	A	10/8/2019	Brown Bullhead	225	140.0
ML2	A	10/8/2019	Brown Bullhead	270	235.0
ML2	A	10/8/2019	Goldfish	263	440.0
ML2	A	10/8/2019	Lahontan Redside	85	7.0
ML2	B	10/8/2019	Bluegill	161	75.0
ML2	B	10/8/2019	Bluegill	133	42.0
ML2	B	10/8/2019	Bluegill	149	60.0
ML2	B	10/8/2019	Bluegill	152	59.0
ML2	B	10/8/2019	Bluegill	148	56.0
ML2	B	10/8/2019	Bluegill	151	62.5
ML2	B	10/8/2019	Bluegill	152	57.0
ML2	B	10/8/2019	Bluegill	145	54.0

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML2	B	10/8/2019	Bluegill	144	50.0
ML2	B	10/8/2019	Bluegill	147	58.0
ML2	B	10/8/2019	Bluegill	na	na
ML2	B	10/8/2019	Bluegill	na	na
ML2	B	10/8/2019	Bluegill	na	na
ML2	B	10/8/2019	Bluegill	na	na
ML2	B	10/8/2019	Bluegill	na	na
ML2	B	10/8/2019	Bluegill	na	na
ML2	B	10/8/2019	Goldfish	221	266.0
ML2	B	10/8/2019	Goldfish	269	425.0
ML2	B	10/8/2019	Goldfish	235	294.0
ML2	B	10/8/2019	Goldfish	246	324.0
ML2	B	10/8/2019	Goldfish	285	644.0
ML2	B	10/8/2019	Largemouth Bass	163	48.0
ML2	B	10/8/2019	Largemouth Bass	54	4.0
ML2	D	10/8/2019	Bluegill	157	71.0
ML2	D	10/8/2019	Bluegill	130	40.4
ML2	D	10/8/2019	Bluegill	142	61.0
ML2	D	10/8/2019	Bluegill	155	68.0
ML2	D	10/8/2019	Bluegill	132	49.0
ML2	D	10/8/2019	Bluegill	135	48.0
ML2	D	10/8/2019	Bluegill	142	57.0
ML2	D	10/8/2019	Bluegill	142	52.0
ML2	D	10/8/2019	Bluegill	171	100.0
ML2	D	10/8/2019	Bluegill	136	46.5
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Bluegill	na	na
ML2	D	10/8/2019	Largemouth Bass	336	650.0
ML2	D	10/8/2019	Largemouth Bass	297	430.0
ML2	D	10/8/2019	Largemouth Bass	159	54.0
ML2	D	10/8/2019	Largemouth Bass	150	39.0
ML2	D	10/8/2019	Largemouth Bass	47	7.0
ML2	D	10/8/2019	Largemouth Bass	304	356.0
ML2	D	10/8/2019	Brown Bullhead	219	116.0
ML2	D	10/8/2019	Brown Bullhead	235	175.0
ML2	D	10/8/2019	Brown Bullhead	215	131.0

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML2	D	10/8/2019	Brown Bullhead	224	141.0
ML2	D	10/8/2019	Brown Bullhead	243	182.0
ML2	D	10/8/2019	Brown Bullhead	231	179.5
ML2	D	10/8/2019	Brown Bullhead	245	180.0
ML2	D	10/8/2019	Brown Bullhead	250	199.0
ML2	D	10/8/2019	Brown Bullhead	235	160.0
ML2	D	10/8/2019	Black Crappie	271	375.0
ML2	D	10/8/2019	Black Crappie	275	365.0
ML2	D	10/8/2019	Black Crappie	150	47.0
ML2	D	10/8/2019	Black Crappie	286	444.0
ML2	D	10/8/2019	Black Crappie	272	330.0
ML2	D	10/8/2019	Black Crappie	172	77.0
ML2	D	10/8/2019	Goldfish	265	465.0
ML2	C	10/8/2019	Bluegill	138	53.0
ML2	C	10/8/2019	Bluegill	163	76.0
ML2	C	10/8/2019	Bluegill	136	45.0
ML2	C	10/8/2019	Bluegill	130	47.0
ML2	C	10/8/2019	Bluegill	145	58.0
ML2	C	10/8/2019	Bluegill	131	41.0
ML2	C	10/8/2019	Bluegill	155	75.0
ML2	C	10/8/2019	Bluegill	141	53.0
ML2	C	10/8/2019	Bluegill	151	66.0
ML2	C	10/8/2019	Bluegill	138	47.0
ML2	C	10/8/2019	Bluegill	na	na
ML2	C	10/8/2019	Bluegill	na	na
ML2	C	10/8/2019	Bluegill	na	na
ML2	C	10/8/2019	Bluegill	na	na
ML2	C	10/8/2019	Bluegill	na	na
ML2	C	10/8/2019	Largemouth Bass	52	2.5
ML2	C	10/8/2019	Largemouth Bass	50	4.0
ML2	C	10/8/2019	Largemouth Bass	158	42.0
ML2	C	10/8/2019	Largemouth Bass	121	23.0
ML2	C	10/8/2019	Largemouth Bass	355	716.0
ML2	C	10/8/2019	Largemouth Bass	48	4.0
ML2	C	10/8/2019	Largemouth Bass	57	5.0
ML2	C	10/8/2019	Largemouth Bass	49	5.0
ML2	C	10/8/2019	Black Crappie	314	580.0
ML2	C	10/8/2019	Black Crappie	172	69.0
ML2	C	10/8/2019	Black Crappie	234	na
ML2	C	10/8/2019	Brown Bullhead	190	91.0
ML2	E	10/8/2019	Bluegill	151	59.0
ML2	E	10/8/2019	Bluegill	147	61.5
ML2	E	10/8/2019	Bluegill	126	36.5
ML2	E	10/8/2019	Bluegill	160	73.0

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML2	E	10/8/2019	Bluegill	148	57.0
ML2	E	10/8/2019	Bluegill	144	57.0
ML2	E	10/8/2019	Bluegill	137	51.0
ML2	E	10/8/2019	Bluegill	28	1.0
ML2	E	10/8/2019	Largemouth Bass	59	3.0
ML2	E	10/8/2019	Largemouth Bass	53	2.0
ML2	E	10/8/2019	Brown Bullhead	249	188.0
ML3	A	10/7/2019	Bluegill	147	59.9
ML3	A	10/7/2019	Bluegill	144	56.6
ML3	A	10/7/2019	Bluegill	153	66.4
ML3	A	10/7/2019	Bluegill	148	60.5
ML3	A	10/7/2019	Bluegill	146	60.6
ML3	A	10/7/2019	Bluegill	145	48.5
ML3	A	10/7/2019	Bluegill	118	30.4
ML3	A	10/7/2019	Bluegill	135	44.5
ML3	A	10/7/2019	Tahoe Sucker	335	337.8
ML3	A	10/7/2019	Tahoe Sucker	315	371.8
ML3	A	10/7/2019	Brown Bullhead	251	215.5
ML3	A	10/7/2019	Brown Bullhead	225	165.4
ML3	A	10/7/2019	Brown Bullhead	230	150.6
ML3	A	10/7/2019	Brown Bullhead	215	143.7
ML3	A	10/7/2019	Goldfish	276	505.5
ML3	A	10/7/2019	Black Crappie	273	350.6
ML3	A	10/7/2019	Largemouth Bass	122	21.9
ML3	A	10/7/2019	Largemouth Bass	165	50.1
ML3	B	10/7/2019	Bluegill	163	88.3
ML3	B	10/7/2019	Bluegill	141	53.2
ML3	B	10/7/2019	Bluegill	156	67.8
ML3	B	10/7/2019	Bluegill	151	63.9
ML3	B	10/7/2019	Bluegill	130	37.4
ML3	B	10/7/2019	Bluegill	155	66.7
ML3	B	10/7/2019	Bluegill	142	52.2
ML3	B	10/7/2019	Bluegill	157	72.9
ML3	B	10/7/2019	Bluegill	152	61.2
ML3	B	10/7/2019	Bluegill	145	52.7
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Bluegill	na	na
ML3	B	10/7/2019	Brown Bullhead	208	116.7
ML3	B	10/7/2019	Largemouth Bass	165	47.7
ML3	C	10/7/2019	Bluegill	146	62.3
ML3	C	10/7/2019	Bluegill	143	52.2
ML3	C	10/7/2019	Bluegill	141	46.7
ML3	C	10/7/2019	Bluegill	140	50.6
ML3	C	10/7/2019	Bluegill	161	73.6
ML3	C	10/7/2019	Bluegill	163	79.2
ML3	C	10/7/2019	Bluegill	152	66.1
ML3	C	10/7/2019	Bluegill	140	46.7
ML3	C	10/7/2019	Bluegill	143	54.6
ML3	C	10/7/2019	Bluegill	137	49.3
ML3	C	10/7/2019	Largemouth Bass	228	146.2
ML3	C	10/7/2019	Largemouth Bass	145	40.3
ML3	C	10/7/2019	Largemouth Bass	182	62.5
ML3	C	10/7/2019	Tahoe Sucker	277	158.6
ML3	C	10/7/2019	Brown Bullhead	200	101.1
ML3	D	10/7/2019	Bluegill	165	74.7
ML3	D	10/7/2019	Bluegill	147	56.2
ML3	D	10/7/2019	Bluegill	152	65.3
ML3	D	10/7/2019	Bluegill	143	57.5
ML3	D	10/7/2019	Bluegill	125	35.1
ML3	D	10/7/2019	Bluegill	140	51.1
ML3	D	10/7/2019	Bluegill	145	57.4
ML3	D	10/7/2019	Bluegill	146	62.0
ML3	D	10/7/2019	Largemouth Bass	174	61.4
ML3	D	10/7/2019	Largemouth Bass	50	1.5
ML3	E	10/7/2019	Bluegill	140	50.2
ML3	E	10/7/2019	Bluegill	150	61.1
ML3	E	10/7/2019	Bluegill	163	81.4
ML3	E	10/7/2019	Bluegill	171	96.7
ML3	E	10/7/2019	Bluegill	156	65.4
ML3	E	10/7/2019	Bluegill	148	63.6
ML3	E	10/7/2019	Bluegill	130	42.6
ML3	E	10/7/2019	Bluegill	137	44.7
ML3	E	10/7/2019	Bluegill	164	78.4
ML3	E	10/7/2019	Bluegill	143	54.1
ML3	E	10/7/2019	Bluegill	na	na
ML3	E	10/7/2019	Bluegill	na	na
ML3	E	10/7/2019	Bluegill	na	na

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML3	E	10/7/2019	Bluegill	na	na
ML3	E	10/7/2019	Bluegill	na	na
ML3	E	10/7/2019	Bluegill	na	na
ML3	E	10/7/2019	Bluegill	na	na
ML3	E	10/7/2019	Largemouth Bass	57	1.5
ML3	E	10/7/2019	Brown Bullhead	325	582.0
MRL1	A	10/8/2019	Largemouth Bass	374	833.6
MRL1	A	10/8/2019	Largemouth Bass	241	173.6
MRL1	A	10/8/2019	Largemouth Bass	195	105.1
MRL1	A	10/8/2019	Largemouth Bass	177	60.6
MRL1	A	10/8/2019	Largemouth Bass	289	316.5
MRL1	A	10/8/2019	Largemouth Bass	50	1.9
MRL1	A	10/8/2019	Brown Bullhead	193	86.4
MRL1	A	10/8/2019	Brown Bullhead	186	78.9
MRL1	A	10/8/2019	Brown Bullhead	193	83.9
MRL1	A	10/8/2019	Brown Bullhead	171	63.0
MRL1	A	10/8/2019	Bluegill	153	69.6
MRL1	A	10/8/2019	Bluegill	175	112.3
MRL1	A	10/8/2019	Bluegill	134	43.3
MRL1	B	10/8/2019	Bluegill	168	83.0
MRL1	B	10/8/2019	Bluegill	176	110.4
MRL1	B	10/8/2019	Bluegill	162	81.6
MRL1	B	10/8/2019	Bluegill	148	59.9
MRL1	B	10/8/2019	Largemouth Bass	51	3.9
MRL1	B	10/8/2019	Largemouth Bass	343	706.9
MRL1	B	10/8/2019	Largemouth Bass	76	4.6
MRL1	B	10/8/2019	Largemouth Bass	145	34.8
MRL1	B	10/8/2019	Largemouth Bass	49	2.4
MRL1	B	10/8/2019	Brown Bullhead	195	91.6
MRL1	B	10/8/2019	Brown Bullhead	146	41.4
MRL1	C	10/8/2019	Largemouth Bass	275	317.5
MRL1	C	10/8/2019	Largemouth Bass	292	353.6
MRL1	C	10/8/2019	Largemouth Bass	330	605.4
MRL1	C	10/8/2019	Largemouth Bass	56	2.1
MRL1	C	10/8/2019	Largemouth Bass	64	3.4
MRL1	C	10/8/2019	Bluegill	148	60.7
MRL1	D	10/8/2019	Largemouth Bass	42	0.9
MRL1	D	10/8/2019	Largemouth Bass	295	420.6
MRL1	D	10/8/2019	Brown Bullhead	220	134.3
MRL1	D	10/8/2019	Brown Bullhead	207	106.3
MRL1	D	10/8/2019	Tahoe Sucker	325	326.6
MRL1	D	10/8/2019	Unknown Sucker	254	157.2
MRL1	D	10/8/2019	Bluegill	183	127.8
MRL1	E	10/8/2019	Brown Bullhead	242	173.5

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
MRL1	E	10/8/2019	Brown Bullhead	182	68.8
MRL1	E	10/8/2019	Brown Bullhead	175	62.6
MRL1	E	10/8/2019	Brown Bullhead	207	105.4
MRL1	E	10/8/2019	Brown Bullhead	203	101.1
MRL1	E	10/8/2019	Largemouth Bass	112	14.6
MRL1	E	10/8/2019	Largemouth Bass	62	3.5
MRL1	E	10/8/2019	Largemouth Bass	54	3.2
MRL1	E	10/8/2019	Largemouth Bass	100	11.2
MRL1	E	10/8/2019	Largemouth Bass	54	1.3
MRL1	E	10/8/2019	Largemouth Bass	48	1.2
MRL1	E	10/8/2019	Largemouth Bass	143	32.5
MRL1	E	10/8/2019	Largemouth Bass	152	41.9
MRL1	E	10/8/2019	Largemouth Bass	137	24.6
MRL1	E	10/8/2019	Largemouth Bass	56	3.0
MRL1	E	10/8/2019	Largemouth Bass	na	na
MRL1	E	10/8/2019	Largemouth Bass	na	na
MRL1	E	10/8/2019	Largemouth Bass	na	na
MRL2	A	10/8/2019	Largemouth Bass	278	351.3
MRL2	A	10/8/2019	Largemouth Bass	387	1008.8
MRL2	A	10/8/2019	Largemouth Bass	111	15.5
MRL2	A	10/8/2019	Largemouth Bass	66	6.2
MRL2	B	10/8/2019	Bluegill	130	31.7
MRL2	B	10/8/2019	Bluegill	174	117.8
MRL2	B	10/8/2019	Largemouth Bass	44	1.4
MRL2	D	10/8/2019	Bluegill	117	15.7
MRL2	D	10/8/2019	Bluegill	183	114.5
MRL2	D	10/8/2019	Bluegill	125	27.2
MRL2	D	10/8/2019	Bluegill	135	40.8
MRL2	D	10/8/2019	Bluegill	148	54.2
MRL2	D	10/8/2019	Largemouth Bass	296	392.1
MRL2	D	10/8/2019	Largemouth Bass	131	24.8
MRL2	D	10/8/2019	Largemouth Bass	113	16.5
MRL2	D	10/8/2019	Largemouth Bass	52	2.0
MRL2	D	10/8/2019	Black Crappie	187	90.4
MRL2	D	10/8/2019	Black Crappie	162	61.4
MRL2	E	10/8/2019	Bluegill	130	29.4
MRL2	E	10/8/2019	Bluegill	147	50.7
MRL2	E	10/8/2019	Largemouth Bass	142	31.6
MRL2	E	10/8/2019	Largemouth Bass	54	1.7
MRL2	E	10/8/2019	Largemouth Bass	55	1.2
MRL2	E	10/8/2019	Largemouth Bass	53	1.5
MRL2	E	10/8/2019	Largemouth Bass	48	1.2
MRL2	E	10/8/2019	Largemouth Bass	93	7.8
ML4	A	10/7/2019	Bluegill	174	81.7

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML4	A	10/7/2019	Bluegill	173	91.6
ML4	A	10/7/2019	Largemouth Bass	130	23.8
ML4	A	10/7/2019	Tui Chub	na	na
ML4	B	10/7/2019	Bluegill	142	51.6
ML4	B	10/7/2019	Bluegill	148	53.5
ML4	B	10/7/2019	Bluegill	146	52.9
ML4	B	10/7/2019	Bluegill	149	55.7
ML4	B	10/7/2019	Bluegill	163	75.4
ML4	B	10/7/2019	Bluegill	153	67.4
ML4	B	10/7/2019	Bluegill	145	46.1
ML4	B	10/7/2019	Bluegill	119	28.3
ML4	B	10/7/2019	Bluegill	140	46.9
ML4	B	10/7/2019	Bluegill	152	63.8
ML4	B	10/7/2019	Bluegill	na	na
ML4	B	10/7/2019	Bluegill	na	na
ML4	B	10/7/2019	Bluegill	na	na
ML4	B	10/7/2019	Bluegill	na	na
ML4	B	10/7/2019	Bluegill	na	na
ML4	B	10/7/2019	Bluegill	na	na
ML4	B	10/7/2019	Bluegill	na	na
ML4	B	10/7/2019	Largemouth Bass	64	1.4
ML4	B	10/7/2019	Goldfish	241	360.3
ML4	B	10/7/2019	Goldfish	238	319.3
ML4	B	10/7/2019	Tui Chub	318	347.2
ML4	C	10/7/2019	Bluegill	147	52.2
ML4	C	10/7/2019	Bluegill	146	53.7
ML4	C	10/7/2019	Bluegill	159	80.8
ML4	C	10/7/2019	Bluegill	140	50.3
ML4	C	10/7/2019	Bluegill	157	70.5
ML4	C	10/7/2019	Bluegill	144	44.4
ML4	C	10/7/2019	Bluegill	179	117.3
ML4	C	10/7/2019	Bluegill	139	46.4
ML4	C	10/7/2019	Bluegill	188	117.6
ML4	C	10/7/2019	Bluegill	152	59.6
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Bluegill	na	na

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML4	C	10/7/2019	Bluegill	na	na
ML4	C	10/7/2019	Largemouth Bass	61	2.2
ML4	C	10/7/2019	Largemouth Bass	52	1.8
ML4	C	10/7/2019	Largemouth Bass	144	29.5
ML4	C	10/7/2019	Largemouth Bass	56	2.0
ML4	D	10/7/2019	Bluegill	143	46.2
ML4	D	10/7/2019	Bluegill	155	62.0
ML4	D	10/7/2019	Bluegill	135	39.1
ML4	D	10/7/2019	Bluegill	153	54.1
ML4	D	10/7/2019	Bluegill	158	65.6
ML4	D	10/7/2019	Bluegill	134	40.6
ML4	D	10/7/2019	Bluegill	148	49.6
ML4	D	10/7/2019	Bluegill	158	66.6
ML4	D	10/7/2019	Bluegill	137	44.1
ML4	D	10/7/2019	Largemouth Bass	194	87.2
ML4	D	10/7/2019	Largemouth Bass	181	55.3
ML4	D	10/7/2019	Largemouth Bass	164	48.8
ML4	D	10/7/2019	Largemouth Bass	160	48.0
ML4	D	10/7/2019	Largemouth Bass	173	55.4
ML4	D	10/7/2019	Largemouth Bass	164	47.1
ML4	D	10/7/2019	Largemouth Bass	128	25.3
ML4	D	10/7/2019	Largemouth Bass	184	73.1
ML4	D	10/7/2019	Largemouth Bass	163	45.8
ML4	D	10/7/2019	Largemouth Bass	161	47.4
ML4	D	10/7/2019	Brown Bullhead	226	153.2
ML4	D	10/7/2019	Brown Bullhead	240	164.8
ML4	E	10/7/2019	Bluegill	145	54.7
ML4	E	10/7/2019	Bluegill	148	59.1
ML4	E	10/7/2019	Bluegill	156	57.2
ML4	E	10/7/2019	Bluegill	171	93.4
ML4	E	10/7/2019	Bluegill	146	57.1
ML4	E	10/7/2019	Bluegill	143	42.0
ML4	E	10/7/2019	Bluegill	132	40.3
ML4	E	10/7/2019	Bluegill	152	63.6
ML4	E	10/7/2019	Bluegill	167	78.9
ML4	E	10/7/2019	Bluegill	138	45.0
ML4	E	10/7/2019	Bluegill	na	na
ML4	E	10/7/2019	Largemouth Bass	48	1.1
ML4	E	10/7/2019	Brown Bullhead	269	255.8
ML4	E	10/7/2019	Brown Bullhead	198	100.6
ML4	E	10/7/2019	Brown Bullhead	206	101.5
ML4	E	10/7/2019	Brown Bullhead	333	557.2
ML5	A	10/7/2019	Bluegill	153	67.4
ML5	A	10/7/2019	Bluegill	138	44.6

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML5	A	10/7/2019	Largemouth Bass	79	5.3
ML5	A	10/7/2019	Largemouth Bass	62	2.9
ML5	A	10/7/2019	Rainbow Trout	174	42.5
ML5	B	10/7/2019	Bluegill	137	49.6
ML5	B	10/7/2019	Bluegill	145	56.0
ML5	B	10/7/2019	Bluegill	140	46.8
ML5	B	10/7/2019	Bluegill	141	56.3
ML5	B	10/7/2019	Bluegill	137	45.8
ML5	B	10/7/2019	Bluegill	155	66.3
ML5	B	10/7/2019	Bluegill	155	70.7
ML5	B	10/7/2019	Bluegill	152	64.5
ML5	B	10/7/2019	Goldfish	270	421.3
ML5	C	10/7/2019	Bluegill	150	60.0
ML5	C	10/7/2019	Bluegill	140	43.9
ML5	C	10/7/2019	Bluegill	150	64.9
ML5	C	10/7/2019	Bluegill	144	51.5
ML5	C	10/7/2019	Bluegill	158	81.4
ML5	C	10/7/2019	Largemouth Bass	211	106.4
ML5	C	10/7/2019	Brown Bullhead	235	190.6
ML5	D	10/7/2019	Bluegill	155	66.7
ML5	D	10/7/2019	Bluegill	158	63.4
ML5	D	10/7/2019	Bluegill	177	107.1
ML5	D	10/7/2019	Bluegill	149	62.7
ML5	D	10/7/2019	Bluegill	37	2.1
ML5	D	10/7/2019	Bluegill	141	50.5
ML5	D	10/7/2019	Bluegill	168	82.1
ML5	D	10/7/2019	Largemouth Bass	51	4.1
ML5	D	10/7/2019	Largemouth Bass	300	355.6
ML5	D	10/7/2019	Largemouth Bass	161	70.9
ML5	D	10/7/2019	Largemouth Bass	397	788.5
ML5	D	10/7/2019	Largemouth Bass	48	2.5
ML5	D	10/7/2019	Tui Chub	245	149.9
ML5	E	10/7/2019	Bluegill	160	73.5
ML5	E	10/7/2019	Bluegill	110	21.4
ML5	E	10/7/2019	Bluegill	99	14.5
ML5	E	10/7/2019	Bluegill	156	68.1
ML5	E	10/7/2019	Bluegill	182	112.4
ML5	E	10/7/2019	Bluegill	na	na
ML5	E	10/7/2019	Bluegill	na	na
ML5	E	10/7/2019	Bluegill	na	na
ML5	E	10/7/2019	Largemouth Bass	418	1084.3
ML5	E	10/7/2019	Largemouth Bass	214	115.2
ML5	E	10/7/2019	Largemouth Bass	160	41.9
ML5	E	10/7/2019	Black Crappie	182	80.3

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML5	E	10/7/2019	Black Crappie	220	136.1
ML6	E	10/7/2019	Bluegill	146	57.7
ML6	E	10/7/2019	Bluegill	92	15.9
ML6	E	10/7/2019	Bluegill	163	84.7
ML6	E	10/7/2019	Bluegill	146	55.0
ML6	E	10/7/2019	Bluegill	97	15.5
ML6	E	10/7/2019	Largemouth Bass	190	83.5
ML6	E	10/7/2019	Largemouth Bass	80	5.7
ML6	E	10/7/2019	Largemouth Bass	178	71.0
ML6	E	10/7/2019	Largemouth Bass	38	0.8
ML6	E	10/7/2019	Largemouth Bass	50	1.4
ML6	E	10/7/2019	Largemouth Bass	80	7.3
ML6	E	10/7/2019	Black Bullhead	210	124.0
ML6	E	10/7/2019	Black Bullhead	235	170.4
ML6	E	10/7/2019	Black Bullhead	243	190.2
ML6	A	10/7/2019	Bluegill	154	55.7
ML6	A	10/7/2019	Bluegill	164	71.9
ML6	A	10/7/2019	Bluegill	152	59.5
ML6	A	10/7/2019	Bluegill	141	54.4
ML6	A	10/7/2019	Largemouth Bass	171	62.2
ML6	A	10/7/2019	Largemouth Bass	198	84.3
ML6	A	10/7/2019	Largemouth Bass	233	172.8
ML6	A	10/7/2019	Largemouth Bass	51	2.3
ML6	A	10/7/2019	Largemouth Bass	44	2.8
ML6	A	10/7/2019	Black Bullhead	257	228.8
ML6	B	10/7/2019	Bluegill	138	42.6
ML6	B	10/7/2019	Bluegill	169	82.5
ML6	B	10/7/2019	Bluegill	105	16.6
ML6	B	10/7/2019	Bluegill	163	70.6
ML6	B	10/7/2019	Bluegill	146	51.4
ML6	B	10/7/2019	Bluegill	92	11.8
ML6	B	10/7/2019	Bluegill	117	24.6
ML6	B	10/7/2019	Bluegill	158	67.9
ML6	B	10/7/2019	Bluegill	105	17.3
ML6	B	10/7/2019	Bluegill	147	56.2
ML6	B	10/7/2019	Bluegill	na	na
ML6	B	10/7/2019	Bluegill	na	na
ML6	B	10/7/2019	Bluegill	na	na
ML6	B	10/7/2019	Largemouth Bass	145	35.7
ML6	B	10/7/2019	Largemouth Bass	62	4.2
ML6	B	10/7/2019	Largemouth Bass	43	2.0
ML6	B	10/7/2019	Largemouth Bass	57	3.1
ML6	C	10/7/2019	Bluegill	30	0.5
ML6	C	10/7/2019	Bluegill	30	0.5

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
ML6	C	10/7/2019	Bluegill	130	39.5
ML6	C	10/7/2019	Bluegill	28	0.3
ML6	C	10/7/2019	Largemouth Bass	60	2.8
ML6	C	10/7/2019	Largemouth Bass	64	3.0
ML6	C	10/7/2019	Largemouth Bass	163	50.7
ML6	C	10/7/2019	Largemouth Bass	185	75.2
ML6	D	10/7/2019	Bluegill	115	25.6
ML6	D	10/7/2019	Bluegill	162	78.3
ML6	D	10/7/2019	Bluegill	166	90.5
ML6	D	10/7/2019	Bluegill	89	11.2
ML6	D	10/7/2019	Bluegill	102	18.5
ML6	D	10/7/2019	Bluegill	154	65.8
ML6	D	10/7/2019	Bluegill	64	4.5
ML6	D	10/7/2019	Bluegill	155	70.0
ML6	D	10/7/2019	Bluegill	146	61.8
ML6	D	10/7/2019	Bluegill	58	3.5
ML6	D	10/7/2019	Largemouth Bass	275	280.2
ML6	D	10/7/2019	Largemouth Bass	171	56.2
ML6	D	10/7/2019	Largemouth Bass	145	57.9
ML6	D	10/7/2019	Largemouth Bass	83	7.4
ML6	D	10/7/2019	Largemouth Bass	66	3.7
ML6	D	10/7/2019	Largemouth Bass	72	4.0
ML6	D	10/7/2019	Largemouth Bass	62	2.6
ML6	D	10/7/2019	Largemouth Bass	51	1.7
ML6	D	10/7/2019	Largemouth Bass	43	1.5
ML6	D	10/7/2019	Largemouth Bass	55	2.6
LT2	A	10/9/2019	Brown Bullhead	131	21.5
LT2	A	10/9/2019	Brown Bullhead	152	31.5
LT2	A	10/9/2019	Bluegill	143	46.4
LT2	A	10/9/2019	Bluegill	157	50.3
LT2	A	10/9/2019	Bluegill	105	14.1
LT2	A	10/9/2019	Bluegill	140	42.5
LT2	A	10/9/2019	Bluegill	68	4.1
LT2	A	10/9/2019	Bluegill	134	37.5
LT2	A	10/9/2019	Bluegill	142	47.1
LT2	A	10/9/2019	Bluegill	129	35.2
LT2	A	10/9/2019	Bluegill	132	40.4
LT2	A	10/9/2019	Bluegill	125	31.4
LT2	A	10/9/2019	Largemouth Bass	279	312.4
LT2	A	10/9/2019	Largemouth Bass	178	62.0
LT2	A	10/9/2019	Largemouth Bass	363	730.6
LT2	A	10/9/2019	Largemouth Bass	371	757.4
LT2	B	10/9/2019	Largemouth Bass	154	41.8
LT2	B	10/9/2019	Largemouth Bass	129	23.8

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT2	B	10/9/2019	Bluegill	92	8.8
LT2	B	10/9/2019	Bluegill	145	41.9
LT2	B	10/9/2019	Bluegill	114	23.6
LT2	B	10/9/2019	Goldfish	236	244.8
LT2	B	10/9/2019	Goldfish	218	192.3
LT2	B	10/9/2019	Brown Bullhead	148	37.9
LT2	C	10/9/2019	Bluegill	129	32.9
LT2	C	10/9/2019	Bluegill	126	27.0
LT2	C	10/9/2019	Bluegill	121	28.2
LT2	C	10/9/2019	Bluegill	133	36.0
LT2	C	10/9/2019	Bluegill	134	34.5
LT2	C	10/9/2019	Bluegill	133	36.5
LT2	C	10/9/2019	Bluegill	106	18.5
LT2	C	10/9/2019	Bluegill	145	50.5
LT2	C	10/9/2019	Bluegill	123	30.5
LT2	C	10/9/2019	Bluegill	146	50.4
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Bluegill	na	na
LT2	C	10/9/2019	Brown Bullhead	152	37.2
LT2	C	10/9/2019	Brown Bullhead	164	49.3
LT2	C	10/9/2019	Brown Bullhead	147	35.3
LT2	C	10/9/2019	Brown Bullhead	158	39.1
LT2	C	10/9/2019	Largemouth Bass	242	155.5
LT2	C	10/9/2019	Largemouth Bass	158	44.7
LT2	C	10/9/2019	Largemouth Bass	152	37.1
LT2	C	10/9/2019	Largemouth Bass	304	400.4
LT2	C	10/9/2019	Largemouth Bass	170	51.2
LT2	C	10/9/2019	Largemouth Bass	401	949.8
LT2	C	10/9/2019	Goldfish	190	141.8
LT2	C	10/9/2019	Goldfish	183	110.5

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT2	C	10/9/2019	Goldfish	215	198.2
LT2	C	10/9/2019	Goldfish	264	380.5
LT2	C	10/9/2019	Goldfish	196	143.2
LT2	C	10/9/2019	Goldfish	310	762.9
LT2	C	10/9/2019	Goldfish	198	154.0
LT2	D	10/9/2019	Bluegill	139	38.5
LT2	D	10/9/2019	Bluegill	141	43.8
LT2	D	10/9/2019	Bluegill	128	30.5
LT2	D	10/9/2019	Bluegill	130	32.3
LT2	D	10/9/2019	Bluegill	140	44.7
LT2	D	10/9/2019	Bluegill	123	30.0
LT2	D	10/9/2019	Bluegill	149	55.2
LT2	D	10/9/2019	Bluegill	120	26.2
LT2	D	10/9/2019	Bluegill	148	60.0
LT2	D	10/9/2019	Bluegill	148	57.9
LT2	D	10/9/2019	Brown Bullhead	154	37.6
LT2	D	10/9/2019	Brown Bullhead	160	48.0
LT2	D	10/9/2019	Brown Bullhead	145	32.2
LT2	D	10/9/2019	Goldfish	200	152.4
LT2	D	10/9/2019	Goldfish	190	136.5
LT2	D	10/9/2019	Goldfish	192	137.2
LT2	D	10/9/2019	Goldfish	186	130.6
LT2	D	10/9/2019	Goldfish	195	150.1
LT2	D	10/9/2019	Goldfish	200	162.5
LT2	D	10/9/2019	Largemouth Bass	56	4.0
LT2	E	10/9/2019	Bluegill	130	35.7
LT2	E	10/9/2019	Bluegill	140	43.2
LT2	E	10/9/2019	Bluegill	120	25.0
LT2	E	10/9/2019	Bluegill	154	54.6
LT2	E	10/9/2019	Bluegill	113	20.3
LT2	E	10/9/2019	Bluegill	89	8.7
LT2	E	10/9/2019	Largemouth Bass	159	42.7
LT2	E	10/9/2019	Brown Bullhead	151	39.0
LT2	E	10/9/2019	Goldfish	265	337.3
LT1	A	10/9/2019	Bluegill	112	26.0
LT1	A	10/9/2019	Bluegill	136	39.2
LT1	A	10/9/2019	Bluegill	150	61.1
LT1	A	10/9/2019	Bluegill	110	19.4
LT1	A	10/9/2019	Bluegill	141	51.0
LT1	A	10/9/2019	Bluegill	159	71.4
LT1	A	10/9/2019	Bluegill	132	40.0
LT1	A	10/9/2019	Brown Bullhead	172	57.2
LT1	A	10/9/2019	Brown Bullhead	159	45.6
LT1	A	10/9/2019	Brown Bullhead	134	24.2

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT1	A	10/9/2019	Brown Bullhead	146	36.1
LT1	A	10/9/2019	Brown Bullhead	152	42.8
LT1	A	10/9/2019	Brown Bullhead	162	49.8
LT1	A	10/9/2019	Brown Bullhead	158	49.0
LT1	A	10/9/2019	Largemouth Bass	254	247.1
LT1	A	10/9/2019	Largemouth Bass	397	1056.8
LT1	A	10/9/2019	Largemouth Bass	404	980.5
LT1	A	10/9/2019	Goldfish	200	148.2
LT1	A	10/9/2019	Goldfish	183	120.6
LT1	A	10/9/2019	Goldfish	263	363..5
LT1	A	10/9/2019	Goldfish	265	354.8
LT1	A	10/9/2019	Goldfish	180	117.1
LT1	C	10/9/2019	Bluegill	138	38.4
LT1	C	10/9/2019	Bluegill	152	52.5
LT1	C	10/9/2019	Bluegill	141	47.8
LT1	C	10/9/2019	Bluegill	160	76.7
LT1	C	10/9/2019	Bluegill	136	45.8
LT1	C	10/9/2019	Bluegill	122	28.3
LT1	C	10/9/2019	Bluegill	122	32.0
LT1	C	10/9/2019	Bluegill	141	47.4
LT1	C	10/9/2019	Bluegill	152	67.5
LT1	C	10/9/2019	Bluegill	148	53.4
LT1	C	10/9/2019	Bluegill	na	na
LT1	C	10/9/2019	Bluegill	na	na
LT1	C	10/9/2019	Largemouth Bass	222	130.4
LT1	C	10/9/2019	Largemouth Bass	52	5.0
LT1	C	10/9/2019	Largemouth Bass	137	36.4
LT1	C	10/9/2019	Largemouth Bass	462	1744.1
LT1	C	10/9/2019	Largemouth Bass	170	68.3
LT1	C	10/9/2019	Brown Bullhead	140	33.7
LT1	C	10/9/2019	Brown Bullhead	142	35.9
LT1	C	10/9/2019	Brown Bullhead	165	59.9
LT1	C	10/9/2019	Brown Bullhead	153	44.4
LT1	C	10/9/2019	Brown Bullhead	156	45.6
LT1	C	10/9/2019	Brown Bullhead	150	41.5
LT1	C	10/9/2019	Brown Bullhead	146	35.8
LT1	C	10/9/2019	Brown Bullhead	135	29.1
LT1	C	10/9/2019	Brown Bullhead	150	35.5
LT1	C	10/9/2019	Brown Bullhead	145	39.9
LT1	C	10/9/2019	Goldfish	181	14.1
LT1	C	10/9/2019	Goldfish	186	125.8
LT1	C	10/9/2019	Goldfish	182	121.7
LT1	C	10/9/2019	Goldfish	171	92.9
LT1	C	10/9/2019	Goldfish	200	145.5

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT1	D	10/9/2019	Bluegill	119	28.4
LT1	D	10/9/2019	Bluegill	130	36.2
LT1	D	10/9/2019	Bluegill	118	25.7
LT1	D	10/9/2019	Bluegill	126	33.2
LT1	D	10/9/2019	Bluegill	130	38.6
LT1	D	10/9/2019	Bluegill	138	45.6
LT1	D	10/9/2019	Bluegill	116	28.5
LT1	D	10/9/2019	Bluegill	116	26.1
LT1	D	10/9/2019	Bluegill	118	25.5
LT1	D	10/9/2019	Bluegill	120	30.2
LT1	D	10/9/2019	Bluegill	na	na
LT1	D	10/9/2019	Bluegill	na	na
LT1	D	10/9/2019	Bluegill	na	na
LT1	D	10/9/2019	Bluegill	na	na
LT1	D	10/9/2019	Bluegill	na	na
LT1	D	10/9/2019	Bluegill	na	na
LT1	D	10/9/2019	Brown Bullhead	149	37.2
LT1	D	10/9/2019	Brown Bullhead	150	39.3
LT1	D	10/9/2019	Brown Bullhead	150	39.7
LT1	D	10/9/2019	Brown Bullhead	135	30.5
LT1	D	10/9/2019	Brown Bullhead	142	36.0
LT1	D	10/9/2019	Goldfish	178	121.7
LT1	D	10/9/2019	Goldfish	184	119.2
LT1	D	10/9/2019	Goldfish	180	122.2
LT1	D	10/9/2019	Goldfish	178	128.0
LT1	D	10/9/2019	Goldfish	198	154.0
LT1	D	10/9/2019	Goldfish	180	121.7
LT1	B	10/9/2019	Bluegill	143	47.0
LT1	B	10/9/2019	Bluegill	132	32.0
LT1	B	10/9/2019	Bluegill	157	57.9
LT1	B	10/9/2019	Bluegill	39	0.7
LT1	B	10/9/2019	Bluegill	148	49.1
LT1	B	10/9/2019	Bluegill	140	41.3
LT1	B	10/9/2019	Bluegill	152	52.7
LT1	B	10/9/2019	Bluegill	120	26.0
LT1	B	10/9/2019	Bluegill	120	24.6
LT1	B	10/9/2019	Goldfish	189	126.5
LT1	B	10/9/2019	Goldfish	181	111.7
LT1	B	10/9/2019	Goldfish	194	147.1
LT1	B	10/9/2019	Goldfish	183	118.2
LT1	B	10/9/2019	Brown Bullhead	156	43.9
LT1	B	10/9/2019	Brown Bullhead	147	35.5
LT1	B	10/9/2019	Brown Bullhead	155	40.8
LT1	B	10/9/2019	Brown Bullhead	171	52.6

Boat Electrofishing Fish Catch

Site	Location	Date	Species Code	Total Length (mm)	Weight (g)
LT1	B	10/9/2019	Largemouth Bass	224	130.6
LT1	B	10/9/2019	Largemouth Bass	42	2.4
LT1	E	10/9/2019	Brown Bullhead	163	48.8
LT1	E	10/9/2019	Brown Bullhead	147	35.0
LT1	E	10/9/2019	Bluegill	138	38.2
LT1	E	10/9/2019	Bluegill	118	23.2
LT1	E	10/9/2019	Bluegill	105	16.0
LT1	E	10/9/2019	Bluegill	130	31.8
LT1	E	10/9/2019	Bluegill	40	1.5
LT1	E	10/9/2019	Black Crappie	139	35.8
LT1	E	10/9/2019	Black Crappie	148	39.8
LT1	E	10/9/2019	Golden Shiner	193	64.2
LT1	E	10/9/2019	Largemouth Bass	52	2.5
LT1	E	10/9/2019	Largemouth Bass	249	200.6

Otter Trawl Events

Site	ML2	ML2	ML2	ML2	ML2	ML1	ML1	ML1	ML1	ML1
Location	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
Date	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/20/2019	6/20/2019	6/20/2019	6/20/2019	6/20/2019
Start_Depth_ft	8	14.4	12.3	17.8	11.7	16	15.5	12.8	10	11.5
End_Depth_ft	11.7	26.4	16.8	14.5	19.9	18	25.5	16.2	18	21.9
Start_Time	2:11 PM	2:36 PM	2:52 PM	3:13 PM	4:01 PM	9:08 AM	9:33 AM	9:54 AM	10:38 AM	11:06 AM
End_Time	2:19 PM	2:42 PM	3:00 PM	3:22 PM	4:07 PM	9:17 AM	9:40 AM	9:57 AM	10:40 AM	11:10 AM
Trawl_Distance_m	340.5	288.2	433.5	481.4	261.7	509.4	360.5	130.6	134	197
Crew_Recorder	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	M. Silva	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	C. Reyes	M. Silva	M. Silva	M. Silva	M. Silva
Turbidity_NTU	2.12	2.05	1.86	2.27	3.14	2.31	na	na	2.37	2.38
Water_Temp_degC	21.3	21.3	21.4	21.5	21.4	20.1	na	na	20.2	20.7
Conductivity_µS*cm-1	na	na	na	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	8.96	na	na	8.83	8.67
Notes	YSI not able to stabilize DO	No fish caught - trawl may not have sampled on the bottom due to depths over 15'. YSI not able to stabilize DO.	Trawl not on bottom past 15' deep. YSI not able to stabilize DO.	Sucker was too large to weigh with scale. Trawl not on bottom past 15' deep. YSI not able to stabilize DO.	No fish caught. Trawl not on bottom past 15' deep. YSI not able to stabilize DO.	No fish captured - trawl possibly fouled by SAV	50' of lead line out to attempt to capture benthic fishes but minimize SAV fouling.	Lahontan Redside mortality due to processing	na	na

Otter Trawl Events

Site	ML1	ML1	ML2	ML1/ML2	ML1/ML2	ML1/ML2	ML2
Location	T1	T2	T3	T4	T5	T6	T7
Date	10/14/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/16/2019
Start_Depth_ft	36	21.5	na	11.4	15.0	11.0	16.5
End_Depth_ft	na	na	21.5	na	na	14.0	22.5
Start_Time	3:33 PM	8:25 AM	8:51 AM	9:20 AM	9:54 AM	10:18 AM	8:49 AM
End_Time	3:40 PM	8:30 AM	8:54 AM	9:33 AM	10:04 AM	10:29 AM	8:58 AM
Trawl_Distance_m	375.2	143.4	134.2	511	326.5	419	290.9
Crew_Recorder	N. Dunkley	T. Spaulding	K. Berridge	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
Crew_Other1	K. Berridge	K. Berridge	N. Dunkley	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	N. Dunkley	C. Reyes	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Turner	C. Reyes	T. Spaulding	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Turbidity_NTU	na	2.26	2.40	4.06	2.51	3.10	3.42
Water_Temp_degC	na	11.4	11.2	11.3	11.4	11.3	11.2
Conductivity_µS*cm-1	na	97.8	103.0	106.1	102.3	na	100.8
pH	na	8.15	8.37	8.31	8.30	8.30	8.30
DO_percent	na	82.9	84.5	84.7	84.3	85.8	84.0
DO_mg*L-1	na	9.07	9.27	9.27	9.23	9.40	9.22
Notes	End depth not determined; water quality not recorded	na	Depth finder (Lowrance) not working accurately	Net twisted, bad sample	na	na	First test using 100' leader ropes; Vegetation occluded opening - not a good sample; required too much time to clear - fish health impacted

Otter Trawl Fish Catch

Site	Location	Date	Start_Time	Species_code	Total Length (mm)	Weight (g)
ML2	T1	6/19/2019	2:11 PM	Bluegill	97	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	26	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	96	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	114	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	31	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	25	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	124	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	110	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	25	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	103	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	na	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	na	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	na	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	na	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	na	na
ML2	T1	6/19/2019	2:11 PM	Bluegill	na	na
ML2	T1	6/19/2019	2:11 PM	Largemouth Bass	126	na
ML2	T3	6/19/2019	2:52 PM	Largemouth Bass	135	na
ML2	T3	6/19/2019	2:52 PM	Largemouth Bass	159	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	132	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	139	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	34	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	41	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	62	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	52	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	52	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	110	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	123	na
ML2	T4	6/19/2019	3:13 PM	Bluegill	24	na
ML2	T4	6/19/2019	3:13 PM	Black Crappie	159	na

Otter Trawl Fish Catch

Site	Location	Date	Start_Time	Species_code	Total Length (mm)	Weight (g)
ML2	T4	6/19/2019	3:13 PM	Brown Bullhead	190	na
ML2	T4	6/19/2019	3:13 PM	Tahoe Sucker	277	200+
ML1	T2	6/20/2019	9:33 AM	Bluegill	26	na
ML1	T3	6/20/2019	9:54 AM	Lahontan Redside	71	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	57	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	56	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	54	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	135	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	52	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	82	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	80	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	67	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	64	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	na	na
ML1	T3	6/20/2019	9:54 AM	Bluegill	na	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	134	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	99	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	54	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	55	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	138	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	129	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	60	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	110	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	61	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	100	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	na	na
ML1	T4	6/20/2019	10:38 AM	Bluegill	na	na
ML1	T4	6/20/2019	10:38 AM	Spotted Bass	81	na
ML1	T4	6/20/2019	10:38 AM	Lahontan Redside	78	na
ML1	T5	6/20/2019	11:06 AM	Bluegill	148	na

Otter Trawl Fish Catch

Site	Location	Date	Start_Time	Species_code	Total Length (mm)	Weight (g)
ML1	T5	6/20/2019	11:06 AM	Bluegill	121	na
ML1	T5	6/20/2019	11:06 AM	Bluegill	134	na
ML1	T5	6/20/2019	11:06 AM	Bluegill	133	na
ML1	T5	6/20/2019	11:06 AM	Bluegill	114	na
ML1	T5	6/20/2019	11:06 AM	Bluegill	122	na
ML1	T1	10/14/2019	3:33 PM	Bluegill	125	33.7
ML1	T1	10/14/2019	3:33 PM	Bluegill	137	43.2
ML1	T1	10/14/2019	3:33 PM	Bluegill	25	1.0
ML1	T1	10/14/2019	3:33 PM	Bluegill	25	1.0
ML1	T1	10/14/2019	3:33 PM	Bluegill	24	1.0
ML1	T1	10/14/2019	3:33 PM	Bluegill	27	1.0
ML1	T1	10/14/2019	3:33 PM	Bluegill	113	26.2
ML1	T1	10/14/2019	3:33 PM	Bluegill	92	15.3
ML1	T1	10/14/2019	3:33 PM	Bluegill	126	37.5
ML1	T1	10/14/2019	3:33 PM	Bluegill	127	36.3
ML1	T1	10/14/2019	3:33 PM	Bluegill	na	na
ML1	T1	10/14/2019	3:33 PM	Brown Bullhead	200	98.7
ML1	T2	10/15/2019	8:25 AM	Black Crappie	295	475.0
ML1	T2	10/15/2019	8:25 AM	Black Crappie	280	398.0
ML1	T2	10/15/2019	8:25 AM	Black Crappie	185	82.0
ML1	T2	10/15/2019	8:25 AM	Bluegill	103	19.9
ML1	T2	10/15/2019	8:25 AM	Bluegill	115	27.6
ML1	T2	10/15/2019	8:25 AM	Bluegill	122	32.0
ML1	T2	10/15/2019	8:25 AM	Brown Bullhead	170	60.1
ML2	T3	10/15/2019	8:51 AM	Bluegill	96	14.8
ML2	T3	10/15/2019	8:51 AM	Bluegill	129	39.0
ML2	T3	10/15/2019	8:51 AM	Bluegill	24	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	120	30.6
ML2	T3	10/15/2019	8:51 AM	Bluegill	96	15.1
ML2	T3	10/15/2019	8:51 AM	Bluegill	139	45.4

Otter Trawl Fish Catch

Site	Location	Date	Start_Time	Species_code	Total Length (mm)	Weight (g)
ML2	T3	10/15/2019	8:51 AM	Bluegill	93	14.0
ML2	T3	10/15/2019	8:51 AM	Bluegill	20	1.0
ML2	T3	10/15/2019	8:51 AM	Bluegill	22	1.0
ML2	T3	10/15/2019	8:51 AM	Bluegill	23	1.0
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Bluegill	na	na
ML2	T3	10/15/2019	8:51 AM	Largemouth Bass	52	1.8
ML2	T3	10/15/2019	8:51 AM	Largemouth Bass	57	3.5
ML2	T3	10/15/2019	8:51 AM	Brown Bullhead	223	142.5
ML2	T3	10/15/2019	8:51 AM	Brown Bullhead	269	na
ML2	T3	10/15/2019	8:51 AM	Black Crappie	50	2.5
ML1/ML2	T4	10/15/2019	9:20 AM	Black Crappie	235	230.7
ML1/ML2	T4	10/15/2019	9:20 AM	Largemouth Bass	273	298.4
ML1/ML2	T4	10/15/2019	9:20 AM	Bluegill	155	73.0
ML1/ML2	T4	10/15/2019	9:20 AM	Bluegill	118	29.0
ML1/ML2	T5	10/15/2019	9:54 AM	Bluegill	126	30.0
ML1/ML2	T5	10/15/2019	9:54 AM	Bluegill	24	na
ML1/ML2	T5	10/15/2019	9:54 AM	Bluegill	17	na
ML1/ML2	T5	10/15/2019	9:54 AM	Bluegill	18	na
ML1/ML2	T5	10/15/2019	9:54 AM	Bluegill	130	37.6
ML1/ML2	T5	10/15/2019	9:54 AM	Bluegill	21	na
ML1/ML2	T6	10/15/2019	10:18 AM	Bluegill	157	73.1

Otter Trawl Fish Catch

Site	Location	Date	Start_Time	Species_code	Total Length (mm)	Weight (g)
ML1/ML2	T6	10/15/2019	10:18 AM	Bluegill	18	na
ML1/ML2	T6	10/15/2019	10:18 AM	Bluegill	19	na
ML1/ML2	T6	10/15/2019	10:18 AM	Bluegill	149	54.8
ML2	T7	10/16/2019	8:49 AM	Bluegill	93	12.0
ML2	T7	10/16/2019	8:49 AM	Bluegill	44	2.2
ML2	T7	10/16/2019	8:49 AM	Bluegill	95	16.2
ML2	T7	10/16/2019	8:49 AM	Bluegill	104	19.6
ML2	T7	10/16/2019	8:49 AM	Bluegill	24	na
ML2	T7	10/16/2019	8:49 AM	Bluegill	96	na

Minnow Trapping Events

Site	ML1	ML1	ML1	ML1	ML1	ML2	ML2	ML2	ML2	ML2
Location	A	B	C	D	E	A	B	C	D	E
Set_Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019
Set_Time	4:15 PM	4:18 PM	4:22 PM	4:25 PM	4:30 PM	4:12 PM	4:00 PM	3:57 PM	3:54 PM	4:04 PM
Check_Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Check_Time	12:17 PM	12:19 PM	12:23 PM	12:27 PM	12:30 PM	12:13 PM	11:54 AM	11:51 AM	11:48 AM	11:57 AM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Trap_Depth_ft	2.0	4.0	4.0	2.0	5.0	3.0	4.0	4.0	6.0	4.0
Turbidity_NTU	2.64	2.24	1.66	2.11	2.81	1.88	2.07	1.72	2.02	1.9
Water_Temp_degC	20.3	19.9	20.6	20.4	20.0	20.1	20.0	20.1	19.9	20.1
Conductivity_µS*cm-1	na	na	na	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na	na	na	na
DO_mg*L-1	9.72	9.75	8.84	9.71	9.38	9.98	8.85	8.97	8.77	9.11
Notes	No fish	No fish	No fish; 4 signal crawdads	No fish	na	No fish; 1 signal crawdad	No fish; 1 signal crawdad	No fish	No fish	na

Minnow Trapping Events

Site	ML3	ML3	ML3	ML3	ML3	ML4	ML4	ML4	ML4	ML4
Location	A	B	C	D	E	A	B	C	D	E
Set_Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019
Set_Time	3:48 PM	3:41 PM	3:38 PM	3:31 PM	3:26 PM	6:15 PM	6:09 PM	5:55 PM	6:01 PM	5:49 PM
Check_Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019
Check_Time	11:42 AM	11:37 AM	11:34 AM	11:27 AM	11:23 AM	3:15 PM	3:10 PM	2:57 PM	3:01 PM	2:52 PM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Trap_Depth_ft	10.0	1.5	2.0	4.0	2.0	5.0	5.0	1.5	1.5	2.5
Turbidity_NTU	1.91	2.05	3.16	2.8	3.31	4.59	24.2	3.17	2.9	2.49
Water_Temp_degC	20.0	20.4	20.3	21.0	19.9	20.9	20.3	20.6	21.7	21.0
Conductivity_µS*cm-1	na	na	na	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na	na	na	na
DO_mg*L-1	9.03	9.11	8.97	9.03	9.03	8.91	9.36	11.14	9.54	10.14
Notes	No fish	No fish	No fish	No fish	No fish	Rocky, bouldery, substrate; 2 bullfrog tadpoles; No fish	Turbidity high from algae particles in water at sample location	No fish	No fish	No fish

Minnow Trapping Events

Site	ML5	ML5	ML5	ML5	ML5	ML6	ML6	ML6	ML6	ML6
Location	A	B	C	D	E	A	B	C	D	E
Set_Date	6/16/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019	6/16/2019
Set_Time	5:35 PM	5:28 PM	5:24 PM	5:17 PM	5:12 PM	4:35 PM	4:41 PM	4:50 PM	5:00 PM	5:09 PM
Check_Date	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019	6/17/2019
Check_Time	2:35 PM	2:30 PM	2:29 PM	2:21 PM	2:15 PM	1:41 PM	1:47 PM	1:54 PM	2:00 PM	2:05 PM
Crew_Recorder	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	C. Reyes	C. Reyes	M. Silva	M. Silva	M. Silva
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	M. Silva	M. Silva	C. Reyes	C. Reyes	C. Reyes
Trap_Depth_ft	6.0	2.0	2.0	3.0	4.0	3.0	7.5	4.0	2.0	7.0
Turbidity_NTU	2.1	2.67	2.42	2.64	na	3.89	4.62	2.78	2.77	3.22
Water_Temp_degC	20.3	19.9	20.1	20.7	21.3	21.5	21.7	21.6	21.4	21.7
Conductivity_µS*cm-1	na	na	na	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na	na	na	na
DO_mg*L-1	9.89	9.57	9.47	10.51	10.59	9.22	9.85	9.99	10.05	10.38
Notes	Deployed in thick SAV; No fish	No fish	No fish	No fish	No fish	Weather - overcast, winds 5-10 mph, ~73F; No fish	No fish; 2 crawfish captured	No fish	No fish	No fish

Minnow Trapping Events

Site	MRL2	MRL2	MRL2	MRL2	MRL2	MRL1	MRL1	MRL1	MRL1
Location	A	B	C	D	E	A	B	C	D
Set_Date	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019	6/18/2019
Set_Time	2:00 PM	1:50 PM	1:45 PM	1:33 PM	1:13 PM	3:06 PM	2:58 PM	2:55 PM	2:43 PM
Check_Date	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019
Check_Time	1:11 PM	1:06 PM	1:05 PM	1:02 PM	12:58 PM	1:31 PM	1:26 PM	1:25 PM	1:21 PM
Crew_Recorder	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Trap_Depth_ft	4.0	5.0	9.0	9.0	6.5	4.5	3.0	4.0	5.0
Turbidity_NTU	3.46	na	na	na	3.51	2.91	na	na	na
Water_Temp_degC	20.3	na	na	na	21.9	20.9	na	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na	na	na
DO_mg*L-1	na	na	na	na	na	na	na	na	na
Notes	Trap set in vegetation; No fish; YSI not working - no DO	No fish	No fish	No fish	No fish; YSI not working - no DO	No fish; YSI not working - no DO	No fish	Overhanging willows, woody structure in water - increased habitat complexity	na

Site	MRL1	LT2	LT2	LT2	LT2	LT2	LT1	LT1	LT1
Location	E	A	B	C	D	E	A	E	B
Set_Date	6/18/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019	6/19/2019
Set_Time	2:32 PM	9:10 AM	9:24 AM	9:35 AM	9:46 AM	10:00 AM	10:35 AM	10:45 AM	10:54 AM
Check_Date	6/19/2019	6/20/2019	6/20/2019	6/20/2019	6/20/2019	6/20/2019	6/20/2019	6/20/2019	6/20/2019
Check_Time	1:17 PM	11:55 AM	12:00 PM	12:04 PM	12:07 PM	12:11 PM	12:16 PM	12:22 PM	12:28 PM
Crew_Recorder	N. Dunkley	K. Berridge	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other1	K. Berridge	N. Dunkley	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva	M. Silva
Trap_Depth_ft	4.0	1.0	3.0	3.0	4.5	3.0	4.0	3.0	3.0
Turbidity_NTU	2.5	3.08	na	na	na	3.3	2.66	na	na
Water_Temp_degC	20.9	22.8	na	na	na	22.6	23.0	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	na	na	na
pH	na	na	na	na	na	na	na	na	na
DO_percent	na	na	na	na	na	na	na	na	na
DO_mg*L-1	na	8.39	na	na	na	9.13	10.74	na	na
Notes	No fish; YSI not working - no DO	No fish	Trap set in vegetation, next to a log; No fish	No fish	Trap set in lily pads	No fish	No fish	No fish	No fish

Minnow Trapping Events

Site	LT1	LT1	ML4	ML4	ML4	ML4	ML4	ML3	ML3
Location	C	D	E	C	D	B	A	C	B
Set_Date	6/19/2019	6/19/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Set_Time	11:06 AM	11:16 AM	2:05 PM	2:10 PM	2:14 PM	2:21 PM	2:25 PM	2:39 PM	2:43 PM
Check_Date	6/20/2019	6/20/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019
Check_Time	12:31 PM	12:33 PM	11:09 AM	11:16 AM	11:24 AM	11:34 AM	11:46 AM	12:17 PM	12:33 PM
Crew_Recorder	C. Reyes	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	M. Silva	M. Silva	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Trap_Depth_ft	4.0	4.0	3.0	2.0	3.0	4.0	4.0	4.0	3.0
Turbidity_NTU	na	2.61	na	na	na	na	7.90	na	na
Water_Temp_degC	na	23.5	na	na	na	na	10.8	na	na
Conductivity_µS*cm-1	na	na	na	na	na	na	120.7	na	na
pH	na	na	na	na	na	na	7.72	na	na
DO_percent	na	na	na	na	na	na	9.11	na	na
DO_mg*L-1	na	11.15	na	na	na	na	82.2	na	na
Notes	No fish	No fish	No fish	No fish	No fish	No fish	No fish	No fish	No fish

Minnow Trapping Events

Site	ML3	ML3	ML3	ML2	ML2	ML2	ML2	ML2	ML1
Location	D	E	A	D	C	E	B	A	A
Set_Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Set_Time	2:34 PM	2:31 PM	2:47 PM	2:53 PM	2:55 PM	2:59 PM	3:03 PM	3:06 PM	3:08 PM
Check_Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/15/2019
Check_Time	12:08 PM	12:05 PM	12:41 PM	1:36 PM	1:46 PM	1:56 PM	2:00 PM	2:14 PM	2:28 PM
Crew_Recorder	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Trap_Depth_ft	2.0	2.0	5.0	6.0	4.0	3.0	4.0	3.0	3.0
Turbidity_NTU	na	na	3.35	na	na	na	na	3.06	na
Water_Temp_degC	na	na	12.0	na	na	na	na	12.2	na
Conductivity_µS*cm-1	na	na	107.4	na	na	na	na	107.6	na
pH	na	na	7.80	na	na	na	na	8.34	na
DO_percent	na	na	8.72	na	na	na	na	9.49	na
DO_mg*L-1	na	na	80.5	na	na	na	na	88.6	na
Notes	No fish	No fish	No fish	No fish	No fish	No fish; One crayfish	No fish; One crayfish	No fish	No fish

Minnow Trapping Events

Site	ML1	ML1	ML1	ML1	ML6	ML6	ML6	ML6	ML6
Location	B	C	D	E	A	B	C	D	E
Set_Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019
Set_Time	3:10 PM	3:12 PM	3:14 PM	3:17 PM	2:22 PM	2:27 PM	2:35 PM	2:39 PM	2:44 PM
Check_Date	10/15/2019	10/15/2019	10/15/2019	10/15/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Check_Time	2:31 PM	2:41 PM	2:46 PM	2:57 PM	11:15 AM	11:24 AM	11:35 AM	11:39 AM	11:53 AM
Crew_Recorder	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Turner	C. Turner	C. Turner	C. Turner	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Trap_Depth_ft	2.5	4.0	6.0	5.0	6.0	4.0	3.5	3.5	6.0
Turbidity_NTU	na	na	na	3.37	na	na	na	na	7.61
Water_Temp_degC	na	na	na	12.6	na	na	na	na	11.7
Conductivity_µS*cm-1	na	na	na	106.9	na	na	na	na	139.0
pH	na	na	na	8.41	na	na	na	na	7.95
DO_percent	na	na	na	9.37	na	na	na	na	8.52
DO_mg*L-1	na	na	na	88.2	na	na	na	na	78.5
Notes	No fish	No fish	No fish	No fish	No fish	Set under dok walkway; No fish; One crayfish	No fish	No fish	No fish

Minnow Trapping Events

Site	ML5	ML5	ML5	ML5	ML5	MRL1	MRL1	MRL1	MRL1	MRL1
Location	A	B	C	D	E	A	B	C	D	E
Set_Date	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019
Set_Time	3:10 PM	3:05 PM	3:02 PM	2:57 PM	2:52 PM	1:54 PM	1:51 PM	1:48 PM	1:45 PM	1:38 PM
Check_Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Check_Time	12:44 PM	12:36 PM	12:32 PM	12:20 PM	12:07 PM	10:21 AM	10:17 AM	10:12 AM	10:05 AM	9:55 AM
Crew_Recorder	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Trap_Depth_ft	10.0	5.0	4.5	3.0	7.0	2.5	2.5	2.5	3.0	6.5
Turbidity_NTU	3.60	na	na	na	na	2.95	na	na	na	na
Water_Temp_degC	11.7	na	na	na	na	10.7	na	na	na	na
Conductivity_µS*cm-1	113.3	na	na	na	na	94.6	na	na	na	na
pH	8.77	na	na	na	na	8.62	na	na	na	na
DO_percent	9.85	na	na	na	na	9.27	na	na	na	na
DO_mg*L-1	90.4	na	na	na	na	83.1	na	na	na	na
Notes	No fish	No fish; One crayfish	No fish; One crayfish	No fish; One crayfish	No fish	No fish	No fish; One crayfish	No fish; One crayfish	No fish	No fish

Minnow Trapping Events

Site	MRL2	MRL2	MRL2	MRL2	MRL2	LT2	LT2	LT2	LT2
Location	A	B	C	D	E	A	B	C	D
Set_Date	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/13/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019
Set_Time	1:32 PM	1:27 PM	1:24 PM	1:20 PM	1:13 PM	10:43 AM	10:50 AM	11:00 AM	11:11 AM
Check_Date	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/17/2019	10/17/2019	10/17/2019	10/17/2019
Check_Time	9:29 AM	9:18 AM	9:12 AM	9:05 AM	8:58 AM	8:33 AM	8:35 AM	8:38 AM	8:40 AM
Crew_Recorder	C. Turner	C. Turner	C. Turner	C. Turner	C. Turner	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
Trap_Depth_ft	7.0	8.0	8.0	7.0	8.0	8.0	6.0	4.0	2.0
Turbidity_NTU	2.34	na	na	na	na	na	na	na	na
Water_Temp_degC	11.2	na	na	na	na	na	na	na	na
Conductivity_µS*cm-1	99.34	na	na	na	na	na	na	na	na
pH	7.31	na	na	na	na	na	na	na	na
DO_percent	8.52	na	na	na	na	na	na	na	na
DO_mg*L-1	77.6	na	na	na	na	na	na	na	na
Notes	No fish	No fish	No fish	No fish	No fish	No fish	No fish	No fish	No fish

Minnow Trapping Events

Site	LT2	LT1	LT1	LT1	LT1	LT1
Location	E	D	A	E	B	C
Set_Date	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019	10/16/2019
Set_Time	11:21 AM	11:28 AM	11:50 AM	12:07 PM	12:14 PM	12:22 PM
Check_Date	10/17/2019	10/17/2019	10/17/2019	10/17/2019	10/17/2019	10/17/2019
Check_Time	8:42 AM	8:53 AM	8:44 AM	8:47 AM	8:49 AM	8:51 AM
Crew_Recorder	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge	K. Berridge
Crew_Other1	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley	N. Dunkley
Crew_Other2	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes	C. Reyes
Crew_Other3	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding	T. Spaulding
Trap_Depth_ft	2.0	2.0	3.0	2.0	1.0	2.0
Turbidity_NTU	4.12	3.51	na	na	na	na
Water_Temp_degC	10.1	10.6	na	na	na	na
Conductivity_µS*cm-1	297	294	na	na	na	na
pH	7.27	8.18	na	na	na	na
DO_percent	7.67	10.79	na	na	na	na
DO_mg*L-1	68.0	97.0	na	na	na	na
Notes	No fish	No fish	No fish; two bullfrog tadpoles	Location change - original site inaccessible due to vegetation; No fish	No fish	No fish

Minnow Trap Catch

Site	Location	Set Date	Species Code	Total Length (mm)	Weight (g)
ML1	E	6/17/2019	Bluegill	92	11.5
ML2	E	6/17/2019	Bluegill	60	3.0
ML4	B	6/16/2019	Bluegill	69	na
MRL1	D	6/18/2019	Bluegill	56	na
LT2	D	6/19/2019	Bluegill	52	na
LT2	D	6/19/2019	Bluegill	59	na

Appendix H

Public Communication and Engagement Plan for Draft EIR/EIS Review

Communication + Engagement Plan
Tahoe Keys AIS
2020 Milestones

DATE	SPRING 2020 MEETINGS + ACTIVITIES	OBJECTIVE
MARCH 3	**SC Workshop**	Review and update project FAQ + Communication Plan Data Collection + Nutrient Cycling Workshop
MARCH 4	**SCC Workshop** • **Record presentations**	Data Collection + Nutrient Cycling Workshop
MARCH 18	**Administrative Draft EIS/EIR**	Lead Agency review
MARCH 25	**TRPA Board Meeting**	AIS Program update
APRIL 7	**Lead Agency + TKPOA Working Session**	Review DEIS/DEIR with project proponent
MAY 5	**SC Meeting?**	Prepare for DEIS/DEIR posting and public comment period
DATE	**SUMMER 2020 MEETINGS + ACTIVITIES**	**OBJECTIVE**
JUNE 2	**SC Meeting**	Prepare for DEIS/DEIR posting and public comment period
JUNE 15-22	**DEIS/DEIR Notice of Availability** • **60+ day public comment period**	Notify public with official posting **Newsletter + social media + website**
JUNE 24	**TRPA Board Meeting**	Information update
JULY 7	**SC Meeting**	DEIS/DEIR presentation, collect SC comments
JULY 8 AM	**TRPA Advisory Planning Commission Meeting**	Information update
JULY 8 PM	**SCC Meeting** o **Record presentations**	DEIS/DEIR presentation, collect SCC comments
JULY 9	**Public Workshop South Lake Tahoe**	DEIS/DEIR presentation, collect public comments
JULY 7-11	**Placeholder: Keys Field Trips**	Inform stakeholders, show the problem
JULY 22	**TRPA Board Meeting**	Public hearing
JULY 23-30	**Media Event with Keys Field Trips?**	Inform stakeholders, show the problem
AUGUST 4	**SC Meeting**	DEIS/DEIR review (as needed)
AUGUST 5	**Public Workshop North Lake Tahoe**	
AUGUST 4-8	**Placeholder: Keys Field Trips**	Inform stakeholders, show the problem
AUGUST 25ish	**Tahoe Summit – Field Trips for Elected Officials/Staffers**	Inform stakeholders, show the problem
AUGUST 20-28	**End of public comment period**	
DATE	**FALL 2020 MEETINGS + ACTIVITIES**	**OBJECTIVE**
SEPTEMBER 8-30	**Placeholder: Keys Field Trips**	Inform stakeholders, show the problem
SEPTEMBER 16-17	**Lahontan Board Meeting in South Lake Tahoe**	Information update

SEPTEMBER 20-28	**Lead Agency response to public comments DRAFT**	Draft response to public comments for review
OCTOBER 6	**SC Meeting**	Review public comments and draft responses
OCTOBER 14	**TRPA Advisory Planning Commission Meeting**	Information Item
OCT 28 or NOV 18	**TRPA Board Meeting**	Information Item
OCTOBER 30	**Lead Agencies Post Response to Public Comments on DEIS/DEIR**	**Newsletter + social media + website**
DATE	**WINTER 2020-2021 MEETINGS + ACTIVITIES**	**OBJECTIVE**
DECEMBER 1	**Lahontan posts Draft NPDES Permit + Basin Plan Exemption Resolution** o **30-60 day public comment period**	**Newsletter + social media + website**
DEC - JAN	**SC Meeting**	Review FEIS/FEIR and next steps
MID-JANUARY	**Lahontan posts Notice of Adoption Hearing date for CMT based on FEIS/FEIR**	**Newsletter + social media + website**
FEBRUARY XX	**Lahontan Board Meeting**	Action on Project Application
FEBRUARY 24	**TRPA Board Meeting**	Action on Project Application
MARCH 2021	**SC Meeting**	Review FEIS/FEIR and next steps
MARCH 2021	**SCC Meeting**	Review FEIS/FEIR and next steps **Newsletter + social media + website**

2020 Meetings + Activities by Type

LEAD AGENCY + BOARD MEETINGS + ACTIVITIES

MARCH 18 Administrative Draft available for Lead Agency review

MARCH 25 TRPA Board Meeting Brief Update

APRIL 7 Lead Agency + TKPOA meet to review Administrative Draft

JUNE 15 - 22 DEIS/DEIR Notice of Availability posted

o 60+ day public comment period begins

JUNE 24 TRPA Board Meeting - Information item

JULY 8 AM TRPA Advisory Planning Commission Meeting

JULY 22 TRPA Board Meeting - Public hearing

SEPTEMBER 16 - 17 Lahontan Board Meeting in South Lake Tahoe

SEPTEMBER 20 - 28 Lead Agency response to public comments DRAFT

OCTOBER 14 TRPA Advisory Planning Commission Meeting

OCTOBER 28 TRPA Board Meeting

OCTOBER 30 Lead Agencies Post Response to Public Comments on DEIS/DEIR

DECEMBER 1 Lahontan posts Draft NPDES Permit + Basin Plan Exemption Resolution

o 30-60 day public comment period begins

MID-JANUARY Lahontan posts Notice of Adoption Hearing date for CMT based on FEIS/FEIR

FEBRUARY XX Lahontan Board Meeting - Action on Project Application
FEBRUARY 24 TRPA Board Meeting - Action on Project Application

STAKEHOLDER COMMITTEE (SC) MEETINGS + ACTIVITIES

MARCH 3 SC Workshop + Communication Plan + Project FAQ
MAY 5 Prepare for release of DEIS/DEIR and public comment period (if needed)
JUNE 2 Prepare for release of DEIS/DEIR and public comment period
JULY 7 Discuss DEIS/DEIR and SC comments
AUGUST 4 Discuss DEIS/DEIR and SC comments (if needed)
OCTOBER 6 Review public comments and Lead Agencies' response
DECEMBER 1 - JANUARY 2021 Review FEIS/FEIR and discuss next steps
MARCH 2021 Review Lead Agencies' decision and determine next steps

STAKEHOLDER CONSULTATION CIRCLE (SCC) MEETINGS + ACTIVITIES

MARCH 4 Workshop
JULY 8 Discuss DEIS/DEIR and SCC comments
MARCH 2021 Review Lead Agencies' decision and next steps

PUBLIC WORKSHOPS

JULY 9 Public Meeting South Lake Tahoe
JULY 22 TRPA Board Meeting with Public Hearing
AUGUST 5 Public Meeting North Lake Tahoe

FIELD TRIPS

Work with TKPOA to determine best schedule for field trips and how many are possible

JULY 7-11 Placeholder for Keys Field Trips
JULY 23-30 Possible Media Event in Keys with Field Trips
AUGUST 4-8 Placeholder for Keys Field Trips
AUGUST 25 Tentative Field Trips for Tahoe Summit elected officials/staffers
SEPTEMBER 8-30 Field Trips for SC + SCC Boards and others

OUTREACH: NEWS + WEBSITE+ SOCIAL MEDIA

Newsletter + Social Media

MARCH Notice of availability Workshop recording on website
JUNE 15 - 22 Notice of Availability DEIS/DEIR
JUNE 15-22 Save the dates for public meetings and fieldtrips
JULY Notice of availability of DEIS/DEIR presentations recording on website
OCTOBER 30 Notice of Lead Agency response to public comments on DEIS/DEIR
FEBRUARY 2021 Notice of Lead Agency decision on FEIS/FEIR

Website

- Website updates: Weed Control Methods + Project
    - Date of sea bin installation
    - Installation of bubble curtain in the east lagoon
    - Current small-scale tests for LFA + UVC in the Keys
- Video recordings for website
    - **MARCH** Workshop
    - **JULY** SCC Workshop
    - others?
- Project FAQ
    - Post to website
    - SC distribute via newsletters + social media posts
    - Add to after DEIS/DEIS comment period
    - Add to after Lead Agencies' determination
- Website updates: Events
    - **JUNE** TRPA + Lahontan 2020 board meeting dates
    - **JUNE** Public meetings during DEIR/DEIS comment period
    - **OCTOBER** Notice of Lead Agency response to public comments on DEIS/DEIR
    - **FEBRUARY 2021** Lead Agency decision on FEIR/FEIS

Tahoe Keys Weeds
Public Engagement Contingency Plan
Summer 2020

Days 0-60 Comment Period	Activities	Topics	Format	Notes
0	**Draft EIR/EIS released**	Proposed project	Multi-format distribution	
0-60	Survey and comment collection	All comments and questions collected and catalogued	Website/email submissions Online survey applications	Runs throughout comment period Optional: targeted surveys about proposed project
0-7	**Workshop 1- DEIS Overview** Concurrently: **SCC meeting**	Overview of the analysis and proposed project	2.5 hour teleconference	*Workshop also serves as SCC meeting Optional: hold separate, shorter SCC session in afternoon
7-14	Morning: **Workshop 2- Large Scale Treatment** Afternoon: **Workshop 3 Long Term Management** (same day)	Detailed review of analysis of Large Scale treatment options, potential impacts and efficacy Detailed review of Long Term Management methods	90 minute teleconference 90 minute teleconference	For each session: 45 minute detailed walkthrough of the analysis and comparison of alternatives 45 Q+A

14-21	**Workshop 4- Policy and Guidance**	Proposed project in light of: - Anti-degradation regulation and guidance - TRPA regulation, guidance, programs and environmental doc. requirements	90 minute teleconference	
21-60	**Small group calls or meetings**	Customized check-ins with key partners and stakeholders: - Tahoe Fund - Marina - Sierra Club+ - Water Suppliers - League Board - **LWB Board?*	In person, online or phone call 30-60 minutes	Structure teams of 4 project staff: - 1 TRPA - 1 LWB - 1 Tech team - 1 Facilitator
45-55	**Steering Committee Meeting**	Review of Public Comments to date Comments and Questions regarding DEIR/DEIS	Online or in person	
50-60	**Board Hearings**	TRPA Board Hearing Lahontan Board Hearing	Online or in person	3-4 hour session.
September	**Field Trips**	TBD		