FINAL
Environmental Impact Report /
Environmental Impact Statement

Appendix C
Draft EIR/EIS July 6, 2020

Tahoe Keys Lagoons Aquatic Weed Control Methods Test

Lead Agencies:
Tahoe Regional Planning Agency and Lahontan Regional Water Quality Control Board

JANUARY 2022

DRAFT
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EXECUTIVE SUMMARY

Project Background

The spread of aquatic invasive species (AIS) is threatening Lake Tahoe's ecosystem, water quality, iconic clarity, and $5 billion recreation-based economy. Public and private partners have joined together over the last decade to control the spread of aquatic invasive weeds by engaging scientists, prioritizing control areas, deploying weed removal techniques, and testing new control technologies. Natural resource managers are treating between 10-20 acres of weeds a year to eradicate isolated populations and bring larger infestations under control.

The biggest factor in the fight against aquatic weeds in Lake Tahoe is the Tahoe Keys, a residential development directly connected to the lake through lagoons and channels. Lake Tahoe scientists and natural resource managers have ranked the Tahoe Keys lagoons as the top priority location for weed control. The size of the area's infestation and its high recreational use by boaters pose a substantial risk of spreading weed fragments to other areas of the lake and spurring new infestations. Despite the concerted efforts by the Tahoe Keys Property Owners Association (TKPOA) to control the infestation, the population of weeds and its risk to Lake Tahoe continue to grow.

The Tahoe Keys weed infestation presents a unique set of challenges to solve. First, the infestation inhabits 172 acres of waterways. The sheer size of this infestation doesn't allow for an expedient or easy solution. Second, the infestation is largely on private property and is a major recreational access point to Lake Tahoe for the boating public. Lastly, solving the weed issue garners major interest from stakeholders regionwide. It is true that this weed infestation is not just a Tahoe Keys problem, it is a lake-wide problem.

When TKPOA applied to the Lahontan Regional Water Quality Control Board (LWB) and the Tahoe Regional Planning Agency (TRPA) to utilize aquatic herbicides as a treatment method – a method that has never been utilized in Lake Tahoe before – it triggered the TRPA and LWB to do two things: 1) initiate as lead agencies a comprehensive environmental analysis of the potential environmental impacts of this proposal, and 2) initiate a broad stakeholder engagement process to ensure all interests were considered in developing a proposed project and the environmental analysis.

What resulted from this stakeholder process was the proposal to conduct a **test** of a variety of control methods, both herbicidal and non-herbicidal, in the Tahoe Keys. This testing program would allow TKPOA and resource managers to study, analyze, and compare a variety of options prior to developing, evaluating, and implementing a future large-scale aquatic weeds control project in the Tahoe Keys.

This document provides the analysis of the potential environmental effects of conducting this test program (as well as two action alternatives and a no action alternative). This document does not provide a recommendation, but rather provides the environmental analysis of an array of alternatives as a tool to aid the public and lead agencies in the decision-making process. If a Control Methods Test (CMT) is approved, data from this test will inform the development of a long-term weed control strategy for the Tahoe Keys, and another environmental analysis will be needed to analyze the environmental effects of such a full-scale treatment project.

ES.1 PROJECT LOCATION AND SETTING

Lake Tahoe is a unique alpine lake located in California and Nevada. Known worldwide for its outstanding recreational value and famous for the clarity and purity of its transparent blue waters, Lake Tahoe has been designated an Outstanding National Resource Water (ONRW) by the State of California and the USEPA.

The Tahoe Keys, a multi-use development situated at the southern end of Lake Tahoe, was constructed in the 1960s on the Upper Truckee River Marsh. The development includes 1,529 homes and townhomes sited on artificially constructed lagoons that afford boating access to the Lake. The Tahoe Keys lagoons connect to Lake Tahoe via two narrow, direct channels: The West Channel which connects the West Lagoon; and the East Channel, which connects the East Lagoon. Lake Tallac borders the Tahoe Keys to the south and is separated from the West Lagoon by a weir and gate structure. A second weir gate connects Lake Tallac to Pope Marsh; seasonal water exchange between Lake Tallac and Pope Marsh occurs in most years, but neither are directly connected to Lake Tahoe.

The Tahoe Keys lagoons are much shallower than Lake Tahoe and tend to be much warmer during spring and summer (and much cooler at times during the fall and winter months). The waters of the Tahoe Keys lagoons are typically more turbid than Lake Tahoe and the substrate of the lagoons is covered with fine organic sediments originating from the original marsh, supplemented by decades of aquatic weed decomposition.

The Tahoe Keys Property Owners Association (TKPOA) is responsible for maintaining the common areas of the development as well as navigation in the portions of the waterways of the Tahoe Keys lagoons it manages.

Lake Tahoe, including the Tahoe Keys, are considered “Waters of United States” and therefore under the jurisdiction of the U.S. Army Corps of Engineers (USACE). USACE jurisdiction over these waters brings with it the designation of Lake Tahoe and the Tahoe Keys as Tier 3 waters (or Outstanding Natural Resource Waters (ONRW). The areas west and south of the development are under the jurisdiction of the U.S. Forest Service.

ES.1.1 HISTORY OF AQUATIC WEEDS INFESTATION IN TAHOE KEYS LAGOONS

The abundant growth of non-native and undesired native aquatic plants (“aquatic weeds”) in the Tahoe Keys Lagoons has caused several adverse effects to cold water ecosystems, impaired navigation, created potential health and safety risks, impaired fishing and aesthetic quality, and led to increased predation of native fish species by invasive fish species, as summarized in the Findings of the Lahontan Regional Water Quality Control Board (Lahontan Water Board or LWB) in the Tahoe Keys waste discharge requirements (WDRs) (Lahontan Water Board Order No. R6T-2014-0059). Water quality effects have included changes in pH, dissolved oxygen, water column nutrient concentrations and temperature. The accumulation of nutrient-rich organic sediment in the lagoons as a result of aquatic weed growth and die-off contributes to elevated water column nutrients and can contribute to the occurrence of harmful algal blooms (HAB), which can lead to the presence of cyanotoxins. The extensive boat traffic entering and leaving the lagoons, coupled with the dense infestation of aquatic weeds, makes the Tahoe Keys a primary source for plant fragment dispersal to areas outside of the lagoons that can result in new infestations around the lake.

Invasive aquatic plants were first reported in the Tahoe Keys lagoons in the 1980s (TKPOA 2015), though they were likely present as far back as the 1960s or 1970s (Loeb and Hackley 1988; Anderson and Spencer 1996). Seasonal harvesting has been the main aquatic weed control practice employed by TKPOA since the mid-1980s. However, nearly two decades of mechanical harvesting has not limited the spread of aquatic weeds in the Tahoe Keys lagoons, and in fact the volume of aquatic weeds harvested from the lagoons has increased 100-fold since 1984, to a total of 10,125 cubic yards in 2016. In recent years, up to 90% of the available wetted surface in the lagoons has been infested with aquatic weeds, with the primary species of concern being Eurasian watermilfoil, coontail, and curlyleaf pondweed.

ES.1.2 TKPOA Response To Infestation

In response to the growing infestation of target aquatic weeds in the Tahoe Keys and to limit non-point sources of pollution, the Water Board issued Waste Discharge Requirements (WDRs) to TKPOA on July 14, 2014. As part of these requirements, TKPOA was tasked with developing a Non-Point Source Water Quality Management Plan (NPS Plan), and an Integrated Management Plan (IMP) to address target aquatic plant species management. Both plans are being implemented and a variety of non-herbicidal control methods have been utilized. However, due to the size, density and dominance of the infestation in the Tahoe Keys lagoons, these control methods have produced limited results. In addition, these current control methods also produce large quantities of weed fragments, which risk the further spread of aquatic weed infestations throughout the shallow nearshore waters of Lake Tahoe.

After many years of attempting to control and contain the weeds in the Tahoe Keys, TKPOA expressed interest in learning more about the potential to use aquatic herbicides. However, only non-herbicidal control methods are currently approved for use by the lead agencies. The use of herbicides to control aquatic weeds requires an exemption from the Lahontan Region (Basin Plan) prohibition on the use of herbicides in the ONRW of Lake Tahoe.

In 2017 TKPOA submitted an Exemption Application to the Lahontan Water Board seeking an exemption to the Basin Plan prohibition on the use of herbicides that would allow a test of herbicides to control aquatic weeds in the Tahoe Keys. Concurrently, an application was submitted to the Tahoe Regional Planning Agency for a project permit to authorize the test (Environmental Improvement Program (EIP) permit). These applications were withdrawn and amended applications were resubmitted in July 2018 once it was determined that higher level of environmental documentation would be required to evaluate the potential environmental effects of the proposed project.

The TKPOA exemption application was evaluated in an Initial Study (IS) prepared on behalf of the LWB pursuant to California Environmental Quality Act (CEQA) and an Initial Environmental Checklist (IEC) prepared on behalf of TRPA. The IEC/IS, issued in early 2018, determined that the test could result in potentially significant environmental effects and that insufficient information existed to evaluate some potentially significant effects. On that basis, TKPOA resubmitted an amended application and the Lahontan Water Board and TRPA subsequently initiated development of this DEIR/DEIS.

DEVELOPMENT OF THE PROPOSED PROJECT

In 2018, the lead agencies convened a Stakeholder Committee (SC) to work together with TKPOA to inform the development of a proposed project for treating the aquatic weed infestation in the Tahoe Keys. It became clear through their discussions that developing a long-term plan to treat this major weed population would be very challenging without having more data regarding the efficacy, effects, advantages or challenges of alternative treatment methods.

One thing Lake Tahoe AIS managers have learned over the last decade is that no weed infestation has been eradicated using only one treatment method. Stakeholders agreed that they wanted to see a variety of methods included in the DEIS/DEIR that would provide important information on which methods to ultimately incorporate in a test program on the ground. Stakeholder discussions resulted in TKPOA reshaping the Proposed Project as a Control Methods Test (CMT). The primary objective of the CMT is to determine which combination of treatment methods is most effective in controlling aquatic weeds within the Tahoe Keys lagoons.

AREAS OF CONTROVERSY

This broad stakeholder engagement process was instrumental in bringing different viewpoints to inform the project design and environmental analysis. It is without doubt that evaluating the use of aquatic herbicides for the first time in Lake Tahoe will be controversial. Some stakeholders believe using aquatic herbicide is the only way to confront a weed infestation of this magnitude, to avoid suffering further short and long term significant environmental consequences. Others strongly oppose the use of any chemical form of treatment that may pose environmental or health risks to the communities of Lake Tahoe. Based on stakeholder feedback, it is anticipated that the following topics may be areas of controversy:

- Potential environmental and health effects of using aquatic herbicides
- The need to act quickly on the environmental threat of the spread of aquatic weeds
- Maintaining beneficial uses of the Tahoe Keys

ES.2 OVERVIEW OF EIR/EIS PROCESS

TRPA and the LWB are the Lead Agencies for this DEIR/DEIS. In 2019, the lead agencies hired a consulting team to prepare the DEIS/DEIR which included an intensive baseline study of the project area, collecting over 1.5 million data points on the existing environmental conditions of the Tahoe Keys lagoons. The lead agencies also engaged geotechnical experts, aquatic invasive species control experts, leaders in new experimental AIS control technology and scientists to inform proposed project components. The team conducted extensive literature review and technical review of potential environmental issues and their potential effects. This DEIR/DEIS contains the analysis and findings for public review.

The purpose of this DEIR/DEIS is neither to recommend approval or denial of the project, but to disclose objective information and analysis addressing potential environmental impacts in evaluating the proposed project and a range of reasonable alternatives.

Prior to approving a project, the Lahontan Water Board must certify that the final DEIR/DEIS has been completed in compliance with CEQA, that it has reviewed and considered the information in the Final DEIR/DEIS, and that the Final DEIR/DEIS reflects its independent judgment and analysis. Once the Lahontan Water Board approves a project, it will file a Notice of Determination (NOD) with the State Clearinghouse.

TRPA is the primary permitting agency and the Lead Agency under the Tahoe Regional Planning Compact. Under the Compact and under TRPA's Code of Ordinances and Rules of Procedure, a TRPA EIS is an informational document used in the planning and decision-making process for a proposed project.

This DEIR/DEIS is being distributed to interested agencies, stakeholder organizations, and individuals to ensure that interested parties have an opportunity to express their views regarding the environmental effects of the Proposed Project and alternatives, and to ensure that information pertinent to permits and approvals is provided to decision makers for the Lead and Responsible Agencies.

The Lead Agencies will respond to each significant impact identified in the EIR/EIS. If significant adverse environmental impacts are identified or if regional thresholds established by TRPA are affected, the required written findings will show that changes or alterations have been required in or incorporated into the project that mitigate or avoid the significant environmental effects to the extent possible, or that mitigating action will be taken by another agency, or that specific economic, social or other considerations make further mitigation infeasible.

Mitigation measures that are made a condition of the approval of the project will be addressed in an adopted mitigation monitoring plan. The Lead Agencies will balance all benefits against environmental risks when determining whether to approve the Proposed Project. If the project will likely result in significant and unavoidable impacts, a Statement of Overriding Considerations will be prepared, or the project will be modified to avoid the effect.

ES.3 SUMMARY OF PROPOSED PROJECT & ALTERNATIVES

Chapter 2 presents a full description of the Proposed Project, the Action Alternatives, and the No Action Alternative. The process of alternatives development and selection is described in Chapter 2.2. The Proposed Project is described in Chapter 2.3; Action Alternative 1 is described in Chapter 2.4; Action Alternative 2 is described in Chapter 2.5; and the No Action Alternative is described in Chapter 2.6. Alternatives eliminated from consideration are presented in Chapter 2.7.

ES.3.1 PURPOSE AND NEED AND PROJECT OBJECTIVES

The purpose of the Proposed Project is to test methods to control the spread of non-native aquatic weeds that have compromised water quality and degraded a wide variety of beneficial uses of the Tahoe Keys lagoons and threaten the natural conditions and human use of Lake Tahoe. LWB needs to act on the Exemption Application and TRPA on the EIP Permit Application submitted as a joint application by TKPOA in 2018.

The goal of the Proposed Project is to test a range of large-scale and localized aquatic weed control methods suitable for management of target aquatic weeds, to determine what combination of methods within the test areas will:

- Reduce target aquatic weed infestations as much and as soon as feasible.
- Bring target aquatic weed infestations to a level that can be managed over the long term with localized non-herbicidal treatment methods.
- Improve the water quality of the Tahoe Keys lagoons and reestablish native aquatic habitat.
- Improve navigation and enhance recreational benefits and aesthetic values.

- Reduce the potential for target aquatic weed re-infestation after initial treatment.

ES.3.2 Proposed Project: Aquatic Weeds Control Methods Test (CMT)

The Proposed Project consists of a program to test alternative aquatic weed control methods, both as stand-alone treatments and in combination. Some methods were considered as full alternatives and others were applied in support of these alternatives. Control test methods were grouped as follows:

- **Group A methods** are herbicide and non-herbicide treatments to achieve extensive reduction in target aquatic weeds (targeting at least 75 percent reduction) within test sites. The Proposed Project tests stand-alone treatments using EPA and State of California approved aquatic herbicides, ultraviolet light, and laminar flow aeration [LFA], as well as combined herbicide and ultraviolet light treatments. Group A herbicide methods would be tested only in the initial year of the test project. Non-herbicide Group A treatments (i.e., ultraviolet light [ultraviolet-C], see Section 2.3.3 below; and LFA, see Section 2.3.4 below) may be extended to additional years if monitoring indicates further treatment may be useful. For example, ultraviolet light may be repeated for a second year, while LFA testing is planned to extend over several years. Figure 2-2 shows the initial proposed test periods for each treatment. In addition, ultraviolet light could be employed as a follow-up "Group B" method for spot treatments.
- **Group B methods** are non-herbicide maintenance treatments that are applied locally to follow up Group A treatments and control residual target aquatic weeds. Group B methods are intended to be long-term, sustainable control methods capable of maintaining aquatic weed control after initial Group A treatments have been applied to "knock down" the abundant target aquatic weeds in the Lagoons. For example, following a Group A herbicide treatment that achieves at least a 75% reduction in targeted aquatic weeds, Group B methods would be used to further control aquatic weeds and in no case would repeated use of herbicides be permitted as part of the project. Group B methods may include such actions as spot treatments with ultraviolet light, bottom barriers, diver-assisted suction and diver hand pulling techniques. Use of Group B methods would be implemented in years 2-3, following Group A methods in year 1. Group B methods to be used would be informed by the decision tree shown in Figure 2-3.

In addition to Group A and B methods, **protective measures** have been selected and incorporated into the CMT alternatives, as described in Section 2.3.7. Protective measures are prescribed to contain and accelerate the degradation of aquatic herbicide applications, improve water circulation, control nutrient availability, enhance water quality (e.g., dissolved oxygen, pH, nutrient concentrations), and reduce the occurrence of harmful algal blooms (HABs). Additional mitigation measures are identified through the environmental evaluations described in Chapter 3, including those that may be implemented as needed, based on monitoring results.

ES.3.3 Action Alternative 1: Testing Of Non-Herbicide Methods Only

Action Alternative 1 would proceed only with tests of non-herbicide methods of aquatic weed control. Under this alternative, no treatments with herbicides would be conducted, and other elements of the test program (i.e., ultraviolet light, LFA, and Group B methods) would be as described above for the Proposed Project. This alternative was identified as the environmentally superior alternative (Section 5.7).

ES.3.4 Action Alternative 2: Dredge and Replace Substrate

Action Alternative 2 responds to comments received during public scoping and would consist of hydraulic dredging (i.e., wet excavation or suction dredging) of the bottom layers of organic material and sediment to remove the roots and turions of aquatic weeds at three test sites in the Tahoe Keys lagoons, followed by placement of a new layer of bottom sediment (e.g., coarse sand or gravel).

ES.3.5 No Action Alternative: Existing Treatment/Control Continues

The No Action Alternative considers the long-term consequences to the Tahoe Keys lagoons and Lake Tahoe of undertaking no new weed control activities in the Tahoe Keys lagoons. Under this alternative only current control methods would be employed by TKPOA and individual property owners (e.g., voluntary use of bottom barriers, the existing LFA project, mechanical harvesting, and weed fragment control). Because herbicide and ultraviolet light applications would not be tested under this alternative, it is assumed that these methods for target aquatic weed control would not be used in the foreseeable future under a No Action Alternative.

ES.4 KEY ENVIRONMENTAL IMPACTS, MITIGATION MEASURES, ISSUES TO BE RESOLVED, AND AREAS OF CONTROVERSY

ES.4.1 Issues To Be Resolved And Areas Of Controversy

This DEIR/DEIS is a full-scope environmental document that evaluates a broad range of potential environmental impacts at a comparable level of detail for all four alternatives. The analysis identifies and addresses key environmental issues (listed in Chapter 3.1) where significant or potentially significant effects on the environment could occur. Where significant or potentially significant impacts have been identified, the document describes feasible mitigation measures. The summary of impacts and mitigation measures for the alternatives addressed in the DEIR/DEIS is presented in Table ES-1 (provided at the end of this section), and in Chapter 5, Table 5-1.

CEQA requires a statement of issues to be resolved and areas of controversy. The following issues were identified as of particular interest in scoping and through agency consultation, stakeholder involvement and public outreach. These are key issues for which controversy may arise or that will require resolution during the selection of an alternative:

- The need for long-term aquatic weeds control and the prevention of further dispersal of fragments into Lake Tahoe, especially under the No Action Alternative.
- The use of herbicides in the waters of Lake Tahoe and the Tahoe Keys, including a test of aquatic herbicide for comparison to other aquatic weed treatment options.
- A desire to test non-herbicidal treatments to control aquatic weeds (addressed in Action Alternative 1).
- A desire to test modifications to the Tahoe Keys lagoons as a means to control aquatic weeds (addressed in Action Alternative 2).
- The long-term costs of aquatic weeds management, and of inaction to control weeds.
- The potential for harmful algal blooms (HABs) to occur, resulting in the presence of cyanotoxins.
- The need to preserve and improve water quality and protect the aquatic biology and ecology of Lake Tahoe and the Tahoe Keys.

- The need for a full and complete antidegradation analysis to address all potential effects of herbicides.
- Effects of aquatic weeds on recreational boating.
- The need to meet regulatory requirements in permitting tests of aquatic weeds control methods.
- A desire to assure review by qualified, independent experts
- The need to avoid any potential impact on drinking water quality or the brand of water purveyors sourcing Lake Tahoe water.

ES.4.2 Comparison of Proposed Project and Alternatives

Table ES-1 presents a matrix comparison of the Proposed Project and alternatives, summarizing significant unavoidable effects after mitigation, consequences for TRPA environmental thresholds, effects on the relationship between short-term uses and long-term enhancement of long-term productivity, growth-inducing effects, and irreversible or irretrievable effects. As shown in Table ES-1 and Table 5-1, Action Alternative 1 (Testing Non-Herbicide Methods Only) is the only alternative that entirely avoids potentially significant impacts after mitigation. As discussed in Section 5.7, Action Alternative 1 was identified as the **environmentally superior alternative**.

ES.4.3 Summary of Significant Unavoidable Effects and Measures or Alternatives to Reduce or Avoid Effects

Chapter 3 of this DEIR/DEIS contains full environmental evaluations of all issues identified for the Proposed Project and alternatives. As summarized in Chapter 5 (Table 5-1), all effects for the Proposed Project and Action Alternatives have been reduced to less than significance. The non-herbicide control methods tests, including parts of the CMT and the full Action Alternative 1, will have no impact on recreational boating. The No Action Alternative (NAA) could have potentially significant unavoidable effects to all water quality issues (water temperature, turbidity, dispersal of aquatic fragments, changes in pH, dissolved oxygen, total phosphorus, and total nitrogen concentrations) as a result of inaction on aquatic weeds management. The NOA could also have a significant effect on recreational boating if aquatic weeds continue to proliferate.

ES.4.4 Significant Irreversible/Irretrievable Effects

The Proposed Project and alternatives would have no significant irreversible or irretrievable effects.

ES.4.5 Relationship Between Short-Term Uses and Long-Term Effects

The Proposed Project and alternatives would not present significant tradeoffs between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

ES.4.6 Growth-Inducing Effects

The Proposed Project and alternatives would have no growth-inducing effects.

ES.4.7 Mandatory Findings of Significance

In general, no mandatory findings of significance as defined under CEQA 15065 and Appendix G would apply to the Proposed Project and Action Alternatives 1 and 2 for any of the identified environmental issues evaluated in this DEIR/DEIS, with the exception of a slight potential for Pope Marsh to be affected by discharges of treated effluent under Action Alternative 2. However, alternative discharges and mitigations in terms of timing and amounts of discharge are available, and this effect is expected to be reduced to less than significance.

The No Action Alternative requires a mandatory finding of significance due to its potential to substantially degrade water quality in the shallow, nearshore areas of Lake Tahoe and in Tahoe Keys lagoons (as described above in ES.4.3).

ES.5 TRPA FINDINGS

ES.5.1 CONSISTENCY WITH REGIONAL PLAN

The TRPA Regional Plan, adopted by the Agency's Governing Board in 2012, is one of the implementation tools for achieving the threshold standards, (see Section 1.4) for the Lake Tahoe Region. Chapter 3.4.1 of this DEIR/DEIS reports on Regional Plan policy consistency (see Table 3.4.1-1). The Proposed Project and alternatives do not conflict with regional policy and are consistent with the overall goals and objectives of the TRPA Regional Plan.

ES.5.2 PROJECT WILL NOT EXCEED ENVIRONMENTAL THRESHOLD STANDARDS

In 1982, TRPA adopted nine categories of environmental measures, which established regional environmental threshold standards for the Lake Tahoe Region, recognizing that because many of the environmental threshold standards will take generations to achieve a sustained commitment to conservation is imperative. Chapter 5.7 of this DEIR/DEIS provides an initial review of the potential for the Proposed Project and alternatives to exceed these threshold standards. Preliminary evaluations indicate that neither the CMT nor its alternatives are expected to exceed any of the adopted environmental threshold standards.

ES.5.3 EFFECTS REDUCED TO LESS THAN SIGNIFICANCE

As described above in Section ES.4.2, all effects of the Proposed Project and Action Alternatives have been reduced to less than significance. The non-herbicide control methods tests, including parts of the CMT and Action Alternative 1, will not have unavoidable significant effects on recreational boating. The No Action Alternative will have potentially significant unavoidable effects in the nearshore waters of Lake Tahoe for all water quality issues, as well as for recreational boating.

Table ES-1 Summary of Impacts and Mitigation Measures.

Impact Issues	Significance Before Mitigation	Mitigation	Significance After Mitigation
B = Beneficial NI = No impact LTS = Less than significant PS = Potentially Significant SU = Significant and Unavoidable NA = Not Applicable PP = Proposed Project AA1 = Action Alternative 1 AA2 = Action Alternative 2 NAA = No Action Alternative			
Environmental Health			
EH-1: Herbicide Applicator Exposure and Health. Herbicide applicators could suffer health effects due to exposure during application of herbicides. Only the risks of acute exposure are pertinent since the limited testing period would assure that no chronic exposures would occur.	PP = PS AA1 = NA AA2 = NA NAA = NA	**EH-1 Applicator qualifications:** Herbicide applications would be performed only by Qualified Applicator License (QAL) holders, who would be trained to follow NPDES permit requirements, use proper personal protective equipment, and follow product label specifications.	PP = LTS AA1 = NA AA2 = NA NAA = NA
EH-2: Detectable Concentrations of Herbicides and Degradants in Receiving Waters. Impacts could occur if detectable concentrations of active ingredients and chemical degradants of herbicides proposed for testing persisted in lagoon waters. The environmental fate and persistence of each herbicide proposed for testing in the West Lagoon and Lake Tallac are defined in the literature. There is a potential for excess discharge concentrations if an herbicide product were spilled.	PP = PS AA1 = NA AA2 = NA NAA = NA	Detectable concentrations of discharged herbicides and their degradants would be controlled as a temporary condition allowable only for weeks to months. **EH-2, EH-3a, EH-4 Spill prevention and response plan:** A spill prevention and response plan would be implemented by a QAL holder to minimize and contain any spills during herbicide mixing and application, submitted for review as required by permitting agencies, and implemented at the work sites. **EH-6b Aeration:** Aeration technologies such as LFA would be implemented at each herbicide test site immediately after target aquatic weeds die back from the herbicide application. Aeration during plant decomposition would increase aerobic microbial degradation of herbicide active ingredients.	PP = LTS AA1 = NA AA2 = NA NAA = NA
EH-3: Protection of Drinking Water Supplies. Although even minimal dilution would prevent concentrations exceeding drinking water criteria from reaching drinking water supplies, degradation would occur if concentrations of active ingredients and chemical degradants of herbicides proposed for testing were detectable in or near the locations of potable water intakes. The potential for detectable concentrations at drinking water supply intakes is a function of the potential for transport of chemicals to these locations, the environmental fate and persistence of each herbicide proposed for testing, and the maximum allowable application rates for the proposed herbicides.	PP = LTS AA1 = NA AA2 = NA NAA = NA	**EH-2, EH-3a, EH-4 Spill prevention and response plan:** A spill prevention and response plan would be implemented by a QAL holder to minimize and contain any spills during herbicide mixing and application, submitted for review as required by permitting agencies, and implemented at the work sites. **EH-3b Dye tracing:** Rhodamine WT dye would be applied by TKPOA during the herbicide applications and tracked to determine the movement and dissipation of dissolved herbicide products and chemical transformation products. If herbicides are detected in nearby wells, contingency plans include shutting off the wells and distributing water to all users until residues are no longer detected in the samples.	PP = LTS AA1 = NA AA2 = NA NAA = NA

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		EH-3c Well monitoring and contingencies: A monitoring plan would address potential effects to human health, based on the TKPOA (2018) Aquatic Pesticide Application Plan. Sampling would be conducted at all three TKPOA well water intakes, and would include sampling for contamination by herbicides or degradants 24 hours prior to each application, and at 48-hour intervals thereafter for 14 days. Samples would be analyzed for active herbicide ingredients in the products applied, and contingency plans specified actions if herbicides are detected. **EH-3d West Channel monitoring and contingencies:** If herbicides are detected within the West Channel, additional monitoring stations would be sampled outside the Tahoe Keys in Lake Tahoe and monitoring would continue south and north of the channel (TKPOA 2018). In any event, if herbicide residue is detected within 500 feet of the West Channel, the LWB would be notified within 24 hours. Well monitoring would verify the effectiveness of carbon filtration to remove any herbicide residues. If herbicides were detected in wells, contingency plans would include shutting off wells and distributing bottled drinking water until residues are no longer detected in the samples. **EH-3e Public outreach:** TKPOA would design and carry out an information campaign targeting homeowners, renters, and rental agencies, to provide advance notice regarding the CMT before and during aquatic herbicide applications. TKPOA would also hold a workshop and informational meeting with Tahoe Water Suppliers Association (TWSA) at least 45 days before herbicide applications are conducted. **EH-3f Carbon filtration contingency:** Carbon filtration systems already installed at water supply wells would remove any herbicide residues. A mobile filtration system would pump and treat water at wells where exceedances are detected above drinking water standard concentrations.	

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		EH-3g Double turbidity curtain barriers: Double turbidity curtain barriers would be installed outside West Lagoon areas where herbicide testing sites are located, to confine the herbicide applications and ensure that herbicide residues or chemical transformation products do not migrate toward the West Channel connecting the West Lagoon to Lake Tahoe.	
EH-4: Introduction of Toxic Substances into the Environment. Impacts could occur if detrimental physiological responses could occur when humans, plants, animals, or aquatic life are exposed to the herbicides proposed for testing. Exposure could occur due to spills or in the course of application of the herbicides. Acute toxicity levels for each herbicide are defined by the USEPA. The maximum allowable application rates for each herbicide determine the potential for effects.	PP = PS AA1 = NA AA2 = NA NAA = NA	The herbicides proposed for testing would not have acute or chronic toxicity to fish or invertebrates, and even minimal dilution would prevent concentrations from exceeding drinking water criteria at drinking water intakes (see EH-3). **EH-2, EH-3a, EH-4 Spill prevention and response plan:** A spill prevention and response plan would be implemented by a QAL holder to minimize and contain any spills during herbicide mixing and application.	PP = LTS AA1 = NA AA2 = NA NAA = NA
EH-5: Short-term Increases in Aluminum Concentrations (NAA). Aluminum persistent in sediments of the lagoons could be mobilized into the water column by project activities. If mobilized, it could affect aquatic life. The USEPA defines acute and chronic water quality criteria for the protection of aquatic life.	PP = PS AA1 = PS AA2 = PS NAA = PS	**EH-5a Best management practices:** Best management practices to minimize sediment disturbance would be followed. Turbidity would be monitored to ensure that sediment disturbance and the consequent potential for mobilization of aluminum into the water column is minimized. BMPs also would be used to prevent accidental releases of sediment to the lagoons during dredge spoils transport and handling. **EH-5b Treatment and testing of dewatering effluent (AA2):** Before any effluent is discharged to Lake Tallac or to the sanitary sewer system, it would be tested to ensure that aluminum levels comply with water quality criteria for aluminum. **EH-5c Leak Prevention, Spill Control, and Containment Plans (AA2):** A leak-detection program would be implemented for the transport of dredge spoils. Containment plans would assure adequate storage and safe handling of dredge spoils during processing. The plans would minimize the risk of dredged sediment containing aluminum from being released outside of approved discharge locations.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU

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		EH-5d Turbidity Curtain Barriers (AA2): Turbidity curtain barriers would be used to isolate test areas for suction dredging and prevent the migration of disturbed sediment containing aluminum beyond the boundaries of test sites.	
EH-6: Harmful Algal Blooms (HABs). A risk exists that the dieback and decay of aquatic weeds consequent upon test activities, and subsequent release of nutrients to the waters of the lagoons could stimulate HABs. The potential for impacts to occur depends on a host of conditions, the timing of herbicide applications, volume of plant biomass, water and nighttime air temperatures, stratification of the lagoons, and plant photosynthesis and respiration levels.	PP = PS AA1 = PS AA2 = NA NAA = PS	**EH-6a Timing and size of treatments:** Spring aquatic plant surveys would be conducted to ensure that herbicide treatments occur at times when target aquatic weeds plants are in their early stages of growth so that the volume of decomposing plant material is minimized. The locations of test sites would be adjusted as needed to ensure that the targeted species are present for each herbicide application and ultraviolet light test, and areas dominated by native plant communities are avoided. The treatment area would be as small as possible given the objectives of the CMT. To minimize the biomass of plants killed by ultraviolet light treatment and the consequent release of nutrients that could stimulate HABs, an initial round of ultraviolet light treatment would be conducted in the spring to stunt plant growth so that plants would only be a few feet tall when they are treated again in the summer. **EH-6b Aeration:** Aeration technologies such as LFA would be implemented at each herbicide test site immediately after target aquatic weeds die back from the herbicide application. Aeration during plant decomposition would improve aerobic microbial degradation of herbicide active ingredients and reduce the risk of HABs by breaking up thermal stratification, reducing near-surface water temperature, and stabilizing pH conditions. The aeration systems would be continually operated until herbicide active ingredients and degradants are no longer detected above background concentrations, and would continue through the summer and early fall to reduce oxygen depletion from plant decay.	PP = LTS AA1 = LTS AA2 = NA NAA = SU
Earth Resources			
Issue ER-1: Suction Dredging and Dredge Materials Disposal. Effects to earth resources could occur under Action Alternative 2, as soft organic sediment in three test sites would be removed by	PP = NA AA1 = NA AA2 = PS	Spill control, containment and contingency plans would be developed for installing and operating a pipeline transporting aluminum-contaminated dredge spoils. Spills in the dredge	PP = NA AA1 = NA AA2 = LTS

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suction dredging, potentially destabilizing docks and bulkheads. Effects could also occur if spills of dredged sediment (consisting of organic silt and fine sand, plant roots and other organic matter, and lagoon water) occur during transported by pipeline to the location of the old Tahoe Keys Water Treatment Plant for handling, dewatering, or during transport for ultimate disposal.	NAA = NA	handling area would by contained by installing barriers and impermeable layers. Performance specifications would be promulgated for the design of the pipeline to minimize the risks of leakage or other failures. Appropriate leak detection systems would be installed in the pipeline systems to quickly detect any leaks and shut systems down prior to significant contamination. Soils in material handling areas would be tested and the existing concrete tank would undergo an engineering evaluation to determine whether it is safe and suitable for storing dewatering effluent; portable Baker tanks would be used if it were found unsuitable. Secondary containment and liners would be employed as necessary to provide surface and ground water protection in the event of an accident. The effects of spill in transport would be remediated by clean-up operations. Any bulkheads or docks removed or destabilized by dredging would be fully mitigated by replacing them in kind, and any slopes that are destabilized would be mitigated by slope restabilization after the dredging test is completed. Speed limits and travel restrictions would be placed on roads used for dredge spoil transportation and disposal to reduce the potential for releases due to collisions and other accidents. These restrictions would need to be in place for at least six months based on current understanding.	NAA = NA
Air Quality & GHG			
Issue AQ-1: Compliance with the Basin Air Quality Plan. Conflicts with the applicable air quality plan or any effect on its implementation could affect compliance with air quality standards.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	No conflict with the Basin Air Quality Plan would occur, therefore no mitigation measures are proposed.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS
Issue AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants. Effects could occur if the Proposed Project or Alternatives resulted in a cumulatively considerable net increase of any criteria pollutant for which the region is non-attainment under an applicable federal or State ambient air quality standard.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	Emissions associated with the Proposed Project and action alternatives are expected to be less than significant, therefore no mitigation measures are proposed.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS

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Issue AQ-3: Exposure of Sensitive Receptors. If the Proposed Project or Alternatives exposed sensitive receptors to substantial pollutant concentrations, effects could occur.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	Emissions associated with the Proposed Project and action alternatives are expected to be less than significant, therefore no mitigation measures are proposed.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS
Issue GHG-1: Greenhouse Gas Emissions. CEQA requires the evaluation of the potential to generate greenhouse gas emissions, either directly or indirectly. The California Air Resources Board (CARB) has issued the draft Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act (2008), which indicates that a project would be considered less than significant if it meets minimum performance standards during construction and if the project, with mitigation, would emit no more than approximately 7,000 metric tons of carbon dioxide per year (MTCO2e/yr). The El Dorado County Air Quality Management District (EDCAQMD) currently uses CEQA guidance developed by the adjacent Sacramento Metropolitan Air Quality Management District (SMAQMD) (EDCAQMD, 2020), which states a GHG significance threshold of 1,100 MTCO2e/yr for the construction phase of all projects.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	Emissions associated with the Proposed Project and action alternatives are expected to be less than significant, therefore no mitigation measures are proposed.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS
Hydrology			
Issue HY-1: Disposal of Dewatering Effluent. Under Action Alternative 2 (suction dredging) approximately 33 million gallons (i.e., 100 acre-feet) of dewatering effluent would be produced and would require disposal over a period of approximately six months. Discharge could occur to the South Lake Tahoe sanitary sewer system, if approved by the wastewater utility's Board of Directors, or to Lake Tallac, potentially affecting surface water levels and groundwater flows to the West Lagoon. These discharges could affect flooding.	PP = NA AA1 = NA AA2 = PS NAA = NA	For the Proposed Project and Action Alternative 1, no potential adverse effects to hydrology would occur, therefore no mitigation measures are proposed. **Disposal of Dewatering Effluent.** For Action Alternative 2, mitigation includes discharging treated effluent to the sanitary sewer system, if approved. If discharge is made to Lake Tallac, dewatering effluent would be treated to meet water quality criteria and discharged in the late summer and early fall months, when water levels are lower and the risk of contributing to flood conditions would be negligible.	PP = NA AA1 = NA AA2 = LTS NAA = NA
Water Quality			
Issue WQ-1: Water Temperature Effects. Short-term heating from ultraviolet light may occur during treatment. Where aquatic weed density is reduced by any of the treatment methods, a	PP = LTS AA1 = LTS AA2 = LTS	**WQ1 Real-Time Temperature Monitoring and Adjustments to Treatment Rates:** Real-time temperature monitoring during the implementation of ultraviolet light testing or injection of hot	PP = LTS AA1 = LTS AA2 = LTS

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long-term increase in solar radiation penetration may add heat to the water. Increased water circulation during LFA operations is expected to eliminate thermal density stratification, leading to cooler waters near the surface and warmer waters at depth.	NAA = PS	water under bottom barriers would be used to determine whether the rates of ultraviolet light application or injection of hot water under barriers would need to be reduced.	NAA = SU
Issue WQ-2: Sediment Disturbance and Turbidity. Sediment disturbance would be caused by suction dredging under Action Alternative 2, and by installation, startup, and removal of LFA systems; or installation and removal of bottom barriers under the Proposed Project or Action Alternative 1. These actions could cause short-term increases in turbidity and a temporary decline in water clarity within and near treatment areas. There is also a potential for short-term increased turbidity and decreased water clarity during suction dredging, from any accidental spills during transport and processing of dredge spoils, or during discharge of treated effluent from sediment dewatering.	PP = LTS AA1 = LTS AA2 = PS NAA = PS	**WQ-2: Real-Time Turbidity Monitoring and Adjustments in Practices.** Divers would minimize sediment disturbance where employed in Group B activities (hand-pulling of weeds or removal of bottom barriers) because underwater visibility is necessary to carry out the work, and work would have to cease if the water became turbid. Turbidity monitoring would be conducted in association with these activities, and if permit limits could be exceeded, the methods or pace of bottom barrier removal or other activities would be adjusted to achieve compliance with permit limits for turbidity. **WQ-2: Sediment Disturbance and Turbidity (AA2).** Under Action Alternative 2, impacts from suction dredging resuspension of the sediments in the water column would be minimized by optimizing the cutter head speed and movement with suction capacity, and using a moveable shield around and above the cutter head. Turbidity monitoring would indicate when engine speeds or auger pressures would need to be adjusted. These steps would also minimize the release of nutrients from disturbed sediment into the water column, reducing its availability to algae and minimizing the release of aluminum in sediments to the lagoon water. The rate and method of new sediment placement also would be adjusted in response to monitoring. Silt curtains would be used to confine water quality impacts within test sites during dredging and substrate replacement. Performance specifications for sand or fine gravel used for substrate replacement would require testing prior to placement to ensure that the material did not contain excessive amounts of fine particles that could cause turbidity. Spill control and containment plans would be used to control accidental spills of dredge spoils, and would include provisions for	PP = LTS AA1 = LTS AA2 = LTS NAA = SU

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		adequate storage for safe handling of dredge spoils during processing. No discharge of dewatering effluent would be allowed until monitoring has demonstrated that treatment systems reduced turbidity sufficiently to meet standards, as required by contract performance specifications. Treatment system designs could include settling and flocculation in batches stored in tanks for testing before discharge to the sanitary sewer system or Lake Tallac.	
Issue WQ-3: Dispersal of Aquatic Weed Fragments. Fragments may incidentally break off from aquatic plants during herbicide applications, ultraviolet light treatments, and placement of LFA systems, and suction. Floating plant fragments may escape, cause nuisance or adversely affect beneficial uses.	PP = NA AA1 = NA AA2 = LTS NAA = PS	**WQ-3: Dispersal of Aquatic Weed Fragments (AA2).** Performance specifications for sand or gravel used for substrate replacement would require that the material not contain excessive amounts of organic matter that could increase amounts of floating materials.	PP =NA AA1 = NA AA2 = LTS NAA = SU
Issue WQ-4: Changes in pH. Short-term changes in pH could result from the introduction of herbicide products in treatment areas. Long-term beneficial changes in pH fluctuation could result from reduced photosynthesis, respiration and decomposition as dense aquatic weed beds are controlled. Increased water circulation and oxygenation of deep waters during LFA operation could also improve pH conditions.	PP = LTS AA1 = LTS AA2 = LTS NAA = PS	**WQ4 Real-Time pH Monitoring and Adjustments to Treatment Rates:** If real-time monitoring of pH indicates that permit limits are exceeded, herbicide rates would be adjusted until compliance with permit limits for pH is demonstrated.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU
Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Rapid dieback of dense aquatic weed beds from testing herbicide applications or ultraviolet light could result in significant changes to DO conditions within and near test sites. This could cause biochemical oxygen demand (BOD) from decomposing plants to decrease DO concentrations during the normal growing season for aquatic plants. Herbicide products could also create short-term chemical oxygen demand during applications. Offsetting beneficial effects may result where LFA increases water circulation and improves low-oxygen conditions in the deeper portions of the water column during summer thermal stratification.	PP = PS AA1 = PS AA2 = PS NAA = PS	**WQ5a Timing and Limited Extent of Testing:** The overall reduction in aquatic weed biomass from testing control methods is generally expected to reduce oxygen depletion at test sites. Herbicide applications would occur in the late spring when target weed species are in their early stages of growth and plant biomass is minimal, and the timing would be adjusted based on pre-application macrophyte surveys. This timing is expected to minimize the biomass of decaying vegetation, mitigating the effects of oxygen depletion and nutrient release that could occur from dieback of mature plants. Similarly, ultraviolet light applications would include an early-season treatment to stunt plant growth, reducing the decaying biovolume that could contribute to reduced DO in the summer. Effects would also be mitigated by the limited size of test sites.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU

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		WQ5b Aeration: LFA or other aeration systems would be deployed in herbicide test sites immediately after plant dieback to increase aerobic microbial degradation of the herbicides and offset the potential for BOD from plant decomposition that could cause low DO impacts. If real-time monitoring indicated that DO was not meeting permit requirements at an ultraviolet light test site, an LFA system would be deployed to aerate during the period of plant decay and ensure that DO impacts were not significant.	
Issue WQ-6: Increases in Total Phosphorus Concentrations. Short-term increases in lagoon total phosphorus concentrations could result from sediment disturbance during suction dredging or LFA installation, or during the initial operation of LFA systems circulating deep waters to the surface. Release of phosphorus from decaying aquatic plants to the water column could be accelerated during and after weed control treatments, which could increase concentrations during those periods but lead to lower concentrations from aquatic plant dieback in the fall. Long term, phosphorus release from decaying plants would be reduced where dense aquatic weed beds are successfully treated.	PP = PS AA1 = PS AA2 = PS NAA = PS	**WQ6 Timing and Limited Extent of Testing:** The overall reduction in aquatic weed biomass from testing control methods is generally expected to reduce TP release from macrophytes at test sites. Herbicide applications would occur in the late spring when target weed species are in their early stages of growth and plant biomass is minimal, and the timing would be adjusted based on pre-application macrophyte surveys. This timing is expected to minimize the biomass of decaying vegetation, mitigating the effects of nutrient release that could occur from dieback of mature plants. Similarly, ultraviolet light applications would include an early-season treatment to stunt plant growth, reducing the decaying biovolume that could contribute to reduced TP in the summer. Effects would also be mitigated by the limited size of test sites. **Discharge of Treated Effluent (AA2):** No discharge of dewatering effluent would be allowed until monitoring has demonstrated that treatment systems reduced phosphorus sufficiently to meet standards, as required by contract performance specifications. Treatment system designs could include settling and flocculation in batches stored in tanks for testing before discharge to the sanitary sewer system or Lake Tallac. Mitigation measures to meet project permit limits for turbidity (WQ-2) would also be effective in controlling nutrient entrainment in the water column from sediment resuspension.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU

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Issue WQ-7: Increases in Lagoon WaterTotal Nitrogen Concentrations. Short-term increases in lagoon water total nitrogen concentrations could result from sediment disturbance during suction dredging or LFA installation, or during the initial operation of LFA systems circulating deep waters to the surface. Release of nitrogen from decaying aquatic plants to the water column could also be accelerated during and after weed control treatments, which could increase concentrations during those periods but lead to lower concentrations from aquatic plant dieback in the fall. Long term, a reduction in nitrogen release from decaying plants would be accomplished where dense aquatic weed beds are successfully treated.	PP = PS AA1 = PS AA2 = PS NAA = PS	**WQ7 Timing and Limited Extent of Testing:** The overall reduction in aquatic weed biomass from testing control methods is generally expected to reduce the release of TN from macrophytes at test sites. Herbicide applications would occur in the late spring when target weed species are in their early stages of growth and plant biomass is minimal, and the timing would be adjusted based on pre-application macrophyte surveys. This timing is expected to minimize the biomass of decaying vegetation, mitigating the effects of oxygen depletion and nutrient release that could occur from dieback of mature plants. Similarly, ultraviolet light applications would include an early-season treatment to stunt plant growth, reducing the decaying biovolume that could contribute to reduced TN in the summer. Effects would also be mitigated by the limited size of test sites. **Discharge of Treated Effluent (AA2):** No discharge of dewatering effluent would be allowed until monitoring has demonstrated that treatment systems reduced nitrogen sufficiently to meet standards, as required by contract performance specifications. Treatment system designs could include settling in batches stored in tanks for testing before discharge to the sanitary sewer system or Lake Tallac. Mitigation measures to meet project permit limits for turbidity (WQ-2) would also be effective in controlling nutrient entrainment in the water column from sediment resuspension.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU
Aquatic Biology and Ecology			
Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species. Non-target plant species could be affected by direct contact with herbicides or through exposure to ultraviolet light treatments or implementation of some Group B methods. The magnitude of short-term impacts depends on the herbicide applied, with endothall being a less-selective contact herbicide that would likely result in the greatest impacts to non-target species.	PP = PS AA1 = PS AA2 = PS NAA = PS	Spring macrophyte surveys would be used as a basis to adjust testing to better target dense beds of target species and avoid native plant communities.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU

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Issue AQU-2: Competitive Exclusion of Aquatic Macrophytes Due to Increased Growth of Curlyleaf Pondweed. If the application of aquatic herbicides favors the more competitive nuisance plants such as curlyleaf pondweed, this species could expand as other aquatic weeds are reduced at test sites, leading to the competitive exclusion of native species.	PP = LTS AA1 = NA AA2 = NA NAA = NA	Pre-treatment surveys would help focus the test sites on target species, thus implementation of Group A methods is expected to reduce the competitive pressure exerted by curlyleaf pondweed.	PP = LTS AA1 = NA AA2 = NA NAA = NA
Issue AQU-3: Effects on Sensitive Aquatic Macrophyte Species. No aquatic plant species occur in the vicinity of the Tahoe Keys lagoons that are identified by TRPA as sensitive, or which are listed under federal or state Endangered Species Acts (ESA). Watershield (a 2B.3 CRPR sensitive species) is known to occur in Lake Tallac where endothall treatments are proposed. There is the potential for impacts to watershield due to drift of aquatic herbicides as part of Group A methods associated with the Proposed Project.	PP = PS AA1 = NA AA2 = NA NAA = NA	Although the drift of endothall from the treatment sites in Lake Tallac may contact watershield, there is no published evidence that it would cause substantial adverse effects. Pre-treatment surveys described for AQU-1 would be implemented. These measures to avoid watershield in Lake Tallac, are expected to avoid effects on sensitive macrophyte species.	PP = LTS AA1 = NA AA2 = NA NAA = NA
Issue AQU-4: Changes in Aquatic Macrophyte Community Composition. Direct and indirect effects to the macrophyte community could occur in the West Lagoon as well as Lake Tahoe proper as a result of sediment dredging and replacement under Action Alternative 2. Direct removal of vegetation and organic sediments followed by replacement with substantially courser material could open up habitat for the introduction and establishment of fragments from other plant species, including the target aquatic weed species.	PP = PS AA1 = PS AA2 = PS NAA = PS	Spring macrophyte surveys would be used as a basis to adjust testing to better target dense beds of target species and avoid adverse changes in macrophyte community composition.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU
Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Potential direct and indirect effects to the benthic macroinvertebrate community could include the loss of organisms as a result of exposure to ultraviolet light, through placement of bottom barriers, and/or through entrainment associated with suction dredging. Potential indirect adverse effects could result from short-term water quality degradation associated with vegetation decomposition.	PP = LTS AA1 = LTS AA2 = LTS NAA = PS	All treatments would be temporary and localized. Implementation of Group A methods would not be expected to result in a substantial change or reduction in the diversity or distribution of the aquatic BMI community, and no mitigation is required.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU
Issue AQU-6: Effects on Special-Status Fish Species. Toxicity tests indicate that the herbicides proposed for use in the Tahoe Keys lagoons are not toxic to fish and BMI species and the USEPA has determined that the herbicides would have no significant acute	PP = LTS AA1 = LTS AA2 = LTS NAA = PS	Lahontan Cutthroat Trout would not be expected to be present and Tui Chub would only be expected to occur as a small number of individuals, if at all. Both species would be anticipated to sense the treatment activity (i.e., disturbance) and move away to avoid	PP = LTS AA1 = LTS AA2 = LTS NAA = SU

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or chronic impact on fish or BMI when recommended rates are used. Ultraviolet light treatments could result in temporary effects on special-status fish if they are present in the immediate treatment areas; however, fish would be expected to quickly move away to avoid exposure. LFA would be expected to generally improve water quality, which could result beneficial, albeit small, effects to fish species.		becoming trapped, entrained, and/or affected by temporary habitat disturbance, as long as adequate habitat space is available for their movement. All treatments would be temporary and localized. Implementation of Group A methods would not be expected to result in a substantial reduction in numbers or reduced viability of special-status fish species and no mitigation is required.	
Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. Potential direct and indirect effects could occur if access to spawning habitat were blocked or delayed during the implementation of the Proposed Project or alternatives.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	No significant potential to block fish movements was identified and no mitigation is required.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS
Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. Potential effects to the suitability of habitat for native or recreationally important game fish species could include short-term degradation of habitat associated with herbicide treatments, ultraviolet light, through the placement of bottom barriers, increases in turbidity associated with suction dredging, and changes in submerged aquatic vegetation, which provides important habitat structure for certain fish species.	PP = LTS AA1 = LTS AA2 = LTS NAA = PS	No significant effects on habitat for native or recreationally important game fish species identified and no mitigation is required.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU
Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. Potential effects associated with the introduction or spread of aquatic invasive species could include the introduction of aquatic invasive species associated with equipment and personnel implementing the control methods. All of the control methods could result in the release and transport of aquatic weed seed and propagules to areas outside of the Tahoe Keys where aquatic invasive weed species have not yet become established.	PP = PS AA1 = PS AA2 = PS NAA = PS	The existing watercraft inspection program, and permit conditions requiring cleaning and inspection of all in-water equipment, would minimize risks for introduction or spread of AIS.	PP = LTS AA1 = LTS AA2 = LTS NAA = SU
Terrestrial Biology and Ecology			
Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species. Short-term effects to terrestrial species and habitat may arise from disturbance or alteration of the existing habitat. Upland habitats that may be affected include ruderal and disturbed areas adjacent to the old Water Treatment Plant on the	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	**Field Reconnaissance and Monitoring.** Prior to initiating the test program, TKPOA will conduct a pre-test field reconnaissance of potentially affected terrestrial, riparian, and aquatic (benthic and littoral zones), habitat and species. This will include the test sites and buffer zones appropriate to each potentially affected species.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS

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south shore of Lake Tallac. Wildlife species which utilize open water for foraging could be affected. Impacts may include: • Introduction and spread of invasive plant species within terrestrial, riparian, and wetland habitats. • Damage or mortality of special-status plants or altered extent of special-status plant habitat. • Disturbance to sensitive communities, including jurisdictional wetlands and riparian vegetation. • Injury or mortality of special-status wildlife individuals or otherwise protected species. • Disruption to wildlife habitat including extent of special-status wildlife habitat. • Interference with wildlife movement. • Disturbance caused by dredge and replacement substrate.		The occurrence of any sensitive or listed species and/or habitat will be recorded. If sensitive receptors are observed, an evaluation will be made as to the potential impacts. If direct or indirect impacts are possible, coordination will be initiated with the appropriate federal (USFWS) or state (CDFW) agency to determine further mitigation to avoid impacts. Examples of mitigation measures could include environmental tailboards prior to the start of work, the establishment of exclusionary zones (i.e., around active nests), and/or assigning biological field monitors with stop work authority if impacts to receptors are possible. Should work stop based on discovery of sensitive or listed species, and TKPOA will consult with appropriate agencies to determine next steps prior to work restarting.	
Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. Riparian and wetland species and habitats could be affected if herbicide applications affect non-target species; if LFA changes current riparian or habitat conditions; or if the discharge of dewatering effluent from test dredging affects water levels in Lake Tallac or Pope Marsh.	PP = LTS AA1 = LTS AA2 = PS NAA = LTS	Mitigation measures would be the same as those identified for Issues HY-1 and AQU-1.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS
Land Use			
Issue LN-1: Physical Division of an Established Community. Effects could occur if an established community were physically divided.	PP = NI AA1 = NI AA2 = NI NAA = NI	No new development would occur; therefore, there would be no impacts and no mitigation are required.	PP = NI AA1 = NI AA2 = NI NAA = NI
Issue LN-2: Conflicts with Land Use Plans, Policies, or Regulations. Conflicts with a land use plan, policy or regulation adopted for the purpose of avoiding or mitigating an environmental effect, could affect compliance. Potential conflicts evaluated include the environmentally mitigating policies and regulations listed in the TRPA Code of Ordinances, the Plan Area Statement (PAS) for Tahoe Keys (PAS-102), and the City of South Lake Tahoe General Plan.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	No conflicts with land use plans, policies or regulations would occur, and no mitigation is required.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS

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Issue LN-3: Inclusion of Unpermitted Land Uses. Effects could occur if the Proposed Project or alternatives led to land uses that were not permitted under the PAS for Tahoe Keys, or if it resulted in expansion or intensification of an existing non-conforming use.	PP = NI AA1 = NI AA2 = NI NAA = NI	No change in existing land uses would occur, including intensification of any existing land use. Therefore, there would be no impacts and no mitigation is required.	PP = NI AA1 = NI AA2 = NI NAA = NI
Recreation			
Issue RE-1: Obstruction of Recreational Boat Passage. Recreational boat passage may be obstructed for Tahoe Keys property owners or their guests (e.g., vacation rentals) by turbidity curtains or other barriers placed in the Tahoe Keys lagoons during the proposed CMT or dredge and substrate replacement test. The threshold of significance is defined as a permanent loss of direct recreational boating access from the Tahoe Keys, including during the recreational boating season (from Memorial Day weekend through Labor Day weekend).	PP = LTS AA1 = NA AA2 = LTS NAA = PS	**Public Noticing.** An information campaign would target home-owners, renters, and rental agencies, to provide advance notice on any public access or recreational restrictions during the test period. The campaign would employ emails, flyers, letters, TKPOA's periodical (The Breeze), and social media to provide announcements and project summaries three to six months in advance of proposed actions. Signage would be displayed by TKPOA 30 days prior to project implementation, throughout project implementation and 14 days after project completion. Notices will be posted in publicly visible locations immediately adjacent to test sites and at the intersection of Tahoe Keys Blvd and Venice Drive, to inform property owners and visitors about the project and current status of waterways. **Timing for Placement and Removal of Barriers.** Herbicide treatments would be timed to allow treatments to be completed before the onset of the peak recreational boating season if possible. As soon as monitoring shows that acceptable limits of herbicides and degradation products are reached, barriers would be removed. For Action Alternative 2, barriers would remain in place for up to 4.5 months at each dredge site, and no provision is made for their early removal. **Swimming and Other Direct Water Contact Restriction.** As part of the information campaign noted above, property owners and visitors would be alerted regarding the need to avoid direct water contact.	PP = LTS AA1 = NA AA2 = LTS NAA = SU
Issue RE-2: Increased Use of Tahoe Keys Marina and Other Facilities. Recreational boat launches may be displaced to the Tahoe Keys Marina and other nearby launching facilities during	PP = LTS AA1 = NA AA2 = LTS NAA = NA	No significant issues would occur for the Proposed Project and Action Alternatives; no mitigation is required.	PP = LTS AA1 = NA AA2 = LTS NAA = NA

Impact Issues	Significance Before Mitigation	Mitigation	Significance After Mitigation
B = Beneficial NI = No impact LTS = Less than significant PS = Potentially Significant SU = Significant and Unavoidable NA = Not Applicable PP = Proposed Project AA1 = Action Alternative 1 AA2 = Action Alternative 2 NAA = No Action Alternative			
the period that barriers are placed within the Keys to implement the CMT.			
Issue RE-3: Inconsistency with TRPA Recreation Thresholds. Environmental analysis considers two thresholds: R-1. High Quality Recreational Experience and R-2. Public's Fair Share of Resource Capacity.	PP = LTS AA1 = NA AA2 = LTS NAA = PS	No significant issues would occur for the Proposed Project and Action Alternatives; no mitigation is required.	PP = LTS AA1 = NA AA2 = LTS NAA = PS
Utilities			
Issue UT-1: Effects on Water Supply. Effects could occur if herbicide residues and degradants reached water supply intakes on Lake Tahoe, and led to the loss of filtration exemption for purveyors drawing from the lake. An impact could occur if turbidity increased in nearshore shallows near drinking water intakes as a result of the dieback and decay of aquatic weeds.	PP = NI AA1 = NA AA2 = NA NAA = PS	Due to dilution, no detectable concentration of herbicides or degradants attributable to the test program would occur at drinking water intakes, and therefore no impact would occur and no mitigation is required. TKPOA has proposed contingency plans, including monitoring and alert systems to be implemented if necessary to remove herbicides and other chemicals to treat the potable water before distribution.	PP = NI AA1 = NA AA2 = NA NAA = SU
Traffic and Transportation			
Issue TR-1: Generation of New Daily Vehicle Trips. The Project would have a potentially significant impact if it generated more than 100 new daily trip ends (one-way vehicular trips), as defined by TRPA Code 65.2.	PP = LTS AA1 = LTS AA2 = LTS NAA = NI	Because the Proposed Project and action alternatives would generate less than the threshold minimum number of trips, no mitigation is required. Further, prior to commencement of work under Action Alternative 2, TKPOA would coordinate with the City of South Lake Tahoe Public Works Roads Division for the operation of heavy vehicles on City streets, and would submit an application for a transportation permit and/or a traffic control plan, as required.	PP = LTS AA1 = LTS AA2 = LTS NAA = NI
Issue TR-2: Changes in Demand for Parking. An impact could occur if changes to parking facilities or new demand for parking affected the ability of Tahoe Keys property owners or members of the general public to find parking spaces in reasonable proximity to their destination.	PP = LTS AA1 = LTS AA2 = LTS NAA = NI	Because the Proposed Project and action alternatives would not generate a significant amount of demand for parking in relation to that available in the area, no mitigation is required.	PP = LTS AA1 = LTS AA2 = LTS NAA = NI
Issue TR-3: Effects on Roads and Level of Service. Effects could occur if there were a substantial impact on the condition or level of service of existing road segments along the planned haul routes for sediment and clean substrate could occur, or if patterns of circulation were altered, or if traffic hazards to vehicles, bicyclists or pedestrians were to increase.	PP = LTS AA1 = LTS AA2 = PS NAA = NI	Because no existing roadways would be modified or closed for the Project, and further because truck trips for Action Alternative 2 would utilize trucks appropriately sized for the roadways, no impacts are expected to occur, and no mitigation would be required. Further, prior to commencement of work under Action Alternative 2, TKPOA would coordinate with the City of South	PP = LTS AA1 = LTS AA2 = LTS NAA = NI

Impact Issues	Significance Before Mitigation	Mitigation	Significance After Mitigation
B = Beneficial NI = No impact LTS = Less than significant PS = Potentially Significant SU = Significant and Unavoidable NA = Not Applicable PP = Proposed Project AA1 = Action Alternative 1 AA2 = Action Alternative 2 NAA = No Action Alternative			
		Lake Tahoe Public Works Roads Division for the operation of heavy vehicles on City streets. As required by the City, TKPOA would submit a program for minimizing damage to the road surface as a result of the project.	
Issue TR-4: Effects on Water Traffic. The Project could have a potentially significant impact if it would alter waterborne traffic. The dredge and ultraviolet light alternatives would each deploy a single small barge.	PP = LTS AA1 = LTS AA2 = LTS NAA = NI	Because the travel paths of the barges under the Proposed Project and Action Alternative 2 are not expected to significantly alter existing waterborne traffic, and because there are no commercial transportation services in the Project area, no impacts would occur and no mitigation is required.	PP = LTS AA1 = LTS AA2 = LTS NAA = NI
Noise			
Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. The Proposed Project and Action Alternative 2 could cause short-term noise impacts, similar to a construction project.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	The type of noise expected to be generated by the Proposed Project or Action Alternative 1 is considered exempt under local noise ordinances, and no mitigation is required. For Action Alternative 2, the following measures would be implemented: **Work During Daylight Hours.** Action Alternative 2 activities will occur only during daylight hours between 8:00 a.m. and 6:30 p.m. **Maintenance and Muffling of Equipment.** All equipment used during performance of Action Alternative 2 will be maintained in good working order and fitted with factory-installed muffling devices throughout the duration of the project.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS
Cultural Resources			
Issue CR-1: Traditional Native American Resources and Values. Potential effects were determined through consultation with the affected Indian Tribe; identified concerns include effects cause by unanticipated discovery of cultural resources, or a lack of awareness by consultants and construction workers.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS	On November 15, 2018, the United Auburn Indian Community provided a written request for consultation and recommendations for mitigation measures. These measures included an Unanticipated Discovery Plan, Awareness Training for workers, and an associated Tribal Cultural Resources Awareness brochure to be included in the Proposed Project Mitigation Monitoring Plan. Incorporation of the Unanticipated Discovery Plan, Awareness Training, and Associated Awareness brochure into the final Mitigation Monitoring Plan for the Proposed Project will satisfy AB 52 compliance for the United Auburn Indian Community and meet mitigation requirements.	PP = LTS AA1 = LTS AA2 = LTS NAA = LTS

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1.0 INTRODUCTION AND STATEMENT OF PURPOSE AND NEED

Lake Tahoe is one of the largest, deepest, and clearest lakes in the world. Its cobalt blue appearance, spectacular alpine setting, and remarkable water clarity is recognized worldwide. The Lake's earliest inhabitants, the Washoe Tribe, demonstrated a deep respect for the fragile environment that was their home and still revere this magnificent water. Recreational opportunities and scenic vistas have made Lake Tahoe a top national and international tourist destination. Existing aquatic invasive species such as Eurasian watermilfoil (*Myriophyllum spicatum*) and curlyleaf pondweed (*Potamogeton crispus*), threaten those special characteristics. Those two species, together with coontail (*Ceratophyllum demersum*), an undesired native species (collectively termed "aquatic weeds"), have become established in the Tahoe Keys. This infestation is ground zero for the rest of Lake Tahoe. Due to the sheer size and scale of the problem in relation to the rest of the lake, methods currently used to successfully eradicate local populations are likely ineffective at this scale. Therefore, it is proposed to test methods never before used in Lake Tahoe (such as aquatic herbicides), as well as promising innovative (but still unproven) approaches, such as ultraviolet light and laminar flow aeration, as a step toward designing an effective long-term management plan. This Draft EIR/EIS contains the required environmental analysis to implement an effective test project to deal with this infestation.

This Draft Environmental Impact Report/Environmental Impact Statement (DEIR/DEIS) is prepared in accordance with the California Environmental Quality Act (CEQA) (Public Resources Code [PRC] §21000 et seq.), the State CEQA Guidelines (14 California Code of Regulations [CCR] §15000 et seq.), and the Tahoe Regional Planning Agency (TRPA) Regional Planning Compact (P.L. 96-551, 94 Stat. 3233), and Code of Ordinances (Chapter 3, 2012 as amended 2018), and Articles 6 and 7 of the TRPA Rules of Procedure, respectively.

This DEIR/DEIS evaluates the potentially adverse and beneficial environmental effects of a proposed Tahoe Keys Lagoons Aquatic Weeds Control Methods Test (Proposed Project, or CMT). The Proposed Project (CMT) is a scientific program designed to test a wide range of measures to control aquatic weeds in the Tahoe Keys. It would test both herbicide and non-herbicide treatments in both stand-alone and combined applications. Alternatives to the CMT are considered which are either subsets of the full CMT program (Action Alternative 1, which would implement only non-herbicide treatments), or would test an entirely different approach to weed control (Action Alternative 2, Dredge and Replace Substrate).

As an informational document for both decision-makers and the public, this DEIR/DEIS describes the environmental setting, evaluates the environmental effects of the Proposed Project, and proposes mitigation measures that may reduce or avoid significant adverse impacts.

Following public review of the DEIR/DEIS, a Final EIR/EIS (FEIR/FEIS) will be prepared, in which the joint Lead Agencies will respond to comments relating to the environmental analysis provided in the DEIR/DEIS.

TRPA and the California Regional Water Quality Control Board, Lahontan Region (Lahontan Water Board or LWB) are the Lead Agencies for this DEIR/DEIS. The LWB is responsible for certifying the Final EIR and filing a Notice of Determination (NOD) under CEQA. TRPA is responsible for certifying the Final EIS, finding that it is procedurally and substantively in compliance with Article VII of the Compact, Chapter 3 of the TRPA Code of Ordinances, and the TRPA Rules of Procedure.

1.1 PROJECT REQUIRING ENVIRONMENTAL ANALYSIS (TAHOE KEYS LAGOONS AQUATIC WEEDS CONTROL METHODS TEST)

The Proposed Project, Action Alternatives and No Action Alternative are described in detail in Chapter 2. The CMT has been developed based on an application by the Tahoe Keys Property Owners Association (TKPOA), submitted jointly to TRPA and the LWB (Exemption Application). TKPOA is seeking an exemption from provisions that prohibit the use of aquatic herbicides in the waters of Lake Tahoe designated under the Clean Water Act and the Water Quality Control Plan for the Lahontan Region (Basin Plan), even for testing purposes (described further in sections 1.1.2 and 1.1.3.2 below). The exemption is needed in order to undertake the CMT. TKPOA also needs a project permit from TRPA (an Environmental Improvement Program (EIP) project permit) in order to conduct the CMT.

The CMT focuses on the control of invasive, non-native aquatic plants and undesired native weeds (collectively referred to as "aquatic weeds") in the Tahoe Keys waterways. The focus is specifically on three target aquatic weeds: Eurasian watermilfoil (*Myriophyllum spicatum*), curlyleaf pondweed (*Potamogeton crispus*), and coontail (*Ceratophyllum demersum*). The CMT program would test and compare the effectiveness of three registered aquatic herbicides with the use of non-herbicide treatments such as ultraviolet light and laminar flow aeration. The three aquatic herbicides proposed for tests are Endothall, ProcellaCOR[1], and Triclopyr. All three are approved by the United States Environmental Protection Agency (USEPA) and the California Department of Pesticide Regulation (CDPR) or are expected to be approved in the near future (in the case of ProcellaCOR).

Two levels of test application are distinguished in the CMT. "Primary treatment methods," also termed "Group A methods," have the potential to achieve reductions in population size at larger scales (with a goal of a 75% reduction of weeds, see Section 1.2.2 below). Smaller-scale, local methods, termed "Group B method," are proposed to follow up Group A methods, to control any residual aquatic weeds remaining in test sites. Chapter 2 of this DEIR/DEIS describes the range of Group A and Group B methods to be tested, the test protocols, and the sites at which tests will be carried out.

The CMT will assess the following outcomes: (1) the responses of both target aquatic weeds and non-target native plants to herbicides and non-herbicide control methods; (2) the ability of combinations of aquatic weed control methods to meet the Proposed Project Goals, Objectives and Performance Measures (see Section 1.2.2 below) in controlling target aquatic weeds in the lagoons; and (3) the effectiveness of proposed mitigation measures methods to mitigate potential adverse effects.

1.1.1 Project History and Planning Context

TKPOA has extensively consulted with the Lead Agencies and stakeholders regarding the control of aquatic weeds over a number of years. In 2017, TKPOA submitted a predecessor application to conduct an "Integrated Methods Test" to control aquatic weeds. That application was evaluated by the Lead Agencies in a TRPA Initial Environmental Checklist and CEQA Initial Study (IEC/IS), published in early

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[1] ProcellaCOR is the name of a commercial product, whose active ingredient is florpyrauxifen-benzyl. Assessment of this herbicide in this DEIR/DEIS is generally conducted under the name of that active ingredient.

2018. The IEC/IS identified potentially significant effects and areas of data insufficiency, leading the Lead Agencies to determine the need to undertake the present joint environmental review (DEIR/DEIS). Subsequently, TKPOA withdrew its 2017 application and submitted its present joint application in 2018.

1.1.2 Project Location, Setting, and Surrounding Land Use

Lake Tahoe is a unique alpine lake located on the California-Nevada border, with portions of the lake in both states. The lake is known worldwide for its outstanding recreational value and the clarity and purity of its transparent blue waters, as described above. Importantly, Lake Tahoe including the Tahoe Keys are considered "Waters of United States" (WOUS), and therefore some activities conducted in these waters are subject to requirements of the Clean Water Act (CWA) under the jurisdiction of the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA). Of greatest significance for this project, Lake Tahoe and the Tahoe Keys lagoons are designated as Tier 3 Waters (also referred to as "Outstanding National Resource Waters") by the State of California under the USEPA approved State antidegradation policy. This designation brings with it strict antidegradation requirements, described in Section 1.4.1 below. Lake Tallac and Pope Marsh are not considered waters of Lake Tahoe and thus not Tier 3 waters. Pope Marsh comprises a non-WOUS area to the west and south of the Tahoe Keys, under the jurisdiction of the U.S. Forest Service. The hydrologic connections of all three of these waters are described in Section 3.3.3 below.

Figure 1-1 Overview of Tahoe Keys Lagoons. **Source: APAP (TKPOA 2017a)**

The Tahoe Keys (Figure 1-1[2]) comprise a multi-use development situated at the southern end of Lake Tahoe on approximately 372 acres of land located 60 miles south of Reno, 195 miles east of San Francisco, and 100 miles northeast of Sacramento. The Tahoe Keys development was constructed in the 1960s on the Upper Truckee River Marsh by excavating the lagoons and capping the soil with sand to

[2] Figure 1-1, taken from the TKPOA Aquatic Pesticide Application Plan (2017a), uses the naming conventions "Main Lagoon" and "Marina Lagoon". In this document these are the "West Lagoon" and "East Lagoon", respectively.

form stable building sites. The development includes 1,529 homes and townhomes, a commercial marina, and a commercial center. The Tahoe Keys development is zoned High Density Residential in the South Lake Tahoe General Plan. The Tahoe Keys development includes beaches, swimming pools, tennis courts, basketball courts, a pedestrian pier to Lake Tahoe, boat docks within the lagoons, park areas, a commercial marina, and a commercial center including a restaurant. The development also includes water wells and a potable water distribution system, a water treatment facility, and a lagoon water circulation system (currently inoperable).

The Tahoe Keys lagoons are comprised of three primary man-made water features totaling 172 acres in surface area: (1) the West Lagoon (110 acres), (2) the East Lagoon (32 acres), and (3) the Lake Tallac lagoon (30 acres) (Figure 1-1). These three water features are referred as the “Tahoe Keys lagoons” or “lagoons” throughout this document. The lagoons are connected to Lake Tahoe via two narrow, direct channels: The West Channel connects the West Lagoon; and the East Channel, connects the East Lagoon. Lake Tallac drains to Pope Marsh through a concrete and wood weir, and during high runoff events surface water from Pope Marsh drains into Lake Tahoe.

The lagoons present suitable location to test the use of aquatic weed treatments, including selective herbicides, in that the waters of the inner coves formed at the ends of the lagoons do not readily transport dissolved matter, and the narrow channels connecting the lagoons to the lake reduce the potential for water mixing between the lagoons and Lake Tahoe. The lagoons are much shallower than Lake Tahoe (average depths are 12 feet and 1,000 feet, respectively), so the lagoons tend to be much warmer during spring and summer and much cooler at times during the fall and winter months. The lagoons also are typically more turbid than the clear waters for which Lake Tahoe is famous. Lastly, the bed substrate of the lagoons is covered with fine organic sediments originating from the marsh that previously occupied the area and supplemented by decades of aquatic weed decomposition. By contrast, coarse, decomposed granite characterizes most of the bed substrate of Lake Tahoe.

The lagoons provide boating access to Lake Tahoe and are used by residents and visitors for recreational boating and fishing. These waterways are key attractions for residents and visitors. Boat access to Lake Tahoe from the lagoons is restricted to the East and West two channels (Figure 1-1). TKPOA is responsible for maintaining navigation in the portions of the waterways of the Tahoe Keys lagoons it manages, as well as the common areas of the development. The Tahoe Keys Marina and Yacht Club (TKMYC), in the East Lagoon, is one of the largest publicly accessible marinas on Lake Tahoe. The launch ramp at the TKMYC is also generally considered one of the busiest in the lake.

1.1.3 History and Current Status of Aquatic Weed Infestation in Keys Lagoons

1.1.3.1 History of Aquatic Weeds Infestation

TKPOA reports that, “until the 1980’s, the lagoons and waterways were largely clear and free of invasive weeds” (TKPOA 2018), though they were likely present in Lake Tahoe proper as far back as the 1960s or 1970s and first reported in the lake in 1988 just outside the Tahoe Keys lagoons (Loeb and Hackley 1988; Anderson and Spencer 1996).

Non-native aquatic weed populations in the Tahoe Keys have been growing rapidly. Surveys by TKPOA from 2014 to 2019 indicate an overall increase in percent area cover and plant biovolume (i.e., the percentage of the water column occupied by aquatic vegetation). Surveys showed that, during summer and early fall, up to 80 to 90 percent of the available wetted surface in the lagoons had been infested with aquatic weeds, with 59 to 72 percent biovolume (TKPOA 2020). The preponderance of plant biovolume surveyed has been non-native species.

Aquatic weeds have expanded in the lagoons due to several environmental conditions, including abundant nutrient availability and the provision of relative warm and shallow waters with sufficient light for weed growth. Aquatic weeds introduced to the lagoons have found these to be ideal habitat conditions for prolific growth.

The Lahontan Water Board found that an abundant growth of non-native and undesired aquatic weeds has degraded water quality and provided habitat for non-native warm water fish (see Lahontan Water Board Order No. R6T-2014-0059, Tahoe Keys Waste Discharge Requirements (WDRs)). Among the effects to water quality found to be caused by the presence of aquatic weeds were changes in pH, dissolved oxygen, water column nutrient concentrations and temperature. Excessive aquatic weed growth impedes boating, can be hazardous to swimmers, results in accumulation of nutrient rich organic sediment in the lagoons from aquatic weed growth and die-off, contributes to elevated water column nutrients, can contribute to the occurrence of harmful algal blooms (HAB), and provides sources of aquatic weed fragments that contribute to continuing infestations of aquatic weeds within the lagoons and in the near-shore areas of Lake Tahoe.

Seasonal harvesting has been the main weed control practice in the Tahoe Keys since the mid-1980s. Each summer, mechanical harvesting has been undertaken in the Tahoe Keys lagoons to keep the waterways navigable. These machines cut aquatic weeds approximately three to five feet below the water surface. The bulk of the cut biomass is transferred to shore, dried, and transported to a disposal site outside the Tahoe Basin. However, nearly four decades of mechanical harvesting has not limited the spread of aquatic weeds in the Tahoe Keys lagoons, and in fact the biovolume (i.e., the portion of the water column occupied by vegetation) of aquatic weeds harvested from the lagoons has increased from 100 cubic yards in 1984 to 6,274 cubic yards in 2019 (TKPOA 2019d). Although harvesting throughout the summer months helps keep the lagoons navigable by boat, harvesting operations do not, overall, reduce aquatic weed biomass and "*appears to be enhancing aquatic weed infestations in the lagoons*" by means of fragmentation (Crowell et al. 1994, TKPOA 2015).

Formal surveys of submersed aquatic weeds have been conducted in Lake Tahoe since 1988 (Loeb and Hackley 1988). Eurasian watermilfoil has been observed at locations just outside the Tahoe Keys lagoons, suggesting that may have been the original source of infestation (Figure 1-2) (from Anderson, summarized in Wittmann and Chandra 2015). Wittmann and Chandra (2015) summarized the Eurasian watermilfoil expansion from 13 nearshore sites in 1995 with fluctuations from 17 to 22 sites between the years 2000 and 2012. Using empirical measurements of nearshore wave action around Lake Tahoe, a number of high-risk areas were identified where the potential for Eurasian watermilfoil to spread is greatest, including Lake Forest Boat Launch, Camp Richardson, Carnelian Bay and other areas generally protected from high wave action and containing suitable habitat conditions (Wittmann et al. 2015).

The extensive boat traffic entering and leaving the lagoons that can carry weed fragments, coupled with the dense infestation of aquatic weeds, resulted in the West Lagoon being the highest site prioritization in the Lake Tahoe region for aquatic weed management (Wittmann and Chandra 2015). Prior to implementation of measures to reduce plant fragments from leaving the lagoons (e.g., sea bins, boat back-up station, bubble curtains), fragments produced by harvesting were estimated between 2,500 to 4,000 per acre (Anderson 2014). These fragments are a direct source for aquatic weed fragment dispersal to other nearshore areas of Lake Tahoe.

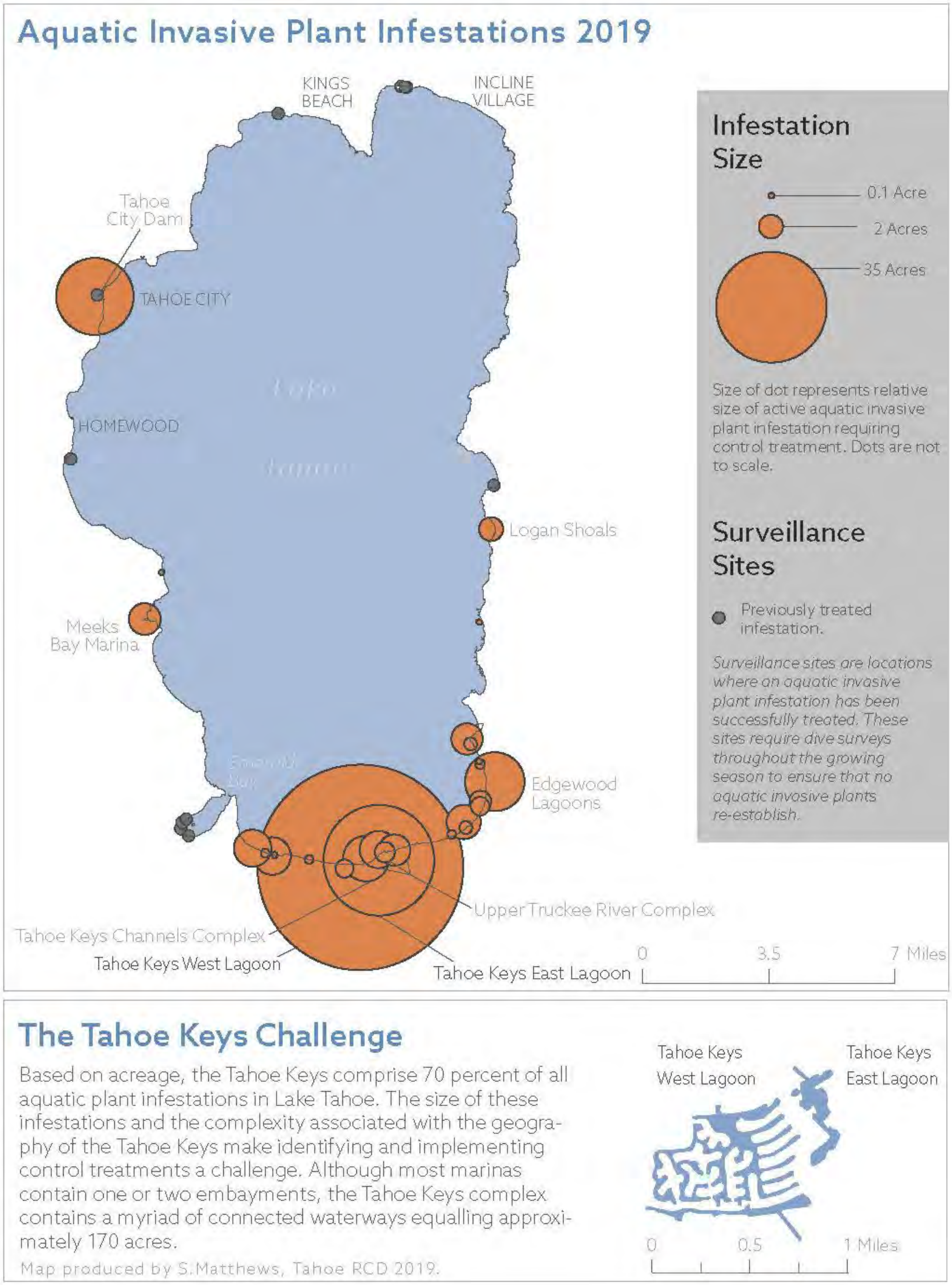

Figure 1-2 Aquatic Invasive Plant Infestations 2019.

Eurasian watermilfoil (*Myriophyllum spicatum*) was likely introduced to a marina in South Lake Tahoe as early as the 1970s, though evidence is limited (Anderson 2003). Formal surveys beginning in the 1980s documented its presence and continued spread around the lake (Loeb and Hackley 1988, Anderson and Spencer 1996). Based on a lake-wide survey conducted in 2018, the greatest coverages of Eurasian watermilfoil outside the lagoons in the nearshore areas of Lake Tahoe were found at Ski Run Marina, Baldwin Beach, and the mouth of the Upper Truckee River (MTS 2019). Wovoka Bay, Lakeside Beach, and Meeks Marina had the highest percent of Eurasian watermilfoil cover among marina and embayments. Of the major tributaries, Tallac Creek, Taylor Creek, and the Upper Truckee River were highest. Taylor Creek Marsh was highest in Eurasian watermilfoil percent cover among marsh areas.

Curlyleaf pondweed (*Potamogeton crispus*) was first observed in Lake Tahoe in 2003, based on USDA Agricultural Research Service surveys between 1995 and 2006, and a small infestation was found in Emerald Bay in 2009 and promptly removed (TRCD 2014). Curlyleaf pondweed populations have recently been reported to range from Taylor Creek in the south to Edgewood Creek in the southeast, and north to Elk Point Marina where recent management efforts have been implemented (Wittmann and Chandra 2015, TRPA 2020, TRPA and LWB 2020). Based on a lake-wide survey conducted in 2018, the greatest coverages of curlyleaf pondweed outside the lagoons in the nearshore areas of Lake Tahoe were found lake-ward of the East Lagoon and at Timber Cove Pier (TRPA 2020). Lakeside Beach had the highest percent of curlyleaf pondweed cover in the marinas and embayment strata. Of the major tributaries surveyed, the highest percent cover of curlyleaf pondweed was found in Edgewood Creek, located north of Lakeside Marina.

The recent rapid growth and spread of curlyleaf pondweed is of particular concern, as it not only has the potential to infest significantly greater areas of Lake Tahoe's aquatic habitat than Eurasian watermilfoil because it can grow in deeper (up to 20 feet deep), colder waters, but also because it can 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, have spread throughout the Tahoe Keys lagoons, and have the potential to remain dormant for several years.

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 is not a rooted plant, but generally floats in the water column, in contrast to curlyleaf pondweed. The ability of coontail to be moved by wind and currents throughout the lagoons is an important characteristic of this species relative to treatment and containment. Coontail has heavily infested the deeper channels of all the lagoons, most abundantly in Lake Tallac followed by the East Lagoon. In Lake Tallac, coontail has the highest frequency of occurrence of all macrophyte species, ranging from 83 to 91 percent in recent years (2018 and 2019). Similarly, in the East Lagoon frequency of occurrence has ranged from 57 to 64 percent in recent years (TKPOA 2020).

1.1.3.2 TKPOA Response to Infestation

In response to the growing infestation of aquatic weeds in the Tahoe Keys, and to limit non-point sources of pollution, the Lahontan Water Board issued Waste Discharge Requirements (WDRs) to TKPOA on July 14, 2014 (Order R6T-2014-0059). In response, TKPOA has undertaken an extensive program of aquatic weed control, as summarized in the TKPOA application. Under the WDR requirements, TKPOA was tasked with developing a Non-Point Source Water Quality Management Plan (NPS Plan), and an

Integrated Management Plan (IMP) to address aquatic weed management. Both of these plans have been prepared and are being implemented. The purpose of the IMP is to optimize aquatic weed management by incorporating a suite of feasible and proven control methods that can be tailored to fit site constraints, infestation size, and urgency of control. As stated in the conditions of Order R6T-2014-0059 and prior permits issued to TKPOA, only mechanical methods have been allowed and can be implemented for aquatic invasive plant control.

At present, only non-herbicide control methods are approved for use by the Lead Agencies. Currently approved and implemented non-herbicide methods utilized in greater Lake Tahoe consist primarily of the above-noted mechanical harvesting conducted by TKPOA, together with small-scale, localized use of bottom barriers. Due to the size, density and dominance of the infestation in the Tahoe Keys lagoons, these control methods have produced limited results. In addition, the current primary control method, aquatic weed harvesting, produces large quantities of weed fragments (TKPOA 2014). Without proper controls, these fragments, which are capable of regeneration, may be transported by wind, aquatic animals, and boat traffic from the lagoons into other areas of Lake Tahoe, thus contributing viable weed fragments and turions that can become established in nearshore habitats and marinas.

After several years of stakeholder and agency meetings to identify the best available methodologies to address the aquatic weed infestation, and after utilizing the advice of an expert panel, TKPOA developed a proposal to test herbicide and non-herbicide controls of aquatic weeds in the lagoons. TKPOA submitted an application to the Lahontan Water Board for an exemption to the Basin Plan prohibition on the use of pesticides for the CMT, and to the Tahoe Regional Planning Agency for a permit authorizing an aquatic herbicide test. Based on agency feedback, an amended supplemental Basin Plan Exemption Application was submitted to the Water Board in July of 2017. The TKPOA Exemption Application documents the use of aquatic herbicides in a variety of lakes, ponds, reservoirs, streams, irrigation canals, flood control channels and wetland sites in other regions to treat the same aquatic weeds as are found in the Tahoe Keys lagoons.

1.2 PROJECT PURPOSE, NEED, AND OBJECTIVES

1.2.1 Purpose and Need

The purpose of the Proposed Project is to test methods to control the spread of non-native target aquatic weeds that have compromised water quality and degraded a wide variety of beneficial uses of the Tahoe Keys lagoons and threaten Lake Tahoe, including both natural conditions and human use. If the current trend continues, the target aquatic weed infestation will continue to impact and threaten the nearshore areas of the remainder of Lake Tahoe. Unless primary sources of aquatic weed infestation are controlled, the management of both the Tahoe Keys infestation and other infestations around the lake may be defeated as populations continue to reestablish and spread.

The LWB and TRPA need to act on the Basin Plan Prohibition Exemption Application and EIP Permit Application submitted by TKPOA in 2018. The Proposed Project will provide a basis for the agencies to decide on the proposed test of aquatic pesticides (specifically aquatic herbicides). Decision-making will include the development and consideration for adoption of the following:

- An exemption from the Basin Plan prohibition on the discharge of aquatic pesticides from the Lahontan Water Board provided in the LWB 2012 Basin Plan Amendment.

- An individual National Pollutant Discharge Elimination System (NPDES) permit for use of aquatic herbicides (required per the CWA and adopted under delegated authority by the LWB).
- General or individual 401 certifications for activities requiring Army Corps of Engineers 404 permitting (decision required by LWB required per the CWA and adopted under delegated authority by the LWB).
- An Environmental Improvement Program (EIP) permit (TRPA).

1.2.2 Project Goals and Objectives, and Performance Measures

1.2.2.1 Goals and Objectives

The goal of the Proposed Project is to test a range of large-scale and localized aquatic weed control methods suitable for long-term management of target aquatic weeds, to determine what combination of methods within the test areas will:

- Reduce target aquatic weed infestations as much and as soon as feasible.
- Bring target aquatic weed infestations to a level that can be managed over the long term with localized non-herbicide treatment methods.
- Improve the water quality of the Tahoe Keys lagoons and reestablish native aquatic habitat.
- Improve navigation and enhance recreational benefits and aesthetic values.
- Reduce the potential for target aquatic weed re-infestation after initial treatment.

While not a specific goal, it is anticipated that reducing aquatic weed density in the Tahoe Keys lagoons will result in habitat conditions less favorable for invasive fish species.

1.2.2.2 Performance Measures

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

- Meet all applicable regulatory requirements for water quality protection in the Tahoe Keys lagoons, as specified in the WDR's, TRPA threshold standards, and antidegradation requirements.
- Achieve and maintain 75% reduction in aquatic weed biovolume, as measured against baseline biovolumes in test sites by hydroacoustic scans in the summer prior to treatment. This performance measure is based on prior studies regarding the efficacy of herbicide treatments (Anderson 2017) and would be applied to all aquatic weed control alternatives. This level of reduction of aquatic weed biovolume is considered a meaningful target for the treatment alternatives because it is expected to sufficiently reduce competition for space, light, and nutrients such that native aquatic habitat may become re-established.
- Achieve and maintain a minimum of three feet of vessel hull clearance within Tahoe Keys lagoons navigation channels year-round to maintain beneficial uses and prevent weed fragment generation and dispersal.

1.2.2.3 Principles

The principles guiding the test program design are based on scientific studies, data, regulatory requirements and results from other locations. They include:

- Utilizing best available science, applied through emerging and proven technologies.
- Incorporating Integrated Pest Management approaches (IPM)
- Mapping, monitoring, and quantifying performance metrics
- Employing adaptive management based on monitoring results
- Minimizing the number and amount of herbicides discharged.

1.3 AGENCY ROLES AND RESPONSIBILITIES

1.3.1 Lead Agencies

The Lead Agencies for the Proposed Project are the Tahoe Regional Planning Agency and the Lahontan Regional Water Quality Control Board. This section provides an overview of their roles and responsibilities with regard to this DEIR/DEIS. Section 1.4 provides more information and detail on their regulatory requirements.

1.3.1.1 Tahoe Regional Planning Agency (TRPA)

TRPA was formed in 1969 through a bistate compact between California and Nevada (Tahoe Regional Planning Compact, PL 96-551 94 Statute 3233), which was ratified by the U.S. Congress. TRPA is the primary permitting agency and the Lead Agency under the Compact. The agency is mandated to protect the environment of the Lake Tahoe Basin and is one of only two watershed-based regulatory agencies in the United States. TRPA's mission is to lead cooperative efforts to preserve, restore, and enhance the unique natural and human environment of the Lake Tahoe Region.

Under the Compact, Code of Ordinances, and Rules of Procedure, a TRPA EIS is an informational document used in the planning and decision-making process for a proposed project. The purpose of this DEIR/DEIS is neither to recommend approval or denial of the project, but to disclose objective information that can be used in the development of a preferred alternative to the project/action for evaluation in the DEIR/DEIS.

Article VII of the Compact presents important TRPA policies relevant to the preparation and use of an EIS. Key provisions of the article are presented below:

- Article VII(a)(2) states that when acting upon matters that have a significant effect on the environment, TRPA shall "*prepare and consider a detailed environmental impact statement before deciding to approve or carry out any project*."
- Article VII(a)(3) states that the EIS shall "*study, develop and describe appropriate alternatives to recommended courses of action for any project which involves unresolved conflicts concerning alternative uses of available resources*."
- Article VII(a)(4) requires that TRPA "*make available to states, counties, municipalities, institutions and individuals, advice and information useful in restoring, maintaining and*

enhancing the quality of the region's environment."

- Article VII(a)(5) requires TRPA to "*initiate and utilize ecological information in the planning and development of resource-oriented projects*."

Chapter 3 of the Code of Ordinances provides direction regarding the TRPA environmental documentation. Section 3.7 describes the approach and contents of an EIS. Article 6 of the Rules of Procedure, Environmental Impact Statements, provides guidance on the procedural steps necessary for conducting environmental review consistent with Article VII of the Compact and Chapter 3 of the Code.

Importantly, TRPA has adopted nine categories of environmental measures, which established environmental threshold standards for the Lake Tahoe Region (thresholds or threshold standards). TRPA may not approve a project if any of the thresholds would be exceeded. If a project would exceed an identified threshold, mitigation must be imposed to reduce the impact and maintain the threshold. Under Chapter 4 of the TRPA Code of Ordinances, findings must be made in writing regarding all significant environmental impacts and their associated mitigation measures, with substantial evidence provided in the record of review before final project approval.

The nine threshold categories include water quality, air quality, scenic resources, soil conservation, fisheries, vegetation, wildlife, noise, and recreation. Although many of the environmental thresholds may take generations to achieve, TRPA's Environmental Improvement Program is intended to accelerate threshold attainment. A Threshold Evaluation Report is completed every four years as part of the Agency's adaptive management cycle to assess the degree to which the Regional Plan is working to achieve and maintain thresholds and to advise the TRPA Governing Board on making critical adjustments in the Code of Ordinances and other planning documents.

1.3.1.2 Lahontan Regional Water Quality Control Board (LWB)

The primary responsibility for the protection of water quality in California rests with the State Water Resources Control Board (State Water Board or SWB) and nine Regional Water Quality Control Boards (Regional Water Boards), collectively referred to as the Water Boards. The LWB is one of nine regional boards and the CEQA Lead Agency for the Proposed Project.

CEQA requires lead agencies to consider physical environmental effects that may occur with approval of a project and to avoid or substantially lessen significant effects on the environment when feasible. When a project may have a significant effect on the environment, the agency with primary responsibility for carrying out or approving the project (the lead agency) is required to prepare an EIR. CEQA defines a significant effect on the environment as "a substantial change in the physical conditions which exist in the area affected by the proposed project" (15002(g), but clarifies that "if a physical change causes adverse economic or social effects" those effects may be considered (15064(e)). An example would be adverse effects consequent on the installation of turbidity curtains in the Tahoe Keys lagoons.

The State Water Board sets statewide policy to protect water quality. It coordinates and supports the efforts of the Regional Water Boards, which develop Basin Plans and exercise rulemaking and regulatory activities within all water basins in the state. Pursuant to CWA requirements, the LWB has adopted and implemented the Water Quality Control Plan for the Lahontan Region (Basin Plan), which sets forth water quality standards for the surface and ground waters of the Lahontan region, including both designated beneficial uses of water and narrative and numerical objectives which must be maintained or attained to protect those uses (discussed below, in Section 1.4.3).

1.3.2 Trustee and Responsible Agencies, and Consulted Tribes

Under CEQA, a trustee agency is a state agency that has jurisdiction by law over natural resources that are held in trust for the people of the State of California.

Under CEQA, a responsible agency is a public agency other than the lead agency that has legal responsibility for carrying out or approving a project or elements of a project (PRC Section 21069).

CEQA Lead Agencies consult with Trustee and Responsible agencies to gain their input and enable the agencies to review and comment on the draft document. Responsible agencies use the CEQA document in their decision making.

STATE RESPONSIBLE AGENCIES

- California Air Resources Board
- California Department of Fish and Wildlife
- State Historic Preservation Officer

STATE TRUSTEE AGENCIES

- California State Lands Commission

OTHER INTERESTED AGENCIES

- United States Army Corps of Engineers
- United States Environmental Protection Agency
- USDA Forest Service
- USDOI Bureau of Reclamation
- USDOI Fish and Wildlife Service

In addition, California State Assembly Bill 52 (AB 52) requires CEQA lead agencies to initiate consultation with California Native American groups that are traditionally and culturally affiliated with a project, including tribes that may not be federally recognized, prior to the release of an Environmental Impact Report.

Lahontan Water Board staff have consulted with and provided AB 52 notification of the CMT Project proposal and CEQA document preparation to the United Auburn Indian Community and Wilton Rancheria and non-AB52 notification to the Pyramid Lake Paiute Tribe and Washoe Tribe of Nevada and California. The results of these consultations are discussed in 3.4.6.

TRIBES

- United Auburn Indian Community
- Washoe Tribe of Nevada and California

1.4 REGULATORY REQUIREMENTS, PERMITS, AND APPROVALS

Federal and State agencies exercise jurisdiction concerning specific resources. Land and water resources potentially affected by the proposed project are under the jurisdiction of Federal and State agencies, the City of South Lake Tahoe, and TRPA. Table 1-1 identifies potential permits, consultations, and other potential approval actions from federal, state, regional, and local agencies for which this DEIR/DEIS may be used during these agencies' decision-making processes. The specific required approvals may vary depending on the selection of the preferred alternative.

This section identifies each agency's responsibility relative to the Proposed Project, as well as the plans and policies with which the CMT must comply. The Proposed Project will be conducted in the West Lagoon of the Tahoe Keys lagoons, considered part of Lake Tahoe, therefore this section primarily addresses plans, policies and regulations related to water rather than land use. For more detail, refer to the Regulatory Setting sections for each resource addressed in Chapter 3.

1.4.1 Federal Requirements

1.4.1.1 USEPA Antidegradation Policy

Lake Tahoe is designated as a WOUS and a Tier 3 ONRW for both its recreational and ecological value. ONRWs are provided the highest level of protection (i.e., Tier 3) under the State and USEPA's antidegradation policies, stipulating that NPDES permits issued by the States may allow some limited discharges that result in temporary and short-term changes to base-line water quality, but that such changes should not adversely affect existing uses or alter the essential character or special uses for which the water was designated an ONRW. The ONRW regulations (40 CFR 131.12(a)(3)) prohibit any discharge which would lower base-line water quality in an ONRW, which could include any new or increased discharge even if that discharge is in compliance with water quality objectives and no beneficial uses are adversely affected. The detectable presence of any herbicide active ingredients or degradation products, or other lowering of water quality as a result of project discharges, including aquatic herbicide or other chemical discharges, for a period greater than "short-term," would constitute "long-term" degradation and would not be permittable.

A complete Antidegradation Analysis (AA) will be required for the Proposed Project consistent with State and Federal antidegradation policies, following the Administrative Procedures Update on Antidegradation Policy Implementation for National Pollutant Discharge Elimination System (NPDES) Permitting (State Water Board 1990), the Basin Plan and policy originating from the process developed to allow for exemptions to the Basin Plan prohibition on use of aquatic pesticides and herbicides. The AA will include an evaluation of whether the project has any unreasonable effects on beneficial uses, such as long-term water quality degradation, exceedance of Basin Plan water quality objectives, and impacts to non-target native species. Consistent with State and Federal antidegradation policies and SWB Resolution 6816 Statement of Policy with Respect to Maintaining High Quality in California, the AA will also address balancing potential degradation with socioeconomic effects of the Proposed Project and alternative approaches to aquatic weed control at the Tahoe Keys lagoons test areas.

The federal Clean Water Act (CWA) §301(a) broadly prohibits the discharge of any pollutant (including herbicide products) to waters of the U.S., except in compliance with an NPDES permit. The State of California is delegated to implement this CWA provision via statewide general and individual permits (see discussion below).

Table 1-1 Overview of Permit Approval and Consultation Requirements for Tahoe Keys Lagoons Project.

Jurisdiction	Permits, Approvals & Consultations
FEDERAL AGENCIES	
U.S. Army Corps of Engineers (USACE)	Section 404 Permit, Clean Water Act (CWA). The USACE must determine compliance with Section 404(b)(1) guidelines for projects relating to Aquatic Habitat Restoration, Establishment and Enhancement Activities. Executive Order (E.O). 11990 Wetland Protection provides for the protection of wetlands and is enforced by the USACE.
U.S. Environmental Protection Agency	Approves Plans, Permits & Policies developed under delegated authority to the State including Basin Planning under CWA Section 303 and NPDES permitting under CWA Section 402. Concurs with the Clean Air Act (CAA) Conformity Statement, the CWA Section 401 Water Quality Certifications and the 402 CWA permit.
U.S. Fish and Wildlife Service (USFWS)	Administers Endangered Species Act (ESA) for certain federally listed species (including California red-legged frog). Consults under Section 7 of the ESA with the lead federal agency (USACE). Determines whether a proposed action is likely to jeopardize the continued existence or destroy or adversely modify critical habitat of federally listed species. If appropriate, issues a Biological Opinion with an Incidental Take Statement for affected species. Enforces the Migratory Bird Treaty Act (MBTA); provisions for protection of migratory birds, include basic prohibitions against any take not authorized by the Act.
National Marine Fisheries Service (NMFS)	Administers ESA for federally listed marine mammals and marine and anadromous fish (including steelhead). Consults under Section 7 of the ESA with the lead federal agency (USACE). Determines whether a proposed action is likely to jeopardize the continued existence or destroy or adversely modify critical habitat of federally listed species. If appropriate, issues a BO with an Incidental Take Statement for affected species. Under Section 305(b)(4) of the Magnuson-Stevens Act (MSA), NMFS is required to provide Essential Fish Habitat (EFH) conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH.
Other federal permits/regulations: E.O. 11988 Flood Management, E.O. 12898 Environmental Justice	
STATE AGENCIES	
California Department of Pesticide Regulation	The LWB approval of herbicides for use in the Proposed Project must draw on those that have been approved by CDPR, as well as USEPA.
California Office of Historic Preservation (SHPO)	Section 106, National Historic Preservation Act (NHPA) compliance.
California Department of Transportation (Caltrans)	Transportation Permit (*for Action Alternative 2*). Required for transport of oversized loads on State highways. (This permit is usually obtained by the construction contractor or subcontractors.)
California Department of Fish and Wildlife (CDFW)	California Trustee Agency (CEQA Guidelines section 15386) with jurisdiction over natural resources affected by a project which are held in trust for the people of the State of California with regard to the fish and wildlife of the State, to designated rare or endangered native plants, and to game refuges, ecological reserves, and other areas administered by the department. Lake and Streambed Alteration Agreement (California Fish and Game Code Sections 1601 and 1603 permits) (*for Action Alternative 2*). Issues agreement with conditions to protect resources whenever a bed or bank of stream, lake or reservoir is altered. Issues incidental take permits for State-listed species.
CalRecycle and Nevada Department of Environmental Protection	CalRecycle is the responsible agency for implementing CCR Title 27, Environmental Protection--Division 2, Solid Waste pertaining to waste disposal on land. Nevada Department of Environmental Protection (NDEP) is responsible for implementing NRS 444/NAC 444, Collection and Disposal of Solid Waste. Action. Alternative 2 may require a California or Nevada permit to dispose of dredged spoils at a compost or landfill facility, depending on how spoil is handled.
CA SWRCB, CalRecycle and Nevada Department of Environmental Protection	CalRecycle and the California State Water Resources Control Board (SWRCB) (through the regional water quality control boards) implement 27 CCR Environmental Protection, Division 2. Solid Waste pertaining to treatment, storage, processing or waste disposal in California. NDEP is responsible for implementing NRS 444/NAC 444, Collection and Disposal of Solid Waste. Dredged spoils defined as a waste under 22 CCR Social Security, Division 4.5. Env. Health Standards for the Mgt. of Haz. Waste would require characterization to determine whether they are classified as California hazardous or non-hazardous. 40 CFR Protection of Env., Chapter I EPA, Subchapter I Solid Wastes, Part 260 Haz Waste Mgt. System requires characterization to determine classification under RCRA as hazardous or non-hazardous. For waste classified as hazardous, the waste generator may be required to obtain hazardous waste generator ID numbers from the California Department of Toxic Substances Control (DTSC) and/or EPA prior to transportation. Transportation of hazardous waste may only be conducted by licensed haulers. Regardless of waste classification, it must be profiled and accepted by the disposal facility prior to transportation. Proper transportation manifests, signed by the project owner, are required by CA, NV and federal DOT.
Lahontan Water Board (LWB)	One of nine regional boards operating under the State Water Board, the LWB is the CEQA Lead Agency for Joint EIR/EIS with TRPA. Certification or waiver of certification according to Section 401 of the Clean Water Act (CWA) for construction-related disturbance to water quality from USACE 404 permitted activities. The project may require a National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activity issued by the Water Boards under delegated authority of USEPA. The LWB has the authority to grant an exemption to the prohibition on the use of aquatic herbicides when the project satisfies Basin Plan prohibition exemption criteria, including meeting the requirements of State and Federal antidegradation policies. The proposed discharge of aquatic herbicides is unlikely to be covered under the statewide general NPDES permit for aquatic pesticide discharges. This discharge, or any other chemical discharge, will require an individual NPDES permit developed and adopted by the LWB under delegated authority of USEPA. The testing of acetic acid injections under bottom barriers will also require coverage under a CWA §401 Certification and individual NPDES permit. Ongoing TKPOA aquatic weed control and nonpoint water quality control activities are covered by a CWA §401 Water Quality Certification and Waste Discharge Requirements (WDRs).
REGIONAL AGENCIES	
El Dorado County Air Quality Management District (EDCAQMD)	Responsible for attaining and maintaining air quality conditions in El Dorado County. Prepares plans for the attainment of ambient air quality standards, adopts and enforces rules and regulations concerning sources of air pollution, and issue permits for stationary sources of air pollution.
Tahoe Regional Planning Agency (TRPA)	Lead Agency for Joint EIR/EIS with LWB. Bi-state environmental planning agency responsible for overseeing development and adopting and enforcing environmental quality standards in the Lake Tahoe Region. Has jurisdiction to enforce compliance with the TRPA Regional Plan and Code of Ordinances. A TRPA Environmental Improvement Project permit will be required for the project.
LOCAL AGENCIES	
South Tahoe Public Utility District	If treated dewatering effluent were to be discharged to the local sanitary sewer system, a special permit agreement would be required from the utility.

1.4.1.2 Other Potentially Pertinent Federal Requirements

U.S. Army Corps of Engineers (USACE): Issues permits under Section 404 of the Clean Water Act (CWA) for discharges of dredged or fill material into waters of the United States. TKPOA has applied for and received Nationwide Permit (NWP) 27 from the United States Army Corps of Engineers in accordance with Section 404 of the Clean Water Act. NWP 27 coverage applies to projects relating to Aquatic Habitat Restoration, Establishment and Enhancement Activities. On federally managed land, EO 11990, amended in 42 U.S.C. 4321 et seq., requires the federal agencies "to avoid adverse impacts associated with the destruction or modification of wetlands wherever there is a practicable alternative" and to "include all practicable measures to reduce harm to wetlands." Further, the agencies are required to preserve and enhance the natural and beneficial values of wetlands in carrying out their responsibilities. This order is enforced by the USACE.

U.S. Fish and Wildlife Service (USFWS): Administers the ESA for certain federally listed species. Consults under Section 7 of the ESA with the USACE to determine whether a proposed action is likely to jeopardize the continued existence of, or destroy or adversely modify critical habitat of, federally listed species. If appropriate, issues a Biological Opinion with an Incidental Take Statement for affected species. As described in Chapter 3, surveys undertaken for the DEIR/DEIS suggest that there may be no need for consultation with USFWS under Section 7 of the ESA. The FWS also has authority under the MBTA of 1918, as amended to conserve migratory birds; EO 13186 encourages federal agencies to consider conservation actions for birds in the course of their operations, documented in Memoranda of Understanding (MOU).

National Marine Fisheries Service (NMFS): Administers ESA for federally listed marine mammals and marine and anadromous fish (including steelhead). Consults under Section 7 of the ESA with USACE to determine whether a proposed action is likely to jeopardize the continued existence of or destroy or adversely modify critical habitat of federally listed species. Issues a BO with an Incidental Take Statement for affected species. NMFS also has the authority under the MSA of 1976, as amended, to review a project's effects on essential fish habitats. Whenever possible, NMFS uses existing interagency coordination processes to fulfill EFH consultations with federal agencies.

U.S. Environmental Protection Agency: Concurs with the Clean Air Act (CAA), the CWA Section 401 Water Quality Certifications and 402 CWA permit. EO 11990, Wetland protection: the EPA retains veto authority for wetland permits issued by the USACE.

Other Federal Permits/Regulations: E.O. 11988 Flood Management, E.O. 12898 Environmental Justice.

1.4.2 TRPA Requirements

TRPA has the authority to establish environmental threshold standards (Thresholds or threshold standards) and to adopt and enforce a regional plan and implementing ordinances that achieve and maintain the Thresholds while providing opportunities for orderly growth and development (Article I (b), Tahoe Regional Planning Compact).

TRPA implements its authority (described above) through its adopted Thresholds, Regional Plan, Code of Ordinances, and agreements with other agencies and public service providers. TRPA's Regional Plan Goals and Policies establish an overall framework for development and environmental conservation in the Lake Tahoe Region. In December 2012, the TRPA Governing Board adopted an updated Regional Plan. Other jurisdictions may enact plans, ordinances, rules, regulations, and policies, so long as they are in compliance with the Regional Plan. Key provisions with respect to the CMT include:

- Goal FI-1, Policy FI-1.9 of the Regional Plan is to: "*Prohibit the release of non-native aquatic invasive species in the region in cooperation with public and private entities. Control or eradicate existing populations of these species and take measures to prevent accidental or intentional release of such species*."
- Policy VEG-1.9 of the Regional Plan is to: "*Work to eradicate and prevent the spread of invasive species*."

Scientific study projects are considered a "special use" in the shorezone and lakezone of Lake Tahoe, in accordance with Section 81.3.3 of the TRPA Code of Ordinances. Action Alternative 2 would require a dredging permit under TRPA Code 84.9.2 which places limits on dredging within the lakezone or shorezone except where found by TRPA to be beneficial. Project activities that use diesel engines in vehicles exceeding 10,000 pounds gross vehicle weight or a diesel engine in off-road self-propelled equipment exceeding 25 horsepower would need to adhere to TRPA Code 65.1.8 that limits engine idle time to no more than five minutes.

1.4.2.1 TRPA Environmental Improvement Program

Launched in 1997 as an effort to achieve and maintain Thresholds, the Lake Tahoe Environmental Improvement Program (EIP) is a partnership of federal, state, and local agencies, private interests, and the Washoe Tribe of Nevada and California, created to better protect and enhance the extraordinary natural and recreational resources of the Lake Tahoe Basin. EIP partners implement projects that range from new bike trails to creek restorations, to programs that protect the lake from aquatic weeds. The 2010 EIP Handbook, Restoration in Progress (TRPA 2010), focuses on six categories—Watersheds, Habitat, and Water Quality; Forest Management; Air Quality and Transportation; Recreation and Scenic Resources; Applied Science, and Program Support—and outlines the following restoration goals relevant to implementation of the CMT:

- Restoring and protecting the Lake Tahoe Basin's watersheds and stream environment zones
- Adopting and implementing a comprehensive aquatic weeds management plan
- Improving Lake Tahoe access and recreational facilities

The EIP Aquatic Invasive Species Program recognizes that aquatic weeds pose one of the most serious threats to Lake Tahoe and their continued spread constitutes one of the most immediate threats to the lake., In the University of Nevada's 2015 Implementation Plan for the Control of Aquatic Invasive Species within Lake Tahoe, a science-based plan that helps resource managers prioritize AIS management areas, the Tahoe Keys locations were top-ranked "*due to the magnitude of the plant and fish infestations as well as the high recreational use of these areas by Tahoe boaters*" (UNR 2015).

Goals of the Invasive Species Program pertinent to the CMT include the following:

- Protecting the biological diversity and scenic resources of the Lake Tahoe Basin from aquatic invasive species

- Limiting the spread of existing invasive species, such as the Asian clam, while minimizing impacts to native species
- Abating harmful ecological, economic, social and public health impacts resulting from aquatic weeds.

The 2010 EIP Handbook notes that top science priorities for managing invasive species include the following:

- Using carefully designed pilot projects, complete science-based evaluations of the effectiveness of alternative strategies to control and manage invasive and noxious species that are now established in the Tahoe Basin.
- Develop and maintain a Basin-wide monitoring program of both aquatic and terrestrial habitats to assess the distribution and abundance of invasive species now established in the Tahoe Basin. This monitoring program should also serve as one component of an early warning system to detect new invasions.
- Examine factors affecting nearshore water quality and ecology.
- Conduct focused studies to develop invasive species threshold carrying capacities for terrestrial and aquatic habitats.

1.4.3 State Requirements

1.4.3.1 Lahontan Regional Water Quality Control Board (LWB)

The LWB is delegated authority by the USEPA to conduct Basin Planning under CWA Section 303 and issue Water Quality Certifications and permits under CWA Sections 401 and 402, including implementation of the antidegradation policies described above, in acting on the TKPOA Exemption Application. To act on the TKPOA exemption application, LWB must comply with CEQA. The proposed discharge of aquatic herbicides, or any other chemical discharge, into the Tahoe Keys West lagoon would require an NPDES permit issued by the Lahontan Water Board. Section 401 of the Clean Water Act requires that any person applying for a Federal permit which may result in a discharge of pollutants into waters of the United States, must obtain a State Water Quality Certificate (State Water Board 2017).

Activities subject to an Army Corps of Engineers 404 permit (for example, the placement of bottom barriers or laminar flow aeration) also would require a Section 401 Water Quality Certification issued by the Lahontan Water Board.

As noted above, the LWB has adopted and implemented the water quality Basin Plan, which provides the basis for the Lahontan Water Board's regulatory program. It sets forth discharge prohibitions and water quality standards for the surface and ground waters of the region, which include both designated beneficial uses of water and the narrative and numerical objectives which must be maintained or attained to protect those uses. It also summarizes past and present water quality monitoring programs and identifies monitoring activities that should be carried out to provide the basis for future Basin Plan updates and for waste discharge requirements or conditional waivers.

In 2011, the Lahontan Water Board approved Resolution R6T-2011-0102, *Approval of Amendment to the Water Quality Control Plan for the Lahontan Region to Replace the Regionwide Pesticide Water Quality*

Objective with a Regionwide Waste Discharge Prohibition on Pesticides with Exemption Criteria for Aquatic Pesticide Applications and Certification of Substitute Environmental Documentation. The State Water Board approved the Basin Plan amendment in 2012, and the USEPA certified it on September 5, 2015. This Basin Plan amendment provides a means for the Lahontan Water Board to regulate aquatic herbicide applications and other aquatic pesticides, where appropriate. The Lahontan Water Board only allows a prohibition exemption if aquatic herbicide use is proposed for purposes of protecting public health or safety or ecological preservation, and only if such projects satisfy specific Basin Plan exemption criteria. Granting an exemption to the use of pesticides is a discretionary action by the Lahontan Water Board. Consistent with these requirements, the Lahontan Water Board may find that the benefits of the project render acceptable any impacts of the project provided State and federal requirements to limit water quality degradation in ONRWs to short-term (i.e., "*weeks to months, not years*") are met. Conversely, the Lahontan Water Board may find that impacts of the proposed aquatic herbicide applications outweigh the impacts of the invasive species.

TKPOA's Exemption Application to test treatments of aquatic weeds requires compliance with State and Federal antidegradation policies and the LWB Basin Plan amendment prohibition exemption criteria described above. The target aquatic weeds occurring in the Tahoe Keys lagoons adversely affect the water quality and ecosystem of the lagoons, create optimum habitat for non-native fisheries; and impact such beneficial uses as aesthetics, navigation, and recreation. Effects on beneficial uses are identified in TKPOA's current Waste Discharge Requirements (WDRs (Order R6T-2014-0059).

Action Alternative 2 is expected to require an individual NPDES General Permit for Storm Water Discharges Associated with Construction Activity from the LWB and with an associated Stormwater Pollution Prevention Plan (SWPP). An individual NPDES permit for discharge of dewatering effluent may also be required for this alternative.

1.4.3.2 California Department of Fish and Wildlife (CDFW)

CDFW administers the California Endangered Species Act (CESA Section 2081 Management Authorization) and must agree with conditions to protect resources whenever a bed or bank of stream, lake or reservoir is altered. CDFW may issue an incidental take permit for any State-listed species not covered by federal incidental take permit.

CDFW requires a Lake and Streambed Alteration Agreement (LSAA, California Fish and Game Code Sections 1601 and 1603) any time a proposed activity may:

- Substantially divert or obstruct the natural flow of any river, stream or lake;
- Substantially change or use any material from the bed, channel or bank of any river, stream, or lake; or
- Deposit debris, waste or other materials that could pass into any river, stream or lake.

CDFW action on a LSAA requires compliance with CEQA.

Other State Permits/Regulations: Other potentially pertinent State requirements govern compliance with solid waste regulations for the transport and disposal of dredge spoils to a qualified landfill for Action Alternative 2 (dredge and replace substrate), e.g., California Code of Regulations Title 22 Social

Security, Division 4.5. Env. Health Standards for the Mgt. of Haz. Waste, requires characterization of waste to determine if it is classified as California hazardous or non-hazardous.

1.4.4 Local Requirements

El Dorado County Air Pollution Control District: Oversees Rule 223 for fugitive dust to reduce the amount of particulate matter entrained in the ambient air by anthropogenic (human-made) fugitive dust sources by requiring actions to prevent, reduce, or mitigate fugitive dust emissions.

South Lake Tahoe Public Utility District: If Action Alternative 2 discharges dewatering effluent to the South Lake Tahoe sanitary sewer, it would likely require a special discharge permit agreement (South Tahoe Public Utility District Administrative Code, STPUD 2019). Fees for such a discharge would be determined by the utility Board. The City retains all its police powers under applicable Federal and State law, court cases, and the federal and California constitutions, while acknowledging the role of TRPA to adopt environmental threshold standards and a regional plan to achieve and maintain the long-term protection of Lake Tahoe.

1.5 PUBLIC PARTICIPATION AND REVIEW

The Lead Agencies initiated their review of potential actions to address aquatic weeds control methods in the Tahoe Keys lagoons by making a commitment to a highly transparent and inclusive public involvement process, summarized below (Section 1.5.2). An extensive stakeholder process was conducted to identify potentially feasible approaches and alternatives for the Proposed Project and surface concerns and issues. The scoping process required under CEQA and TRPA regulations occurred as a natural continuation of that process, which had been underway for more than six months before scoping began. The scoping process is summarized below (Section 1.5.1) and discussed in further detail in Section 6.3.1. Comments and issues identified in both the public and stakeholder involvement process and through scoping are summarized in the project Scoping Report and in Section 6.3.4 below.

1.5.1 Scoping

On June 17, 2019, TRPA and the Lahontan Water Board released a Notice of Preparation (NOP) to prepare a joint DEIR/DEIS to public agencies and interested individuals in the community for a period of 45 days for public comment. The NOP was posted on the project website, www.tahoekeysweeds.org, and hard copies were made available at both lead agency offices. Public scoping meetings were held at multiple locations around Lake Tahoe on June 25, June 26, and July 16 to allow the public to submit verbal and written input on the scope of the proposed project, project alternatives and environmental document. An email address, tahoekeysweeds@trpa.org, was also established to accept written comments throughout the comment period.

A copy of the NOP and the supporting Public Engagement Plan is attached as Appendix A. The resultant Scoping Report containing comments received on the NOP is attached in Appendix B. Comments received after August 2, 2019, the closing day of the comment period, were included. The Scoping Report was posted in November 2019 to the project website at www.tahoekeysweeds.org. An email with project updates and a link to the Scoping Report was sent to all project partners and interested stakeholders on December 2, 2019.

1.5.2 Stakeholder Process

In order to develop a DEIR/DEIS that is fully informed by the best available information and reflective of the range of values, priorities and concerns, the Lead Agencies, TRPA and the Lahontan Water Board, have committed to transparency with the public and collaboration with partners.

TRPA retained an independent third party to conduct an assessment of stakeholder interests, themes, and questions surrounding aquatic weed control and water quality issues potentially associated with the treatment of weeds within the Tahoe Keys. A Stakeholder Assessment Report was prepared summarizing input derived from 29 interviews with 44 stakeholders between August and October 2018 and was used to inform an ongoing Stakeholder Committee and process conducted throughout the development of this DEIR/DEIS.

As part of this stakeholder process, the following sources of information were used by the Lead Agencies to help develop the range of alternatives:

- **Interviews** with more than 40 stakeholders were conducted by third party facilitators to identify initial interests, concerns and questions of a broad range of stakeholders at the initiation of the process in September of 2018.
- **Public workshops** were conducted at key milestones. The first public workshops were conducted in tandem with the Notice to Proceed/Notice of Preparation (NOP) in July of 2019.
- A **Stakeholder Consultation Circle**, a broad and widely diverse set of public and private interests comprised of EIP partners, resource agencies, local jurisdictions, non-profit organizations, and interested individuals was established. This group has met approximately twice a year to hear updates and provide feedback on process design and progress.
- A **Stakeholder Committee**, a focused group of key stakeholders comprised of the two Lead Agencies, TKPOA, the Tahoe Water Suppliers Association, the League to Save Lake Tahoe, and the Tahoe Resource Conservation District was also established for more focused consultation on the identified issues from the stakeholder assessment. This group met 10 times in 2018 and 2019 to comment on DEIR/DEIS goals, design and approach.
- A **project website** was developed and is used to provide stakeholders a resource to track the development of the DEIR/DEIS and the results of analyses. The project website also provides stakeholders a portal to submit written questions or comments on the DEIR/DEIS work products as they are developed and posted to the site.

All of these elements have informed the Lead Agencies as they developed the project purpose and scope, as well as developed and reviewed alternatives for the DEIR/DEIS. For example, after considerable deliberation in 2018-19, the members of the Stakeholder Committee concurred that the testing of multiple treatment methods, including emerging technologies, prior to developing a long-term management approach would better position the Lead Agencies to understand potential benefits and impacts of aquatic weed control alternatives. This approach was taken and is the subject of this DEIR/DEIS. The DEIS/DEIR analyses and test project implementation will inform future annual updates to the Tahoe Keys Integrated Management Plan required under the existing WDRs.

1.5.3 Draft EIR/EIS Review

The Lead Agencies will distribute this DEIR/DEIS to interested agencies, stakeholder organizations, and individuals. This distribution ensures that interested parties have an opportunity to express their views regarding the environmental effects of the project and to ensure that information pertinent to permits and approvals is provided to decision makers for the Lead and Responsible Agencies.

This document is available for review by the public in hard copy at the Lead Agency offices below. Due to current COVID-19-related guidelines, a review appointment needs to be made by calling the numbers below:

Lahontan Water Board
2501 Lake Tahoe Boulevard
So. Lake Tahoe, CA 96150
530-542-5400

El Dorado County Library
South Lake Tahoe Branch
1000 Rufus Allen Blvd
South Lake Tahoe, CA 96150
775-589-5255

Links to review the document are posted electronically at:

https://www.waterboards.ca.gov/lahontan/water_issues/programs/tahoe_keys_weed_control

www.trpa.org

www.tahoekeysweeds.org

The DEIR/DEIS is being distributed for a 60-day review period that will end on September 3, 2020.

Written comments postmarked no later than August 22, 2020 should be sent to the following address:

Lahontan Water Board
2501 Lake Tahoe Boulevard
So. Lake Tahoe, CA 96150

Tahoe Regional Planning Agency
P.O. Box 5310
128 Market Street
Stateline, Nevada 89449

If comments are provided via e-mail, please include the project title in the subject line, attach comments in Microsoft Word format, and include the commenter's U.S. Postal Service mailing address and email to: tahoekeysweeds@trpa.org, or russell.norman@waterboards.ca.gov.

Announcements for public information meetings and Public Hearings will be posted on the project website and sent to the email distribution list used for the DEIR/DEIS by the Lead Agencies. Until further notice, meetings and Public Hearings will be held virtually due to current COVID-19-related guidelines for public meetings and best practices to protect public health.

Please go to the lead agency links above for more information on how to participate.

It is not necessary to provide oral testimony during the public hearing; written comments on the DEIR/DEIS will be accepted throughout the meeting and will be recorded, provided to decision-makers, and made part of the record. Comments may also be submitted throughout the comment period as described above.

After all comments have been assembled and reviewed, responses will be prepared to address significant environmental issues that have been raised in the comments. The responses will be included in the FEIR/FEIS.

1.6 SCOPE AND FOCUS OF THE DEIR/DEIS

1.6.1 Overview of DEIR/DEIS Process

This DEIR/DEIS will inform both the public and agency decision makers in considering whether to approve the application submitted by TKPOA. Prior to approving a project, the Lahontan Water Board must certify that the Final EIR/EIS has been completed in compliance with CEQA, that it has reviewed and considered the information in the Final EIR/EIS and that the Final EIR/EIS reflects its independent judgment and analysis. Once the Lahontan Water Board approves a project, it will file a Notice of Determination (NOD) with the State Clearinghouse.

Under CEQA, the Lahontan Water Board must respond to each significant impact identified in the EIR. If significant, adverse environmental impacts are identified in the EIR, approval of the project under CEQA must be accompanied by written findings, determining the following, as appropriate:

- Changes or alterations have been required in, or incorporated into, such project that mitigate or avoid the significant environmental effects thereof as identified in the completed EIR.
- Such changes or alterations are within the responsibility and jurisdiction of another public agency and such changes have been adopted by such other agency or can and should be adopted by such other agency.
- Specific economic, social or other considerations make infeasible the mitigation measures or project alternatives identified in the EIR.

If mitigation measures are to be made a condition of the approval of the project, a mitigation monitoring and reporting plan/program must be adopted before the project is approved. CEQA requires the decision-making agency to balance, as applicable, the economic, legal, social, technological, or other benefits of a proposed project against its environmental risks when determining whether to approve a project. When an agency approves a project that will result in significant and unavoidable impacts, it must make a Statement of Overriding Considerations. The NOD filed for the project must include information on whether the agency certified the EIR and made the findings, if required, under CEQA and whether it adopted a mitigation monitoring and reporting plan/program and/or a Statement of

Overriding Considerations.

TRPA must certify that the Final EIS is in compliance, procedurally and substantively, with Article VII of the Compact, Chapter 3 of the TRPA Code of Ordinances, and the TRPA Rules of Procedure.

It is not the purpose of an EIR/EIS to recommend either approval or denial of a project. Although the EIR/EIS does not control the Lead Agencies' ultimate decisions on the project, the Lead Agencies must consider information in the EIR/EIS during the approval process.

1.6.2 DEIR/DEIS Organization, Scope, and Focus

As noted in Section 1.1.1 above, a TRPA Initial Environmental Checklist and CEQA Initial Study (IEC/IS) were completed for a proposed "Integrated Methods Study" in 2018. The IEC/IS identifies potentially significant effects and areas of data insufficiency, which, although for a somewhat different project, are pertinent to the Proposed Project and led the Lead Agencies to prepare the present joint environmental review (DEIR/DEIS). The original IEC/IS is posted at:

https://www.waterboards.ca.gov/lahontan/water_issues/programs/tahoe_keys_weed_control/docs/TKPOA_IEC_IS.pdf

Based on the IEC/IS to the extent pertinent and focused by scoping comments, pursuant to CEQA, the discussion of potential effects on the environment is focused on those impacts that the Lead Agencies have determined may be potentially significant. Pursuant to the TRPA Code of Ordinances, the discussion is focused on any effects on environmental threshold standards for the Lake Tahoe Region and any other identified environmental impacts. (CEQA and TRPA allow a lead agency to limit a discussion of the environmental effects in an EIR/EIS when the effects are not considered potentially significant.)

This DEIR/DEIS includes an evaluation of 41 environmental issues in 12 issue areas considered potentially significant. These issues were selected after initial review in the IEC/IS, scoping, and consideration of CEQA-mandated topics. The 12 issue areas are:

- Air Quality and Greenhouse Gases
- Aquatic and Terrestrial Biological Resources
- Cultural Resources
- Earth Resources
- Environmental and Human Health/Risk of Upset
- Hydrology and Flooding
- Water Quality
- Land and Shoreline Use
- Noise
- Recreation
- Traffic and Transportation
- Utilities

Other CEQA-mandated topics addressed in this DEIR/DEIS are:

- Cumulative Effects
- Growth-Inducing Effects
- Significant Environmental Effects That Cannot Be Avoided
- Relationship Between Short-Term Uses of The Environment and Maintenance and Enhancement of Long-Term Productivity
- Identification of the Environmentally Superior Alternative

This DEIR/DEIS is organized into six chapters which conform to the required contents of an EIR established in CEQA (Article 9, Contents of Environmental Impact Reports) and the recommended format of an EIS under TRPA (TRPA Rules of Procedure Articles 6 and 7, and Chapter 3.7 of the Code of Ordinances).

- **Chapter 1** (this chapter) provides an introduction to the DEIR/DEIS, the project history and setting, regulatory requirements, roles and responsibilities of the Lead Agencies and other agencies, the history of public involvement and review, and an overview of the document.
- **Chapter 2** provides a summary of the Proposed Project and alternatives.
- **Chapter 3** presents the environmental setting, consequences and recommended mitigation measures. It is organized into major sections that present the approach to the environmental analysis, environmental health and risk, and the natural and built/human environments. The natural and human environmental sections are comprised of subsections addressing the major elements of the environment. Each of these sections identifies a list of potential issues to be evaluated, and describes the regulatory and environmental settings, potential effects and proposed mitigation for each issue, comparing the Proposed Project, Action Alternatives, and No Action Alternative. Each environmental issue has been analyzed against stated standards of significance where applicable. Mitigation measures are recommended for each significant impact, however no mitigation is provided for the No Action Alternative, as it represents conditions that would occur in the absence of any action.
- **Chapter 4** addresses potential cumulative effects.
- **Chapter 5** summarizes potentially significant effects and measures to reduce or avoid them; unavoidable significant effects; irreversible or irretrievable commitments of environmental resources; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity; potential growth-inducing effects; mandatory findings of significance; and consequences for TRPA environmental threshold carrying capacities. It also identifies the environmentally superior alternative. As described above, TRPA adopted Thresholds to protect the unique values of the Tahoe Region and Ordinances designed to achieve and maintain those standards. In Section 5.8, the Proposed Project and alternatives are evaluated in terms of attaining and maintaining TRPA's environmental threshold standards.
- **Chapter 6** summarizes compliance, consultation and coordination at all levels of government.

At the end of the DEIR/DEIS are provided a list of acronyms, a list of preparers, a list of agencies and other stakeholders consulted, and a list of references.

1.6.3 Terminology Used in the DEIR/DEIS

The DEIR/DEIS uses the following terminology consistent with CEQA Guidelines to denote the significance of potential environmental impacts.

- A “less than significant” impact or an impact that is “not significant” would cause no substantial adverse changes in the environment; no mitigation is needed.
- A “significant” impact could or would cause substantial physical changes in the environment. Mitigation is recommended to reduce the impact to a less-than-significant level.
- A “significant and unavoidable” impact is one that could or would cause a substantial adverse change in the environment that cannot be avoided if the project is implemented. Mitigation may be recommended but would not reduce the impact to a less-than-significant level.

In general, impacts for each resource or issue are analyzed and evaluated based on factors such as:

- Extent — considers whether the impact would be local or regional in nature.
- Duration — considers whether the impact is short-term (typically construction-related) or long-term (typically described in terms of years).
- Seasonality/Timing — considers variation in impact based on timing of effects.
- Intensity — considers whether the impact would be negligible (imperceptible or not detectable), minor (slightly perceptible and generally localized), moderate (apparent and having the potential to become larger) or major (substantial, highly noticeable and possibly permanent).
- Type — considers whether the impact would be beneficial or adverse.

2.0 PROJECT DESCRIPTION AND ALTERNATIVES

This chapter presents the Proposed Project, Action Alternatives, and No Action Alternative considered in this DEIR/DEIS to implement a Comprehensive Methods Test (CMT) for controlling target aquatic weeds in portions of the Tahoe Keys West Lagoon and Lake Tallac. The CMT is intended to evaluate the effectiveness of alternative methods for controlling target aquatic weeds in selected areas within the Tahoe Keys lagoons. Depending on outcomes of the CMT, an additional environmental review may be conducted to evaluate alternatives for a long-term strategy to manage target aquatic weeds throughout the Tahoe Keys lagoons. The history and status of aquatic weed infestation in Tahoe Keys lagoons is described in Section 1.1.3. This chapter explains the process used for alternatives development and selection, and summarizes alternatives that were considered and eliminated. Elements common to all alternatives are described, followed by a detailed description of the Proposed Project and Alternatives.

2.1 SUMMARY OF PROPOSED PROJECT AND ALTERNATIVES

This DEIR/DEIS considers the Proposed Project and two Action Alternatives for aquatic weed control methods testing (CMT), as well as the required No Action Alternative (Figure 2-1). (The terms and acronyms referenced in the figure below are defined in the pages immediately following.)

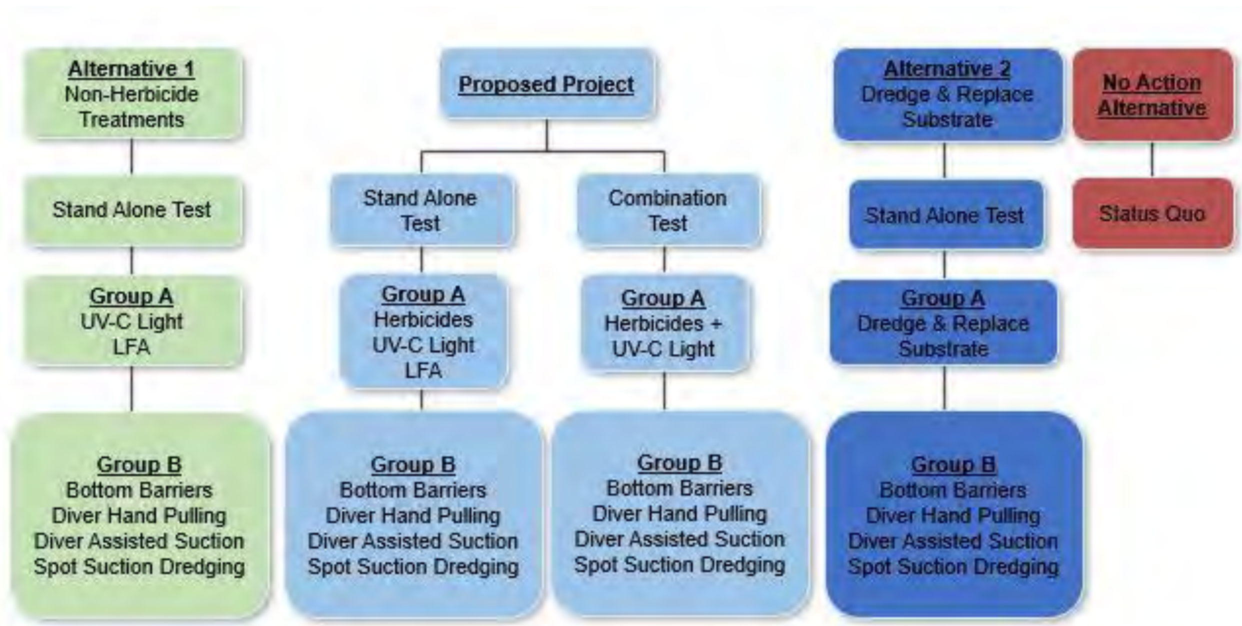

Figure 2-1 Components of the Proposed Project and Alternatives.

1. **Proposed Project:** The Proposed Project consists of a program to test a range of aquatic weed control methods, both as stand-alone treatments and in combination. Control methods were grouped as follows:

   a. **Group A methods** are initial treatments, both herbicide and non-herbicide, intended to achieve extensive reduction in target aquatic weeds (at least 75 percent reduction) within test sites. The Proposed Project tests stand-alone treatments using aquatic herbicides, ultraviolet light, and laminar flow aeration (LFA), as well as combined herbicide and ultraviolet light treatments. Non-herbicide Group A treatments (i.e., ultraviolet light (ultraviolet-C), see Section 2.3.3 below; and LFA, see Section 2.3.4 below) may be extended to additional years if monitoring indicates further treatment may be useful. For example, ultraviolet light may be repeated for a second year, while LFA testing is planned to extend over several years. Figure 2-2 shows the initial proposed test periods for each treatment.

b. **Group B methods** are non-herbicide maintenance treatments that are applied locally to follow up Group A treatments and control residual target aquatic weeds. Group B methods are intended to be long-term, sustainable control methods capable of maintaining aquatic weed control after initial Group A treatments have been applied to "knock down" the abundant target aquatic weeds in the Lagoons. For example, following a Group A herbicide treatment that achieves at least a 75% reduction in targeted aquatic weeds, Group B methods would be used to further control aquatic weeds and in no case would repeat use of herbicides be permitted as part of the project. Group B methods may include such actions as spot treatments with ultraviolet light, bottom barriers, diver-assisted suction and diver hand pulling techniques. Use of Group B methods would be implemented in years 2-3, following Group A methods (Figure 2-2). The selection of Group B methods would be informed by the decision tree shown in Figure 2-3, and also consider constraints from bottom morphology or other physical obstructions.

In addition to Group A and B methods, protective measures were identified and incorporated into the CMT alternatives, as described in Section 2.3.8 below. Protective measures were prescribed to contain and accelerate the degradation of aquatic herbicide applications, improve water circulation, control nutrient availability from sediments, enhance water quality (e.g., dissolved oxygen, pH, nutrient concentrations), and reduce the occurrence of harmful algal blooms (HABs). Additional mitigation measures were identified through the environmental evaluations described in Chapter 3, including those that may be implemented as needed, based on monitoring results.

2. **Action Alternative 1- Non-Herbicide Treatments:** One action alternative is to proceed only with tests of non-herbicide Group A methods of aquatic weed control. Under this alternative, no treatments with herbicides would be conducted, and other elements of the test program (i.e., ultraviolet light, LFA, and Group B methods) would be as described above for the Proposed Project.

3. **Action Alternative 2- Dredge and Replace Substrate:** This action alternative responds to comments received during public scoping and would consist of hydraulic dredging (i.e., wet excavation or suction dredging) of the bottom layers of organic material and sediment to remove the roots and turions of aquatic weeds, followed by placement of a new layer of bottom sediment (e.g., coarse sand or gravel).

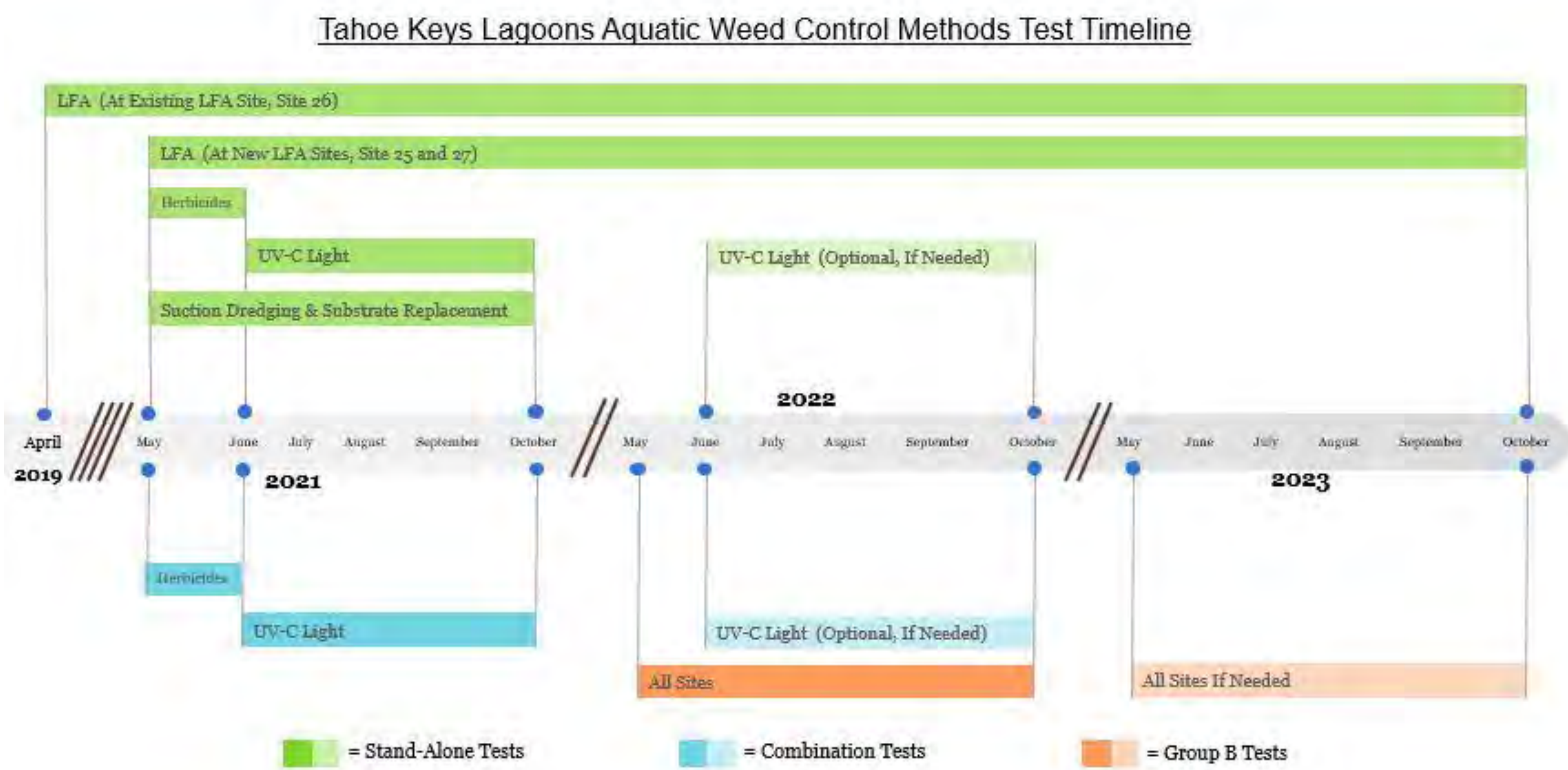

Figure 2-2 Tahoe Keys Lagoons Aquatic Weed Control Methods Test Timeline.

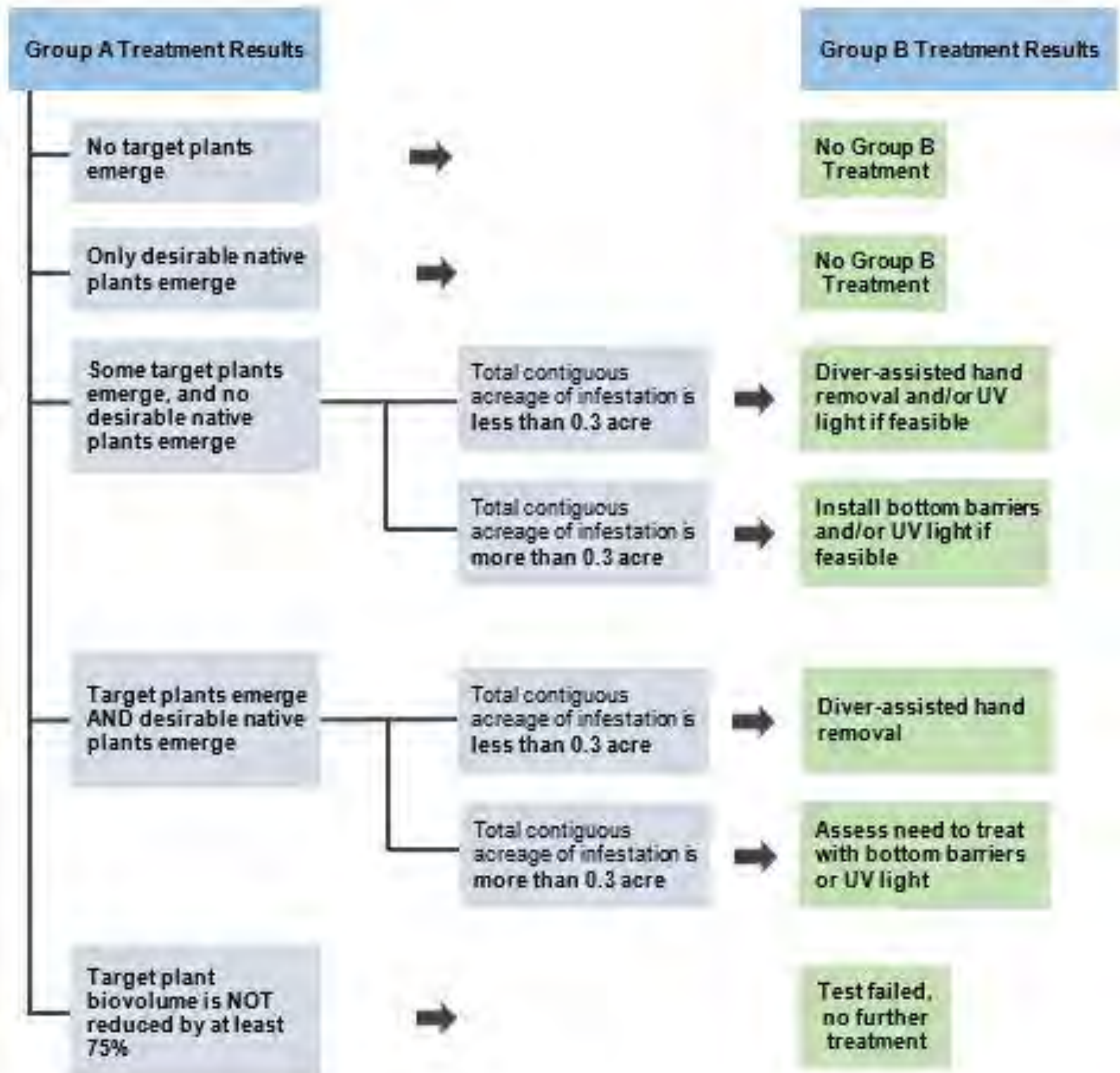

Figure 2-3 Decision Tree for Selecting Follow-up Group B Aquatic Weed Control Methods Based on Monitoring of Group A Treatments.

4. **No Action Alternative:** This alternative would consider the long-term consequences to the Tahoe Keys lagoons and Lake Tahoe of undertaking no new weed control activities in the Tahoe Keys lagoons. Under this alternative only existing control methods would be employed by TKPOA and individual property owners (e.g., voluntary use of bottom barriers, the existing LFA project, mechanical harvesting, and weed fragment control). Because herbicide and ultraviolet light applications would not be tested under this alternative, it is assumed that these methods for target aquatic weed control would not be used in the foreseeable future under a No Action Alternative.

2.2 ALTERNATIVES DEVELOPMENT AND SELECTION

2.2.1 Alternatives Development

As described in Chapter 1, the Lead Agencies worked with a Stakeholder Committee to provide broad guidance and input to the development of the Proposed Project and action alternatives. Building on initial work by the Stakeholder Committee, the Lead Agencies defined, screened, selected and characterized the proposed CMT and alternatives. This work included:

- Developing criteria for alternatives review and selection.
- Reviewing a wide range of potential alternatives against the criteria.
- Assigning alternatives to various parts of the test program (i.e., determining which methods for controlling aquatic weeds should be considered “Group A methods,” which are “Group B” methods, and which should be incorporated as design mitigation in the test program).
- Considering which alternatives should be carried forward for review and which should be eliminated and prepare statements that explain these decisions. Those alternatives that were considered and eliminated from consideration are described in Section 2.7 at the end of this chapter.
- In-depth development of the components and approach to be used in the Proposed Project and Action Alternatives, as well as the No Action Alternative.
- Preparation of narrative descriptions of the Proposed Project, Action Alternatives, and No Action Alternative, with accompanying graphics, maps, figures, tables, and appendices.
- Supervision of the preparation of DEIR/DEIS materials presenting the alternatives process and the description of the Proposed Project and alternatives.

2.2.2 Selection Criteria

The following four criteria were used to screen and select alternatives to be used in the proposed control methods test and action alternatives:

1. **Ability to meet Proposed Project goals and objectives**

   Project Goals and Objectives are set forth in Chapter 1 of the DEIR/DEIS. This criterion considers whether a project alternative will meet these goals and objectives, and related performance measures. If the alternative was considered unable to meet project goals and objectives, it was eliminated from further consideration.

   This criterion incorporates consideration of the efficiency and efficacy of methods to control aquatic weeds. For this DEIR/DEIS, it also focuses on the objective of testing aquatic weed control methods, as opposed to long-term management of aquatic weeds, which will be addressed in subsequent work under CEQA and TRPA.

2. **Feasibility**

   In accordance with the requirements of CEQA and TRPA, only alternatives which are feasible need be considered (CEQA Guidelines Section 15126.6[a] & TRPA Code of Ordinances 3.7.4.B.). The CEQA Guidelines and the TRPA both define feasible as “*Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic,* *environmental, legal, social, and technological factors*." (State CEQA Guidelines Section 15364). In determining which alternatives are potentially feasible, this DEIR/DEIS focuses on consideration of technical and economic feasibility/practicality; the potential to violate federal, regional or State statutes or regulations; and whether an alternative balances relevant economic, environmental, social, and technological factors.

In determining whether an alternative was infeasible due to legal factors, alternative screening considered the antidegradation policy and prohibition exemption criteria outlined in the LWB Basin Plan, including the potential to violate any water quality objective; the potential to cause long-term degradation of water quality; and the ability to limit any short-term degradation of water quality to the shortest possible time and confine it to the smallest area necessary for success.

a. The only discussion on infeasibility of an alternative that I see in this chapter relates to dry dredging. How was Lahontan's antidegradation analysis and water quality objectives used to consider the "infeasibility" of an alternative? Many of our approved permits and the underlying discharge associated with them have the potential to exceed a water quality objective (that is why we include effluent limitations in the permit). I don't think we exclude those as being infeasible. I'm supposing that alternatives that were certain to create long term degradation and violation of objectives were not discussed. This may or may not need to be rewritten. I would first like to understand how our Basin Plan was used to determine infeasibility.

3. **Level of impacts**

Alternatives should avoid or substantially lessen the significant environmental effects of the project. This criterion considers the extent of impacts and the degree to which potentially significant impacts were judged capable of being avoided or mitigated. It also considers whether the residual (unmitigatable) impacts of the project are large relative to other alternatives. It considers the risks and unintended consequences potentially posed by the project to the extent that they can be reasonably foreseen.

4. **Similarity to other alternatives carried forward**

This criterion recognizes that while a representative range of alternatives must be considered, neither CEQA nor TRPA generally require the evaluation of every variation within that range. Some alternatives can be eliminated from consideration because they are sufficiently similar to those that are carried forward (State CEQA Guidelines Section 15126.6(a)).

2.2.3 Group A Methods Selected

Treatments carried forward for evaluation in the DEIR/DEIS include Group A methods selected based on their ability to meet the criteria described above. The selected Group A methods are listed below, with a brief summary of the reasons they were selected for consideration. The selected test methods are more fully described in the sections below presenting the Proposed Project and Action Alternatives. Group A herbicide methods would be tested only for the initial treatment year (one year), followed by Group B methods in years two and three. However, as noted above, it may prove informative to continue Group A ultraviolet light and LFA treatments for additional testing; this would be determined as initial treatments were completed.

- Aquatic herbicides: proposed by TKPOA following research and consultation with aquatic weed control specialists from government agencies and academia[1], herbicide products were selected to target aquatic weed species in Tahoe Keys lagoons and minimize potential effects to non-target plants, animals, and people.
- Ultraviolet Light: an emerging aquatic weed control technology that was tested at Lakeside Marina and Lakeside Beach in 2017, resulting in some dieback of Eurasian watermilfoil, curlyleaf pondweed, and coontail.
- Laminar Flow Aeration: a technology to improve water quality in water bodies with low dissolved oxygen and buildup of fine organic sediment, LFA has recently been tested at a small site at Ski Run Marina resulting in reductions in organic sediment thickness, sediment nitrogen concentrations, and aquatic plant coverage.
- Suction Dredging and Substrate Replacement: among alternatives proposed in public scoping comments to physically modify the Tahoe Keys lagoons, suction dredging and replacing bottom substrate was selected as the most feasible approach for further evaluation.

2.2.4 Group B Methods Carried Forward in the DEIR/DEIS

Bottom Barriers: Synthetic bottom barriers have been used in the Tahoe Keys West Lagoon since 2011, limited to a maximum of five acres in any single application are currently permitted. The barriers are mats of fabric that are anchored to the substrate with weights before or during the early stages of seasonal plant growth, with the purpose of physically suppressing growth and blocking sunlight. Barriers are hand-placed by diver crews and remain in place for two to four months before they are relocated or removed from the water. Bottom barriers are not species selective, and native plants and invertebrates in the covered areas would be at least temporarily impacted.

Bottom barriers have shown success in other areas of the lake for discreet aquatic weed infestations. For example, bottom barrier treatments complemented by diver hand pulling and suction removal of pulled plants, successfully controlled Eurasian watermilfoil within Lake Tahoe's Emerald Bay (on a total of six acres in three locations). While their use has been effective at small scales in other areas of the lake, their success in the Tahoe Keys has been shown to be short-term, and recolonization is common. Many areas of the Tahoe Keys are covered with a thick organic layer, which limits the ability of bottom barriers to function effectively. In densely infested areas plant fragments can root and grow in sediment that has settled on top of barriers.

Impermeable Bottom Barriers with Hot Water or Acetic Acid: Scoping comments have suggested that bottom barrier effectiveness may be improved by injecting hot water, steam and/or acetic acid underneath impermeable barriers after they are anchored on the substrate. Although these methods have not been demonstrated in the field, bench- and mesocosm-scale experiments have shown that these methods have the potential to inhibit sprouting of curlyleaf pondweed sprouting (Barr and DiTomaso 2014), supporting a decision to include them in the test program. These injections would be

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[1] TKPOA consulted with a panel that included Joel Trumbo, Senior Environmental Scientist with CDFW; Dr. Kurt Getsinger, Leader of the Cheical Control and Physiological Processes Team for the U.S. Army Corps of Engineers; Dr. Pat Akers, Supervising Scientist of Aquatic Weed Eradication Programs at CDFA; Dr. Sudeep Chandra, Associate Professor of Limnology at the University of Nevada, Reno; and Dr. Joe DiTomaso, Cooperative Extension Specialist in the Department of Plant Sciences at the University of California, Davis.

considered a discharge and subject to NPDES permitting and antidegradation policy requirements, with concerns for impacts to water temperature and pH. Other aspects of bottom barriers would be similar to those described above for bottom barriers.

Diver-assisted Suction/Hand Pulling: This method employs SCUBA divers (or snorkelers in very shallow water) to manually pull aquatic weeds from the sediment and guide them into a suction device that pumps the plant materials onto a barge where they are bagged and removed for offsite disposal. Water is returned away from where the divers are working. Trained divers can selectively remove target species while limiting sediment disturbance and impacts to native plants and animals. This labor-intensive method, complemented by bottom barrier use, was successful at removing all or nearly all viable propagules in treated areas of Emerald Bay; however, due to the scale of the Tahoe Keys, diver assisted suction/hand pulling is considered a Group B method. Shaw et al. (2016) reported approximately 340 to 380 hours of dive time per year at approximately six acres of sites in Emerald Bay between 2010 and 2013, with the dive time required to maintain sites being much less at each site after the year when intensive treatment was completed. The production rate for dive crews performing Eurasian watermilfoil removal at Upper Saranac Lake in New York was considerably higher, at approximately 1.1 to 1.4 days per acre during years of intensive management, and 0.4 to 0.6 days per acre during the following two maintenance years (Kelting and Laxson 2010). Risk factors are higher for divers at high elevations, and worker productivity is less compared to sea level. Fragment control and turbidity are potential environmental challenges.

Spot Suction Dredging: Spot suction dredging intended to remove targeted aquatic plants and sediment could be used around obstructions, but would come with significant challenges for: (1) structural stability of docks, (2) sediment dewatering before the sediment could be transported for off-site disposal, and (3) treatment of dewatering water before it could be discharged. Although residual aquatic weeds would be targeted, like other dredging methods spot suction dredging would result in some loss of non-target plants and animals.

2.3 PROPOSED PROJECT: AQUATIC WEEDS CONTROL METHODS TEST (CMT)

This section describes the Proposed Project (CMT) and provides detailed information on the proposed treatment schedule and duration for aquatic weed control methods that would be tested. The Proposed Project would test both stand-alone treatments of Group A methods (i.e., herbicides, ultraviolet light, and LFA), and a combination of herbicide and ultraviolet light treatments. Descriptions of herbicide methods include the specific herbicide products proposed for use, spatial extent of herbicide applications, estimated cost of treatment, method and rate of application, control and containment measures, and best management practices proposed for herbicide application and monitoring. Group A methods, applied in the first year of the CMT, would be followed by implementation of Group B methods in the two years following. Specific follow-on Group B methods would be selected based on the presence of target aquatic weed and other plants, Group A monitoring results, and site conditions present at the time of implementation. Figure 2-3 illustrates how Group B methods may be selected. Where potentially significant impacts are identified in Chapter 3 of this EIR/EIS, Group A and Group B treatments would be supported by the implementation of mitigation measures, also identified in Chapter 3.

Mechanical harvesting would continue to be performed at all sites (both test and control sites) during the testing period. As a baseline condition of the test project, harvesting would be conducted when and as needed following the existing harvesting protocol implemented by TKPOA; however, mechanical harvesting equipment and boats would not enter herbicide test sites until at least 72 hours following the end of a chemical application. The current program of mechanical harvesting and fragment control methods would also continue during this period in areas of the lagoons outside of test sites. Barriers in place to prevent herbicide movement toward the West Channel would be briefly pushed below the surface just enough to enable the passage of shallow-bottom boats used for mechanical harvesting and fragment control. The boat motors would be turned off during passage to prevent any damage to the barrier from propellers.

2.3.1 Overview of Test Program

2.3.1.1 Target Aquatic Weeds

The Proposed Project tests the efficacy, compatibility, and utility of methods to control three target aquatic weeds: Eurasian watermilfoil (*Myriophyllum spicatum*), curlyleaf pondweed (*Potamogeton crispus*), and coontail (*Ceratophyllum demersum*).

2.3.1.2 Location and Size of Test Plots, Including Controls

Tests would be conducted at selected sites within the Tahoe Keys lagoons. Figure 2-4 shows the currently anticipated locations of the sites for testing Group A methods (note that these locations may be adjusted based on Spring 2021 hydroacoustic scans and macrophyte surveys in the lagoons). Adjustments to the locations or site boundaries would not result in an expansion of the overall area for aquatic weed control testing or the total area where aquatic herbicides would be tested.

A total of 21 test sites are proposed for treatment using Group A methods (herbicides, ultraviolet light, both herbicide and ultraviolet light, or LFA) in year one of the CMT (Figure 2-4). An additional three sites would be monitored as control/reference sites for comparison. The test plan comprises the following distribution of sites:

- Six herbicide-only sites in the West Lagoon (three replicate sites each for two herbicide products)
- Three herbicide-only sites in Lake Tallac (three replicate sites for one herbicide product)
- Three ultraviolet light-only sites
- Six combination sites (herbicides and ultraviolet light treatment)
- Three LFA-only sites
- Three control sites

The 21 test treatment sites (and the three control sites) reflect the heterogeneity of the Tahoe Keys lagoons, including 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 total area proposed for treatment with Group A methods is 41.4 acres divided among 21 sites. This represents approximately 24 percent of the total surface area of the Tahoe Keys lagoons. The total area to be treated with herbicides would be 16.7 acres, including those test sites where herbicides would be

SOURCE: DigitalGlobe, 2016

Tahoe Keys Lagoons Restoration Program EIR/EIS, D180990

ESA

Figure 2-4 Anticipated Locations of Proposed Project Aquatic Weed Control Group A Test Sites and Control Sites in Tahoe Keys Lagoons.

Table 2-1 Proposed CMT Test and Control Sites.

Site Number	Treatment	Area (ac)	Herbicide Treated Area
1	Herbicide	1.5	1.5
2	Herbicide	1.5	1.5
3	Herbicide	2.1	2.1
5	Herbicide	2.2	2.2
8	Herbicide	1.6	1.6
9	Herbicide	1.5	1.5
10	Herbicide/Ultraviolet Combination	2.0	0.7
11	Herbicide/Ultraviolet Combination	1.6	0.5
12	Herbicide/Ultraviolet Combination	1.9	0.7
13	Herbicide/Ultraviolet Combination	1.7	0.6
14	Herbicide/Ultraviolet Combination	2.0	0.7
15	Herbicide/Ultraviolet Combination	1.2	0.4

Site Number	Treatment	Area (ac)	Herbicide Treated Area
16	Control	1.8	0.0
17	Control	2.2	0.0
18	Control	1.5	0.0
19	Herbicide	1.0	1.0
20	Herbicide	1.0	10
21	Herbicide	0.9	0.9
22	Ultraviolet Light	1.5	0.0
23	Ultraviolet Light	1.6	0.0
24	Ultraviolet Light	1.8	0.0
25	Laminar Flow Aeration	4.1	0.0
26	Laminar Flow Aeration	6.1	0.0
27	Laminar Flow Aeration	2.7	0.0
Total acreage (not including Control Sites)		**41.5**	**16.9**

Note: The numbers 4, 6 and 7 are not used in the site numbering.

used alone or in combination with ultraviolet light treatments (see Table 2-1). (Within the combination treatment sites, one-third of the area is assumed to be used for herbicide applications.) This represents approximately 10 percent of the total surface area of the 172-acre Tahoe Keys lagoon system.

Test plot locations may be adjusted based on the results of spring macrophyte surveys to ensure that target weed infestations are dominant in treatment areas. Figure 2-4 illustrates the location and size of each of the 21 proposed treatment sites and identifies the three control sites. Table 2-1 corresponds to Figure 2-4, and identifies the treatment type, site acreage and area of herbicide treatment planned for each site. Any adjustments to these site locations would not expand the total area for testing aquatic weed control methods or the total area of herbicide tests.

Treatment areas and receiving waters (i.e., waters outside of treatment areas) for the Proposed Project are located within the Tahoe Keys West Lagoon and Lake Tallac. No treatment areas are located in the East Lagoon or Lake Tahoe proper. Areas of the West Lagoon with herbicide testing sites would be isolated from other areas of the lagoon using double turbidity curtain barriers, and thus also be isolated from the West Channel and Lake Tahoe.

2.3.1.3 Test and Monitoring Period

A three-year test program is proposed:

> Group A methods would be used first to reduce the population of the target aquatic weeds, with a target reduction of at least 75 percent in the treatment areas. It is important to understand that, within the three-year test program, each Group A method functions on its own timeline; some methods are expected to work more quickly than others in achieving the target reduction. Only a single treatment with aquatic herbicides would occur at all herbicide test sites in late spring of the first year of the test program. Ultraviolet light treatments would extend through the summer and possibly into the fall of the first year. Based on monitoring results, it may be determined that a second year of ultraviolet light treatments may be necessary to achieve the 75 percent target species reduction. LFA would be installed in the spring of the first year and operated year-round for

the entire three-year test program, with monitoring each year to determine progress toward the 75 percent target reduction.

Group A treatments generally would be followed by monitoring and up to two years of treatments applying Group B aquatic weed management methods, to eliminate or manage residual aquatic weed populations. It should also be noted that NPDES permit conditions may require monitoring beyond the three-year test program.

2.3.1.4 Control Sites

Three sites would be monitored as controls for the testing program (see Figure 2-4). The control sites would be of a similar size (1.5 to 2.2 acres each) as the proposed treatment sites and exhibit a similar plant distribution and abundance. No new weed control methods would be applied at control sites during the methods test. Information on treatment performance and environmental effects from treatment site monitoring would be compared using similar monitoring at control sites to evaluate the significance of differences in plant populations and environmental conditions resulting from treatments.

2.3.2 Stand-Alone Tests of Aquatic Herbicides

Detailed hydroacoustic and aquatic macrophyte surveys would be completed in the test sites in the spring prior to initiating the testing program, as soon as water conditions allow. These survey results would provide information on the species mix and biovolumes of macrophytes, and would be used to decide (1) final test site locations and boundaries to minimize effects on non-target species, and (2) which of the proposed herbicides to apply at each herbicide test site to best match the target species present. Any adjustments to site locations and boundaries would not expand the total area of herbicide testing.

2.3.2.1 Test Frequency and Timing

Each application of an herbicide at an individual test site would occur in a single day and monitoring for herbicide residues would continue both within treatment areas and in adjacent receiving waters for a minimum of 30 days after application. Monitoring would continue after 30 days, if necessary, until the herbicide active ingredient and degradate concentrations (i.e., chemical compounds resulting from herbicide degradation) are non-detectable.

One round of aquatic herbicides would be applied at each herbicide or combination test site in a single day, estimated to be in either May or the first half of June, and completion of applications to all herbicide test sites would take several days. Timing would be determined by assessing Lake Tahoe Basin snowmelt runoff conditions and the associated hydraulic flow patterns between Lake Tahoe and the lagoons. Lake Tahoe is typically filling in late spring during the proposed herbicide application period. Under this hydrologic condition, water flowing into the lagoons from Lake Tahoe would provide an additional safeguard to keep herbicide active ingredients and degradates from moving northward toward the lake during the application period. Specific herbicide application dates would be determined by weather patterns, Lake Tahoe Basin snowmelt runoff conditions, and the associated hydraulic flow patterns between Lake Tahoe and the East Lagoon, prior to the proposed herbicide application period. This late spring herbicide application schedule is also designed to kill the target plants during their early stages of growth when biomass and resulting decomposition would be minimized.

2.3.2.2 Geographical Extent of Testing

The nine stand-alone herbicide test sites would apply one of two herbicides (endothall and either florpyrauxifen-biphenyl or triclopyr if florpyrauxifen-biphenyl is not approved in California) at three sites each in the West Lagoon. In addition, endothall, would be tested at an additional three sites in Lake Tallac. Only endothall would be tested in Lake Tallac (Sites 19-21) because: (1) in a mesocosm study (TKPOA 2016) this product was effective in killing all three target aquatic weed species found in Lake Tallac; (2) three replicate sites are needed in Lake Tallac to provide a consistent level of replication in the study design of herbicide efficacy and environmental effects; and (3) the area outside of the direct flow path of stormwater was limited at the east end of Lake Tallac, allowing room for only three small test sites there. Testing three replicates for each treatment would allow statistical comparisons of data (e.g., Analysis of Variance "ANOVA") both among treatment sites and with non-treated "control" sites. The replications would provide data on variability among those sites treated with the same herbicide, as well as in comparison to other herbicide treatments, non-herbicide weed control methods, and control sites. Documenting this variability would provide the basis for differentiating the treatments on the basis of their efficacy in controlling aquatic weeds and detecting differences in environmental effects. At those sites identified as herbicide-only test treatment areas in the West Lagoon, the minimum treatment site area would generally be larger than one acre, to adequately represent the aquatic weed diversity present and to allow for typical diffusion of the active ingredients of the aquatic herbicides (Kolada 2016). The proposed one-acre minimum size would be representative of the variation between and commonalities with other sites in the Tahoe Keys lagoons (e.g., bathymetric characteristics and species diversity). Herbicide test treatment areas in Lake Tallac would be slightly less than one acre in order to: (1) fit them into the area east of and away from direct influence of the primary stormwater inflow channel, and (2) provide space to differentiate treatment effects between the three sites.

Due to the presence of target aquatic weed propagules such as rhizomes, turions, and seeds, the aquatic herbicide test is not expected to completely eradicate all targeted aquatic weeds in the treatment area. The total size of the treatment sites is expected to provide sufficient area to apply and evaluate several follow-up Group B non-herbicide treatments. To minimize herbicide drift during testing and to control the drift of weed fragments into the treatment sites, most herbicide-only application sites are proposed to be located in backwater dead-end coves located away from the West Channel (the channel connecting the West Lagoon to Lake Tahoe). Further, double turbidity curtain barriers are also proposed to be located to prevent drift toward the West Channel. These proposed locations have been selected to represent typical infested conditions throughout most of the lagoons; with dead-end coves comprising more than 75 percent of the total infested areas.

Stand-alone herbicide test site selection considered the following characteristics and goals:

- Treat target aquatic weed species present in the Tahoe Keys lagoons test sites, where effects on non-target aquatic plants can also be evaluated.
- Expose the target aquatic weeds to full recommended and approved concentrations of aquatic herbicides in adequately sized test areas. Test plots and volumes that are too small can result in rapid dilution, which is not typical of conditions recommended for aquatic herbicide treatments.
- Select sites that represent the range of bathymetric variability (e.g., water depth conditions) present in the lagoons.

2.3.2.3 Specific Herbicide Test Application Parameters

Herbicides Considered for Use and Application

In their NPDES permit and Basin Plan Exemption application for the Proposed Project (TKPOA 2018), TKPOA proposed specific herbicide products to use for controlling target aquatic weeds. These products were proposed based on literature review, a mesocosm-scale study of effects on target and non-target plants from Tahoe Keys (TKPOA 2016), and consultation with a panel of aquatic plant management experts from government agencies and academia. The herbicides were chosen as those expected to be most effective in killing target aquatic weed species in the shortest time period and with the least potential adverse effects to non-target plants, aquatic life, and people.

Endothall and triclopyr are currently used throughout the United States, including in California, to control the same aquatic weeds found in the Tahoe Keys lagoons. Florpyrauxifen-biphenyl is a newer aquatic herbicide product that has been approved for use by the U.S. Environmental Protection Agency (USEPA) and is under review for use in California. If approved before the initiation of the CMT, florpyrauxifen-biphenyl would be substituted for triclopyr in treating sites dominated by Eurasian watermilfoil. The uses, approved sites, methods of application, limitations and restrictions of use, and the targeted aquatic weeds of each of the proposed aquatic herbicides are specified by each product's labeling.

Endothall (e.g., Aquathol K liquid): Endothall is a contact[2] herbicide applied as a liquid formulation directly to target aquatic weeds. It typically requires a contact time of 12 to 24 hours at concentrations of either four or two parts-per-million (ppm) for control of the target species and has a half-life of between five and 10 days. It has some species selectivity and has little effect on Elodea at normal application rates of one to three ppm (Washington Department of Ecology 2001, Gettys et al. 2014, Anderson 2017). Endothall has proven to be effective in controlling curlyleaf pondweed when applied at low rates (Anderson 2016, 2017). It is the one herbicide product proposed in the CMT that has been demonstrated to be effective in controlling all three target species at other lakes.

Triclopyr (e.g., Renovate liquid or granular): Triclopyr is a systemic[3], selective[4] herbicide that is applied either as a liquid or a solid. It acts in two to five days at concentrations of 0.5- 2.5 ppm for selective control of Eurasian watermilfoil and has a half-life of 0.5 to 7.5 days. It has little to no effect on pondweeds, coontail or Elodea (Washington Department of Ecology 2004, Gettys et al. 2014, Anderson 2017); therefore, among the target species it may control only Eurasian watermilfoil. Triclopyr would be tested if florpyrauxifen-biphenyl has not been approved for use in California.

Florpyrauxifen-benzyl (e.g., ProcellaCOR EC liquid): Registered under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) in 2018, florpyrauxifen-biphenyl is a systemic, selective herbicide developed for management of freshwater aquatic vegetation in slow-moving/quiescent waters with little or no continuous outflow (e.g., ponds and lakes) or slow-moving quiescent areas of rivers (USEPA 2018). ProcellaCOR EC liquid is applied at a concentration of 50 micrograms-per-liter (µg/L) or less (TRC 2017)

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[2] Contact herbicides kill only the plant parts contacted by the active ingredient chemical.

[3] Systemic herbicides are absorbed by roots or foliage and translocated throughout the plant.

[4] Selective herbicides are used to kill weeds without damaging desirable plants.

and absorbed by aquatic vascular plants through emergent or floating leaves and from water through submersed plant shoots and leaves. In-water treatments are effective in spot and partial treatment designs with relatively short exposure times (i.e., hours to several days). Effective control can be achieved over a broad range of growth stages and environmental conditions, and best results are observed when applying to actively growing plants. Florpyrauxifen-biphenyl is more short-lived than the other herbicides, with a half-life of four to six days in aerobic aquatic environments and two days in anaerobic aquatic environments (TRC 2017). A 2016 mesocosm study found that florpyrauxifen-biphenyl was very effective in controlling Eurasian watermilfoil, and desirable native plants appeared to be less affected by florpyrauxifen-biphenyl than other herbicides tested (Anderson 2017). Coontail may also be susceptible to florpyrauxifen-biphenyl (USEPA 2018), but it may not be effective in controlling curlyleaf pondweed. Florpyrauxifen-biphenyl is under review but has not yet been approved for use in California and would only be tested at Tahoe Keys if it has been approved.

Herbicide Application Methods and Rates

Aquatic herbicide labels typically specify a range of allowable application rates (i.e., concentrations). This is because: (1) the relative abundance of target aquatic weeds varies and weeds have difference susceptibilities to herbicides; (2) the conditions in the field may vary from flowing to static, thus affecting contact time; and (3) certain application methods can often reduce the need for higher rates. The characteristics of the proposed demonstration sites (e.g., susceptible species, low dilution rates within cover, and vertical mixing) generally preclude the necessity of using maximum label rates. Therefore, all aquatic herbicides may be applied at rates that are below the maximum concentrations allowed by the product registration, yet are anticipated to produce desired efficacy based on mesocosm studies (Anderson 2017). However, maximum allowable rates may be used to ensure the best efficacy results are obtained at a pilot scale. Table 2-2 and Table 2-3 summarize the maximum application rates and application methods for the CMT. The environmental evaluations in this DEIR/DEIS assume that concentrations up to the maximum allowable rates would be used in herbicide testing.

Liquid formulations would 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. Should the Applicator select a granular (solid) formulation (e.g., for areas under and around docks), the pesticide would be applied either by small, powered granular spreader or a powered air stream (i.e., blower) spreader connected to a boat-mounted hopper system. These systems are commonly used and readily available commercially. All systems would be calibrated properly for the herbicide formulation to be used.

The three aquatic herbicides selected for testing, and the proposed formulations, were chosen to optimize management and control of the target aquatic weeds while minimizing effects on non-target plants. The following conditions and criteria were considered as part of the selection process to tailor the product, timing of application, and control of target aquatic weeds while minimizing non-target impacts:

- Plant species present in integrated test area (non-target vs. target species).
- Establishment of threshold treatment conditions (plant growth stage).
- Physical conditions (water movement, wind, total water volume).
- Method of application.
- Duration and rate of application.

Table 2-2 Proposed Herbicides, Application Rates, and Application Methods.

Herbicide* Active Ingredient (Product Name)	USEPA Reg. No.	Maximum Allowable Rate (ppm)	Application Method (s)	Target Plants per Product Labeling
Endothall (Aquathol K) Contact-type	USEPA Reg. No. 70506- 176	5.0	Drop hoses	Eurasian watermilfoil Coontail Curlyleaf pondweed
Triclopyr (Renovate 3 [liquid] or OTF [granular])	USEPA Reg. No. 67690-42	2.5	Drop hoses (liquid) or granular spreader (solid)	Eurasian watermilfoil
Florpyrauxifen-benzyl (ProcellaCOR)	USEPA Reg. No. 67690-80	0.003	Drop hoses	Eurasian watermilfoil Coontail

*No adjuvants (i.e., additives to enhance herbicide activity) would be used. Only products approved for use in California would be used.

Table 2-3 Proposed Test Herbicide Application Treatment Site Details.

Site Number/Treatments	Application Rate (ppm)	Plot Size (acres)	Actual Herbicide/ Zone Size (acres)
1 Herbicide (**Endothall**)	5	1.5	1.5
2 Herbicide (**ProcellaCOR***)	0.003	1.5	1.5
3 Herbicide (**ProcellaCOR***)	0.003	2.1	2.1
5 Herbicide (**Endothall**)	5	2.2	2.2
8 Herbicide (**Endothall**)	5	1.6	1.6
9 Herbicide (**ProcellaCOR***)	0.003	1.5	1.5
10 Combo Herb/Ultraviolet (**Endothall**)	5	2.0	0.7
11 Combo Herb/ Ultraviolet (**ProcellaCOR***)	0.003	1.6	0.5
12 Combo Herb/ Ultraviolet (**ProcellaCOR***)	0.003	1.9	0.7
13 Combo Herb/ Ultraviolet (**Endothall**)	5	1.7	0.6
14 Combo Herb/ Ultraviolet (**Endothall**)	5	2.0	0.7
15 Combo Herb/ Ultraviolet (**ProcellaCOR***)	0.003	1.2	0.4
16 Control	N/A	1.8	0.0
17 Control	N/A	2.2	0.0
18 Control	N/A	1.5	0.0
19 Herbicide (**Endothall**)	2 to 5	1.0	1.0
20 Herbicide (**Endothall**)	2 to 5	1.0	1.0
21 Herbicide (**Endothall**)	2 to 5	0.9	0.9

Notes:
Refer to Figure 2-4 for site locations.
*Triclopyr at an application rate of 2.5 ppm would be substituted for ProcellaCOR if ProcellaCOR is not approved for use in California.

- Potential risks to humans and the natural environment.
- Contingency planning and monitoring access.
- Shown efficacy of herbicide on target plants in other locations or in mesocosm studies.
- Ease of use and handling requirements.
- Minimize interference with beneficial uses such as recreation or habitat.

Because some of these conditions are variable from one year to the next, the locations of herbicide test applications may be adjusted based on the spring macrophyte survey results. The choice of which herbicide product to use at each test site may also be changed from those specified in Table 2-3 to best control the dominant target species present (i.e., endothall that has been shown effective in controlling all three target species vs. triclopyr or florpyrauxifen-benzyl which may not be effective in controlling curlyleaf pondweed and coontail). It is a goal of the CMT design to have three replicates tested for each herbicide product or combination of herbicide product and ultraviolet light.

Herbicide Containment

Double Turbidity Curtains: Double turbidity curtains would be used as barriers to block the movement of dissolved herbicide chemicals from test treatment areas into receiving waters (supplemented by ongoing monitoring to assure the effectiveness of the barriers within the limits prescribed by regulation) and prevent the movement of the chemicals toward the channel connecting the West Lagoon to Lake Tahoe. Fabric turbidity curtains would be suspended from floating booms stretched across lagoon channels and

anchored to the shore and lagoon bottom. A 2016 rhodamine dye study tested the performance of double turbidity curtains at two dead-end lagoon locations in the southwestern area of the Tahoe Keys West Lagoon (Anderson 2016). In that study, the curtains retained 98 percent to 99 percent of the injected dye for at least 12 to 14 days of monitoring, and similar curtains would be deployed for the CMT. Barriers would not be required for test sites located in Lake Tallac, as it is not directly connected to Lake Tahoe.

Figure 2-4 shows proposed locations for double turbidity curtain barriers:

- One barrier north of Site 15 would isolate a back area of the West Lagoon with two herbicide test sites and one herbicide/ultraviolet light combination treatment site from the rest of the West Lagoon;
- Three barriers would isolate herbicide/ultraviolet light applications in combination Site 14 from the rest of the West Lagoon, including the adjacent herbicide-only test Site 2; and
- One barrier would plug the culvert at the north end of herbicide test Site 1 to impede migration of herbicide chemicals toward the West Lagoon connecting channel. A second barrier would plug the culvert between Sites 3 and 16 to separate an herbicide testing site from a control site.

Monitoring in receiving water areas between test sites would be compared with monitoring within control sites and used to evaluate how target aquatic weed control treatment activities affect water quality, including protection of beneficial uses and attainment of Basin Plan water quality objectives.

Double turbidity curtains would be placed around individual or groups of herbicide treatment areas to prevent herbicide active ingredients and degradation chemicals from moving outside of treatment areas. The movement of the applied aquatic herbicide chemicals toward Lake Tahoe would be further controlled through timing, site selection, and taking advantage of hydraulic gradients from Lake Tahoe toward the lagoons.

Applicator Control: A licensed applicator would apply proposed herbicides in compliance with the approved label application rates (i.e., less than or equal to maximum label application rates) to achieve the proper concentrations, 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 near potable water sources and waters used for irrigation, swimming, or fishing. Registered labels and Safety Data Sheets (SDS) for each proposed aquatic herbicide can be found in the 2018 Aquatic Pesticide Application Plan (APAP), Appendix APAP.

As required by California State law, aquatic herbicide applications would be made only by a Qualified Applicator Certificate Holder (QAL) approved by the California Department of Pesticide Regulation (CDPR). Staff directed by the QAL would have knowledge of the proper selection, use, and calibration of the equipment used during the application of aquatic herbicides. The QAL would follow all Best Management Practices (BMPs), monitoring, reporting, and contingency measures set forth in the APAP. The APAP provides all of the details for aquatic herbicide applications, including containment, monitoring and contingency measures, and is prepared by the project proponent as part of the project NPDES permit application. As a condition of the contract with the QAL, TKPOA would receive written documentation and verification of the QAL's training, including any staff used for the Project. In addition, proof of liability insurance coverage would be required of all contractors that do work for TKPOA. These documents would be in possession of the TKPOA before any herbicides were applied, and would be made available to staff of the Lahontan Water Board at least 30 days before herbicide tests begin.

Monitoring and Reporting Programs: To help ensure the safe and efficient use of the herbicides, protective measures and a monitoring and reporting program would be implemented that incorporate requirements described in the Aquatic Pesticide Application Plan (APAP, TKPOA 2018f). They would be implemented to prevent accidental spills, contain herbicides within the treatment area, monitor concentrations and movement of the aquatic herbicide chemicals and degradates after application, and alert the public and water purveyors should aquatic herbicides move beyond the treatment areas into areas of the lagoons or Lake Tahoe beyond planned containment. The APAP includes contingency measures that would be undertaken to provide treatment or bottled water if monitoring detected herbicides moving toward drinking water wells or intakes.

In addition to the protective measures and monitoring proposed in the APAP, Monitoring and Reporting Plan (MRP) would be adopted as part of the conditions required for a CWA §401 certification and an individual project NPDES permit. The MRP would include water quality monitoring and other requirements for plan submission, activity monitoring, and reporting of all required items specific to permit compliance. Activities under the current TKPOA Waste Discharge Requirements (WDRs) also include monitoring and reporting requirements specific to the WDRs. Additionally, the Basin Plan exemption criteria would require a Pre-Project Biological Monitoring Program to be reviewed by a panel of external peer reviewers that was proposed by TKPOA and approved by the LWB. A single comprehensive MRP issued by the LWB would include monitoring and reporting conditions of the existing WDRs, requirements of the Pre-Project Biological Monitoring Program, and any Mitigation, Monitoring and Reporting (MMRP) CEQA requirements to address potentially significant effects identified in this EIR/EIS.

2.3.3 Stand-Alone Tests of Ultraviolet Light

Treatments with ultraviolet light require deployment of boats or towed barge-mounted ultraviolet light arrays, appropriately trained staff, associated safety precautionary protocols, and repeated ultraviolet light applications. Ultraviolet light application utilizes targeted ultraviolet-C light to damage the DNA and cellular structure of aquatic plants, resulting in dieback of leaves and stems (TRCD 2019). The ultraviolet light system was designed to treat rooted aquatic weeds so this control method would not be tested in areas where floating coontail are dominant or co-dominant, based on macrophyte surveys, and the final selection of test sites and determination of site boundaries would include this consideration. The proposed test of ultraviolet light would utilize an existing boat-mounted light system to deploy ultraviolet light at a wavelength of 254 nm (Paoluccio 2019). The existing support vessel for the ultraviolet light apparatus is 24 feet long and 8.5 feet wide, with an ability to lower the 20-foot by eight-foot light array to different depths for 160 square feet of treatment coverage (Figure 2-5). This light array is powered by propane-powered 120-volt electric generators. The light array includes 55 lamps that apply a total of 2,000 watts of ultraviolet light. A second support vessel is under development to deploy a 16-foot by 24-foot light array that includes approximately 600 self-cooling lamps (Paoluccio 2020). Environmental evaluations of the ultraviolet light aquatic weed control method assume that both the existing vessel and equipment, and a second vessel with light arrays would be used in the CMT.

Limited experimentation with the ultraviolet light system within the Tahoe Keys lagoons started in the fall of 2019 and is expected to continue in 2020, to refine equipment and methods that could be utilized for the CMT. Details on the vessel dimensions, numbers of lamps, and wattage could change during further development of the equipment. The exposure time necessary to induce plant mortality may range from as little as five minutes for plants under 12-inches height to as much as 20 minutes for plants over four feet tall (Paoluccio 2020). The current proposed methodology includes initial ultraviolet light treatments in May and June with the array two to three feet off the lagoon bottom, to stunt growth when the plants are small. A second treatment would occur in July and August, and in the case of curlyleaf pondweed, would target irradiating the crowns of the plants causing mortality before they drop turions. A final round of treatments could occur in September and October, as needed. The light array would be kept at least one foot above the bottom sediment and any debris or obstructions to prevent turbidity-causing sediment disturbance that could reduce penetration of the ultraviolet light, and to prevent damage to the equipment.

A recent study has shown promising results following the field use of ultraviolet-C light to control target aquatic weeds at Lakeside Marina and Lakeside Beach over a three-month period in the summer of 2017 (TRCD 2019). Most of the aquatic weeds treated with ultraviolet light at Lakeside Marina and Lakeside Beach exhibited signs of deterioration within 10 days following treatment, including Eurasian watermilfoil, curlyleaf pondweed, and coontail. The weeds collapsed to the sediment surface in about 16 days, and then rapidly decomposed in the next couple of days to a powdery substance, due to cellular destruction (Paoluccio 2020). Ultraviolet light treats the leaves and stems but does not

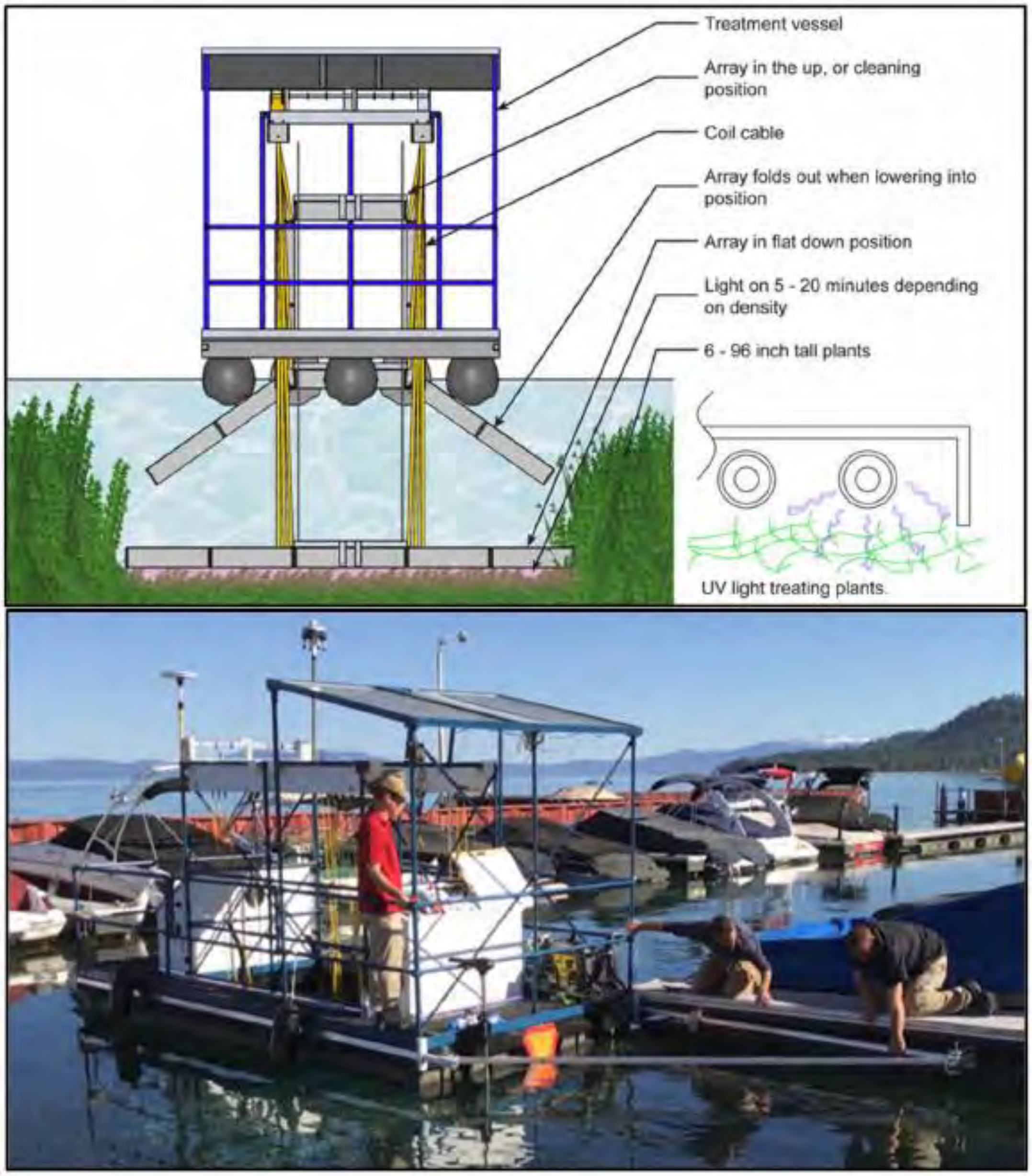

Figure 2-5 Ultraviolet Light Apparatus Deployed by Inventive Resources, Inc. at Lakeside Marina.

penetrate to roots and turions. Surviving weeds did not reach three feet in height after initial treatments in the spring. Monitoring at the Lakeside test sites in South Lake Tahoe found substantial stunting of weed growth in the year following treatment, with native plants outcompeting invasives (TRCD 2019).

Conditions in the Tahoe Keys lagoons are somewhat different from these prior test sites, such as higher turbidity, which can reduce plant exposure to ultraviolet radiation. Repeated treatments several times throughout a growing season are recommended to achieve reduction goals for target aquatic weeds (TRCD 2019). Many variables, including higher turbidity, uneven bottom contours in some areas, and physical interference from structures in the lagoons may significantly reduce the efficiency and increase costs in Tahoe Keys compared to the Lakeside Marina and Beach testing. These structures include approximately nine hundred docks with two to four pilings per dock, related supports, moored vessels, pipes, near-shore rocks and other undetected solid debris. Obstructions not only increase deployment time, but they can also damage components of the ultraviolet light arrays. It is assumed that docks and pilings would remain in place during ultraviolet light operations, and the ultraviolet light equipment would also work under and around recreational boats within each treatment area.

The total area proposed for stand-alone tests of ultraviolet light in the CMT is 4.9 acres, which represents less than three percent of the total surface area of the 172-acre lagoon system. Based on the Lakeside Marina and Beach testing and using an average time of 15 minutes for treatment and repositioning of the light array, approximately 640 square feet could be treated per hour and one acre could be treated in 68 hours, using the existing eight-foot by 20-foot array. This information was used to project how long UV light treatment might take for the proposed testing:

- Coverage using the existing ultraviolet light boat would require four to five days of operation at ultraviolet light-only test site.
- Continuous operations for seven days per week could accomplish a single round of treatment at all three test sites in approximately three weeks using the existing ultraviolet light boat, assuming no down time for cleaning, maintenance, and other activities.
- To complete two rounds of ultraviolet light treatment during the active growing season for target aquatic weeds at all ultraviolet light test sites, including the six ultraviolet light/herbicide test sites described in Section 2.3.5, it is assumed that a mid-sized ultraviolet boat with a 320 square-foot light array would need to be deployed in addition to the existing small ultraviolet boat.
- Working together the two boats could complete one round of treatment in approximately 270 operating hours, or about seven weeks using a normal work schedule.
- Given the plan for two or three rounds of ultraviolet light treatment, it is likely that the two boats could need to work continuously from late May until October if a third round is necessary based on results from the first two rounds.

2.3.4 Stand-Alone Tests of Laminar Flow Aeration

Laminar flow aeration (LFA) is a technology used for improving water quality in waterbodies where there is consistently low dissolved oxygen in deep waters and buildup of fine organic sediment. The technology uses microporous ceramic disks that are placed throughout the area to be aerated. These disks are connected by self-sinking hoses connected to an air compressor. Air is pumped through the system, creating a circulation of oxygenated water from near the water surface to the bottom of the water column and upper layers of bottom sediments. This non-turbulent laminar flow increases water circulation and oxygen levels within the lagoon treatment area, particularly at the bottom of the water column where dissolved oxygen is typically the lowest.

Historically used to increase the degradation of waste in sewage treatment lagoons, LFA has recently been used to improve water quality, and increase water depth through organic matter degradation at the bottom of lakes and ponds (Jermalowicz-Jones 2012). Typical installations add microbes (bacterial or enzyme products) to stimulate the system. The increased oxygenation at the bottom of the water column and the increased presence of microbes promotes an environment where the organic matter is broken down, reducing thickness of the fine, organic sediment layer. For this project, the use of additional microbes is not proposed; the treatment would rely instead on native microbial populations consistent with previous testing in the Lake Tahoe area.

In a small (0.5-acre) pilot test project at the Ski Run Marina in South Lake Tahoe, results after one year of LFA application showed substantial decreases in organic sediment thickness, sediment nitrogen concentrations, and aquatic plant coverage (Singer 2019). Organic sediment thickness in treated areas ranged from 10.5 and 29 inches before LFA startup in 2018, and the thickness decreased to a range of 5.0 to 8.5 inches in 2019 monitoring. Aquatic plant coverage decreased from a range of 38 to 63 percent in 2018 to a range of 0 to 18 percent in 2019. The decrease in aquatic plant coverage was not determined, but may have been due in part to less availability of sediment nitrogen in forms readily utilized by aquatic plants.

Three test sites would be treated with LFA. LFA treatment would involve the temporary installation of five to 10 ceramic air diffusers on the bottom of the channel at each treatment site, together with weighted airlines. The diffusers and airlines would be connected to a land-based electrically powered air compressor, which would be placed in a sound-reducing cabinet. TKPOA was issued permits by TRPA, the Army Corps of Engineers (USACE) and Lahontan Water Board to install a six-acre LFA project at Site 26 in the south-central part of the West Lagoon (Figure 2-4) in April 2019. Two additional smaller test sites are planned to begin operation in the spring of 2021, for a total of 12.8 acres of LFA operation during the CMT.

The LFA test would not disrupt existing recreation uses in the Tahoe Keys since all equipment would be located on the bottom of the channel (except for air compressors that would be located within utility enclosures). No modifications to existing uses or structures are proposed, and no barriers would be used to isolate the LFA treatment areas.

2.3.5 Combination Test of Ultraviolet Light and Herbicides

Tests combining ultraviolet light with herbicides would provide an opportunity to evaluate the potential to increase overall aquatic weed control efficiency within test sites. Considering the challenges described in Section 2.3.3 that may affect the application of ultraviolet light technology in the Tahoe Keys lagoons, these test sites would be used to study the efficacy of combining ultraviolet light treatments applied in linear, unobstructed reaches, with herbicide treatments applied in the relatively narrow zone between the dock footprints and the shorelines. The objective of this combination is to optimize ultraviolet light exposure efficiency by combining it with the application of herbicides in generally “obstructed” areas.

The combination ultraviolet and herbicide test treatment sites would entail application of a single herbicide (endothall or florpyrauxifen-benzyl [or triclopyr if florpyrauxifen-benzyl is not approved for use in California]) in the dock/shoreline zone of a site, and ultraviolet light treatment within the larger central zone (Figure 2-6). The combination sites would include triplicate sites (three sites), both for the use of endothall and for the use of florpyrauxifen-benzyl (or triclopyr). The total area proposed to be treated with ultraviolet light within the combination sites is 6.9 acres, where ultraviolet light treatment would cover about two-thirds of the combination sites and hericides would be applied to the other third of these sites. This area represents about four percent of the total surface area of the 172-acre lagoon system. As described in Section 2.3.3, one acre could be treated in 68 hours using the existing eight-foot by 20-foot array, based on an average of 15 minutes for treatment and repositioning of the array.

Operating the existing ultraviolet light boat for 24 hours per day would require two to four days for each combination treatment site. Continuous operations for seven days per week could accomplish a single round of treatment at all six combination test sites in approximately three weeks with one ultraviolet light boat, with no down time for cleaning, maintenance, and other activities. To complete two rounds of ultraviolet light treatment during the active growing season for target aquatic weeds at all ultraviolet light test sites, including the six ultraviolet light/herbicide test sites described in Section 2.3.5, it is assumed that a mid-sized ultraviolet boat with a 320 square-foot light array would need to be deployed in addition to the existing small ultraviolet boat. Working together the two boats could complete one round of treatment in approximately 270 operating hours, or about seven weeks using a normal work schedule. Given the plan for two or three rounds of ultraviolet light treatment, it is likely that the two boats could need to work continuously from late May until October if a third round is necessary based on results from the first two rounds.

In addition to one dead-end cove location, five of the combined applications of ultraviolet light and herbicide treatments would be tested at sites located along lagoon channels in the western half of the West Lagoon (Figure 2-4). Herbicides are planned to be applied to dock/shoreline zones generally occupying 0.4 to 0.7 acre within each combination treatment site.

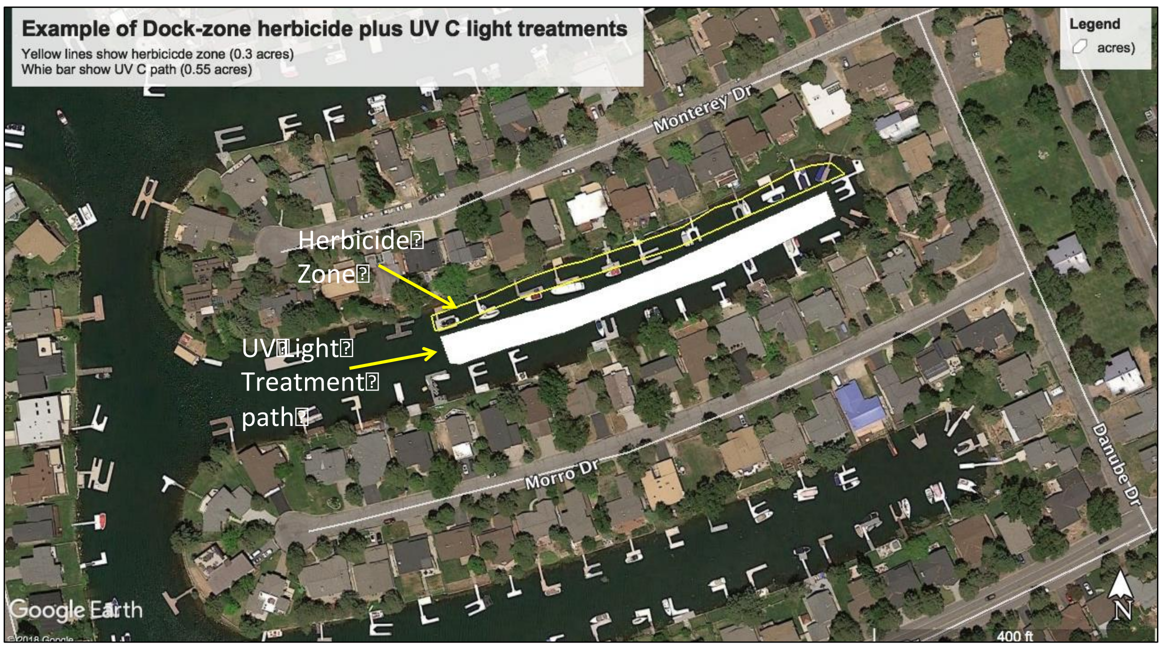

Figure 2-6 Example of Integrated Herbicide with Ultraviolet Light Treatment.

2.3.6 Use of Group B Methods

Group B methods would be implemented following the testing of Group A methods, depending on the target aquatic weeds present, size of infestation, and location of infestation. Where the target plant biovolume reduction does not achieve the 75% reduction goal for Group A methods, that site would be considered a failed test and Group B follow-up maintenance would not be performed. Group B methods are included in the CMT to evaluate their ability to provide sustainable, long-term maintenance options that preclude the need for repeated use of herbicides or other Group A methods. During the Spring of the year following Group A testing at each site, hydroacoustic and macroinvertebrate surveys would be performed to determine the size of the remaining infestation. Group B methods would be implemented during the years following Group A tests.

Figure 2-3 presents a decision tree for selecting Group B (follow-up) treatment methods. The range of follow-up Group B treatment methods are anticipated to include:

- Diver-assisted suction/hand pulling
- Bottom barriers (with or without hot water, steam, or acetic acid injections)
- Localized spot treatment with ultraviolet light
- Localized suction dredging

The deployment of the follow-up Group B maintenance actions would depend on:

- the effectiveness of the primary (Group A) treatment (i.e., total biovolume of target aquatic plants remaining to be controlled);
- the extent (size) of infestation, and
- limitations and constraints to the Group B treatment based on lagoon morphology or physical obstructions.

The use of bottom barriers and ultraviolet light treatment are particularly 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 except diver-assisted hand removal.

2.3.7 Resource Protection Measures

Resource protective measures were selected and incorporated into the Proposed Project to anticipate and proactively address potentially significant environmental effects noted in this analysis Included are measures to survey macrophytes pre-project to fine tune locations and timing of treatments, contain and accelerate the degradation of aquatic herbicide applications, prevent migration of herbicides from treatment areas toward the West Channel and Lake Tahoe, trace the movement of dissolved materials to determine if contingencies are needed to protect drinking water, improve water circulation, control nutrient availability from sediments, enhance water quality (e.g., dissolved oxygen, pH, turbidity, nutrient concentrations), reduce the occurrence of harmful algal blooms (HABs), and monitor water quality during activities to determine if adjustments are necessary to methods or the pace of work.

Pre-Project Macrophyte Surveys to Fine-Tune Test Site Locations and Treatment Timing: Because the density of target aquatic weeds varies from year to year at sites within the lagoons, TKPOA will conduct spring aquatic plant surveys to adjust the locations of test sites to ensure that they are focused in areas dominated by target species and minimize impacts to desirable native plant species. These pre-treatment surveys will also ensure that the selective or non-selective herbicides to be tested at each site are a good match for the target species present, and that testing is timed to treat the aquatic weeds when they are in their early stages of growth so that the volume of decomposing plant material (and nutrient release) is minimized. Any adjustments to the test site locations would not expand the total area for testing aquatic weed control methods testing or the total area of herbicide testing.

Aeration at Each Herbicide Testing Site: LFA or another aeration system would be used at each herbicide and combination ultraviolet light/herbicide test site to oxygenate the bottom of the lagoon in those areas. To avoid burial of and interference with diffusers, aeration would not be installed and activated until within a few days after the target aquatic weeds die back from treatment. When activated the aeration would be expected to (1) accelerate the microbial degradation of herbicides, and (2) counteract the oxygen demand and water quality impacts from decomposing vegetation. Circulating oxygenated water to the lagoon bottom will also help eliminate anoxic conditions at test sites that can cause the release of phosphorus from the sediments to the water column where it can stimulate algal blooms. Because endothall may degrade faster under anaerobic conditions than aerobic conditions (Sprecher et al. 2002), activation of aeration at the endothall test locations would be delayed until the active ingredient was no longer detected.

Double Turbidity Curtain Barriers and Herbicide Monitoring: Although dilution would likely effectively bring concentrations of herbicides below drinking water standards[5] double turbidity curtain barriers would be deployed as an additional protection against herbicide active ingredients or degradates migrating toward Lake Tahoe. Previous testing has demonstrated that the barriers are capable of retaining 98 to 99% of dissolved materials (such as herbicides) for at least 12 to 14 days (Anderson 2016).

Dye Tracing and Herbicide Monitoring: Rhodamine WT dye will be applied by TKPOA during the herbicide applications and tracked to determine the movement and dissipation of dissolved herbicides. In the unlikely event that herbicides are detected in nearby wells, contingency plans described in the APAP include shutting off the wells and distributing water to all users until residues are no longer detected in samples. If herbicides were detected in monitoring within 500 feet of the West Channel the LWB would be notified and additional monitoring would be performed in Lake Tahoe.

Real-Time Water Quality Monitoring: Water quality monitoring with portable instrumentation will be performed during each test activity to determine if any adjustments to the methods or pace of work is necessary to maintain compliance with water quality standards.

- Turbidity monitoring would occur during the installation, startup and removal of LFA and other aeration systems. Compliance with turbidity standards would also indicate whether sediment disturbance and entrainment of aluminum exceeded criteria for the protection of aquatic life. Exceedances of turbidity standards would require the work to stop until the water was clear and sediment-disturbing activities were modified. Real-time turbidity monitoring would be used similarly during implementation of Group B methods such as bottom barrier installation and removal, spot suction dredging, or diver-assisted suction and hand pulling of aquatic weeds.

- Water temperature monitoring would occur during ultraviolet light testing and during injection of hot water under bottom barriers, should that Group B method be tested. If monitoring shows that water temperatures exceed permit limits, then the rate of ultraviolet light or hot water applications would be reduced.

[5] A 25-fold dilution of the maximum application rate for endothall and a six-fold dilution for triclopyr would suffice to fall below drinking water standards. There are no drinking water restrictions for florpyrauxifen-benzy,

- DO would also be monitored during ultraviolet light applications. If DO was not meeting water quality standards at a test site, an LFA or other aeration system would be deployed to oxygenate the water during the period of plant decomposition.
- Real-time monitoring of pH would occur during the injection or other placement of acetic acid under bottom barriers, should that Group B method be selected for testing. The use of acetic acid would be curtailed if monitoring showed that pH was close to exceeding water quality limits.

2.4 ACTION ALTERNATIVE 1: TESTING OF NON-HERBICIDE METHODS ONLY

Action Alternative includes the same ultraviolet light, LFA, and Group B target aquatic weed control methods testing described for the Proposed Project. However, it does not include the testing of herbicides and combined testing of herbicides and ultraviolet light. Figure 2-7 shows the currently anticipated locations for Group A methods, which may be adjusted based on Spring hydroacoustic scans and macrophyte surveys. The test plan includes testing ultraviolet light treatments at three sites, testing LFA at three sites, and monitoring three control sites where these aquatic weed control methods would not be tested (Table 2-4). The total area for the six test sites would be approximately 17.8 acres, or a little more than 10% of the total surface area of the Tahoe Keys lagoons. The periods for testing of Group A and Group B methods under Action Alternative 1 would be as described for the Proposed Project and shown on Figure 2-2, except there would be no herbicide testing or combination tests.

Decisions on implementing Group B methods would also follow the decision tree illustrated on Figure 2-3.

2.4.1 Ultraviolet Light

This action alternative is the same as the Proposed Project test for ultraviolet light described in Section 2.3.3 above. Similar to the Proposed Project, Group B methods would be employed subsequent to Group A methods as described in the section above.

2.4.2 Laminar Flow Aeration (LFA)

This action alternative is the same as the Proposed Project test for LFA described in Section 2.3.4 above. Similar to the Proposed Project, Group B methods would be employed subsequent to Group A methods as described in the section above.

2.5 ACTION ALTERNATIVE 2: DREDGE AND REPLACE SUBSTRATE

The Lead Agencies engaged an engineering consultant (Reno Tahoe Geo Associates (RTGA) and conducted a preliminary review to assess possible tests of methods to remove accumulated organic sediment from Tahoe Keys lagoons and provide a bottom substrate that may be less favorable to target aquatic weed re-infestation (RTGA 2019). Materials that would be dredged are characterized in Section 3.3.1, Earth Resources, Environmental Setting. RTGA examined the feasibility of testing two major types of dredging at a relatively small scale: (1) draining lagoon test areas followed by excavation of the sediment “in the dry,” and (2) keep water levels as-is and dredging submerged sediments “in the

Figure 2-7 Anticipated Locations for Group A Methods and Control Sites for Action Alternative 1.

Table 2-4 Proposed Action Alternative 1 Test and Control Sites.

Site Number	Treatment	Area (ac)
16	Control	1.8
17	Control	2.2
18	Control	1.5
22	Ultraviolet Light	1.5
23	Ultraviolet Light	1.6
24	Ultraviolet Light	1.8
25	Laminar Flow Aeration	4.1
26	Laminar Flow Aeration	6.1
27	Laminar Flow Aeration	2.7
Total acreage (not including Control Sites)		**17.8**

wet". The review considered only physical/constructability impacts of the various methods suggested by the EIR/EIS team or in public scoping comments.

It was concluded that the dry dredging option was infeasible and would have significant impacts that could not be mitigated, including construction of large coffer dams, potential failure of existing retaining walls and undercutting of existing houses, difficulties in accessing the excavation zones, and the possibility that pumping water out to dewater dredging sites would create a low area to accelerate movement of a contaminated groundwater plume from the south toward Tahoe Keys and potentially into the lagoons. This is an existing plume of tetrachloroethylene (PCE) estimated to be at least 400 acres in extent, located south of the Tahoe Keys, as shown in Figure 2-8 (STPUD 2019).

While testing suction dredge excavation would pose substantial challenges, it was considered to be substantially more feasible and have a greater likelihood of achieving sediment removal than other methods of excavation "in the wet." Suction dredging was preferred for testing over clamshell dredging, using barge- or shore-based excavators, or other methods because of its ability to (1) reduce cross-contamination of already dredged areas, and (2) remove dredged material within a closed delivery system.

Suction dredging minimizes turbidity and other water quality impacts associated with dredge operations as compared to other dredging methods because the soft sediment material and much of the turbid water would be vacuumed off the bottom and piped as a slurry from the dredging sites to a staging area where it would be treated for disposal.

2.5.1 Dredging and Substrate Replacement Methods and Equipment

This alternative would be tested at Sites 28, 29, and 30 (see Figure 2-9). As with many areas of the West Lagoon, Sites 29 and 30 include shoreline areas that have potential bulkhead stability issues that would require geotechnical analysis to determine the risk of damage or failure to the bulkheads (see Section 3.3.1). The total area for the three test sites would be approximately 5.6 acres (Table 2-5), or a little more than three % of the total surface area of the Tahoe Keys Lagoons. Decisions on implementing Group B methods would follow the decision tree illustrated on Figure 2-3.

Figure 2-9 shows the potential layout of the dredging operation. Floating docks would be temporarily removed from the test area and smaller piles extracted. Pile extraction and replacement would be accomplished by a vibratory pile driver on a barge. A turbidity curtain and a temporary sheetpile cutoff wall extending one to three feet above the sediment surface would be constructed underwater to reduce turbid water impacts to adjacent areas, and to limit adjacent sediments from drifting into the test areas. The cutoff wall would be low enough to not interfere with equipment barges and boats.

Suction dredging operations would be conducted by barge, with dredge spoils removed through a temporary pipeline routed through the lagoons. The pipeline would not be routed overland, and all streets would be crossed through existing 24-inch corrugated culverts submerged below channel level.

The pipeline may be attached to floats on the surface of the water or laid on the bottom to allow boat passage. At least one booster pump would be required, to deliver the spoils from dredging sites to the proposed dewatering and treatment area (Figure 2-10). The barge would be brought into the Tahoe Keys lagoons through the west channel entrance. The dredging contractor consulted during alternative design estimates that about six people would be required to carry out the dredge operation, plus an additional three for the substrate replacement.

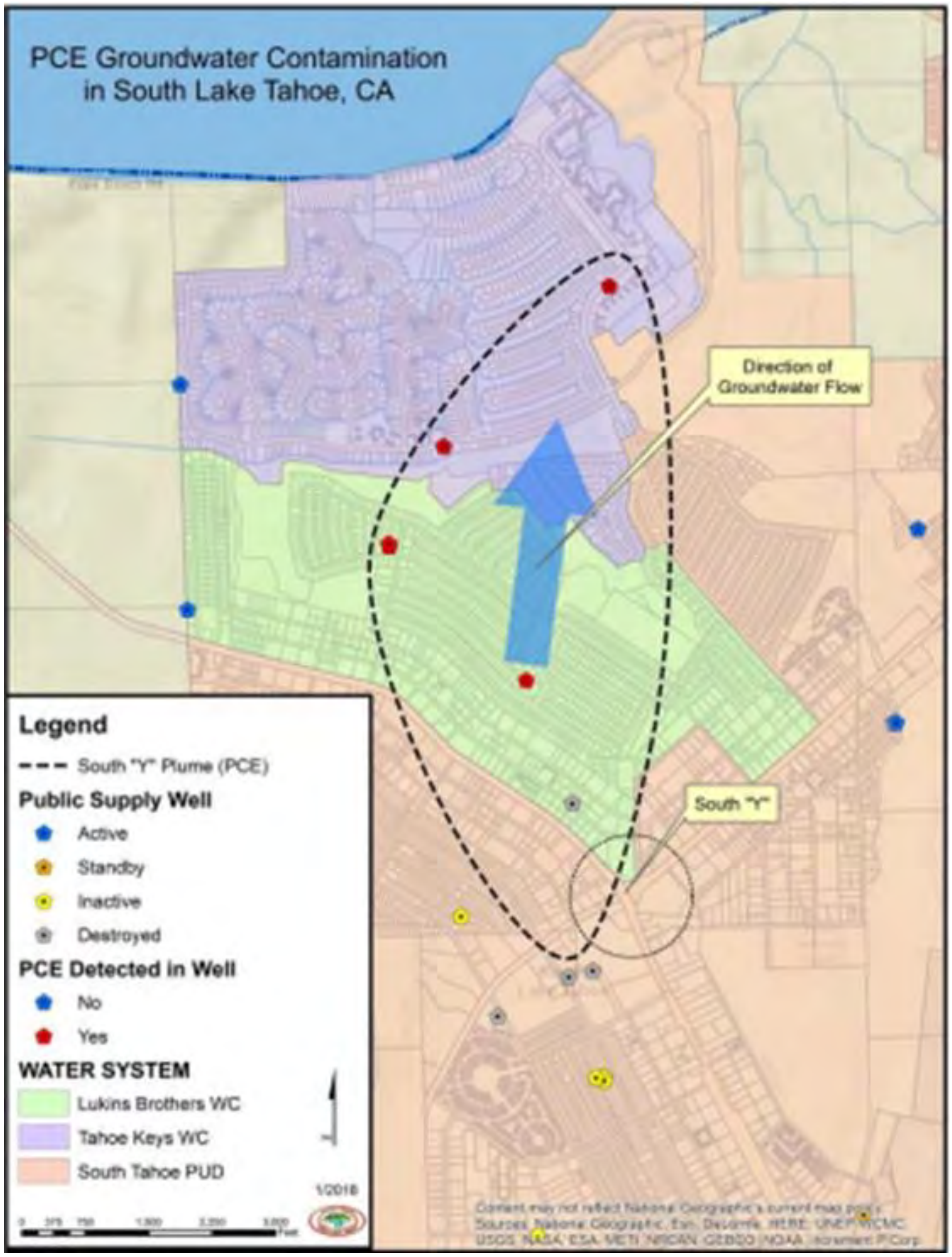

Figure 2-8 PCE Groundwater Contamination in South Lake Tahoe, California.

Table 2-5 **Proposed Action Alternative 1 Test and Control Sites.**

Site Number	Treatment	Area (ac)
16	Control	1.8
17	Control	2.2
18	Control	1.5
27	Dredge & Replace Substrate	1.7
28	Dredge & Replace Substrate	1.2
29	Dredge & Replace Substrate	2.7
Total acreage (not including Control Sites)		**5.6**

Figure 2-9 Anticipated Locations for Group A Methods and Control Sites for Action Alternative 2.

Excavation adjacent to existing retaining walls on Tahoe Keys properties in proximity to the test sites may pose some risk of damage to or failure of these walls (RTGA 2019). Therefore, subsurface rip-rap slope protection would have to be avoided during dredging, or removed and replaced. Property owners with docks along the shores of dredge sites would be prevented from using their boats from their properties during the test period.

A small barge-mounted suction dredge would be used (typically eight feet by 25 feet in plan area with a 140-hp diesel motor), with a suction cutter head and a six-inch-diameter pump mounted on a variable depth boom. A dredge of this size typically operates at a rate of 800 to 1,000 gallons of mixed sediment and water per minute. All sediment would be removed by a flexible six-inch-diameter HDPE pipeline. As shown on Figure 2-9, the maximum pipeline length would be 4,000 feet. Runs greater than 2,500 feet would require a booster pump sited about 1,500 feet from the dredge.

Review of the site vicinity indicated that the mothballed Tahoe Keys Water Treatment Plant (WTP) located on the south side of Lake Tallac would be the most suitable location for dredge processing and dewatering. The proposed dredge spoils treatment area is largely disturbed and would be used to stage equipment, stockpile materials, and handle the dredged slurry for dewatering and shipment to ultimate disposal. This includes former sand drying beds (1.95 acres) and an old driveway (0.4 acre), totaling 2.3 acres in extent.

The WTP has an existing industrial electrical supply and basic sanitation facilities. It could provide about 2.3 acres for siting treatment equipment, contractor access and parking, stockpiling and storage. The existing plant has a low berm around it, which may contain leakage, and probably could be increased to a height of three to four feet or reinforced with a liner to prevent outflow of any dewatering leaks. Treatment equipment (Figure 2-10) would be installed with local liner systems to contain potential leaks or water splashed around each tank.

Based on previous similar projects, a dredging contractor consulted during alternative design suggested the treatment and dewatering equipment shown on Figure 2-11. Applying these recommendations, the dredge spoil processing operations would include a shaker tank (to remove particles greater than 0.25 inch in diameter and weeds), a cyclone (to separate sand from organics, silt and water), vibrating screens to further clean sand materials, a clarifier (to separate out “clean water” from semi-solid materials), an aluminum removal tank if needed, and filter belts and presses (to dewater fine-grained solids to a transportable moisture content).

An anionic polymer would likely be employed to remove aluminum from dewatering effluent, which would chelate (bond to) the aluminum and settle out of solution. Most of the pieces of equipment recommended by the dredge contractor are skid- or trailer-mounted, similar to a Baker tank.

Approximately six trailers/skids would be required for the plant operation. If available, additional storage or treatment could be performed in the existing 177-foot-diameter treatment tank, which has a capacity in excess of one million gallons. All equipment would be wired from the existing circuits and breakers for the former water treatment plant.

2.5.3 Dredged Material Volumes and Disposal

The calculations reported in Table 2-6 assume that dredged material would be two feet thick, based on the volume of materials encountered in the channel-bottom core samples summarized in Section 3.3.1. Water required to transport dredge spoils (i.e., water, sediment, plants, and other materials picked up by the suction dredge) is assumed to be 10 times the existing volume of sediment targeted for dredging. Areas of proposed test sites 28, 29, and 30 are 1.65, 1.16 and 2.73 acres, respectively.

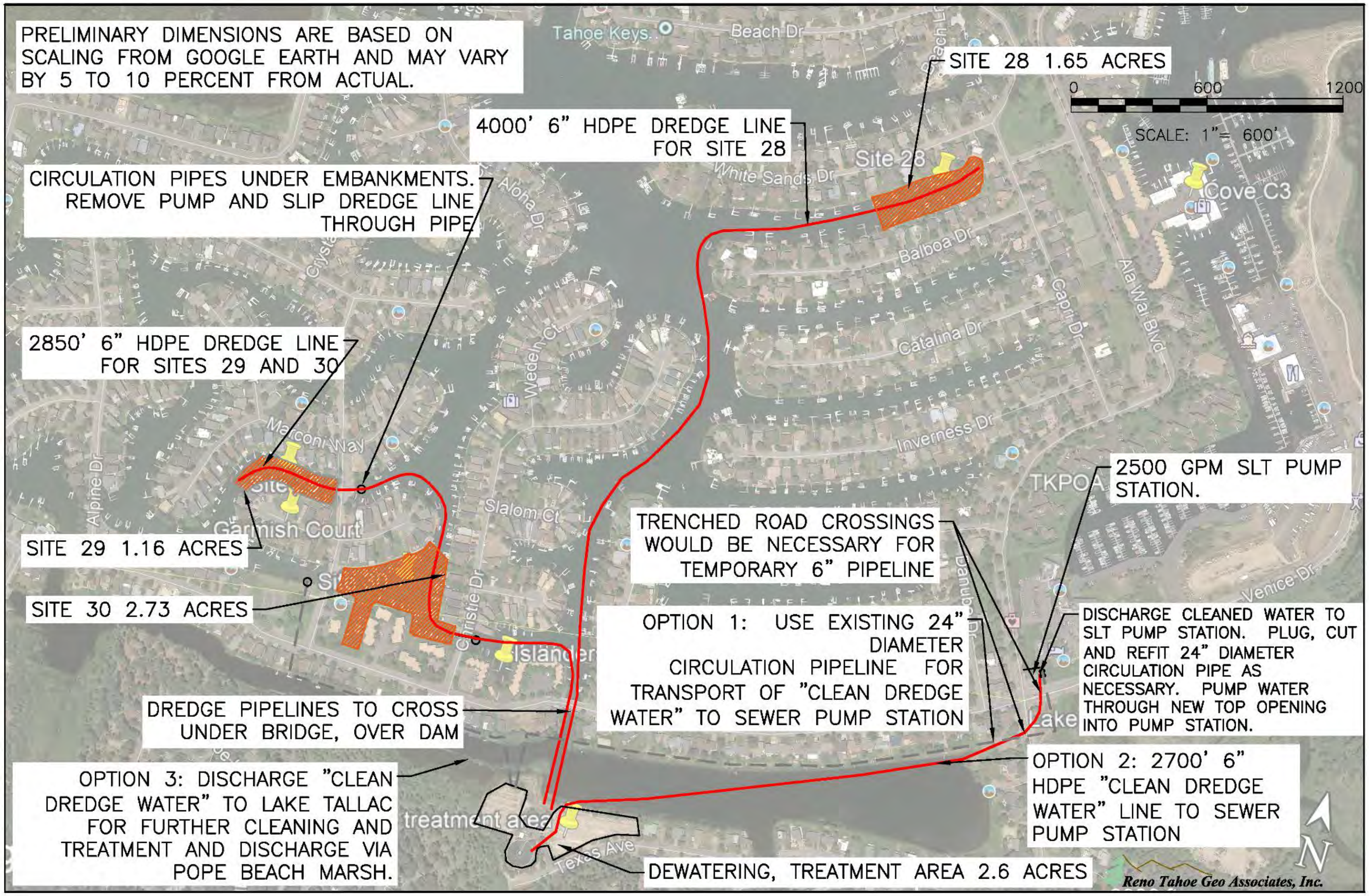

Figure 2-10 Preliminary Layout of Suction Dredging Operations.

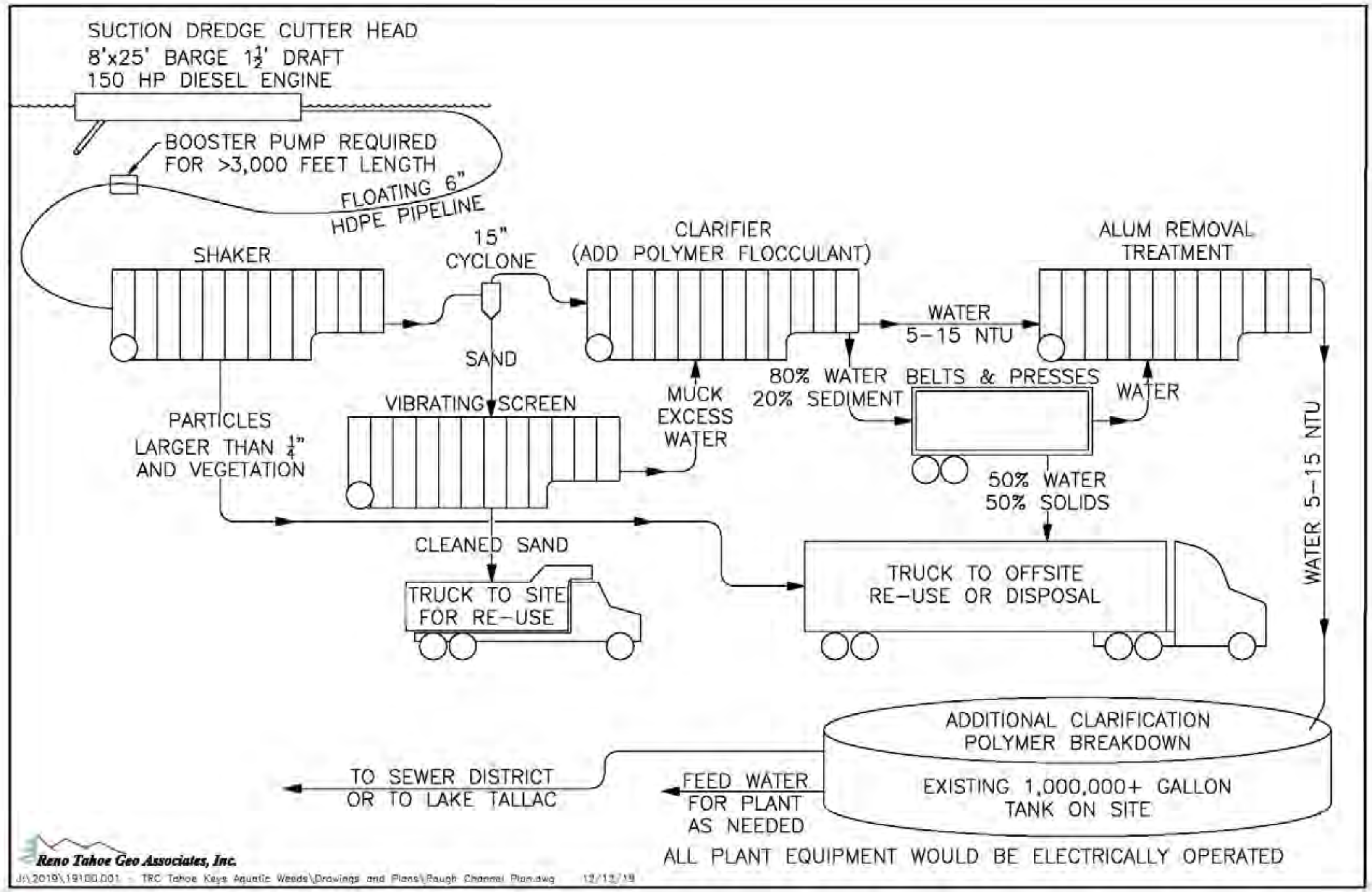

Figure 2-11 **Dredge Dewatering Schematic Drawing.**

Table 2-6 Volume of Soil and Water Materials from Dredging.

Site	Targeted Dredging Volume (cy)	Water Volume of Dredge Transport Water* (gal)	Sand (40%) After Dewatering	Sand (40%) After Dewatering	Organic Silt (60%) After Dewatering	Organic Silt (60%) After Dewatering
			*Volume cubic yards^*	*Truck Loads On-site (20 cy)*	*Volume cubic yards^*	*Truckloads of Off-haul (20 cy truck)*
Site 28	5,324	10,800,000	1,700	85	2,550	130
Site 29	3,747	7,500,000	1,200	60	1,800	90
Site 30	8,764	17,700,000	2,800	140	4,200	210
Total	17,835	36,000,000	5,700	285	8,550	430

*Assumes a 10:1 dilution ratio for pipeline transport

** Assumes 10 percent organic content, 90 percent inorganic content of sediments.

^0.4 x targeted dredging volume x 0.8 (20% shrinkage factor for water content reduction), 0.6 x targeted dredging volume x 0.8 shrinkage factor.

2.5.4 Substrate Replacement & Haul

Backfill material would likely be required to: (1) ensure bottom stability of the lagoon slopes and bulkheads, (2) reduce the volume of inorganic sediment to be hauled from the dredge site, and (3) provide a substrate suitable for reestablishing native aquatic habitat. Clean sand or gravel replacement fill would be delivered by barge to the lagoon backfill test sites and placed with an excavator on a barge (see Figure 2-12 for barge routes).

Backfill material for substrate replacement would come from (1) recovery of sands from processed dredge spoils, and (2) material imported from a quarry. Sand material separated from the dredge spoils would be sieved to remove turions and weed fragments and returned to one or more dredged sites as cover material to reduce weeds currently rooting on organic bottom soils, and to replace material thickness on the side slopes (i.e., to prevent further erosion or instability). To be reused for this purpose, the separated sand

material would need to be tested and meet construction specifications that would limit the amount of silt and clay particles that cause turbidity, and the amount of organic content that could contain nutrients that stimulate algal blooms. Additional replacement substrate material might be comprised of sand, pea gravel or drain rock, probably sourced from the nearest active quarry (Gardnerville, Nevada, ca. 35 miles distant). The replacement material would largely be placed on the channel sides to provide equivalent thickness of material for stability. Channel backfill would be performed by an excavator mounted on a barge. Piles and docks would be reinstalled in the test areas after the backfill is completed.

If sand separated from dredge spoils is reused, about 285 truckloads (assuming 20 cubic-yard trucks, and representing about 40 percent of the spoils material) would be trucked from the dewatering site to the TKPOA boat ramps closest to the test sites; these are located on the opposite ends of Bavarian Island (Figure 2-12). (Alternately, if all backfill material is newly sourced, about 570 10-cubic-yard truckloads would be required.) Sand would be loaded from trucks onto a barge (150 hp), and the barge would transport the material to the test sites. Imported gravel material would be transported in the same manner.

A diesel excavator/skip loader (150 hp) would operate from the existing TKPOA boat ramp. The sand pile would block the ramp until it is loaded onto the barge. Sand or gravel would be dumped from the trucks onto the ground or into a hopper, and then loaded from the stockpile onto the barge either using the excavator bucket or via conveyor. Sand or gravel would not be loaded directly from the truck to the barge, in order to avoid spillage or the possibility of imbalanced loading on the barge. Further, although the paving blocks under the ramp would probably not withstand repeated (300 to 600 trip) truck loading, locating the excavator on the ramp would not be expected to cause significant damage. This approach would be preferable to loading from the top of the aging bulkhead walls adjacent to the ramp.

Remaining materials in need of disposal, including weeds, oversize debris, silt, and clay would be dried to meet transport requirements and loaded in 20-cubic yard haul trucks at the dewatering site. It is assumed that the 20-cubic yard trucks would be compatible with road widths and turns at intersections along the route; if not, smaller 10 cubic-yard trucks may be substituted (doubling the number of truck trips). Material is assumed to be non-hazardous but not particularly desirable. Trucks would follow the route through the adjacent residential neighborhood to Highway 89 as shown on Figure 2-12.

About 430 truckloads of material would be transported to US50, moving through South Lake Tahoe and either along U.S. Route 50 via Spooner Summit, or along Highway 89 via Woodfords, to U.S. Route 395/Interstate 580. The possible end destination for sediments would be either southern Carson City (Full Circle Compost at Snyder Avenue), eastern Carson City (Carson City Landfill where it would be used as daily cover) or east of Reno (Lockwood Landfill where it would be used as daily cover).

If sand was not separated and returned to the lagoons, approximately 715 additional truckloads would be transported to one of the three long-distance destinations above, and an equivalent volume (i.e., approximately 285 truckloads) would need to be imported for lagoon backfill. The total number of truck trips would be two times the number of truckloads noted in the various scenarios above, as empty trucks would return to be filled.

2.5.5 Dredge Dewatering Effluent Treatment and Disposal

The volume of water produced during suction dredging testing may be on the order of 10 or more times the volume of sediment removed (RTGA 2019). The rate of dredging could be adjusted to the available storage and treatment capacity.

Two potential options exist to dispose of partly treated dredge dewatering effluent, assuming it is treated to between five and 15 Nephelometric turbidity units (NTUs). Water would require further treatment before it could be discharged directly to Lake Tallac, where the turbidity of discharges shall not exceed three NTU and increases in receiving water turbidity shall not exceed natural levels by more than 10 percent. One option would be to discharge partially treated dewatering effluent to the South Lake Tahoe sanitary sewer system. Figure 2-8 shows two potential routes for discharge to the sewer.

The first option for sewer system discharge would be to reuse the existing 24-inch-diameter water pipeline from the Tahoe Keys water treatment plant to the nearest South Lake Tahoe sanitary sewer pump station at the corner of Tahoe Keys Boulevard and Venice Drive. The water pipeline would be

Figure 2-12 Materials Transport Routes.

plugged, and an opening made in the top of the pipeline, to allow insertion of a pump to transfer the water into the pump station. The second option would be to install a pump and secondary pipeline floating across Lake Tallac to reach the same location. Under this option, a trench cut would have to be made under both Tahoe Keys Boulevard and Venice Drive to install the temporary pipeline to the pump station.

The South Lake Tahoe sanitary sewer has relatively modest additional capacity (e.g., the pump station has a rating of 2,500 gallons per minute but must maintain capacity to continue to handle existing flows). The seasonal variation in population is not a major driver in the volume of sewage conveyance or treatment. The discharge into the sewers typically becomes most stressed under high precipitation, high snowmelt, and high groundwater conditions. Discharge from dredging might have to be terminated during such conditions.

The South Tahoe Public Utility District Board (STPUD) would have to determine whether capacity is available and whether the effluent characteristics are acceptable to the wastewater treatment plant operation. They would likely be sensitive to alum or aluminum levels, which have caused bacteriological upsets in their plants before. The volume of water from the dredging discharge, if spread over a 24-hour period, would result in an increase in plant throughput by about 35 percent from the sewage levels treated without the project.

The other option for treated dewatering effluent disposal would be to use the existing million-gallon tank on-site or portable storage tanks as part of the dewatering effluent treatment process, with discharge to Lake Tallac. After testing to confirm that a batch of treated effluent met water quality standards for turbidity, the batch would be discharged into Lake Tallac and further clarification would occur as the treated water passes through Lake Tallac, Pope Marsh, and groundwater pathways before returning to the West Lagoon and Lake Tahoe. An organic flocculant would be selected for clarification in the treatment tank, which would typically have a decay period of three to five days. Because sediments in the West Lagoon have elevated concentrations of aluminum, the treatment system would also be required to reduce total recoverable aluminum concentrations to less than site-specific aquatic life toxicity criteria calculated for chronic exposure in Lake Tallac during the discharge period. Individual NPDES permit coverage would be required to implement this option.

2.5.6 Potential Dredge and Replace Substrate Schedule

Using a typical water-to-sediment volume ratio of 10 to 1, a pumping rate of 800 to 1,000 gallons per minute, and an assumed operation schedule of eight hours per day, six days per week, it would take 13 to 15 weeks to dredge 36 million gallons of water and associated cuttings. The actual dredging operation might sequentially require three weeks at Site 29, six weeks at Site 28, and seven weeks at Site 30, for a total of 16 weeks. Considering staging of work, preparation and cleanup, the dredging and substrate removal might require 2.5 to 4.5 months or longer at some dredging sites, and a total period of six months for all three sites.

Rates of trucking and water disposal would need to be managed to limit the extent of stockpiles and water storage needs (e.g., perhaps 10 hours per day, six days per week). If water is delivered to the sewer system, flows could be spread out on a 24-hour basis. An estimated three 20-cubic-yard trucks or six 10-cubic yard trucks per day would deliver reclaimed sand back to the test sites (which would then be transferred to barges for placement back on the three test areas). About five trucks per day would be required to remove fine-grained and organic sediment to the offsite disposal facilities.

2.6 NO ACTION ALTERNATIVE: CONTINUE EXISTING AQUATIC WEED CONTROL METHODS

Under the No Action Alternative, the status quo for the control of target aquatic weeds would be maintained and will be the basis from which other alternatives may be compared. The No Action Alternative assumes there would be no testing of aquatic herbicides or other new control methodologies in the Tahoe Keys lagoons. If the No Action Alternative is selected, TKPOA would not have site-specific information on the performance of aquatic weed control methods to inform a long-term aquatic weed management program.

2.6.1 Tahoe Keys Lagoons No Action

Under the No Action Alternative, only methods currently allowed in the 2014 WDRs would be used to control infestations of Eurasian watermilfoil, curlyleaf pondweed, and coontail in the Tahoe Keys lagoons, including Lake Tallac (TKPOA 2020a) for the foreseeable future. Currently approved methods to control aquatic weeds include mechanical control (harvesting), diver-assisted hand-pulling (although not being conducted currently), fragment control (e.g., seabins, bubble curtains, boat back-up stations), placement of no more than five acres of bottom barriers, or operation of an existing, currently non-operational water circulation system. TKPOA is also planning a removal of yellow pondlily (*Nuphar plysepala*) in the City of South Lake Tahoe stormwater inflow channel that forms a narrow arm of Lake Tallac extending to the south pending permitting (TKPOA 2020b). If approved, mechanical harvesters will be used to cut the floating pond lily tops 1.0 to 1.5 feet below the surface, and divers will then attach cables to the pond lily rhizomes to pull them free of the bottom muck layer.

Mechanical harvesting has been underway in Tahoe Keys since the 1970s yet has not been effective at reducing aquatic weed populations and has accelerated the weed infestation because the machines produce weed fragments that can propagate new plants. Harvesters have continued to be used in the Tahoe Keys to maintain navigation access in the lagoons by cutting off and removing the top three to five feet of plants. TKPOA currently uses three harvesting machines throughout the summer and early fall, rotating between areas of the lagoons. A skimming boat and staff using nets patrol the area around harvesting machines to collect and remove from the water any visible plant fragments. Plants are hauled to boat ramps, placed on trailers, and taken away from the lagoons for drying on TKPOA property, and hauled by trucks for disposal outside of the Tahoe basin. The harvesters are unable to operate close to docks and in tight spaces. Mechanical harvesting is not species selective and can harm non-target plants and animals. TKPOA would continue to employ weed fragment control methods as part of the No Action Alternative.

Additionally, the nonpoint source (NPS) reduction program is expected to continue under any weed control alternative, to help reduce external nutrient loading to the lagoons. Using best management practices (BMPs) for single-family and common properties, and educational efforts are part of an ongoing TKPOA program required by their WDR permit and documented in the Nonpoint Source Water Quality Management Plan (TKPOA 2020b). Current activities include a ban on phosphorus fertilizers, water restrictions for landscapes, backflow prevention valves for irrigation systems. TRPA BMP requirements are applied to all major remodeling projects. TKPOA may also evaluate limited use of the existing water circulation system to improve water quality in dead-end lagoon locations, or the use of rain gardens to reduce impacts from stormwater runoff.

2.7 AQUATIC WEED CONTROL METHODS ELIMINATED FROM GROUP A CONSIDERATION

The Lead Agencies considered a wide range of Group A methods as potential test alternatives and eliminated those considered not potentially feasible. The following methods were considered and eliminated from further analysis based on the criteria stated above in Section 2.2.

Bottom Barriers: Bottom barriers have been permitted and used at a small scale by Tahoe Keys homeowners for several years to control aquatic weeds around their docks, and thus they were incorporated in the Proposed Project to be used at a small scale as a follow-up Group B treatment method. Bottom barriers have been used successfully as primary treatment methods (in combination with hand pulling and suction) in other areas of the lake, but only at much smaller scales. Due to the extensive increase in bottom barrier deployment that would be required, bottom barriers are only considered a feasible Group B treatment method. A thick layer of soft organic sediments covers the bottom of the lagoons. In previous trials at Tahoe Keys, this soft sediment layer was redistributed during the growing season and resulted in substantial weed growth on top of bottom barriers.

Rotovation: Developed in the late 1970s but not commonly used in the U.S., rotovation is a mechanical method that tills underwater sediment to a depth of eight to 10 inches, dislodging roots and rhizomes of plants. Much of the plant material floats to the surface where it is removed with screens or suction. The USACE considers rotovation to be a form of dredging, requiring a CWA §404 permit. Rotovation has been used for Eurasian watermilfoil management in the Pend Oreille River in Washington and in several south-central British Columbia lakes, with reported concerns of weed fragment control and spread or recolonization. Rotovation was attempted in Tahoe Keys in 1988, without success. Rotovation is not species selective and would harm non-target plants and animals. Rotovation was eliminated from further analysis because: (1) failure of a previous attempt indicated it was not effective in reducing aquatic weed infestations, and (2) compared to other methods disproportionately large environmental effects could not be avoided or mitigated, including damage to native plants and extensive disturbance of bottom sediments containing aluminum.

Aquatic Dyes: While never used in the Lake Tahoe Region, aquatic dyes have been used in other regions to inhibit algae and aquatic weed growth in ponds by blocking or reducing the light reaching submerged rooted plants. For example, Aquashade is a blend of blue and yellow dyes that work together to screen portions of the sunlight spectrum (red-orange and blue-violet) that promote underwater weed and algae growth. Registered by USEPA and California Department of Pesticide Regulation (CDPR) as an herbicide, this product is best applied as a pre-emergent before the growing season. Dosage rates range from 0.5 to 2.0 mg/L. It leaves the water with a blue color, and a single application lasts six to eight weeks, depending on water circulation. This product would likely require ongoing repeated use, may not meet water quality objectives for aesthetics, and may not meet antidegradation policy or exemption requirements for discharge to Lake Tahoe. Aquatic dyes are not species selective and are expected to impair growth of non-target plants. Aquatic dyes were eliminated from further analysis because of: (1) likelihood that long-term repeated use would violate water quality regulations, (2) as a non-selective registered herbicide aquatic dyes would be expected to broadly impact native flora and fauna, and (3) selective aquatic herbicides are included in the CMT program and there is no need to test all herbicide products available.

Isolate Tahoe Keys Lagoons from Lake Tahoe: Comments received during scoping suggested isolating the Tahoe Keys lagoons from the rest of Lake Tahoe. Comments suggesting alternatives to isolate the lagoons from the Lake included proposals to eliminate motorized boat travel in and out of the lagoons, installing a system of gates and locks to manage boat traffic, closing off the ends of lagoons with compensation to property owners for loss of access, providing alternative boating access from nearby marinas, placing permanent or temporary barriers at the west channel entrance to prevent the movement of pollutants in general or herbicides and their degradation products during testing (e.g., an inflatable dam, as had been proposed in an earlier generation of the TKPOA Exemption Application) and to prevent the escape of aquatic weed fragments. Water Quality Certification (WQC) under Section 401 of the Clean Water act is needed for any dredge or fill activities which require a Clean Water Act Section 404 permit issued by the USACE. Under many of the suggested alternatives to isolate the lagoons from Lake Tahoe, boats would no longer be able to navigate between the lagoons and the lake. Unless the lagoons were filled or other methods were deployed to control target aquatic weed species, the weeds would continue to grow. Isolating or filling the lagoons may be revisited in the future if alternatives for long-term management of the Tahoe Keys are evaluated, but it is not an aquatic weed control method that requires testing at a pilot scale. Isolating the lagoons from Lake Tahoe was eliminated from further analysis for multiple reasons including: (1) not meeting some project goals and objectives, (e.g., maintain or improve beneficial uses of navigation and recreation), (2) increased potential for harmful algal blooms, and (3) testing of this option is unnecessary.

Fill Tahoe Keys Lagoons: A number of scoping comments proposed partial or complete filling of the Tahoe Keys lagoons to eliminate the open-water habitat colonized by aquatic weeds throughout the Tahoe Keys or in areas with the greatest concentrations of weeds, highest temperatures, or “greatest stagnation.” Filling the lagoons would not be species selective and would eliminate non-target plant and aquatic animal communities. This was not carried forward as an alternative for investigation because, by definition, filling in the lagoons would eliminate aquatic weeds and preclude their reestablishment, and therefore a test is not required to investigate the potential efficacy of the concept for controlling aquatic weeds. This alternative could be reconsidered in a future environmental review of long-term aquatic invasive species management alternatives for the Tahoe Keys.

Drain and Dredge: Comments received in scoping proposed testing an alternative to drain one or more lagoons, dredge out the accumulated organic bottom layer, and replace it with new clean substrate. As described under Action Alternative 2, the Lead Agencies concluded that the risks associated with dewatering would make dry excavation very difficult, including construction of large coffer dams, potential failures of existing retaining walls and undercutting of existing houses, difficulties in accessing the excavation zones, and the possibility that drawdown would accelerate movement of a contaminated groundwater plume from the south. Groundwater inflow over a three- to six-month construction period would potentially exceed the amount of water present in the channels. Overall, RTGA and the EIR/EIS project team concluded that the dry dredging option was infeasible and included disproportionate impacts that could not be mitigated. Suction dredging was retained as an alternative for further evaluation in the DEIR/DEIS.

Biological Control: Biological control methods introduce live organisms to suppress target aquatic weed populations. The watermilfoil weevil is native to North America and has been reported to feed and reproduce on Eurasian watermilfoil. Grass carp, an herbivorous non-native fish, has been used to control aquatic macrophytes, including Eurasian watermilfoil. Studies have shown that grass carp feed on milfoil only after other macrophytes have been consumed. TKPOA previously requested consultation with CDFW on the possible use of grass carp in Tahoe Keys, but they were declined and referred to the conclusions of the Lake Tahoe Lakewide Implementation Plan (Wittmann, Chandra 2015). Less information is available on the development of biological controls for curlyleaf pondweed. TKPOA discussed biological control in their application (TKPOA 2018) and concluded that no commercially or legally available biological controls could be authorized in Tahoe Keys. Biological control was eliminated from further analysis because it is not permittable in the Lake Tahoe basin, and environmental impacts to native plants would conflict with project goals and objectives.

Tahoe Keys Wetland Restoration: Some stakeholders have expressed interest in restoring the wetland habitat that was present in the area before the Tahoe Keys were developed in the Truckee River delta. Comments received during public scoping suggested isolating the lagoons from water exchange with Lake Tahoe and allowing the lagoons to gradually fill with sediment and return to a marshland. Under this scenario, weed populations would not be treated. Other comments proposed actively filling the lagoons and restoring wetland vegetation or restoring the original hydrology through the lagoons. Extensive restoration would have substantive impacts to navigation, and to the recreational and aesthetic values underlying the appeal of Tahoe Keys properties, and thus to property values within the Keys. Wetland restoration options could be considered in a future environmental evaluation of long-term aquatic invasive species management of the Tahoe Keys. However, the purpose of the CMT is to test alternative methods of target aquatic weed control, and by definition aquatic weeds would not occur where their habitat has been eliminated, whether by filling or replacing the habitat that favors weeds with a natural wetland. Therefore, restoration alternatives do not require testing and were not carried forward for further evaluation in this DEIR/DEIS.

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3.0 AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

3.1 APPROACH TO ENVIRONMENTAL ANALYSIS

This section identifies the potential environmental issues for each resource area, and thresholds that are used to evaluate the significance of effects, including specific metrics where applicable. The general approach to analyzing each issue is described below. Also presented in Section 3.2 is a review of findings from the IEC/IS completed for the Tahoe Keys West Lagoon Integrated Control Methods Test in early 2018.

3.1.1 Environmental Issues, Thresholds of Significance, and Metrics

Environmental issues were identified for each resource area based on public and stakeholder comments during the public scoping period, past studies in the project area including in-depth baseline data collection at the Tahoe Keys lagoons in 2019, and information reported from the testing and use of aquatic weed control methods within and outside the Tahoe basin. Each of the environmental issues identified in Section 3.1.1 are assigned a unique alpha-numeric and are evaluated in detail in this chapter. Thresholds of significance for many of the issues are defined by narrative or numerical regulatory standards, including quantitative metrics for some numerical standards where applicable to activities of the Proposed Project or Action Alternatives.

3.1.1.1 Environmental Health

Six environmental health issues were identified with potential effects to human health or environmental receptors. Concerns regarding ecological and human health risks from aquatic herbicides and cyanotoxins figured prominently in public and stakeholder comments during the scoping period. Issues associated with herbicides are direct exposure of workers handling and applying herbicide products, the persistence of applied chemicals and their degradation products at detectable concentrations, protection of drinking water supplies, and potential toxicity to people and aquatic life. In addition to direct effects from aquatic herbicides, there is a potential for indirect adverse effects if aquatic weed control methods change the availability of nutrients for harmful algal blooms (HABs) that facilitate the release of cyanotoxins. Finally, project activities that disturb existing sediments at the bottom of the Tahoe Keys lagoons have the potential to mobilize aluminum in lagoon water, causing concentrations to exceed criteria for protecting aquatic life. The six environmental health issues are described below and evaluated in Section 3.2.

Issue EH-1: Herbicide Applicator Exposure and Heath. There is a risk to the health of workers handling and applying herbicide products unless precautions are taken to protect them. Endothall is toxic if inhaled, may be harmful if swallowed, and may cause skin irritation or serious eye damage. Triclopyr is not metabolized by humans but is excreted unchanged in the urine. Triclopyr does not pose an inhalation risk but can cause skin irritation or eye corrosion. The U.S. Environmental Protection Agency (USEPA) has concluded that occupational exposures to florpyrauxifen-benzyl do not pose a significant human health risk, but it has a potential for eye irritation. The registration labels and safety data sheets (SDS) for each herbicide product specify the proper methods for handling and applying the chemicals, personal protective clothing requirements, and other precautions to protect workers, all of whom must be certified by the State as qualified applicators. Because the exposure of humans to harmful concentrations of herbicides and degradants is only a potentially significant concern to workers that are handling and applying the herbicide products (Issue EH-1), potential direct exposure of other people to herbicides is not evaluated as a separate issue.

Issue EH-2: Detectable Concentrations of Herbicides and Degradants in Receiving Waters. TRPA criteria for pesticide use in Code §60.1.7 require that no detectable concentration of any pesticide shall be allowed to enter surface water unless TRPA finds that application of the pesticide is necessary to attain or maintain environmental threshold standards. In addition, State and federal antidegradation policies and the Basin Plan require that, in receiving waters outside herbicide treatment areas and in all areas after treatment events, detectable concentrations of introduced chemicals are only allowable if beneficial uses are protected and maintained. Based on guidance from LWB staff, any long-term ongoing detections of these chemicals or other observed long-term lowering of baseline water quality would violate antidegradation policy. If pre-application sampling and analysis establishes that proposed herbicides are present at detectable concentrations in water or sediment as a baseline condition, then compliance with antidegradation policies would be, in part, based on any elevated concentrations above baseline levels. Protection of beneficial uses is evaluated using established USEPA methods for human health and ecological risk assessment.

Issue EH-3: Protection of Drinking Water Supplies. Drinking water supplies would be compromised if reached by herbicides or degradation products that pose a risk to human health (see also Issue UT-1). There are no restrictions for using water treated with florpyrauxifen-benzyl for drinking. Water should not be used for drinking where triclopyr exceeds 0.4 ppm or endothall exceeds 0.1 ppm. Because maximum allowable application rates are 2.5 ppm for triclopyr, 5.0 ppm for endothall, and 0.05 ppm for florpyrauxifen-benzyl, and given the dilution factor associated with the volume of water in the Tahoe Keys and Lake Tahoe, no exceedance of drinking water standards is anticipated to occur.

Issue EH-4: Introduction of Toxic Substances into the Environment. Basin Plan water quality objectives state that all waters shall be maintained free of toxic substances in concentrations that are toxic to, or produce detrimental physiological responses to, human, plant, animal, or aquatic life. For example, the survival of aquatic life in surface waters may not be less than that for the same water body in areas unaffected by herbicides. Application of aquatic herbicides can be expected to cause some mortality of non-target native aquatic plants within treatment areas, but the herbicides proposed for testing in Tahoe Keys lagoons would have no significant acute or chronic impact on people, fish, or freshwater invertebrates when used at recommended rates. (See also Aquatic Biology and Ecology issues below addressing effects on plant communities and thresholds for post-treatment conditions.)

Issue EH-5: Short-term Increases in Aluminum Concentrations. Short-term increases of aluminum concentrations in lagoon water may occur in treatment areas during sediment disturbance caused by suction dredging; installation, startup and removal of LFA systems; or installation and removal of bottom barriers. To enable calculation of site-specific criteria for toxicity to aquatic life, surficial sediment samples were collected from the Tahoe Keys lagoons in 2019. Elutriate tests were conducted to mimic conditions that could occur in overlying water during dredging. Samples of overlying water were also collected and analyzed for dissolved organic carbon, hardness, and pH. Aluminum freshwater acute criteria (Criterion Maximum Concentrations or CMC) calculated for the lagoons ranged from 610 to 2,400 µg/L. Short-term exposure to total recoverable aluminum concentrations above these acute criteria could cause harm to aquatic life. These same criteria would apply to any short-term increase in lagoon water aluminum concentrations that could occur if there was an accidental spill during dredge spoil transport and processing.

Issue EH-6: Harmful Algal Blooms (HABs). Environmental conditions in freshwater environments can lead to rapid increases in the biomass of single-celled photosynthetic bacteria (cyanobacteria), resulting in a HAB. HABs can sometimes produce cyanotoxins that can have adverse impacts on drinking water sources, recreational use, pets, and wildlife. Human recreational exposure to these toxins may arise from such activities as swimming or jet skiing. Acute effects can produce a wide range of symptoms, including skin and eye irritation, fever, headaches, muscle and joint pain, blisters, stomach cramps, diarrhea, vomiting, mouth ulcers, and allergic reactions. Some studies have suggested that cyanotoxins can play a role in the development of neurodegenerative diseases, such as Alzheimer's; some stakeholders have expressed concerns regarding Parkinson's disease. HABs have been reported in Tahoe Keys lagoons in recent years, including 2017 to 2019. The conditions that cause cyanobacteria to produce cyanotoxins are not well understood, and do not necessarily coincide with visible algae blooms. However, when blooms occur, the risk of cyanotoxin contamination of the surface water increases. California has issued guidelines for cyanobacteria and cyanotoxins in recreational inland waters. Caution levels for human and animal health are triggered by visual indicators, cyanobacteria cell density greater than 4,000 cells/mL, and cyanotoxin levels of 0.8 µg/L for total microcystins, and 1 µg/L for anatoxin-a or cylindrospermopsin. Warnings are posted if cyanotoxin concentrations reach six µg/L for total microcystins, 20 µg/L for anatoxin-a, or four µg/L for cylindrospermopsin. Danger warnings are posted if cyanotoxin concentrations reach 20 µg/L for total microcystins, 90 µg/L for anatoxin-a, or 17 µg/L for cylindrospermopsin. USEPA drinking water health advisories include lower concentrations for infants and pre-school children (0.3 µg/L for microcystins and 0.7 µg/L for cylindrospermopsin). Recently released recommendations from USEPA for microcystins and cylindrospermopsin are eight µg/L and 15 µg/L, respectively. These recommended AWQC/SA accurately reflect the latest scientific knowledge on the potential human health effects from recreational exposure to these two cyanotoxins.

3.1.1.2 Earth Resources

Issue ER-1: Suction Dredging and Dredge Materials Disposal. Soft organic sediment in three test sites would be removed by suction dredging in order to: (1) reduce the thickness of organic sediment to less than 20 cm and thereby reduce the nutrient supply in sediment substrate that provides the rooting medium for aquatic weeds, and (2) effectively limit re-infestation. It will be important to remove most of the soft sediment to create a more solid foundation for the placement of new, clean, coarser and denser sediment on the bottom. Dredged sediment consisting of organic silt and fine sand, plant roots and other organic matter, and lagoon water would be transported by pipeline to the location of the old Tahoe Keys Water Treatment Plant for handling, dewatering and ultimate disposal.

3.1.1.3 Air Quality and Greenhouse Gas

The Proposed Project is located in the city of South Lake Tahoe, within the El Dorado County Air Quality Management District (EDCAQMD). The EDCAQMD is responsible for attaining and maintaining air quality conditions in El Dorado County and prepares plans for the attainment of ambient air quality standards, adopts and enforces rules and regulations concerning sources of air pollution, and issue permits for stationary sources of air pollution. TRPA has responsibility within the Lake Tahoe Air Basin (LTAB) portion of El Dorado County to establish environmental threshold carrying capacities. The air quality subelement of the TRPA Regional Plan focuses on achieving national and State air quality standards, as well as TRPA-adopted regional standards. Watercraft, off-road equipment, and on-road vehicles that will be used to implement project alternatives will generate air pollutant emissions which may raise environmental issues of concern.

Under CEQA, an alternative is determined to result in a significant effect related to air quality if it would:

- conflict with or obstruct implementation of the applicable air quality plan;
- result in cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard;
- expose sensitive receptors to substantial pollutant concentrations; or
- result in other emissions (such as those leading to odors) adversely affecting a substantial number of people

Based on the IEC/IS, alternatives were determined to have a significant impact related to air quality if they would result in:

- substantial air pollutant emissions;
- deterioration of ambient (existing) air quality;
- the creation of objectionable odors;
- alteration of air movement, moisture or temperature, or any change in climate, either locally or regionally; or
- increased use of diesel fuel

The 2015 TRPA Threshold Evaluation Report reports significance criteria for the Lake Tahoe Region as follows:

- Maintain carbon monoxide concentrations at or below six parts per million.
- Maintain ozone concentrations at or below 0.08 parts per million, averaged over one hour.
- Maintain oxides of nitrogen (NOx) emissions at or below the 1981 level.
- Maintain PM_{10} at or below 50 $\mu g/m^3$ measured over a 24-hour period.
- Maintain PM_{10} at or below annual arithmetic average of 20 $\mu g/m^3$.
- Maintain $PM_{2.5}$ at or below 35 $\mu g/m^3$ measured over a 24-hour period.
- Maintain $PM_{2.5}$ at or below annual arithmetic average of 12 $\mu g/m^3$.

EDCAQMD has prepared the guidance document *Determining Significance of Air Quality Impact Under the California Environmental Quality Act (CEQA)*, which contains Thresholds of Significance for criteria pollutants generated by short-term construction activities. Per this guidance, an alternative is determined to result in a significant impact related to air quality if short-term construction-related emissions of reactive organic gases (ROG) or NOX were to exceed mass emissions of 82 pounds per day (lb/day) (EDCAQMD 2002) or other criteria air pollutants (i.e., CO, PM10, PM2.5, SO2, NO2, sulfates, lead, or hydrogen sulfide) would exceed a national or state ambient air quality standards. Additionally, TRPA has established ambient air threshold standards summarized in Chapter 3 of the 2015 TRPA Threshold Evaluation Report and provided above in Table 3.3.2-1.

Although EDCAQMD has no established significance threshold for PM10, two adjacent air districts, Sacramento Metropolitan Air Quality Management District (SMAQMD) and Placer County Air Pollution Control District (PCAPCD), have established PM10 threshold values that are worth noting for reference.

SMAQMD has adopted a threshold for construction activities of 80 lbs/day, and PCAPCD has adopted a threshold of 82 lbs/day. Similar to El Dorado County, the counties that make up both SMAQMD and PCAPCD are state designated non-attainment areas for PM10.

Impacts from TAC emissions can be estimated by conducting a health risk assessment (HRA). Human health risk from exposure to TACs such as DPM are based on both the concentration of the TAC and the duration over which exposure occurs at a given location. In March 2015, the Office of Environmental Health Hazard Assessment (OEHHA) adopted the "Guidance Manual for Preparation off Health Risk Assessments" that includes procedures for performing an HRA. EDCAQMD considers the health risk results from an HRA to be significant if either of the following two criteria are met:

1. The lifetime probability of contracting cancer is greater than one in one million (ten in one million if T-BACT is applied)
2. The ground-level concentration of non-carcinogenic toxic air contaminants would result in a Hazard Index of greater than 1.

For projects that do not exceed these screening levels, EDCAQMD Guidance indicates that the project will not result in significant emission of TACs. Determinations with respect to these thresholds would require a level of air quality modeling and analysis that would not be warranted for the level of emissions expected and short-term nature of this project, therefore the significance evaluation is based on quantities of emissions rather than emissions modeling.

Issue AQ-1: Compliance with the Basin Air Quality Plan. If the Proposed Project or Alternatives conflicted with or obstructed implementation of the applicable air quality plan, it could have significant effects. The proposed Project is located within the EDCAQMD, which regulates air quality emissions and has prepared guidance for determining significance under CEQA. Additionally, TRPA has established significance criteria summarized in Chapter 3 of the 2015 TRPA Threshold Evaluation Report. Metrics for the EDAQMD and TRPA significance criteria are defined in pounds per day, parts per million, or micrograms per cubic meter. Applicable air quality plans, effects from pollutant emissions, and significance criteria are described in Section 3.3.2.

Issue AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants. Cumulatively considerable means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past, current, and probable future projects. A significant effect could occur if the Proposed Project or Alternatives resulted in cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or State ambient air quality standard. The proposed Project is located in the Lake Tahoe Air Basin, which is either in attainment or designated unclassified for all National Ambient Air Quality Standards (NAAQS). However, it is designated a nonattainment area for PM_{10} for California ambient air quality standards (CAAQS). The threshold of significance is defined by the EDCAQMD, defined in pounds per day, and is described in Section 3.3.2.

Issue AQ-3: Exposure of Sensitive Receptors. If the Proposed Project or Alternatives exposed sensitive receptors to substantial pollutant concentrations, significant effects could occur. Significance is determined by distance to sensitive receptors, which in this case would be residences in or near the Tahoe Keys. The metric for determining significance depends on the exposure of sensitive receptors, as determined by their distance from the emission source, and the concentration and duration of exposure, and is described in Section 3.3.2.

Issue GHG-1: Greenhouse Gas Emissions. Under CEQA, the potential to generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment or conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases must be evaluated. Currently, there are no established GHG significance thresholds from Federal or State agencies. However, in October 2008, the CARB issued the draft *Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act*. This source indicates that a project would be considered less than significant if it meets minimum performance standards during construction and if the project, with mitigation, would emit no more than approximately 7,000 metric tons of carbon dioxide per year ($MTCO_2e$/yr). While neither TRPA nor EDCAQMD have established significance thresholds, EDCAQMD has indicated that in the absence of guidance adopted by El Dorado County, CEQA guidance developed by the adjacent Sacramento Metropolitan Air Quality Management District (SMAQMD) (EDCAQMD, 2020) should be referenced. In May 2018, SMAQMD updated the GHG guidance within their *Guide to Air Quality Assessment in Sacramento County*. This guidance includes a GHG significance threshold of 1,100 $MTCO_2e$/yr for the construction phase of all projects. The metric for determining GHG significance is metric tons per year. Greenhouse gas emissions are described in Section 3.3.2.

3.1.1.4 Hydrology

Neither the proposed aquatic weed control methods test project nor any of the project alternatives would influence surface or groundwater levels, alter drainage patterns, cause runoff to stormwater drainage systems or otherwise affect surface or groundwater hydrology, with one possible exception:

Issue HY-1: Disposal of Dewatering Effluent. Under Action Alternative 2 (suction dredging) approximately 33 million gallons (i.e., 100 acre-feet) of dewatering effluent would be produced, which would require disposal over a period of approximately six months. Disposal to the South Lake Tahoe sanitary sewer system would require approval by the wastewater utility's Board of Directors. Thresholds for treatment system acceptance are decided by the Board on a case-by-case basis. If disposal to the sanitary sewer was not permitted, dewatering effluent would need to be treated to meet water quality criteria before it could be discharged to Lake Tallac. In this scenario, it would add to surface water inflows to Pope Marsh and groundwater flows to the West Lagoon. As an evaluation threshold, no contribution to flooding from discharging treated effluent would be acceptable. Potential effects of additional inflows to Pope Marsh are addressed in Issue TE-2 below.

3.1.1.5 Water Quality

Water quality impacts are a primary concern for the Proposed Project, and include a variety of potential effects to physical, chemical and biological components of the Tahoe Keys lagoons. Testing the efficacy of aquatic weed control methods in improving water quality of the lagoons is a goal of the project. Although only 24 percent of the lagoon areas are proposed to be treated during weed control methods testing, some beneficial effects on water quality constituents can be expected in and near treatment areas. Potential adverse impacts to water quality due to the Proposed Project and Alternatives are expected to be largely short-term effects occurring during installation, removal, or performance of aquatic weed control tests. Because the volume of Lake Tahoe is approximately 58,000 times greater than the combined volume of the Tahoe Keys lagoons, any changes in lagoon water quality are not expected to measurably affect greater Lake Tahoe. Therefore, water quality evaluations focus on receiving waters that must be protected within the lagoons. Proposed measures to protect water quality within the lagoons are expected to minimize risks of potential water quality impacts there and in the lake.

Issue WQ-1: Water Temperature Effects. Some water temperature effects can be expected within and near areas treated with aquatic weed control methods. Short-term heating from ultraviolet light may occur during treatment. Where aquatic weed density is reduced by any of the treatment methods, a long-term increase in solar radiation penetration may add heat to the water. Increased water circulation during LFA operations is expected to eliminate thermal density stratification, leading to cooler waters near the surface and warmer waters at depth. Applicable Basin Plan water quality objectives state simply that water temperature shall not be altered, thus there are no established numerical thresholds and professional judgment is required to evaluate the significance of any potential adverse temperature effects. The metric would be temperature changes measured in degrees Centigrade.

Issue WQ-2: Sediment Disturbance and Turbidity. Sediment disturbance can be caused by suction dredging; installation, startup, and removal of LFA systems; or installation and removal of bottom barriers. This can result in short-term increases in turbidity and a temporary decline in water clarity within and near treatment areas. There is also a potential for short-term increased turbidity and decreased water clarity from any accidental spills during transport and processing of dredge spoils, or during discharge of treated effluent from sediment dewatering. Basin Plan Water Quality Objectives (WQOs) and TRPA threshold standards state that turbidity shall not exceed one Nephelometric Turbidity Unit (NTU), and increases shall not exceed natural levels by more than 10 percent. Baseline turbidity measured from May through October in 2019 samples exceeded three NTUs at many locations in the West Lagoon and Lake Tallac, particularly in mid-depth and near-bottom samples.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. Fragments may incidentally break off from aquatic plants during herbicide applications, ultraviolet light treatments, and placement of LFA systems, and some of these fragments would float. Floating plant fragments may also escape from suction dredging. WQOs state that waters shall not contain floating materials in concentrations that cause nuisance, or adversely affect beneficial uses, and alterations in concentrations of floating material shall not be discernable at the 10% significance level.

Issue WQ-4: Changes in pH. Short-term changes in pH could result from the introduction of herbicide products in treatment areas. Long-term beneficial changes in pH fluctuation can be expected to result from the reduced photosynthesis, respiration and decomposition as dense aquatic weed beds are controlled. Increased water circulation and oxygenation of deep waters during LFA operation would also be expected to improve pH conditions. WQOs state that pH shall not be depressed below 7.0 nor raised above 8.4, and changes shall be no more that ±0.5 from ambient pH. Many baseline pH measurements from May through October 2019 were less than 7.0 in deep waters of the West Lagoon and Lake Tallac, and many shallow water measurements exceeded 8.4.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Rapid dieback of dense aquatic weed beds from testing herbicide applications or ultraviolet light could result in significant changes to DO conditions within and near test sites. The primary concern is that biochemical oxygen demand (BOD) from decomposing plants could decrease DO concentrations during the normal growing season for aquatic plants, particularly given the lack of DO contributed from the photosynthesis of living plants. BOD from decomposing plants would also be less during plant dieback in the fall. There is also a potential for herbicide products to create a short-term chemical oxygen demand during applications. Lastly, potentially beneficial effect may result where LFA increases water circulation and improves low-oxygen conditions that characterize the deep portions of the water column during summer thermal stratification. Thresholds of concern for DO are established by several WQOs: minimum criteria of 8.0 mg/L at all times, a 9.5 mg/L minimum based on seven-day mean concentrations, an 80 percent saturation minimum, and a limit that DO shall not be depressed by more than 10 percent saturation. Baseline monitoring has shown that all minimum DO criteria were not met at times in the deep portions of the water column during the summer of 2019 at some West Lagoon sites and at all monitoring sites in Lake Tallac.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Short-term increases in lagoon total phosphorus concentrations could result from sediment disturbance during suction dredging or LFA installation, or during the initial operation of LFA systems circulating deep waters to the surface. Release of phosphorus from decaying aquatic plants to the water column could also be accelerated during and after weed control treatments, which could increase concentrations during those periods but lead to lower concentrations from aquatic plant dieback in the fall. Long term, phosphorus release from decaying plants would be reduced where dense aquatic weed beds are successfully treated. WQOs specify an annual average or 90 percent maximum criterion of 0.008 mg/L for total phosphorus. This criterion was exceeded in many of the monthly near-surface and near-bottom samples collected from the West Lagoon and Lake Tallac between May and October of 2019. The mean and 90th percentile total phosphorus concentrations from all near-surface and near-bottom sampling locations in the West Lagoon and Lake Tallac exceeded the 0.008 mg/L criterion in 2019.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Short-term increases in lagoon water total nitrogen concentrations could result from sediment disturbance during suction dredging or LFA installation, or during the initial operation of LFA systems circulating deep waters to the surface. Release of nitrogen from decaying aquatic plants to the water column could also be accelerated during and after weed control treatments, which could increase concentrations during those periods but lead to lower concentrations from aquatic plant dieback in the fall. Long term, a reduction in nitrogen release from decaying plants would be accomplished where dense aquatic weed beds are successfully treated. The WQOs specify an annual average or 90 percent maximum criterion of 0.15 mg/L for total nitrogen. This criterion was exceeded in many of the monthly near-surface and near-bottom samples collected from the West Lagoon and Lake Tallac between May and October of 2019. The mean and 90th percentile total nitrogen concentrations from all near-surface and near-bottom sampling locations in the West Lagoon and Lake Tallac exceeded the 0.15 mg/L criterion in 2019.

3.1.1.6 Aquatic Biology and Ecology

Impacts to aquatic biology and ecology are primary concerns for the Proposed Project and Alternatives and include a variety of potential effects to plant and animal communities and their habitats within the Tahoe Keys lagoons. The Tahoe Keys lagoons did not exist until they were constructed in the 1960s and are generally not favorable habitat for sensitive species native to Lake Tahoe. While aquatic weed control will improve habitats, it will also have potential adverse impacts to aquatic biology and ecology for both the Proposed Project and its Action Alternatives. These impacts are expected to be temporary, occurring during and after aquatic weed treatments, until treated areas are recolonized with plants and BMI from adjacent unaffected areas.

Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species. The application of aquatic herbicides can directly affect non-target plant species due to direct contact with the herbicide within the designated treatment site or adjacent open water areas. ultraviolet light treatments are also expected to cause some mortality of non-target plant species, and implementation of some Group B methods could also impact non-target plants. Native aquatic plant species in the West Lagoon include leafy pondweed *(Potamogeton foliosus*), nitella (*Nitella* sp., a macroalga), elodea (*Elodea canadensis*), and Richard's pondweed *(P. richardsonii*) (TKPOA 2019). Native aquatic plants in Lake Tallac include most of the same species (Richard's pondweed is not known to occur); in addition, watershield (*Brasenia schreberi*) is found along the margins. The magnitude of short-term impacts to these species from herbicides depends on the herbicide applied, with endothall being a less-selective contact herbicide that would likely result in the greatest impacts to non-target species.

Potential direct effects to non-target macrophyte species could occur through the use of Group B methods (bottom barriers with or without hot water or acetic acid, diver hand-pulling, or diver-assisted suction). Bottom barriers, being non-selective, are the most likely of the Group B methods to impact non-target macrophytes; however, short-term turbidity from diver activities could also limit visibility and the ability for divers to selectively remove only aquatic weed target species.

Permit requirements for the Proposed Project or its Action Alternatives, and/or conditions of the exemption to the prohibition on use of aquatic pesticides, would likely include recovery time expectations and biotic metrics to assess restoration of non-target species. Impacts to native aquatic plants from either direct contact or drift from aquatic herbicides, or from ultraviolet light treatments, may be considered significant if frequencies of occurrence measured two years after treatment are significantly below those found, on average, during surveys from prior years conducted in the West Lagoon or Lake Tallac.

Issue AQU-2: Competitive Exclusion of Aquatic Macrophytes Due to Increased Growth of Curlyleaf Pondweed. The application of aquatic herbicides might indirectly result in long-term impacts to non-target species by favoring the increased growth of more competitive nuisance plants. The density of curlyleaf pondweed has been increasing in the Tahoe Keys lagoons (TKPOA 2020). Triclopyr is not labelled for use in controlling this species and florpyrauxifen-benzyl has demonstrated inconsistent results in effectively controlling this aquatic weed species at other lakes. At test sites in the West Lagoon where Eurasian watermilfoil is dominant and triclopyr or florpyrauxifen-benzyl are applied, curlyleaf pondweed could increase in density and take its place. Similarly, there is evidence that coontail density can increase following herbicide applications where those treatments may not effectively control coontail (e.g., triclopyr and florpyrauxifen-benzyl). Such increased populations of coontail could outcompete other native species in occupying the space previously dominated by Eurasian watermilfoil. As stated for AQU-1, if an exemption to the prohibition on the use of aquatic pesticides were granted for this project, permit requirements and/or conditions of the exemption would likely include recovery time expectations and biotic metrics to assess restoration of non-target species.

Issue AQU-3: Effects on Sensitive Aquatic Macrophyte Species. There are no aquatic plant species in the vicinity of the Tahoe Keys lagoons that are identified by TRPA as sensitive, or which are listed under federal or state Endangered Species Acts (ESA). The California Natural Diversity Database (CNDDB) was queried for the nine U.S. Geological Survey (USGS) 7.5-minute quadrangle maps surrounding the Tahoe Keys Lagoons. Of these species, watershield is known to occur along the margins of Lake Tallac. Slender-leaved pondweed and crème-flowered bladderwort have been identified as potentially occurring in Lake Tahoe (TRCD 2014), and thus could potentially occur in the West Lagoon or Lake Tallac. CNPS indicates impacts to these species or their habitat must be analyzed during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA. Targeted pre-treatment surveys for these plant species may be warranted and, if found, coordination with California Department of Fish and Game would occur and treatment plans would be adjusted accordingly to avoid harming these species and their habitats.

Issue AQU-4: Changes in Aquatic Macrophyte Community Composition. Potential direct and indirect effects to the macrophyte community could occur in the West Lagoon as well as Lake Tahoe proper as a result of actions under Action Alternative 2 and the No Action Alternative. Dredging and replacement of substrate is intended to remove substrates that currently foster luxuriant growth of target aquatic weeds in the lagoons. This direct removal of vegetation and organic sediments, followed by replacement with substantially courser material, could open up habitat for the introduction and establishment of fragments from other plant species, including the target aquatic weed species, potentially resulting in greater density. Under the No Action Alternative, curlyleaf pondweed is likely to continue spreading into deeper waters of the Tahoe Keys lagoons, as well as into additional nearshore habitats in Lake Tahoe proper. A TRPA threshold for aquatic weeds states that the distribution and abundance of known aquatic weeds should be reduced; any increased abundance in or spread of aquatic weeds to other areas of Lake Tahoe would exceed this threshold.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Potential direct and indirect effects to the benthic macroinvertebrate community as a result of aquatic weed control methods testing could include the loss of organisms as a result of exposure to ultraviolet light, through placement of bottom barriers, and/or through entrainment associated with suction dredging. Potential direct effects of aquatic herbicides on benthic macroinvertebrates were not identified as a potential issue, as discussed above under Issue EH-4. Potential indirect adverse effects could result from short-term water quality degradation associated with vegetation decomposition (see Water Quality issues above). The threshold of significance for this issue area would be a substantial change or reduction in the diversity or distribution of aquatic benthic macroinvertebrate community.

Issue AQU-6: Effects on Special-Status Fish Species. Potential direct and indirect effects to special-status fish species could occur as the result of aquatic weed control methods testing. Potential direct effects include deterioration of fish health, and/or injury or mortality as a result of exposure to ultraviolet light, and/or through entrainment associated with suction dredging. Potential aquatic toxicity of herbicides to fish is evaluated under Issue EH-4. Potential indirect effects could result from short-term water quality degradation associated with vegetation decomposition (e.g., hypoxia from the oxygen demand of decomposing plants). The threshold of significance for this issue area would be a substantial reduction in numbers or reduced viability of special-status fish species.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. Potential direct and indirect effects on fish movement that could block access to spawning habitat could include delays or barriers to fish movement as a result of aquatic herbicide treatments (including physical barriers associated with turbidity curtains), through the placement of bottom barriers on potential spawning substrate, through entrainment associated with suction dredging, and/or from short-term localized water quality degradation associated with vegetation decomposition that could repel fish from lagoon channels (e.g., hypoxia). The threshold of significance for this issue area would be a substantial reduction or blocking of access to spawning habitat.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. Potential effects to the suitability of habitat for native or recreationally important game fish species could include short-term degradation of habitat associated with herbicide treatments, ultraviolet light, through the placement of bottom barriers, increases in turbidity associated with suction dredging, and changes in submerged aquatic vegetation, which provides important habitat structure for certain fish species. The threshold of significance for this issue area would be a substantial reduction in the suitability of habitat for native or recreationally important game fish species.

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. Potential effects associated with the introduction or spread of aquatic invasive species could include the introduction of aquatic invasive species associated with equipment and personnel implementing the control methods. All of the control methods could result in the release and transport of aquatic weed seed and propagules to areas outside of the Tahoe Keys where aquatic invasive weed species have not yet become established. The threshold of significance for this issue area would be further introduction or spread of invasive species resulting in ecological impacts.

3.1.1.7 Terrestrial Biology and Ecology

Although the Proposed Project and alternatives would have minimal intersection with terrestrial resources, data insufficiencies identified during the IEC/IS led to the implementation of a reconnaissance study program in support of the DEIR/DEIS. A wide range of potential issues were identified for investigation, but most have been determined to be less than significant:

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species. Short-term effects to terrestrial species and habitat may arise from disturbance or alteration of the existing habitat by the Proposed Project or alternatives. Upland habitats that may be affected include ruderal and disturbed areas adjacent to the old Water Treatment Plant on the south shore of Lake Tallac. Implementation of the Proposed Project and alternatives may affect wildlife species which utilize open water for foraging.

- **Introduction and Spread of Invasive Plant Species within Terrestrial, Riparian, and Wetland Habitats.** Invasive plant species could preferentially establish in areas that experience disturbance, and they may dominate habitats if this decreases native populations and overall species diversity. Equipment and personnel could carry invasive plant or other material from source populations to the project area. A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA; introduced new vegetation that would require excessive fertilizer or water, or would provide a barrier to the normal replenishment of existing species (TRPA 3); and/or cause a substantial change in the diversity or distribution of species, or the number of any species of plants.
- **Damage or Mortality of Special-Status Plants or Altered Extent of Special-Status Plant Habitat.** A significant impact would be one that: has a substantial effect, either directly or through

habitat modification, on any special-status species; conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; and/or causes the reduction in the numbers of any unique, rare, or endangered species of plants.

- **Disturbance to Sensitive Communities, Including Jurisdictional Wetlands and Riparian Vegetation.** Even a short-term disturbance can create a disruption in the function of the ecosystem and the services provided by wetland and riparian habitats. A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA; involves the removal of vegetation in excess of the area utilized for the actual development permitted by TRPA's land capability program ; results in the removal of riparian vegetation or other vegetation associated with critical wildlife habitat, through either direct removal or in direct lowering of the groundwater table (TRPA 2); results in the cause a substantial change in the diversity or distribution of species, or the number of any species of plants; causes the reduction in the numbers of any unique, rare, or endangered species of plants; and/or removal of streambank and/or backshore vegetation, including woody vegetation such as willows.
- **Injury or Mortality of Special-Status Wildlife Individuals or Otherwise Protected Species.** A significant impact would be one that: has a substantial effect, either directly or through habitat modification, on any special-status species; conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; and/or causes a substantial change in the diversity or distribution of species, or the number of any species of animals.
- **Disruption to Wildlife Habitat including Extent of Special-Status Wildlife Habitat.** A significant impact would be one that: has a substantial effect, either directly or through habitat modification, on any special-status species; conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; causes a substantial change in the diversity or distribution of species, or the number of any species of animals; reduces the number of unique, rare, or endangered animal species; and/or deteriorates existing fish or wildlife habitat quantity or quality.
- **Interference with Wildlife Movement.** A significant impact would be one that would: interfere substantially with the movement of any native resident or migratory wildlife species or established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites; and/or cause the introduction of new species or animals into an area or result in a barrier to the migration or movement of animals.
- **Disturbance Caused by Dredge and Replacement Substrate.** A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA; and/or deteriorates existing fish or wildlife habitat quantity or quality.

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. Riparian and wetland species and habitats could be affected if herbicide applications affect non-target species; if LFA changes current riparian or habitat conditions; or if the discharge of dewatering effluent from test dredging affects water levels in Lake Tallac or Pope Marsh.

- **Herbicide Effects on Non-Target Riparian and Wetland Species.** A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; or has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA.

- **LFA Effects on Riparian and Wetland Conditions.** A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; or has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA. During the reconnaissance level Wetland Inventory survey performed in 2019 no wetlands were observed within the West Lagoon.
- **Discharge of Dredge Effluent to Lake Tallac and Pope March.** A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; or has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA.

3.1.1.8 Land and Shoreline Use

Although the Initial Environmental Checklist/Initial Study (IEC/IS) identified no potentially significant effects on land or shoreline use, and no changes to Proposed Project or Alternatives have been made that would change that evaluation, an analysis is incorporated in Section 3.4.1 to expand upon the conclusions presented in the IEC/IS for the Proposed Project and further evaluate the Proposed Project, two Action Alternatives and No Action Alternative for the following three land and shoreline use issues.

Pursuant to Appendix G (Environmental Checklist Form) of the CEQA Guidelines and the TRPA Environmental Checklist, a project would have a potential land use and planning impact on the environment if it would:

- Physically divide an established community
- Cause a significant environmental impact due to conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect
- Include uses which are not listed as permissible uses in the applicable Plan Area Statement, adopted Community Plan, or Master Plan, or
- Expand or intensify an existing non-conforming use.

Issue LN-1: Physical Division of an Established Community. The Project could have a potentially significant impact if it would physically divide an established community. As neither the Project nor any alternative includes any new development, it is anticipated that there would be no impacts with respect to this issue.

Issue LN-2: Conflicts with Land Use Plans, Policies, or Regulations. The Project could have a potentially significant impact if it conflicted with a land use plan, policy or regulation adopted for the purpose of avoiding or mitigating an environmental effect, including the environmentally mitigating policies and regulations listed in the TRPA Code of Ordinances, the Plan Area Statement (PAS) for Tahoe Keys (PAS-102), and the City of South Lake Tahoe General Plan. A table summarizing applicable policies is presented in Section 3.4.1, with a brief statement of how the Proposed Project and each alternative is consistent or inconsistent with the policy.

Issue LN-3: Inclusion of Unpermitted Land Uses. The Project could have a potentially significant impact if it included land uses that were not permitted under the PAS for Tahoe Keys. The Project would also have a potentially significant impact if it resulted in expansion or intensification of an existing non-conforming use identified in the Tahoe Keys PAS-102, the TRPA Code of Ordinances or the City of South Lake Tahoe Zoning Ordinance. As neither the Proposed Project nor any alternative includes a change in existing land uses, including intensification of any existing land use, it is anticipated that there would be no impacts with respect to this issue.

3.1.1.9 Recreation

The potential to interfere with recreational boating by Keys property owners and their guests has been an important consideration since the preparation of the initial Exemption Application and IECD/IS. This consideration has played a role in scheduling the test program (e.g., prior to the start of the recreational boating season on Memorial Day weekend). The major issues of concern are the potential for the Proposed Project and Action Alternatives to obstruct boating and the potential displacement of boat launches to the nearby Tahoe Keys Marina and other facilities, particularly during the recreational boating season (Memorial Day to Labor Day). The communities most impacted by these potential effects would be the Tahoe Keys Property Owners, and users of Tahoe Keys Marina.

The following criteria were used in evaluating recreation impacts and determining their significance: (1) If the Proposed Project or Action Alternative would increase the use of existing recreational facilities such that substantial physical deterioration of the facility would occur or would be accelerated (CEQA Guidelines Appendix G: Environmental Checklist XVI. Recreation); or (2) require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment. In addition, significance was evaluated in terms of inconsistency with TRPA thresholds R-1 High Quality Recreational Experience Threshold and R-2 Public's Fair Share of Resource Capacity. The level of impact for recreation is based on severity and duration.

Issue RE-1: Obstruction of Recreational Boat Passage. Recreational boat passage may be obstructed for Tahoe Keys property owners or their guests (e.g., vacation rentals) by turbidity curtains or other barriers placed in the Tahoe Keys lagoons during the proposed CMT or dredge and substrate replacement test. The threshold of significance is defined as a permanent loss of direct recreational boating access from the Tahoe Keys, including during the recreational boating season (from Memorial Day weekend through Labor Day weekend).

Issue RE-2: Increased Use of Tahoe Keys Marina and Other Facilities. Recreational boat launches may be displaced to the Tahoe Keys Marina and other nearby launching facilities during the period that barriers are placed within the Keys to implement the CMT.

Issue RE-3: Inconsistency with TRPA Recreation Thresholds: Environmental analysis considers two thresholds: R-1. High Quality Recreational Experience and R-2. Public's Fair Share of Resource Capacity.

3.1.1.10 Utilities

Concerns regarding the potential effect of applying aquatic herbicides in the Keys on potable water supplies and their brand have long been expressed by purveyors:

Issue UT-1: Effects on Water Supply. The Tahoe Water Suppliers Association (TWSA) has raised concerns that herbicide residues and degradants could reach water supply intakes on Lake Tahoe, causing loss of filtration exemption, and that their brand could be affected by implementation of the herbicides test component of the Proposed Project. (Effects on "brand" would be socioeconomic effects, which are excluded from consideration by CEQA. See CEQA 15358 definition of "Effects," which states "*Effects analyzed under CEQA must be related to a physical change*." In general, socioeconomic effects should not be included unless they cause physical change.) Effects on drinking water would be considered significant if any detectable concentration of herbicides or degradants attributable to the test program occurred at drinking water intakes.

A second issue concerns the potential discharge of treated wastewater under Action Alternative 2 (Tahoe Keys Dredge and Replace Substrate) into Lake Tahoe via the South Lake Tahoe sanitary sewer system operated by STPUD. This option would require determination by the STPUD Board that sufficient system capacity exists to handle the load without significantly affecting the wastewater treatment system and discharge system. If the Board determines that the load cannot be handled without a significant effect it is presumed that the request for discharge would be denied, in which case there would be no significant effect and no further analysis of utility effects would be required. (If such a request is denied treated wastewater would be discharged into Lake Tallac and Pope Marsh, as described in Chapter 2.)

3.1.1.11 Traffic and Transportation

The Proposed Project and Action Alternative 1 would generate vehicle trips by contractors and monitors implementing the test applications. The new Tahoe Keys Dredge and Substrate Replacement Alternative would also entail the dispatch of several hundred truckloads of dredge material for disposal (plus return trips). These are new vehicle trips which may raise environmental issues of concern.

Pursuant to Appendix G (Environmental Checklist Form) of the CEQA Guidelines and the TRPA Environmental Checklist, a project would have a potential traffic and transportation impact if it would:

- Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadways, bicycle and pedestrian facilities
- Conflict or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)
- Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)
- Result in inadequate emergency access
- Result in generation of 100 or more new daily vehicle trip ends
- Result in changes to existing parking facilities, or demand for new parking
- Result in substantial impact upon existing transportation systems, including highway, transit, bicycle or pedestrian facilities
- Result in alterations to present patterns of circulation or movement of people and/or goods
- Result in alterations to waterborne, rail or air traffic or
- Result in an increase in traffic hazards to motor vehicles, bicyclists, or pedestrians.

Under the long-range plans of TRPA and the City of South Lake Tahoe, a project could conflict with Regional Plan and General Plan transportation policies if it caused level of service on a roadway to deteriorate to LOS E or F for more than four hours in a day. A project could potentially cause an impact related to VMT if generated more than 110 new daily vehicle trips and did not reduce VMT by 15 or more percent below the per capita average for the Lake Tahoe region.

Issue TR-1: Generation of New Daily Vehicle Trips. The Project would have a potentially significant impact if it generated more than 100 new daily trip ends (one-way vehicular trips), inasmuch as new trip generation below that level is defined by TRPA Code 65.2 to be an insignificant increase in traffic. Existing TKPOA maintenance staff would be utilized in the implementation of the Project and application of the various control methods tests and would not generate new trips beyond the existing condition. Contractors employed for the Proposed Project and alternatives could generate new trips, but these would represent temporary trips and not permanent impacts. The dredge alternative would be evaluated for length and number of trips, and duration of work.

Issue TR-2: Changes in Demand for Parking. The Project would have a potentially significant impact if it resulted in changes to parking facilities or created a demand for new parking that affected the ability of Tahoe Keys property owners or members of the general public to find parking spaces in reasonable proximity to their destination.

Issue TR-3: Effects on Road Level of Service. The Project would have a potentially significant impact if it had a substantial impact on the condition or level of service of the existing road segments along the planned haul routes for sediment and clean substrate, altered present patterns of circulation, or increased traffic hazards to vehicles, bicyclists or pedestrians. No existing roadways would be modified or closed for the Project. Truck trips for the dredge alternative would utilize trucks appropriately sized for the roadways to be used between the dredge and deposition sites.

Issue TR-4: Effects on Water Traffic. The Project could have a potentially significant impact if it would alter waterborne traffic. The dredge and ultraviolet light alternatives would each deploy a single small barge. The travel path of the barge is not expected to significantly alter existing waterborne traffic, and there are no commercial transportation services in the Project area, so it is anticipated that there would be less than significant impacts related to this issue. Potential effects on recreational boat use are evaluated in Section 3.4.4.

3.1.1.12 Noise

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. The Tahoe Keys Dredge and Replace Substrate Alternative could cause short-term noise impacts (similar to a construction project). This type of noise is typically exempt from local noise ordinances. Section 130.37.020.I of the El Dorado County Code of Ordinances states that "*Construction (e.g., construction, alteration or repair activities) during daylight hours provided that all construction equipment shall be fitted with factory installed muffling devices and maintained in good working order*" is exempt from the County Noise Ordinance and consistent with the El Dorado County General Plan Goal 6.5 (Acceptable Noise Levels) for new land uses. TRPA's Noise Ordinance is focused primarily on transportation sources but Section 68.9 states that "*The Standards of this Chapter shall not apply to noise from TRPA-approved construction or maintenance projects or demolition of structures provided such activities are limited to the hours between 8 a.m. and 6:30 p.m.*" There are no applicable quantitative regulatory requirements limiting temporary increases in noise levels due to the activities proposed as part of the Dredge and Replace Substrate Alternative.

3.1.1.13 Cultural Resources

Issue CR-1: Traditional Native American Resources and Values. The United Auburn Indian Community (UAIC) has provided a written request for consultation and recommendations for mitigation measures. These measures included an Unanticipated Discovery Plan, Awareness Training for consultants and construction workers, and an associated Tribal Cultural Resources Awareness brochure to be included in the Proposed Project Mitigation Monitoring Plan. The LWB consulted with the UAIC and agreed to incorporation of these measures, which will satisfy AB 52 compliance.

3.1.2 Summary of IEC/IS Mandatory Findings of Significance and Elements of the Environment Not Found to be Significantly Affected

In 2018, the Lead Agencies completed a TRPA Initial Environmental Checklist and CEQA Initial Study (IEC/IS) on TKPOA's previous proposal for an "Integrated Methods Test" (IMT). As a result of the IEC/IS, a decision was made to undertake the present Draft EIR/EIS. Although the Proposed Project evaluated under this Draft EIR/EIS is different in many respects from the "IMT", this section provides background for the decision to undertake this Draft EIR/EIS by summarizing the key findings of significance and elements of the environment found not to be significantly affected in the IEC/IS.

3.1.2.1 Earth Resources

The IEC/IS considered the potential for the herbicides proposed for use in the CMT and their degradation products to adsorb to soil and sediment particle and reach deeper soil or sediment horizons. Based on their rapid degradation rates, this was determined to be a less than significant effect.

No potentially significant effects on geology, soils, or arising from geological hazards were identified for the Proposed Project in the Initial Environmental Checklist/Initial Study (IEC/IS), and no changes to Proposed Project or Alternatives have been made that would change that evaluation.

3.1.2.2 Air Quality and Noise

The IEC/IS identified the jurisdictional air management district, designated nonattainment areas, and significance criteria for the Project area (see Section 3.3.2). The nearest sensitive receptors were identified as the residences located adjacent to the proposed project area. No schools, hospitals, or nursing homes are located within 0.5 mile of the project. The IEC /IS considered the possibility that herbicides applied to water could volatilize if exposed to air, but determined that the proposed application methods (including timing), low vapor pressures, and solubility of the herbicides proposed to be used during the CMT would likely eliminate the opportunity for significant effects to occur.

The Greenhouse Gas emissions analysis conducted for the IEC/IS has become outdated with the proposed use of trucks, dredge and pumps for the Tahoe Dredge and Replace Substrate alternative, and an updated analysis is provided in Section 3.3.2.

3.1.2.3 Aquatic Biology and Ecology

In the category of biological resources, the IEC/IS found a potentially significant impact of adverse effects, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species. And data were found to be insufficient to address the following checklist items: (1) change in the diversity or distribution of species, or numbers of any species of animals (including fish and benthic organisms), (2) reduction in the number of any unique, rare, or endangered species of animals, and (3) deterioration of existing fish or wildlife habitat quantity or quality. Baseline studies in the Tahoe Keys lagoons in 2019 included summer and fall surveys of fish and benthic invertebrate communities, and additional information has been collected to address data insufficiencies and help evaluate potentially significant adverse effects to aquatic life and habitats. The IEC/IS also found a potentially significant impact of interference with the movement of any native resident or migratory fish or wildlife species, based on the TKPOA's previous project proposal to install a water barrier at the West Channel. This feature is not part of the currently proposed project or project alternatives.

3.1.2.4 Cultural Resources

The Proposed Project and Action Alternatives are primarily focused on actions occurring on or in the waters of the Tahoe Keys lagoons. One land site (at the mothballed Tahoe Keys Water Treatment Plant) would be utilized for staging and sediment and clean substrate handling under the Tahoe Keys Dredge and Replace Substrate Alternative, however that site is highly disturbed. There are currently no historic structures, sites or artifacts identified in this area that would be affected. No potentially significant effects on historic or cultural resources were identified for the Proposed Project in the Initial Environmental Checklist/Initial Study (IEC/IS), and no changes to Proposed Project or Alternatives have been made that would change that evaluation.

3.1.2.5 Hydrology

The IEC/IS found two potentially significant hydrology impacts among IEC checklist items: (1) changes in currents, or the course or direction of water movements, and (2) change in the amount of surface water in any water body. These findings were based on TKPOA's previous project proposal (evaluated in 2018 under the Lead Agency's Initial Environmental Checklist/Initial Study completed prior to undertaking this Draft EIR/EIS) to install a water barrier at the West Channel entrance to the West Lagoon from Lake Tahoe, a structural feature that is not part of the currently proposed project or project alternatives.

3.1.2.6 Land and Shoreline Use

The Project would not result in any land use conversions, modifications to shorelines, or conflicts with existing land management plans. Several potential environmental issues were identified (below), but none are considered to have the potential to cause significant effects. This is consistent with the findings of the IEC/IS, and they are not addressed further in this DEIR/DEIS, with the exception of a summary of applicable local and regional documents in Section 3.4.1.

3.1.2.7 Population, Housing, and Public Services

The Project could have a potentially significant impact if it induced substantial unplanned population growth in the Project area; temporarily or permanently displaced residents or housing units; or reduced the number of market-rate or affordable housing units in the Tahoe Region. As existing TKPOA staff would be utilized in the implementation of the Proposed Project and neither the Project nor any alternative includes a change in existing land uses or demolition of any existing housing units, it is anticipated the number of new jobs generated would be minimal, and population growth would not result. No potentially significant effects on population, housing or public services were identified for the Proposed Project in the Initial Environmental Checklist/Initial Study (IEC/IS), and no changes to Proposed Project or Alternatives have been made that would change that evaluation.

3.1.2.8 Recreation

Recreational effects considered in the IEC/IS also included the visibility of any test program activities from public recreation areas; changes in the character of any recreation lands or waters; recreational access; recreational exposure to aquatic herbicides or their degradation products; and effects on recreational facilities and recreation use. The IEC/IS identified several potential issues related to recreation, however most of these were related to the possible effects of the proposed west channel barrier on recreational boating; the barrier is no longer an element of the CMT. Although the west channel barrier is no longer proposed the current Proposed Project could entail deployment of barriers within the Keys or removal of docks (for the Tahoe Keys Dredge and Replace Substrate Alternative), which could raise similar issues.

3.1.2.9 Terrestrial Biology and Ecology

The IEC/IS identified data insufficiencies for several potential issues related to terrestrial biology and ecology, however these were primarily related to the possible effects of the proposed west channel barrier on listed rare, endangered and sensitive species; the barrier is no longer an element of the CMT. Reconnaissance level surveys of terrestrial species, habitats, and wetlands were undertaken for the DEIR/DEIS to remediate these insufficiencies.

3.1.2.10 Traffic and Transportation

Traffic was considered to be a less than significant issue in the IEC/IS, and most discussion centered on the effects to boat traffic of a proposed barrier at the west channel entrance to the Keys, which is no longer an element of the project. Issues related to new alternatives that were not considered for the IEC/IS are addressed herein.

3.1.2.11 Utilities

The IEC/IS found that TKPOA Water Department operates and maintains all wells, wells, pipe delivery systems and monitoring equipment in order to consistently provide safe drinking water throughout the Tahoe Keys. The Water Department services all Tahoe Keys owners and renters as well as the Tahoe Keys Marina and Tahoe Keys Office Center.

A primary concern was the potential to affect water delivered for potable use that could be reached by the herbicides or their breakdown products, such that water would be rendered contaminated or unsuitable for human use. However, the IEC/IS found that surface water intakes are not located is sufficient proximity to the Tahoe Keys lagoons to be affected. Potential effects to groundwater purveyors were also considered. However, rhodamine dye studies resulted in no detection in samples taken at the three Tahoe Keys Water Company (TKWC) groundwater wells, indicating herbicides would not reach these water supplies. Other wells are located upgradient from the Tahoe Keys lagoons. The

IEC/IS proposed contingency plans, if necessary, to remove herbicides and other chemicals to treat the potable water before distribution. These effects are discussed in Section 3.4.6.

3.1.2.12 Visual and Aesthetic Resources

No potentially significant effects on visual and aesthetic resources were identified for the Proposed Project in the Initial Environmental Checklist/Initial Study (IEC/IS), and no changes to Proposed Project or Alternatives have been made that would change that evaluation. Effects on water clarity are addressed under Water Quality Issue WQ-n.

The activities outlined in the CMT are not expected to cause visually offensive conditions, and therefore would not be expected to cause significant effects. The IEC/IS identified temporary effects that were not considered significant, including some related to actions which are no longer part of the proposed CMT (e.g., placing an impermeable barrier across the west channel entrance to the Keys). No scenic resources would be damaged. The project would not permanently impede any viewsheds. Project-related signage may be visible from parts of Lake Tahoe. No light sources or reflective structures would be constructed as a result of this project. The changes to the visual character or quality of the proposed test sites were considered less than significant given the mitigation listed in the Basin Plan. The use of aquatic herbicides may improve scenic resources by reducing the presence of undesirable weeds. The use of aquatic herbicide applications could temporarily result in views of dead, floating vegetation. A temporary increase of turbidity could occur if bottom barriers are employed as part of the CMT Group B methods.

No potentially significant effects on visual and aesthetic resources were identified for the Proposed Project in the Initial Environmental Checklist/Initial Study (IEC/IS), and no changes to Proposed Project or Alternatives have been made that would change that evaluation, therefore this resource is not considered further in this DEIR/DEIS.

3.1.2.13 Water Quality

Several potentially significant water quality impacts were identified in the IEC/IS: (1) violate any water quality standards or waste discharge requirements, (2) otherwise substantially degrade water quality, and (3) discharge into surface waters, or any alteration to surface water quality, including but not limited to temperature, dissolved oxygen, or turbidity. A very extensive baseline water quality data collection effort was conducted from the late spring through fall of 2019 to document existing conditions in the Tahoe Keys lagoons with respect to water quality standards and other water quality characteristics, including temperature, dissolved oxygen, and turbidity. This information helps inform an understanding of the interaction between physical, chemical and biological components of the lagoon ecosystems, and the evaluations in this DEIR/DEIS of potentially significant water quality effects.

3.2 ENVIRONMENTAL HEALTH

Concerns regarding ecological and human health risks from herbicides and cyanotoxins that may arise from harmful algal blooms (HABs) figured prominently in public and stakeholder comments during the scoping period. In addition, disturbance of aluminum residues in Tahoe Keys sediments has the potential to cause aluminum concentrations in lagoon water to exceed criteria for protecting aquatic life. This section evaluates potential adverse impacts to environmental health (human and ecological) from implementing the Proposed Project (CMT) and Action Alternatives. The potential concentrations and persistence of herbicide active ingredients and degradants in herbicide application areas and in receiving waters is evaluated in Section 3.3.4 (Water Quality) and potential effects on drinking water supplies is evaluated in Section 3.4.3 (Utilities); this section addresses the potential risks of the herbicides and their degradation products to people and ecological receptors. The potential for indirect effects is also evaluated, looking at how aquatic weed control could change the availability of nutrients for HABs that sometimes lead to the release of cyanotoxins. Beyond potential toxicity impacts to aquatic life addressed in this section, additional information is provided in the Aquatic Biology and Ecology section on aquatic macrophytes, benthic macroinvertebrates, fish, and other potential effects of the Proposed Project and alternatives on aquatic life.

Because the volume of Lake Tahoe is approximately 58,000 times greater than the combined volume of the Tahoe Keys lagoons, potential changes in lagoon water quality are not expected to be measurable in the greater Lake Tahoe, and consequent environmental health effects would not be distinguishable either. Measures to protect water quality within the lagoons described in Section 3.3.4 are expected to minimize risks of potential environmental health impacts in the lake.

Methods & Assumptions

Environmental health evaluations are focused on receptors that must be protected in receiving waters within the lagoons, workers implementing herbicide applications, and people in the community. Protection of environmental health within the lagoons is expected to minimize potential environmental health impacts in Lake Tahoe where there would be much greater water circulation and dilution. Ecological and human health risks from herbicides, cyanotoxins that may arise from HABs, and the potential of aluminum concentrations to exceed USEPA's acute and chronic water quality criteria for the protection of aquatic life were evaluated in this section.

The general approach to evaluating water environmental health was to (1) review the available literature to address the environmental health issues, (2) supplement the information from the literature with site-specific information on the Tahoe Keys, and (3) incorporate findings from other studies to inform expectations for how the lagoons might respond to proposed activities. Considerations included the timing, duration, and spatial extent of activities. In many cases, mitigation and resource protection measures were part of the evaluation, including the ability to monitor real-time and alter activities to maintain environmental health protection. The following methods and assumptions were applied in evaluating specific environmental health issues.

EH-1: Herbicide Applicator Exposure and Health. The potential for herbicide applicator exposure and health was evaluated assuming that herbicide applications would only be performed by Qualified Applicator License (QAL) holders. We assume that QAL holders would have completed extensive annual training to minimize any potential risks, including the use of proper personal protective equipment, and they would follow NPDES permit requirements and product label specifications. Only the risks of acute exposure to the herbicides were evaluated since no chronic exposures over months or years would be assumed to occur as part of the Control Methods Test (CMT). The potential acute effects of the herbicides were determined by a review of the available literature, as well as Safety Data Sheets (SDS) from the herbicide manufacturers.

EH-2: Detectable Concentrations of Herbicides and Degradants in Receiving Waters. The existing concentrations of active ingredients and chemical degradants of herbicides proposed for testing were assumed to be undetectable since there are no known past approved or unapproved uses of the aquatic herbicides proposed for testing. Pre-project water and sediment sampling and analysis would be used to verify this assumption. The environmental fate and persistence of each herbicide proposed for testing in the West Lagoon and Lake Tallac were determined by a review of the available literature. The evaluation further assumed that as a permit condition an approved spill response plan would be required.

EH-3: Protection of Drinking Water Supplies. As stated for EH-2, existing concentrations of active ingredients and chemical degradants of herbicides proposed for testing were assumed to be undetectable. The locations of potable water intakes in or near the Tahoe Keys were identified and a recent hydrological investigation was reviewed. The environmental fate and persistence of each herbicide proposed for testing in the West Lagoon and Lake Tallac were determined by a review of the available literature. Comparisons of the maximum allowable application rates to the drinking water standards for the proposed herbicides were made. In many cases, the evaluation assumed that mitigation and resource protection measures would be required to implement the CMT, including spill response plans, containment barriers, and well monitoring. Additional evaluations of potential effects on drinking water supplies are presented as Issue UT-1 in Section 3.4.3.

EH-4: Introduction of Toxic Substances into the Environment. As stated for EH-2, existing concentrations of active ingredients and chemical degradants of herbicides proposed for testing were assumed to be undetectable. A review of each herbicide’s mode of action was performed to understand the potential for detrimental physiological responses of humans, plants, animals, or aquatic life to the herbicides proposed for testing. The acute toxicity of each herbicide was classified according to USEPA guidance and compared to maximum allowable application rates for each herbicide. The potential for the herbicides to bioconcentrate and bioaccumulate was also considered. A spill response plan was assumed to be a permit condition required to implement the CMT. Aluminum is discussed under issue EH-5 and cyanotoxins are discussed under issue EH-6.

EH-5: Short-term Increases in Aluminum Concentrations. Information on existing concentrations of aluminum were summarized from available studies. The aluminum concentrations were then compared to USEPA’s acute and chronic water quality criteria for the protection of aquatic life. A review of aluminum’s effects on aquatic life was conducted. It was assumed that mobile aquatic species (e.g., fish) would be scared away by test activities and able to avoid exposure to elevated aluminum concentrations. It was also assumed that mitigation and resource protection measures would be required for implementing the CMT or project action alternatives, including best management practices to minimize sediment disturbance, turbidity monitoring, and spill control and containment plans for dredge spoils. It was further assumed that measures to minimize turbidity would also minimize the potential for aluminum concentrations in the water to exceed criteria.

EH-6: Harmful Algal Blooms (HABs). Information on measured concentrations of cyanotoxins were summarized from available studies and then compared to the California's Caution Action and Warning Action Triggers for cyanotoxins. Background information on the toxic effects that cyanobacteria can have, as well as the conditions that cause them, was provided. Key assumptions included limiting the risk of increased HABs by prescribing that the herbicide applications occur in the late spring when the plant biomass that would decay and release nutrients is minimal, water temperatures are still cool from snowmelt runoff, nighttime air temperatures are low, the lagoons are not yet strongly stratified, and plant photosynthesis and respiration have not yet reached the high levels that occur in the summer. Mitigation and resource protection measures, such as aeration, were considered in evaluating the potential for increased risks from HABs occurring at or near test sites during the aquatic weed control methods testing.

3.2.1 Proposed Project (Control Methods Test)

This section describes the regulatory setting and environmental setting for the Proposed Project, evaluates potential environmental health effects from each control method proposed for testing (i.e., herbicide treatment, ultraviolet light treatment, LFA, and combined herbicide and ultraviolet light treatments), proposes mitigation and resource protection measures to limit adverse effects, and identifies any significant unavoidable adverse impacts.

Regulatory Setting

Section 1.4 provides an overview of federal, state, and local regulatory requirements including required permits for project implementation. This section describes in more detail the specific requirements that apply to the potential environmental health issues identified in Section 3.1.1 for the CMT. Information on drinking water requirements is presented under Utilities in Section 3.4.3.

Federal

Federal Clean Water Act (Public Law 92-500)

Under CWA Section 401, applicants for a permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain a certification that evaluates potential water quality impacts and requires permit conditions to protect beneficial uses. Following USEPA adoption of a new rule in 2008, an NPDES permit was no longer required for the transfer of water from the Tahoe Keys lagoons to Lake Tahoe, and the LWB replaced the NPDES permit for TKPOA with a Water Quality Certification and Waste Discharge Requirements (WDRs, Order R6T-2014-0059, LWB 2014). The Proposed Project would require a new individual NPDES permit for the discharge of aquatic herbicides as part of the methods testing. Additional information on CWA requirements is presented in Section 3.3.4.

USEPA Antidegradation Policy

The Tier III designation of Lake Tahoe (including the West and East lagoons) under the State and federal Antidegradation Policies requires that states may allow some limited activities that result in temporary and short-term changes to water quality, subject to protection of beneficial uses. These changes would not be allowed to adversely affect existing uses or alter the essential character or special uses for which Lake Tahoe was designated as an ONRW. As discussed in Section 1.4.1.1, if detectable concentrations of applied aquatic herbicide active ingredients or select degradation byproducts are present longer than “weeks to months, not years” the discharges would be assessed to cause long-term water quality degradation. The LWB has discretion in determining the allowable time frames for what constitutes long-term and short-term existing water quality degradation within the “weeks to months, not years” guidance from USEPA.

State

The Water Quality Control Plan for the Lahontan Region (Basin Plan) defines water quality standards for the surface and ground waters of the region, including designated beneficial uses of water and the narrative and numerical water quality objectives (WQOs) to protect those uses. Designated beneficial uses related to environmental health include municipal and domestic water supply (including drinking water), water contact recreation, and habitat for aquatic life. Chapter 5 of the Basin Plan identifies WQOs that apply to the Lake Tahoe Basin, including objectives to be maintained free of toxic substances in concentrations that are toxic to or that produce detrimental physiological responses in human, plant, animal, or aquatic life.

Administration of the State and federal Antidegradation Policies in California follows the Administrative Procedures Update on Antidegradation Policy Implementation for NPDES Permitting (State Water Board 1990), as well as Basin Plan policies, including those developed to guide consideration of exemptions to the Basin Plan prohibition on using aquatic pesticides and herbicides in the Lahontan Basin. The requirements for an exemption to the prohibition apply both to proposed aquatic herbicide testing in the West Lagoon, which is part of the Tier III designation of Lake Tahoe as an ONRW, and to herbicide testing in Lake Tallac, which has Tier II protection under the antidegradation policies. If approved for use, detectable concentrations of herbicide active ingredients and degradants exceeding background would be allowed within treatment areas only for a short-term period (i.e., weeks to months, not years) to maintain compliance with antidegradation requirements. In receiving waters outside of treatment areas, short-term detectable concentrations of herbicide active ingredients and degradants exceeding background concentrations are only allowable if beneficial uses are protected and maintained.

California has guidelines for cyanobacteria and cyanotoxins in recreational inland waters. Caution levels for human and animal health are triggered by visual indicators, cyanobacteria cell density greater than 4,000 cells/mL, and cyanotoxin levels of 0.8 µg/L for total microcystins, and one µg/L for anatoxin-a or cylindrospermopsin. Warnings are posted if cyanotoxin concentrations reach six µg/L for total microcystins, 20 µg/L for anatoxin-a, or four µg/L for cylindrospermopsin. Danger warnings are posted if cyanotoxin concentrations reach 20 µg/L for total microcystins, 90 µg/L for anatoxin-a, or 17 µg/L for cylindrospermopsin.

Environmental Setting

This section summarizes information on the existing conditions for herbicides, aluminum, and cyanotoxins, all constituents of potential concern for people and/or aquatic life in the Tahoe Keys lagoons. Information on drinking water supplies is included in Section 3.4.3 under Utilities. Baseline conditions for other water quality constituents are presented in Section 3.3.4 under Water Quality. Baseline conditions for aquatic invasive species and other biological components of the Tahoe Keys ecosystems are presented in Section 3.3.5, Aquatic Biology and Ecology.

Issue EH-1: Herbicide Applicator Exposure and Health. In the Tahoe Keys lagoons, there are no known past approved or unapproved uses of the aquatic herbicides that are proposed for testing in the CMT.

For the purposes of this evaluation, concentrations of the active ingredients and herbicide degradants are assumed to be undetectable.

Issue EH-2: Detectable Concentrations of Herbicides and Degradants in Receiving Waters. As stated for EH-1, existing concentrations of active ingredients and chemical degradants of herbicides proposed for testing are assumed to be undetectable.

Issue EH-3: Protection of Drinking Water Supplies. As stated for EH-1, existing concentrations of active ingredients and chemical degradants of herbicides proposed for testing are assumed to be undetectable. The APAP states that there are no direct raw, potable water intakes located adjacent to the Tahoe Keys lagoons (TKPOA 2018). Wells located within the lagoons draw water from 150 to 430 feet below the ground surface, and the nearest public drinking water intakes operating under filtration exemption in Lake Tahoe are near Lakeside Marina, approximately four miles to the east of the West Channel of the West Lagoon; the nearest private drinking water sources are reported in public scoping comments to be located in the Jameson Beach community north of Pope Marsh approximately one mile west of the West Channel entrance. Additional information on drinking water supplies in Lake Tahoe is presented in Section 3.4.3, Issue UT-1.

Issue EH-4: Introduction of Toxic Substances into the Environment. As stated for EH-1, existing concentrations of active ingredients and chemical degradants of herbicides proposed for testing are assumed to be undetectable. Information on existing concentrations of aluminum is presented under Issue EH-5, and recent cyanotoxin information from Tahoe Keys sampling is summarized under Issue EH-6.

Issue EH-5: Short-term Increases in Aluminum Concentrations. Samples of sediment and overlying water were collected at five stations in the West Lagoon for elutriate tests of total recoverable aluminum as part of the 2019 baseline hydrology and water quality data collection (ESA 2019, Appendix WQ--1). The elutriate test was used to replicate conditions that could occur in the water column during dredging or other sediment disturbance activities. The West Lagoon aluminum concentrations in the elutriate samples ranged from 430 to 4,000 µg/L (Table 3.2-1). Using site pH measurements to calculate site-specific acute and chronic water quality criteria, the concentrations exceeded both chronic and acute criteria for total recoverable aluminum in samples from three of the five West Lagoon stations. The high aluminum concentrations may be due to the historical use of aluminum sulfate (also known as alum) to remove suspended sediment and improve water clarity in the West Lagoon and East Lagoon after they were constructed (SEA 2018). It may also reflect natural background levels of aluminum in the Lake Tahoe watershed. The LWB conducted a beach sand sampling and analysis project at eight beaches around Lake Tahoe to compare with TKPOA samples analyzed for the West Channel dredging and beach replenishment project, and found bulk sediment aluminum and sediment elutriate aluminum concentrations from Tahoe City Beach and El Dorado Beach similar to TKPOA results (LWB 2016). Alum-treated water was not discharged to Lake Tallac historically, and therefore no sediment samples from that lagoon were analyzed for elutriate aluminum during the 2019 baseline study.

Issue EH-6: Harmful Algal Blooms (HABs). Water samples were collected for cyanotoxin analysis at seven TKPOA water quality stations (June through September 2019) and six LFA treatment sites (April through November 2019) in the Tahoe Keys (TKPOA 2019). Additional water samples were collected

Table 3.2-1 Aluminum Elutriate Sample Results Collected from the Tahoe Keys West Lagoon in 2019 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]**
West 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]**
West 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

1 Grey = sample value exceeds acute and/or chronic criteria.
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.

from May through October 2019 for phycocyanin analysis. Those results are detailed in the Tahoe Keys 2019 baseline data summary report (ESA 2019). The only detection for cyanotoxins at the water quality stations was from a water sample collected on 8/13/19 at the WQ14 station (cyanotoxin concentrations were 0.2 µg/L anatoxin-a and 0.1 µg/L microcystin, TKPOA 2019). WQ14 was located close to Pope Marsh, between the proposed methods test treatment Sites 1 and 10 (Figure 2-4). Cyanotoxins were detected at all six LFA treatment sites (all within Site 26 shown on Figure 2-4) between July and September (cyanotoxin concentrations were 0.11-18.07 µg/L anatoxin-a and 0.15-0.33 µg/L microcystin). Cylindrospermopsin concentrations were undetectable at all of the TKPOA water quality stations and LFA treatment sites.

Water samples from the Tahoe Keys were also collected by TKPOA for cyanotoxin analysis at six stations in August 2017 and 19 stations in May through September 2018 (TKPOA 2020). Cyanotoxin concentrations were 0.13-2.84 µg/L anatoxin-a and 0.12-0.23 µg/L microcystin (Otten 2017 and 2018). Cylindrospermopsin concentrations were undetectable at all of the sample sites (sampled in 2017 only).

In 2019, five of the six LFA treatment sites had samples that were within the Caution Action Trigger range (set at one µg/L) and below the Warning Action Trigger for anatoxin-a (set at 20 µg/L, TKPOA, unpublished data, 2020). In 2017, three of the six sites had samples that were within the Caution Action

Trigger range and below the Warning Action Trigger for anatoxin-a (TKPOA 2020) None of the samples from 2018 had concentrations of cyanobacteria above California's guidelines.

Potential Impacts

Issue EH-1: Herbicide Applicator Exposure and Health. The risk of acute exposure to triclopyr, endothall, and florpyrauxifen-benzyl would be primarily to herbicide applicators (EPA 2017b; WDNR 2012a; 2012b). No chronic exposures to herbicides, defined as continuous or repeated contact with a toxic substance over a long period of time (months or years) (CFEH 2019), would occur as part of the CMT inasmuch as test applications would occur over a much shorter period of no more than a few weeks. Concentrated herbicide products are corrosive and can cause skin irritation and irreversible eye damage if splashed in the eye (WDOE undated). Persons who mix or apply the herbicides need to protect their skin and eyes from contact (EPA 2017b; WDNR 2012a; 2012b). However, only dilute amounts of the herbicides are needed to kill the aquatic weeds (WDOE undated). These dilute concentrations have not been shown to cause skin irritation (EPA 2017b; WDNR 2012a; 2012b). In accordance with California state law, aquatic herbicide applications would be made only by a QAL holder from the California Department of Pesticide Regulation (DPR) (TKPOA 2018). Assuming application by QAL holders follow label restrictions, there would be a **less than significant effect** on applicator exposure and health.

Issue EH-2: Detectable Concentrations of Herbicides and Degradants in Receiving Waters. The environmental fate and persistence of each herbicide proposed for testing in the West Lagoon and Lake Tallac are described below.

Triclopyr

In natural waters, sunlight and microorganisms rapidly degrade triclopyr (WDNR 2012b; WDOE undated). Triclopyr's eventual, final degradant is carbon dioxide (CO_2) (WDOE undated). To get there, triclopyr typically breaks down into trichloropyridinol (TCP), a compound that itself is far less persistent than triclopyr in aquatic ecosystems, as seen in field studies (WDOE undated). TCP itself has a level of toxicity comparable to triclopyr, and field studies frequently find it at low concentrations in early post-application sampling periods (WDOE undated). Its methoxypyridine (TMP) degradant is rarely observed, but also has toxicity comparable to triclopyr and TCP (WDOE undated). Half-lives (the time it takes for half of the active ingredient to degrade) for triclopyr and its breakdown products average six days or less in water and 8.4 days or less in sediment (WDNR 2012b; WDOE undated). Triclopyr concentrations decline sharply over the first several days and residues should be more than 95 percent degraded and dissipated in receiving water within a few weeks after treatment with triclopyr (WDOE undated).

Triclopyr and TCP do not adsorb to soil and sediment particles (EPA 2014b; WDNR 2012b), and may be transported in surface waters (EPA 2014b). Triclopyr's multiple degradation pathways and its rapid degradation significantly decrease the potential for triclopyr to reach deeper soil or sediment horizons (EPA 1998).

Endothall

Endothall disperses with water movement and is broken down by microorganisms into carbon, hydrogen, and oxygen (WDNR 2012a; WDOE 2001). The initial breakdown product of endothall is an amino acid, glutamic acid, which is rapidly consumed by bacteria (WDNR 2012a). Field studies show that low concentrations of endothall persist in water for several days to several weeks, depending on environmental conditions, primarily microbial activity (WDNR 2012a). Sprecher et al. (2002) stated that in general, recent laboratory studies indicate that endothall quickly degrades under aerobic and anaerobic aquatic conditions, with half-lives of approximately 20 and 8.5 days, respectively. In its Reregistration Eligibility Decision, USEPA (2005b) stated that the endothall half-life averages five to ten days. Complete degradation by microbial action is within 30-60 days (WDNR 2012a). When endothall is applied to areas of dense aquatic vegetation, it rapidly kills the treated plants, and the decay of the dead vegetation results in oxygen depletion, which, in turn, results in a loss of microbial activity and longer half-lives (USDA 2009).

Evidence indicates that endothall does not bind strongly to most soils or sediments (USEPA 2005a; WDOE 2001). Rapid degradation rates in soils and aquatic ecosystems means that endothall would be degraded before it has a chance to move very far through the soil or sediment (WDOE 2001).

Florpyrauxifen-benzyl

Florpyrauxifen-benzyl is subject to microbial breakdown and hydrolysis, but the key degradation pathway in water is decomposition by the action of light, also known as photolysis (USEPA 2017a; MDA 2018; WDNR 2018). The herbicide is short lived in aerobic and anaerobic aquatic environments in both water and sediment (MDA 2018, Ecology 2017). It has a half-life ranging from about one to six days (MDA 2018, WDNR 2018). Florpyrauxifen-benzyl degradation would occur faster in shallow, clear-water lakes than in turbid, shaded, or deep lakes (USEPA 2017a, Ecology 2017WDNR 2018). Areas proposed for herbicide tests average about six feet deep and have partial shade from docks. Turbidity measurements from the east end of Lake Tallac ranged from 1.4 to 8.3 NTU in mid-June 2019, and turbidity in the West Lagoon ranged from 1.5 to 5.0 NTU in mid-May and mid-June 2019, with shallow and mid-depth turbidity less than three NTU at most monitoring sites (Table 4 of Appendix WQ-1). Based on these characteristics of areas proposed for testing herbicides, the half-life for florpyrauxifen-benzyl can be expected to be a few days.

Florpyrauxifen-benzyl breaks down into five major degradation products (WDNR 2018). These materials are generally more persistent in water than the active herbicide (up to three-week half-lives), but four of these are minor degradants detected at less than five percent of applied active ingredient concentrations (WDNR 2018). Since the metabolites and/or degradants of florpyrauxifen-benzyl are expected to have the same or lesser toxicity as the parent compounds, USEPA concluded that no additional assessment or control was warranted for them (USEPA 2017b; MDA 2018; WDNR 2018).

Florpyrauxifen-benzyl binds tightly with surface sediments, so leaching into groundwater is unlikely (USEPA 2017a; 2017b; WDNR 2018). Degradation products are more mobile, but aquatic field dissipation studies showed minimal detection of these products in surface sediments (WDNR 2018).

In summary, water quality degradation defined by detectable concentrations of discharged aquatic herbicides and their degradants would be controlled as a temporary condition allowable only for weeks to months. While mortality of non-target aquatic plants followed by recovery of macrophyte communities is expected within herbicide testing sites and may occur to a limited extent in areas adjacent to these sites, no harm is anticipated to human health, other aquatic life, or other beneficial uses. Given the characteristics of the herbicides proposed for use as described above, and proposed mitigation and resource protection measures to limit the area and duration of impacts caused by the discharge of aquatic herbicides (Lahontan Water Board 2011), the potential impact of detectable concentrations of herbicides and degradants in receiving waters would be **less than significant**.

Issue EH-3: Protection of Drinking Water Supplies. As a best management practice and to ensure the safe and efficient use of the herbicides, in their APAP TKPOA (2018) developed extensive and multi-layered plans to be followed by TKPOA and the QAL holder, to prevent accidental spills, contain the herbicides within the treatment area, monitor the concentrations and movement of the aquatic herbicides after application, and alert the public and water purveyors in the unlikely event that detectable concentrations of aquatic herbicides move beyond the treatment areas and enter the unaffected areas of the Tahoe Keys lagoons or Lake Tahoe (TKPOA 2018).

Triclopyr and endothall do not adsorb to soil and sediment particles, and they may be transported in surface waters (USEPA 2005a; 2014b; WDOE 2001). This would normally raise concerns of potential groundwater contamination (WDOE 2001). However, rapid degradation rates in soils and aquatic ecosystems means that these two herbicides would be degraded before they have a chance to move very far through the soil or sediment (USEPA 1998; WDOE 2001). Florpyrauxifen-benzyl binds tightly with surface sediments, so leaching into groundwater is unlikely (USEPA 2017a; 2017b; WDNR 2018). None of the metabolites or degradants of the three herbicides have been identified as having a higher potential toxicity than the parent compounds (MDA 2018; WDNR 2012a; WDOE undated).

Regarding the potential for people to be affected by herbicides through drinking water, there are no direct raw, potable water intakes located within or adjacent to the Tahoe Keys lagoons (TKPOA 2018). As noted above, the nearest Lake Tahoe public drinking water intakes are four miles to the east near Lakeside East (TKPOA 2018), and one mile west, at the Jameson Beach community north of Pope Marsh. Furthermore, a recent hydrological investigation determined that beneath the Tahoe Keys, groundwater shallower than about 40 feet below the ground surface is in communication with the lagoons, but deeper groundwater is not connected to surface waters due to a local confining layer between the shallow aquifer zone and the underlying water-supply aquifer (Alward 2016). Three wells are located within the lagoons, drawing from 150 to 430 feet below the ground surface (TKPOA 2018).

Water treated with triclopyr should not be used for drinking water until concentrations are less than 0.4 ppm (WDNR 2012b). The drinking water standard for endothall is 0.1 ppm (WDNR 2012a), while there are no restrictions for using water treated with florpyrauxifen-benzyl for drinking (USEPA 2017b). Maximum allowable application rates are 2.5 ppm for triclopyr, 5.0 ppm for endothall, and 0.05 ppm for florpyrauxifen-benzyl (TKPOA 2018).

Even though the proposed application rates for triclopyr and endothall are above their respective drinking water use restrictions, both herbicides would be subject to dilution and rapid degradation (i.e., as noted above, half-lives are less than 10 days) before they can migrate miles to the nearest potable water intake or hundreds of feet into the drinking water table.

Because only a 25-fold dilution of the maximum application rate for endothall and a six-fold dilution of the maximum application rate for triclopyr would bring concentrations down to drinking water standards, those amounts of dilution would occur within the lagoons – within or near treatment areas. Furthermore, the proposed double curtain containment barriers are capable or retaining 98-99 percent of dissolved materials (such as herbicides) for at least 12-14 days (Anderson 2016), and would be used to prevent the herbicides or their degradants from entering Lake Tahoe (TKPOA 2018). Therefore, the use of the herbicides at maximum allowable application concentrations would not require water use restrictions or pose a risk to drinking water quality in Lake Tahoe or the Tahoe Keys, and there would be a **less than significant** effect on drinking water supplies. (See also Issue UT-1.)

Issue EH-4: Introduction of Toxic Substances into the Environment. The potential introduction of toxic substances resulting from the Proposed Project is limited to herbicides that would be applied to the Tahoe Lagoons in controlled tests, degradants of these herbicides, aluminum that would be mobilized into lagoon water when sediments are disturbed, and cyanotoxins that may be produced by HABs. Aluminum is discussed under Issue EH-5 and cyanotoxins are discussed under Issue EH-6.

To understand the potential for detrimental physiological responses of humans, plants, animals or aquatic life to herbicides proposed for testing, it is important to first examine how the herbicides target living plant tissue (i.e., their modes of action). The modes by which herbicides act on target plants are as variable as their chemical compositions (Sherwani et al. 2015). The specific mode of action at work may involve a plant enzyme or a biological system that the herbicide may interrupt, thus injuring or disrupting regular plant growth and causing eventual mortality (Sherwani et al. 2015). As a serine/threonine protein phosphatase inhibitor, endothall interferes with plant respiration by affecting protein and lipid biosynthesis and disrupting plant cell membranes (USEPA 2005a; Ortiz et al. 2019). Triclopyr affects actively growing plants by mimicking a specific type of plant growth hormone, known as an auxin, causing uncontrolled plant growth and plant death (Strid et al. 2018). Like triclopyr, florpyrauxifen-benzyl mimics the plant growth hormone auxin, causing excessive elongation of plant cells that ultimately kills the plant (MDA 2018).

Triclopyr

The USEPA classifies pesticides according to their acute toxicity responses (WDOE undated). Acute toxicity describes the adverse effects of a substance that result from a single exposure or from multiple exposures in a short period of time. Acute endpoints are typically reported as EC50 (concentrations at which 50 percent of test organisms exhibit a lethal response such as immobilization) or LC50 (concentration at which 50 percent of test organisms exhibit a lethal response) values. Compounds with acute values >100 ppm are classified as "Practically non-toxic" (the best possible rating), while compounds with acute values of 10-100 ppm are classified as "Slightly toxic" (second best classification). Overall, the evidence indicates that triclopyr's acute toxicity values are ~100 ppm or greater for most invertebrate and vertebrate species, indicating that a collective "Practically non-toxic" rating is most appropriate as a generic classification (Table 3.2-2) (WDOE undated). Even the LC50 of the most sensitive species in Table 3.2-2, the fathead minnow, is ~18 times higher than the maximum allowable application concentration of 2.5 ppm for triclopyr (TKPOA 2018), so acute effects would not be expected. The USEPA has determined that triclopyr would have **no significant acute or chronic impact** on fish or freshwater invertebrates when recommended rates are used (WDOE undated).

Triclopyr is commonly used to treat Eurasian watermilfoil (*Myriophyllum spicatum*) (WDNR 2012b). Desirable native species that may also be affected include native milfoils, water shield (*Brasenia schreberi*), pickerelweed (*Pontederia cordata*), and lilies (*Nymphaea* spp. and *Nuphar* spp.) (WDNR 2012b). In a mesocosm study using sediment and plants from the West Lagoon and Lake Tallac, and water circulated from Lake Tallac, triclopyr was effective in killing Eurasian watermilfoil and curlyleaf

Table 3.2-2 Freshwater Organism Studies for Triclopyr (SePRO 2007).

Study	Organism	Results (Active Ingredient)	Comments
Fish 96-hour LC50	Bluegill	891 ppm	Practically non-toxic
Fish 96-hour LC50	Rainbow trout	552 ppm	Practically non-toxic
Fish 96-hour LC50	Fathead minnow	44 ppm	Slightly toxic
Invertebrate 48-h EC50	*Daphnia magna*	248 ppm	Practically non-toxic

pondweed (*Potamogeton crispus*), but did not kill coontail (*Ceratophyllum demersum*) and the native *Elodea Canadensis* (Anderson 2017). Impacts to non-target aquatic macrophytes would be dependent on the sensitivity of that macrophyte to triclopyr at the application rate utilized, the time of year of application, and the use rate (SePRO 2007).

Triclopyr and TCP do not bioaccumulate (WDNR 2012b). Supplemental studies showed that only slight bioaccumulation (<10x) was observed for triclopyr acid and its degradant TCP (USEPA 1998). TMP does appear to bioaccumulate in fatty fish tissues, such as inedible and visceral tissues, but does not persist in fish following TMP disappearance from the water (WDNR 2012b).

Endothall

On an acute basis, the dipotassium salt of endothall proposed for use in the Tahoe Keys ranges from slightly toxic to practically non-toxic to freshwater fish and invertebrates (USEPA 2005a). As was the case for triclopyr, overall evidence indicates that the acute toxicity values for the dipotassium salt of endothall are ~100 ppm or greater with invertebrate and vertebrate species, indicating that a collective "Practically non-toxic" rating is most appropriate as a generic classification (Table 3.2-3). The LC50 of the most sensitive species in Table 3.2-3, the water flea D. magna, is ~six times higher than the maximum allowable concentration of five ppm for endothall, so acute effects would not be expected. Like triclopyr, the USEPA has determined that endothall would have **no significant acute or chronic impact** on fish or freshwater invertebrates when recommended rates are used (USEPA 2005a).

Table 3.2-3 Freshwater Organism Studies for Endothall Dipotassium Salt (USEPA 2005a).

Study	Organism	Results (Active Ingredient)	Comments
Fish 96-hour LC50	Bluegill	316 ppm	Practically non-toxic
Fish 96-hour LC50	Rainbow trout	107 ppm	Practically non-toxic
Fish 96-hour LC50	Channel catfish	>42.9 ppm	Slightly toxic
Invertebrate 48-h EC50	*D. magna*	>28.6 ppm	Slightly toxic

Endothall is effective on Eurasian watermilfoil (*Myriophyllum spicatum*) and also kills species such as pondweeds (*Potamogeton* spp., including curlyleaf pondweed) and coontail (*Ceratophyllum* spp.) (WDNR 2012a). In a mesocosm study using sediment and plants from the West Lagoon and Lake Tallac, and water circulated from Lake Tallac, endothall killed all target plant species but did not kill native *Elodea Canadensis* (Anderson 2017). The desirable plants that offer important values to aquatic ecosystems may be growing alongside plants targeted for treatment, so careful identification of plants and application of endothall products is necessary to avoid unintended harm to native species (WDNR 2012a).

The dipotassium salt of endothall does not bioconcentrate or bioaccumulate in most aquatic fauna (WDOE 2001). Findings from field and laboratory studies with bluegills suggest that bioaccumulation of dipotassium salt formulations by fish from water treated with the herbicide is unlikely (WDNR 2012a). Tissue sampling has shown residue levels become undetectable a few days after treatment (WDNR 2012a).

Florpyrauxifen-benzyl

Toxicity tests conducted with rainbow trout, fathead minnow, water fleas (*Daphnia* sp.), amphipods (*Gammarus* sp.), and snails (*Lymnaea* sp.) indicate that florpyrauxifen-benzyl is not toxic to these species (USEPA 2017a; WDNR 2018). In general, studies using the technical-grade active ingredient (TGAI) as the test substance were solubility limited (~0.04 – 0.05 ppm AI) in the test system due to the low solubility of florpyrauxifen-benzyl (~0.015 ppm, USEPA 2017a). Even with the use of a co-solvent like acetone to increase solubility, the toxicity endpoints for aquatic animals were greater than the highest dose level tested, resulting in non-definitive (i.e., unbounded ">") toxicity endpoints (Table 3.2-4, USEPA 2017a). Unlike the TGAI, studies using typical florpyrauxifen-benzyl end-use products such as ProcellaCOR EC™ were not solubility limited, and these studies typically established acute endpoints in the >one ppm active ingredient (AI) range for aquatic animals (USEPA 2017a), which is orders of magnitude higher than the maximum label rate of 0.05 ppm AI. As was the case for triclopyr and endothall, the USEPA has determined that florpyrauxifen-benzyl would have **no significant acute or chronic impact** on fish or freshwater invertebrates when recommended rates are used (WDNR 2018).

Table 3.2-4 Freshwater Organism Studies for Florpyrauxifen-benzyl (USEPA 2017a).

Study	Organism	Results	Comments
Fish 96-hour LC50	Fathead Minnow	>0.0518 ppm AI	Solubility in water is ~0.015 ppm AI; toxicity classification not available for non-definitive endpoints.
Fish 96-hour LC50	Rainbow trout	>0.049 ppm AI	
Fish 96-hour LC50	Common carp	>0.0414 ppm AI	
Invertebrate 48-h EC50	*D. magna*	>0.0626 ppm AI	

Florpyrauxifen-benzyl may be used to treat Eurasian watermilfoil (*Myriophyllum spicatum*), hybrid Eurasian watermilfoil (*M. spicatum* X *M. sibiricum*) and floating hearts (*Nymphoides* spp.) (WDNR 2018). In a mesocosm study using sediment and plants from the West Lagoon and Lake Tallac, and water circulated from Lake Tallac, ProcellaCOR was very effective in killing Eurasian watermilfoil, and had sub-lethal effects on curlyleaf pondweed, coontail and native *Elodea Canadensis* (Anderson 2017). Desirable native species like waterlily species (*Nymphaea* spp. and *Nuphar* spp.), pickerelweed (*Pontederia cordata*), and arrowhead (*Sagittaria* spp.) may also be negatively affected, so careful identification of plants and application of florpyrauxifen-benzyl is necessary to limit unintended effects (WDNR 2018).

Florpyrauxifen-benzyl does not bioaccumulate in fish or other aquatic fauna due to rapid metabolism and chemical depuration or purging (USEPA 2017a; WDNR 2018). Due to the lack of bioaccumulation and the low acute and chronic toxicity to a wide variety of receptor organisms, bioconcentration and bioaccumulation are not expected to be of concern for the aquatic use of ProcellaCOR EC™ (TRC Environmental 2017).

Laboratory toxicity testing of the herbicides proposed for testing in the Tahoe Keys indicate that the herbicides would not have acute or chronic toxicity to fish or invertebrates. The testing of aquatic herbicides and other weed control methods in the Tahoe Keys would result in the death of aquatic weeds and non-target aquatic macrophytes. There would be a period of months before aquatic macrophytes reestablish themselves in the niches vacated in the lagoons. However, the long-term benefit to native aquatic macrophyte communities from the control of aquatic weeds would likely outweigh any short-term negative impacts to non-target aquatic macrophytes from herbicide testing, and the impacts to both non-target aquatic plants and BMI from ultraviolet light testing. The total area proposed for herbicide and ultraviolet light treatments where plant mortality is expected is 28.67 acres, or less than 17 percent of the Tahoe Keys lagoons. Therefore, the effect of limited mortality of aquatic macrophyte individuals is expected to be a **less than significant** impact on macrophyte populations because only a small portion of the lagoons would be affected, and aquatic plant communities are expected to recover in these areas.

Issue EH-5: Short-term Increases in Aluminum Concentrations. Elevated levels of aluminum can affect some species' ability to regulate ions, like salts, and inhibit respiratory functions, like breathing (USEPA 2018). Aluminum can accumulate on the surface of a fish's gill, leading to respiratory dysfunction, and possibly death (USEPA 2018). Aquatic plants are generally less sensitive to aluminum than fish and other aquatic life (USEPA 2018).

There is the potential for short-term aquatic toxicity within and near test areas, arising from aluminum toxicity due to sediment disturbance during installation, startup and removal of LFA systems; during the installation and removal of bottom barriers; and during spot suction dredging. There also could be an increase in the water column concentrations of aluminum from accidental spills during the handling and transport of dredge spoils from spot suction dredging. The potential for concentrations of aluminum to reach levels associated with toxicity to aquatic life would be a function of the amount of sediment-caused turbidity in the water. However, sediment-disturbing activities would be limited to small areas within the lagoons, and any fish in those areas would likely have been already scared away by test activities, thus leading mobile species to avoid exposure to any elevated aluminum concentrations.

Based on unpublished 2019 monitoring data from a six-acre LFA test site (Site 26 on Figure 2-4) installed in the West Lagoon in April 2019, mid-depth turbidity was minimally elevated during installation and start-up compared to the control site (TKPOA 2019a). Average turbidity was below the three NTU water quality objective for the first five days of monitoring sites within the LFA test area, and the maximum turbidity measurement was 4.5 NTU. No mortality to fish or other aquatic life was observed. These data indicate that adverse impacts to turbidity from LFA are likely to be **less than significant**, and by extension, the risk of aluminum toxicity to aquatic life is also expected to be **less than significant.**

Hoover (2017, 2018a, 2018b) has reported that removal of bottom barriers in the Tahoe Keys has created a high level of turbidity in the local vicinity, which took several hours to clear. It is not known the extent to which aluminum concentrations may have been elevated in the lagoon waters at these times, but no mortality to fish or other aquatic life was reported. Placement of bottom barriers by divers depends on minimizing sediment disturbance and turbidity to maintain visibility, so the potential for elevated aluminum concentrations would be much less during installation. With the limitation of bottom barriers to areas less than 1.5 contiguous acres and the ability of fish to avoid these sites during sediment disturbance is expected to minimize the risk of toxic aluminum exposures, the potential impact of short-term exposure to increases in aluminum would be **less than significant**.

Issue EH-6: Harmful Algal Blooms (HABs). Under certain environmental conditions in freshwater ecosystems, single celled photosynthetic bacteria, called “cyanobacteria,” can increase rapidly in biomass resulting in a “harmful algal bloom” (HAB), which in some cases can produce toxins (Anderson-Abbs et al. 2016; USEPA 2015a). HABs can have negative impacts on the environment and raise serious concerns for drinking water sources, recreational use, pets, wildlife, and livestock (Anderson-Abbs et al. 2016; USEPA 2015a). The acute effects of contact recreational exposure to HABs from activities like swimming, jet skiing, etc., can result in a wide range of symptoms in humans including skin and eye irritation, fever, headaches, muscle and joint pain, blisters, stomach cramps, diarrhea, vomiting, mouth ulcers, and allergic reactions (USEPA 2015b). Some studies have suggested that environmentally-relevant low doses of cyanotoxins play a role in the development of neurodegenerative diseases like Alzheimer’s and Parkinson’s diseases (Holtcamp 2012; Takser et al. 2016). Wildlife, pets, and livestock illnesses and deaths have been attributed to HABs in affected inland waterbodies (Stewart et al. 2008). The toxicity of a particular bloom is complex, determined by the mixture of cyanobacteria species present and the variation in strains with toxic and nontoxic genotypes involved (WHO 1999). In recent years, HABs and associated cyanotoxins have gained national attention due to increases in the frequency and severity of blooms, and their impacts on drinking water sources (Anderson-Abbs et al. 2016).

The conditions that cause cyanobacteria to produce cyanotoxins are not well understood (USEPA 2015a). For example, even when cyanobacteria capable of producing toxins are present, they may not actually produce toxins under all environmental conditions (USEPA 2014a). Also, cyanotoxins can occur in the absence of a visible bloom as not all blooms are visible (USEPA 2015a). It is not possible to determine solely upon visual observation if a bloom is producing toxins (USEPA 2015a). When blooms do occur, the risk of cyanotoxin contamination of the surface water increases, thus increasing potential risk to drinking water sources (USEPA 2014a). Factors that influence the occurrence of cyanobacteria blooms can include excess nutrient (nitrogen and phosphorus) loadings and concentrations, slow-moving surface water, high water temperature, high intensity and duration of sunlight, water column stratification, changes in water pH, and occurrence of trace metals (USEPA 2015a; 2019). Some of the factors that influence the occurrence of blooms could be affected by the application of aquatic herbicides to control aquatic weeds in the Tahoe Keys (e.g., sunlight intensity, nutrient availability). Additionally, some of the management practices used during the CMT could minimize the potential for such blooms.

Although it is difficult to know if the CMT would affect the occurrence and intensity of HABs, the potential is there. Baseline monitoring in the West Lagoon and Lake Tallac has documented periods of elevated nutrient concentrations in near-surface water samples, high water temperatures, water column stratification, and fluctuations in pH (ESA 2019). Recent nutrient cycling projections indicate that phytoplankton growth in the Tahoe Keys is co-limited by total phosphorus (TP) and total nitrogen (TN) (Tomasko 2020). Furthermore, it appears that the majority of the TP and TN in the Tahoe Keys lagoons is contained within the submerged aquatic vegetation (SAV) community, rather than in the water column itself (Tomasko 2020). These nutrients are released when the plants die back and decay in the fall and winter. Tomasko (2020) suggested that care should be taken in terms of SAV management, so that the nutrient contents of treated SAV do not become available in the water column in such a manner as to be able to initiate HABs and their potential health risks. In response to this need for caution, the Proposed Project limits the risk of increased HABs by prescribing the herbicide applications for the late spring when the plant biomass that would decay and release nutrients is minimal, water temperatures are still cool from snowmelt runoff and low nighttime air temperatures, the lagoons are not yet strongly stratified, and plant photosynthesis and respiration have not yet reached the high levels that occur in the summer and cause widely fluctuating pH.

Due to the unpredictable nature of HABs and consequent production of cyanotoxins from HABs, there remains uncertainty around whether and to what extent these would occur and whether they would cause unavoidable increases in the risk of exposure to cyanotoxins as a result of the release of nutrients from: (1) aquatic plant decomposition that would occur following aquatic herbicide and ultraviolet light treatments, or (2) the circulation of nutrient-rich bottom waters during LFA operation. Performing herbicide tests and initial ultraviolet light treatments in the late spring when plants are small is expected to minimize the release of additional nutrients that could stimulate HABs. Past detections of cyanotoxins have not reached danger levels at Tahoe Keys, and continuation of the existing programs to monitor and warn people at Tahoe Keys when cyanotoxins are present is expected to continue to be effective in protecting against any additional risks of exposure to cyanotoxins.

As a result of the Proposed Project, conditions may become increasingly favorable or less favorable for HABs. Past detections of cyanotoxins have reached caution levels at Tahoe Keys. Continuation of the existing programs to monitor and warn people at Tahoe Keys when cyanotoxins are present would likely continue to be effective in protecting against any additional risks of exposure to cyanotoxins. Because HABs are not always predictable and because the conditions that cause cyanobacteria to produce cyanotoxins are not well understood, there remains some uncertainty about whether the release of nutrients from aquatic weed treatments could increase the risk of HABs and potentially affect people and the environment. However, given the timing of testing and with resource protection measures that have been incorporated into the Proposed Project (i.e., aeration), the risk of increased HABs is considered **less than significant.**

Mitigation and Resource Protection Measures

While no direct impacts to humans are expected from the CMT, resource protection measures are required to protect workers applying herbicides and address public concerns regarding potential migration of herbicides toward drinking water supplies and Lake Tahoe. Additional mitigation and resource protection measures are required to minimize the risks of indirect human health impacts from the potential for increased HABs and exposure to cyanotoxins. Mitigation and resource protection measures are also required to reduce the potential for ecological effects, both direct and indirect. The mitigation and resource protection measures described below would be incorporated as conditions of the TRPA EIP permit and NPDES permit issued by the LWB, to reduce or mitigate the potential for adverse ecological and human health effects, without reducing the efficacy of the methods.

EH-1 Applicator qualifications: Herbicide applications would be performed only by QAL holders. QAL holders would follow NPDES permit requirements and product label specifications. Risks of exposure are primarily to herbicide applicators, and QAL holders would be required to complete extensive annual training to minimize these risks, including the use of proper personal protective equipment.

EH-2, EH-3a, EH-4 Spill response plan: A spill response plan would be developed by a QAL holder to minimize and contain any spills during herbicide mixing and application, submitted for review as required by permitting agencies, and implemented at the work sites.

EH-3b Dye tracing: Rhodamine WT dye would be applied by TKPOA during the herbicide applications and tracked to determine the movement and dissipation of dissolved herbicide products and chemical transformation products. If herbicides are detected in nearby wells, contingency plans include shutting off the wells and distributing water to all users until residues are no longer detected in the samples.

EH-3c Well monitoring and contingencies: If the Proposed Project is selected and testing of herbicides is permitted in the Tahoe Keys lagoons, permit conditions would include a revised monitoring plan to address potential effects to human health. In their latest *Aquatic Pesticide Application Plan*, TKPOA (2018) describes proposed monitoring to protect against potential human health effects from herbicides. To confirm that there would be no effect on groundwater quality, sampling is planned at the three TKPOA well water intakes. The plan includes sampling for contamination by herbicides or degradants 24 hours prior to each application and at 48-hour intervals thereafter for 14 days, for a total of eight sampling events (TKPOA 2018). Samples would be analyzed for active herbicide ingredients in the products applied, and contingency plans specified actions if herbicides are detected (TKPOA 2018).

EH-3d West Channel monitoring and contingencies: If herbicides are detected within the West Channel, then additional monitoring stations would be sampled outside the Tahoe Keys in Lake Tahoe and monitoring would continue south and north of the channel (TKPOA 2018). In any event, if herbicide residue is detected within 500 ft. of the West Channel, the LWB would be notified within 24 hours (TKPOA 2018). Results of monitoring would be included in the required reporting for the project (TKPOA 2018).

The well monitoring plan for area wells would also verify the effectiveness of carbon filtration to remove any herbicide residues. The well monitoring plan would be submitted for review and approval by permitting agencies prior to issuance of a permit. If herbicides are detected in the wells, contingency plans would include shutting off the wells and distributing bottled drinking water to all customers until residues are no longer detected in the samples.

EH-3e Public outreach: TKPOA would design and carry out an information campaign targeting homeowners, renters, and rental agencies, to provide advance notice regarding the CMT before and during aquatic herbicide applications. TKPOA would also hold a workshop and informational meeting with Tahoe Water Suppliers Association (TWSA) at least 45 days before herbicide applications are conducted. At the workshop, TKPOA would present the Proposed Project schedule and answer questions to inform customers of the CMT and dates of herbicide application.

EH-3f Carbon filtration contingency: If monitoring detects herbicide residues, carbon filtration systems already installed at water supply wells would remove any herbicide residues before water enters the distribution systems at Tahoe Keys. A mobile filtration system would also be available to pump and treat water at wells where exceedances are detected above drinking water standard concentrations.

EH-3g Double turbidity curtain barriers: Double turbidity curtain barriers would be installed outside West Lagoon areas where herbicide testing sites are located, to confine the herbicide applications and ensure that herbicide residues or chemical transformation products do not migrate toward the West Channel connecting the West Lagoon to Lake Tahoe (Figure 2-4).

EH-5a Best management practices: Best management practices to minimize sediment disturbance would be followed and turbidity would be monitored during installation and LFA startup to ensure that sediment disturbance and the consequent potential for mobilization of aluminum into the water column is minimized. During installation and removal of bottom barriers, spot suction dredging, and to a lesser extent during diver-assisted suction/hand pulling, the release of aluminum into the water column would be minimized by the use of best management practices paired with turbidity monitoring. Because implementation of any of these methods is in part dependent on adequate visibility for divers doing the underwater work, it is expected that extra care would be taken to minimize sediment disturbance and turbidity. BMPs also would be used to prevent accidental releases of sediment to the lagoons during dredge spoils transport and handling.

EH-6a Timing and size of treatments: TKPOA would conduct spring aquatic plant surveys to ensure that herbicide treatments conducted in the Tahoe Keys lagoons would occur in the appropriate weeks during the late spring (currently planned for late May or early June), when the plants are in their early stages of growth so that the volume of decomposing plant material is minimized. Furthermore, only a small portion of the overall Tahoe Keys area would be treated as part of the CMT. Plant surveys would also be used to adjust the locations of test sites as needed to ensure that the targeted species are present for each herbicide application and ultraviolet light test, and areas dominated by native plant communities are avoided. To minimize the biomass of plants killed by ultraviolet light treatment and the consequent release of nutrients that could stimulate HABs, an initial round of ultraviolet light treatment is planned in the spring to stunt plant growth so that plants would only be a few feet tall when they are treated again in the summer.

EH-6b Aeration: LFA or another aeration technology would be installed and operated within each herbicide test site immediately after target aquatic weeds die back from the herbicide application, to be in place during plant decomposition. Aeration is expected to improve conditions for aerobic microbial degradation of herbicide active ingredients, and also reduce the risk of HABs by breaking up thermal stratification, reducing near-surface water temperature, and stabilizing pH conditions. The aeration systems would be continually operated until herbicide active ingredients and degradants are no longer detected above background concentrations, and aeration would also continue through the summer and early fall to reduce oxygen depletion from plant decay.

Significant Unavoidable Impacts

No significant unavoidable impacts to environmental health would occur from the Proposed Project after mitigation.

3.2.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting

The regulatory setting for Action Alternative 1 is similar to that described for the Proposed Project in Section 3.2.1, except that since Action Alternative 1 does not propose testing herbicides or otherwise discharging herbicides into the Tahoe Keys lagoons, none of the regulations addressed to the use of herbicides would apply. A CWA Section 401 water quality certification would be required to: (1) evaluate potential water quality impacts of testing ultraviolet light and LFA treatments, and (2) specify permit conditions to protect beneficial uses. Unlike the Proposed Project, compliance with the Basin Plan and antidegradation policies for the non-herbicide methods test would not require an exemption to the prohibition on the use of aquatic pesticides in the Lahontan Basin.

Environmental Setting

The environmental setting for the non-herbicide only aquatic weed control methods test is the same as described for Issues EH-5 and EH-6 under the Proposed Project in Section 3.2.1. Issues EH-1 through EH-4 do not apply to Alternative 1 as no herbicides would be introduced to the lagoons.

Issue EH-5: **Short-term Increases in Aluminum Concentrations.** The environmental setting for EH-5 under Alternative 1 is the same as that presented for the Proposed Project.

Issue EH-6: Harmful Algal Blooms (HABs). The environmental setting for EH-6 under Alternative 1 is the same as that presented for the Proposed Project.

Potential Impacts

The potential impacts for the non-herbicide only aquatic weed control methods test are the same as those described for Issues EH-5 and EH-6 under the Proposed Project in Section 3.2.1. Issues EH-1 through EH-4 do not apply to Alternative 1 as no herbicides would be introduced to the lagoons.

Issue EH-5: **Short-term Increases in Aluminum Concentrations.** The potential impacts for EH-5 under Alternative 1 are the same as those presented for the Proposed Project and would be **less than significant**.

Issue EH-6: Harmful Algal Blooms (HABs). The potential impacts for EH-6 under Alternative 1 are less than those presented for the Proposed Project. The potential additional nutrient releases and risk of increased HABs would not include the areas proposed for herbicide or combined herbicide and ultraviolet light testing under the Proposed Project. Therefore, the potential for increased HABs would be limited to the 4.94 acres of sites proposed for ultraviolet light testing and the 12.83 acres proposed for LFA testing.

Continuation of the existing programs to monitor and warn people at Tahoe Keys when cyanotoxins are present would likely continue to be effective in protecting against any additional risks of exposure to cyanotoxins. Because HABs are not always predictable and because the conditions that cause cyanobacteria to produce cyanotoxins are not well understood, there remains some uncertainty about whether the release of nutrients from aquatic weed treatments could increase the risk of HABs and potentially affect people and the environment. However, given the timing of testing and the small scale of testing under Action Alternative 1, the risk of increased HABs is considered **less than significant.**

Mitigation and Resource Protection Measures

While no direct impacts to humans are expected from ultraviolet light and LFA testing, mitigation and resource protection measures are recommended to minimize the risks of indirect human health impacts from the potential for increased HABs and exposure to cyanotoxins. Mitigation and resource protection measures are also recommended to reduce the potential for ecological effects, both direct and indirect. The following mitigation and resource protection measures described for the Proposed Project also would be implemented under Action Alternative 1: EH-5a and EH-6a.

Significant Unavoidable Impacts

No significant unavoidable impacts to environmental health are expected to occur from Action Alternative 1 after mitigation.

3.2.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

The regulatory setting for water quality compliance under Action Alternative 2 is similar to that described for the Proposed Project in Section 3.2.1, except that since Action Alternative 2 does not propose testing herbicides or otherwise discharging herbicides into the Tahoe Keys lagoons, none of the regulations addressed to the use of herbicides would apply. A CWA Section 401 water quality certification would be required to: (1) evaluate potential water quality impacts of suction dredging and substrate replacement, and (2) specify permit conditions to protect beneficial uses. Unlike the Proposed Project, compliance with the Basin Plan and antidegradation policies for the non-herbicide methods test would not require an exemption to the prohibition on the use of aquatic pesticides in the Lahontan Basin.

Environmental Setting

The environmental setting for Alternative 2 is limited to that described for Issue EH-5 under the Proposed Project in Section 3.2.1. Issues EH-1 through EH-4 do not apply to Alternative 1 as no herbicides would be introduced to the lagoons, and Issue EH-6 does not apply because dredging would remove plants and organic sediments that are major sources of nutrients for HABs rather than allow them to decay in the waters of the lagoons.

Issue EH-5: **Short-term Increases in Aluminum Concentrations.** The environmental setting for EH-5 under Alternative 2 is the same as that presented for the Proposed Project.

Potential Impacts

The potential impacts for Alternative 2 are limited to Issue EH-5. Issues EH-1 through EH-4 do not apply to Alternative 2 as no herbicides would be introduced to the lagoons, and Issue EH-6 does not apply because dredging would remove plants and organic sediments that are major sources of nutrients for HABs.

Issue EH-5: **Short-term Increases in Aluminum Concentrations.** There is the potential for short-term aquatic toxicity within and near dredging test areas from aluminum toxicity due to sediment disturbance and increases in turbidity during dredging. However, the total area proposed for dredging and substrate replacement is expected is 5.54 acres, or approximately three percent of the Tahoe Keys lagoons, so potential impacts from aluminum toxicity at test sites would be limited. There may also be an increase in the water column concentrations of aluminum from accidental spills during dredging transport, dredge spoil processing, or discharge of treated sediment dewatering effluent. Elevated levels of aluminum can affect some species' ability to regulate ions, such as salts, and inhibit respiratory functions, such as breathing (USEPA 2018). Aluminum can accumulate on the surface of a fish's gill, leading to respiratory dysfunction, and possibly death (USEPA 2018). Aquatic plants are generally less sensitive to aluminum than fish and other aquatic life (USEPA 2018).

Dredging may also have a potential beneficial impact because there would be a long-term reduction in the potential for aluminum toxicity in test areas due to the removal and proper disposal of sediments with elevated aluminum concentrations. Because the potential for toxicity impacts to aquatic life would be limited to only a small part of the Tahoe Keys lagoons, the potential impact of Action Alternative 2 on aquatic biological communities would be **less than significant** and these areas would be rapidly repopulated. The use of turbidity curtain barriers, treatment and testing of any dredged sediment dewatering effluent before discharge, and implementation of approved leak prevention, spill control, and containment plans for dredge spoils are expected to mitigate potential aluminum toxicity beyond test sites such that risks would be **less than significant**.

Mitigation and Resource Protection Measures

No impacts to humans are expected from the testing of suction dredging. However, there is the potential for adverse ecological effects from these activities. The following mitigation and resource protection measures described for the Proposed Project also would be implemented under Action Alternative 2: EH-5a and EH-6. Section 3.3.4, Water Quality, describes additional mitigation and resource protection measures to minimize turbidity from sediment dredging, and these measures would also be effective in minimizing the risk of aquatic toxicity from aluminum during sediment disturbance. And the following additional mitigation and resource protection measures would apply only to Action Alternative 2.

EH-5b Treatment and testing of dewatering effluent: Dewatering effluent arising from spot suction dredging could be discharged to the sanitary sewer system or into Lake Tallac. Before any effluent is discharged to Lake Tallac, it would be tested to ensure that aluminum levels comply with water quality criteria for aluminum. Discharge to the sanitary sewer system would likely also require testing to assure pre-treatment requirements specified by the wastewater utility were met for aluminum and other water quality constituents.

EH-5c Leak Prevention, Spill Control, and Containment Plans: Detailed plans would have to be developed and approved prior to permitting, and implemented to prevent leaks of dredge spoils from transport pipelines and the processing area, and control and contain any leaks or spills. These plans would also include provisions for adequate storage to safely handle dredge spoils during processing. The plans would be designed to minimize the risk of dredged sediment containing aluminum from being released to the water outside of test sites or approved discharge of treated dewatering effluent.

EH-5d Turbidity Curtain Barriers: Turbidity curtain barriers would be used to isolate test areas for suction dredging and prevent the migration of disturbed sediment containing aluminum beyond the boundaries of test sites.

Significant Unavoidable Impacts

No significant unavoidable impacts would occur to human or environmental health from Action Alternative 2.

3.2.4 No Action Alternative

Regulatory Setting

The regulatory setting for the No Action Alternative is similar to that described for the Proposed Project in Section 3.2.1, except that since the No Action Alternative does not propose testing herbicides or otherwise discharging herbicides into the Tahoe Keys lagoons, none of the regulations addressing the use of herbicides would apply.

Environmental Setting

The environmental setting for the Proposed Project would also apply to the No Action Alternative; however, Issues EH-1 through EH-4 would not exist under the No Action Alternative because there would be no testing of aquatic herbicides.

Issue EH-5: Short-term Increases in Aluminum Concentrations. The environmental setting for EH-5 under Alternative 1 is the same as that presented for the Proposed Project Issue EH-5.

Issue EH-6: Harmful Algal Blooms (HABs). The environmental setting for EH-6 under Alternative 1 is the same as that presented for the Proposed Project Issue EH-6.

Potential Impacts

Issue EH-5: Short-term Increases in Aluminum Concentrations. Elevated concentrations of aluminum would remain in Tahoe Keys lagoon sediments under the No Action Alternative and the risk of exceedances of water quality criteria for aluminum would continue to be associated with any disturbance of lagoon sediments. The disturbance of sediment from aquatic weed control activities that are permitted under the existing WDRs is limited to the small areas where bottom barriers, diver assisted hand suction, and LFA have been tested. It is unknown whether the criteria designed to protect aquatic life from aluminum toxicity have been exceeded during these activities in the past; however, no fish kills or other die-off of aquatic organisms have been documented. Short-term increases in aluminum concentrations that may exceed water quality criteria would remain a **potentially significant effect** during sediment-disturbing activities under the No Action Alternative.

Issue EH-6: Harmful Algal Blooms (HABs). Cyanotoxin samples collected in the Tahoe Keys in 2017 and 2019 were within California's Caution Action Trigger range (set at one µg/L) and below California's Warning Action Trigger for anatoxin-a (set at 20 µg/L). It is likely that the occurrence of HABs would continue, and potentially increase in frequency, under the no action alternative. Factors that influence the occurrence of cyanobacterial blooms, including excess nutrient (nitrogen and phosphorus) loadings and concentrations, slow-moving surface water, high water temperature, high intensity and duration of sunlight, water column stratification, changes in water pH, and occurrence of trace metals (USEPA 2015a; 2019), are likely to continue producing HABs in the Tahoe Keys under the no action alternative. No action on the Proposed Project would not affect conditions that may produce HABs.

Continuation of the existing programs to monitor and warn people at Tahoe Keys when cyanotoxins are present would likely continue to be effective in protecting against risks of exposure to cyanotoxins; however, the conditions that cause cyanobacteria to produce cyanotoxins are not well understood and it is uncertain whether concentrations of these toxins would increase in the future. Given this uncertainty, the impact of HABs may present a **potentially significant impact** of the No Action Alternative.

Mitigation and Resource Protection Measures

No additional mitigation or resource protection measures are included under this alternative beyond existing programs. It is assumed that current efforts to manage water quality in the Tahoe Keys lagoons and respond to HABs would continue. Although additional aquatic weed control efforts and other measures may be necessary to address potentially significant adverse environmental health effects identified in this EIR/EIS for the No Action Alternative, it is beyond the scope of this document to develop those mitigations.

Significant Unavoidable Impacts

As aquatic weed infestations persist and grow in the Tahoe Keys lagoons, conditions may become increasingly favorable for HABs. Past detections of cyanotoxins have reached caution levels at Tahoe Keys, and continuation of the existing programs to monitor and warn people at Tahoe Keys when cyanotoxins are present may continue to be effective in protecting against any additional risks of exposure to cyanotoxins. However, the conditions that cause cyanobacteria to produce cyanotoxins are not well understood, and it is uncertain whether concentrations of these toxins would increase in the future. Given this uncertainty, the impact of HABs may present a **potentially significant unavoidable impact** of the No Action Alternative.

3.3 NATURAL ENVIRONMENT

3.3.1 Earth Resources

This section considers how the proposed Tahoe Keys lagoon aquatic weeds control methods test and alternatives could potentially affect earth resources. The analysis primarily relates to Action Alternative 2, as the Proposed Project and Action Alternative 1 have no potentially significant interaction with earth resources. The primary activities of concern are suction dredging of substrate, replacement with clean substrate, and the potential for spills of dredged material. Analysis is based on geotechnical analysis and sediment sampling conducted in late 2019.

Methods and Assumptions: Earth resources analyses focused on primarily on Action Alternative 2, as the Proposed Project and Action Alternative 1 have no potentially significant interaction with earth resources. The primary activities of concern are suction dredging of substrate, replacement with clean substrate, and the potential for spills of dredged material. Existing geologic and topographic conditions in the project area were assessed using geotechnical analysis and sediment sampling conducted in late 2019, supplemented by aerial photograph review and field visits to the project area by geologists and engineers. Potential hazards associated with earthquake ground shaking were also assessed, given that the project area lies within Seismic Hazard Zone D.

The analysis focused on Keys channels in which the depth of accumulated sediment presented the most suitable conditions for a successful test. For example, it did not consider dredging in areas characterized by the presence of deep soft organic sediment, such as the areas treated by LFA. It was assumed that it would be necessary to remove nearly all sediment in the dredging test sites in order to reduce the thickness of organic sediment to less than 20 cm (and thereby reduce the nutrient supply in sediment substrate that provides the rooting medium for aquatic weeds), effectively limit re-infestation, and allow the creation of a more solid foundation for the placement of new, clean, coarser and denser sediment on the bottom.

It was assumed that dredging could destabilize existing bulkheads and slopes in the test, and that this would be fully mitigated by replacement of any affected docks or bulkheads at the end of the test dredging.

Based on elutriate testing of surficial sediment it was assumed that the potential to mobilize elevated aluminum concentrations that may occur in the top sediment layer would be an important consideration in developing an approach for dredging, dredge spoils handling, and disposal of solids and dewatering effluent. Containment and cleanup measures were devised to address this concern, and the analysis considers potential consequences to earth resources of a spill in transport to the sediment handling site, treatment, and transport to ultimate disposal.

3.3.1.1 Proposed Project (Control Methods Test)

Regulatory and Environmental Setting

There will be no use of or disturbance to earth resources for the Proposed Project, and consequently no regulatory or environmental setting is applicable. A general description of the environmental setting is included under Action Alternative 2 below.

Potential Impacts, Mitigation Measures, and Significant Unavoidable Impacts

No potentially significant effects on geology, soils, or arising from geological hazards were identified. Therefore, no further consideration of this resource in relation to the Proposed Project is undertaken.

3.3.1.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory and Environmental Setting

There will be no use of or disturbance to earth resources for Action Alternative 1, and consequently no regulatory or environmental setting is applicable. A general description of the environmental setting is included under Action Alternative 2 below.

Potential Impacts, Mitigation and Resource Protection Measures, and Significant Unavoidable Impacts

No potentially significant effects on geology, soils, or arising from geological hazards were identified. Therefore, no further consideration of this resource in relation to the Action Alternative 1 is undertaken.

3.3.1.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

Federal

Federal Clean Water Act (Public Law 92-500)

The Clean Water Act (CWA, codified in 33 U.S. Code Section 1251 et seq.), initially enacted in 1948 and significantly amended in 1972, provides the framework for regulating discharges of pollutants into the waters of the United States and regulation of surface water quality standards. Under the CWA, discharge of any pollutant from a point source into navigable waters requires a permit pursuant to the National Pollutant Discharge Elimination System program (NPDES, 44 Code of Federal Regulations Part 122). The federal government has delegated authority for implementation of the NPDES program to the state of California and the state's nine regional water quality control boards, including the Lahontan Regional Water Quality Control Board. In California, NPDES permits for discharges to waters of the United States also serve as waste discharge requirements (WDRs) under the Porter-Colgne Water Quality Control Act (California Water Code, Section 13000 et seq.), the State water quality control law adopted in 1969.

As discussed in Section 3.3.4, Section 401 of the CWA requires applicants requesting a permit to conduct activities that may result in the discharge of a pollutant into waters of the United States to obtain a certification that evaluates potential water quality impacts and requires permit conditions to protect beneficial uses. The Lahontan Regional Board has previously issued to the TKPOA a Water Quality Certification and WDR, although a new individual NPDES permit may be required for the dewatering and stockpile site at Lake Tallac.

Dredging within waters of the United States would require a permit under Section 404 of the CWA and associated Section 401 Water Quality Certification issued by LWB. The U.S. Army Corps of Engineers (USACE) has authority for review of individual Section 404 permit applications, though project coverage under a general nationwide permit (NWP) may be appropriate in certain instances. NWPs are general permits issued on a nationwide basis to streamline the authorization of activities that result in minimal individual and cumulative adverse effects on the aquatic environment. Subject to determination by USACE, the activities under Action Alternative 2 could potentially qualify for a general permit under NWP 27 (Aquatic Habitat Restoration, Enhancement, and Establishment Activities) or NWP 35 (Maintenance Dredging). In order to qualify for the use of a NWP, perspective permittees must comply with all of the terms, general conditions, and regional conditions of the NWP, including any requirements for the submittal of a Pre-Construction Notification (PCN).

In cases where a PCN is required, if the activity complies with the terms and conditions of the NWP, a NWP verification letter will be sent to the perspective permittee. The NWP verification may include additional case specific conditions (special conditions) to ensure no more than minimal individual and cumulative impacts, and will state that the verification is valid for a specific period of time (generally but no more than two years, unless the NWP authorization is modified, suspended, or revoked.)

State

California Department of Fish & Wildlife (CDFW) Lake Streambed Alteration Agreement

Action Alternative 2 would include removal of the substrate and, if appropriate, replacement of sand at specific test sites in the Tahoe Keys lagoons. Streams, lakes, and riparian vegetation that provide habitat for fish and other wildlife species are subject to jurisdiction by the CDFW under Sections 1600-1616 of the California Fish and Game Code. California Fish and Game Code Section 1602 applies to any activity that may do one of the following:

- substantially obstruct or divert the natural flow of a river, stream, or lake;
- substantially change the bed, channel, or bank of a river, stream, or lake;
- use any material from the bed, channel, or bank of a river, stream, or lake;
- deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into a river, stream, or lake; and/or
- remove riparian vegetation.

Any person, state or local governmental agency, or public utility must notify CDFW prior to commencing any activity falling within one of the categories above, that may substantially change or use any material from the bed, channel or bank of any river, stream, or lake. When such activities may substantially adversely affect existing fish or wildlife resources, CDFW is required to propose reasonable project changes to protect the resources. These modifications are formalized in a Lake and Streambed Alteration Agreement (LSAA) that becomes part of the plans and specifications for a project.

Lahontan Regional Water Quality Control Board (LWB)

The Porter-Cologne Water Quality Control Act (California Water Code, Section 13000 *et seq.*) authorizes the State Water Resources Control Board (State Water Board) and regional boards to regulate discharge of pollutants into waters of the State. As described above, the Lahontan Regional Board also has the authority to review applications and issue permits for discharges to waters of the United States under Section 401 of the CWA, and for point source discharges to waters of the United States under Section 402 of the CWA, both pursuant to a 1988 Memorandum of Agreement between the State Water Board and the U.S. Environmental Protection Agency. The Lahontan Regional Board application for Section 401

Water Quality Certification must include information about the project, including area of disturbance and a description of the affected water body; and measures to minimize or avoid impacts to waters of the State. The Application would also include a stormwater pollution prevention plan (SWPPP) for coverage under a general NPDES Construction Storm-Water Permit and a NPDES permit application for point source discharges to Lake Tallac. The NPDES applications would outline erosion control and stormwater treatment measures, best management practices, and post-construction treatment controls that would be implemented to ensure that stormwater quality is maintained during and after the project. Further discussion of LWB regulatory activities and requirements is provided in Section 1.4 and the Regulatory Settings discussions for Sections 3.2 and 3.3.4.

Regional

Tahoe Regional Planning Agency (TRPA)

Chapter 84 (Development Standards Lakeward of High Water) of the TRPA Code of Ordinances authorizes the TRPA to review all projects and activities involving placement of structures or earth disturbance in lagoons or in the nearshore or foreshore of a lake in the Lake Tahoe Region. TRPA Code of Ordinances Section 84.15 specifically covers dredge and fill activities, and allows such activities subject to a determination by the TRPA that the dredge or fill activities would be beneficial to shorezone conditions, water quality or water clarity. Subsection 84.15.5 prohibits deposition of dredge materials in the lakezone or shorezone, in wetlands, or within the 100-year floodplain of lake tributaries. Prior to commencement of the activities pursuant to Action Alternative 2, the permittee would be required to submit to the TRPA a Shorezone Project permit application to demonstrate that the dredge and fill activity would be compliant with regulations in Chapter 84. The application must include a site plan and description of the Proposed Project, and must identify proposed dredge depth, prominent geologic features within the proposed area of disturbance, permanent and temporary best management practices, and staging areas and construction access points.

Environmental Setting

The Tahoe area is within Seismic Hazard Zone D, and within an area characterized by historical seismicity and the hazards inherent within such an area. As described within the Tahoe Valley Plan environmental documentation, there are five known fault zones in the vicinity of the city of South Lake Tahoe, and four of these are considered active or potentially active. The Tahoe Valley plan area is not located within an Alquist-Priolo Earthquake Fault Zone; however, several faults are located in the Lake Tahoe area that could subject the Tahoe Valley plan area to ground shaking.

Several studies have documented littoral processes and conditions in the nearshore areas of Lake Tahoe. Nearshore erosion is a direct consequence of wave energy and the potential for erosion at any particular location around Lake Tahoe is directly related to the material properties of the shoreline, wave activity, and fluctuating water levels (Adams et al. 2004). The bottom layer of the Tahoe Keys lagoons is composed of fine sediments, a remnant of the marsh that previously occupied the area, deposits from stormwater runoff, and organic material from the decomposition of aquatic plants and algae. By contrast, coarse, decomposed granite often characterizes the bottom of Lake Tahoe.

Shoreline erosion is typically caused by waves breaking at the base of easily eroded bluffs when the lake level is high. Although there are no bluffs in the area of Tahoe Keys, a storm in 2017 was reported to have created 2.5-foot waves that eroded the Lake Tahoe beach near the West Channel entrance and some of the landscape at the home immediately east of the channel (Hoover 2017). Information provided to TKPOA regarding water barriers estimates that wave heights up to three feet could occur at the West Channel mouth during wind gusts of 60 mph (Motiejunas 2017).

TRPA threshold standards are minimum standards of environmental quality for the Tahoe area. TRPA has two soil conservation threshold standard categories: one for land coverage (impervious cover) and one for stream environment zone (SEZ). While impervious surfaces contribute to sediment and nutrient inputs to Lake Tahoe and its tributaries, they also alter surface hydrology and diminish groundwater recharge, resulting in negative impacts to environmental resources. SEZs provide important environmental services to the basin, such as flood attenuation, groundwater recharge, and recreational opportunities. Neither of these soil threshold standard categories would be negatively impacted by the Action Alternative 2.

Issue ER-1: Suction Dredging and Dredge Materials Disposal. Anecdotal pre-project monitoring indicates that the soft organic sediment in the existing six-acre, 20-foot deep LFA area in the West Lagoon may be approximately two to five feet thick. The LFA area is not part of the planned treatment test project. Sediment appears to be considerably thinner (only 1.5 to 2.5 feet thick) in the connecting lagoons that are less than 12 feet deep, including the dredging test sites. It may be necessary to remove nearly all of this material in order to: (1) reduce the thickness of organic sediment to less than 20 cm and thereby reduce the nutrient supply in sediment substrate that provides the rooting medium for aquatic weeds, and (2) effectively limit re-infestation. It also will be important to remove most of the soft sediment to create a more solid foundation for the placement of new, clean, coarser and denser sediment on the bottom.

Dredged sediment would contain organic silt and fine sand, plant roots and other organic matter, and lagoon water. Elutriate testing of surficial sediment mixed with overlying water samples collected from the Tahoe Keys lagoons in 2019 found that after settling, aluminum concentrations in the water exceeded criteria for protection of aquatic life. Elevated aluminum concentrations potentially occurring in the top 10 cm of sediment were an important consideration in developing an approach for dredging, dredge spoils handling, and disposal of solids and dewatering effluent.

RTGA performed further sediment sampling in November 2019 at test sites 28 and 30 (Figure 2-4). A Russian peat sampler was used to obtain several channel bottom samples to as deep as 26 inches below the sediment surface, at which point the sampler encountered dense clean sand. Logs of the samples and laboratory testing results are included in Table 3.3.1-1 Fines content indicates the percentage by dry weight of soil materials in the silt or clay range (as compared to sand-sized or larger materials). Water content indicates the weight of water compared to the total weight of the samples and can be used to estimate the dry weight and solids content of a saturated material. Liquid limit and plasticity index provide information on the potential re-use or handling characteristics.

The upper layer defined in Table 3-3 (S1) is about four inches thick, highly fine-grained, and exhibits a measurable plasticity (i.e., it may flow like a liquid). The middle layer (S2) is about 11 to 22 inches thick, has an estimated 27 to 52 percent sand, and the fines are non-plastic. The bottom layer, wherever it would be cut into by the dredge equipment, is primarily sand. The thicknesses of the organic fine-grained sediments (i.e., layers S1 and S2) in the samples at Sites 30 and 28 were 15 and 26 inches, respectively.

The upper two layers (S1 and S2) are believed to be redeposited channel materials, resulting from a combination of bank erosion, stormwater sediment runoff, and organic fine-grained deposition in the channels. Samples from the lower layer (S2) may include some of the natural marsh sediments that were present before the channels were dredged. The deepest samples (S3) are dense clean sand that is representative of the alluvial/glacial outwash plain prior to the geologic origin of the marshes. RTGA performed a seismic survey under adjacent roadways which confirmed that the shallowest depth of stiff, high-shear-wave-velocity sand deposits is consistent with the elevation at which the clean sand layers were encountered under the channels in these core samples.

Potential Impacts

Issue ER-1: Suction Dredging and Dredge Materials Disposal. The overall time required to complete the dredging and removal and rehabilitation process could be six months. Dredging has the potential to destabilize bulkheads and slopes in the test area of the lagoons; however, in some areas bulkheads are already failing. This would be a **potentially significant** impact, which would be fully mitigated by replacement of any affected docks or bulkheads at the end of the test dredging (see mitigation discussion below).

As described in Chapter 2 and shown in Figures 2-9, 2-10, and 2-11, dredged material would be moved from the barge-mounted suction dredge through a temporary pipeline routed through the lagoons to the proposed dewatering and treatment area at the mothballed Tahoe Keys Water Treatment Plant (WTP) on the south side of Lake Tallac. This treatment area is highly disturbed and was historically used for alum removal. It may have higher concentrations of contaminants than the slurry piped from dredge sites. Any release of this material during transport across the lagoons would deposit sediments with high aluminum concentration in the receiving waters or nearby land. An uncontained release of dredge slurry could have a **potentially significant** impact, but this would be mitigated by containment.

Dewatering at the WTP would lead to storage of up to one million gallons of dewatering effluent in an existing concrete tank of unknown integrity. Leakage from this tank could lead to release of aluminum carrying effluent to area groundwater. Leakage could be contained somewhat by an existing low berm around the site. It is assumed that high concentrations of aluminum in the soil may already be in place in the area, since aluminum removal activities historically occurred there. Any water released in the site area could remobilize this aluminum and move it towards groundwater. An uncontained release of dredge slurry could have a **potentially significant** impact, but this would be mitigated by containment.

After dewatering, dredged solid materials greater than ¼-inch diameter and excavated vegetation would be transported to offsite disposal areas. Aluminum removed from the waste stream also would be transported for offsite disposal. It is estimated that approximately five trucks per day would be required to move the sediment to off-site disposal facilities. Trucking could occur 10 hours per day, six days per week during the dredging period. Any accidental releases from truck accidents during transport could lead to contamination in the area of the accident, and would be a **potentially significant** impact, but this would be mitigated by clean-up at any spill site.

Issues EH-5 (Environmental Health) and WQ2 and WQ3 (Water Quality) provide further discussion of potential impacts from aluminum and turbidity associated with the suction dredging and substrate replacement alternative, and proposed mitigations for them.

Table 3-3 Results of Preliminary Geotechnical Sampling Sites 28 and 30.

Location Name	Sample ID	Water Depth (feet)*	Sediment-Surface Water Interface (feet)	Classification	Fines Content (%)	Water Content (%)	Liquid Limit	Plasticity Index
TK28-0A				Top of sample was below mudline				
	S1	11.35	0 to 0.52	Silt (ML) some organics		89	48	17
	S2	11.35	0.52 to 1.31	Sandy Silt (SM) some organics	48	63		NP
	S3	11.35	1.31 to 1.56	Poorly Graded Sand with Silt (SP-SM)				
TK28-0B	S1	10.50	0 to 1.16	Silt (ML) some organics		144	48	17
	S2	10.50	1.16 to 1.80	Sandy Silt (SM) some organics	48	64		NP
TK30-0A	S1	9.75	0 to 0.33	Silt (ML) some organics		95		
	S2	9.75	0.33 to 1.25	Sandy Silt (SM) some organics	73	61		
	S3	9.75	1.25 to 1.63	Poorly Graded Sand with Silt (SP-SM)				

*Depth from water surface to sediment surface, Lake Tahoe water surface elevation was 6277.4 feet on the date of exploration.
^ NP = non-plastic

Mitigation and Resource Protection Measures

Standard permit conditions that would be required if this alternative were selected include further site characterization at the WTP. Spill control, containment and contingency plans would be developed for

installing and operating a pipeline transporting aluminum-contaminated dredge spoils. Performance specifications would be promulgated for the design of the pipeline to minimize the risks of leakage or other failures. Appropriate leak detection systems would be installed in the pipeline systems to quickly detect any leaks and shut systems down prior to significant contamination. Soils in material handling areas would be tested and the existing concrete tank would undergo an engineering evaluation to determine whether it is safe and suitable for storing dewatering effluent; portable Baker tanks would be used if it were found unsuitable. Secondary containment and liners would be employed as necessary to provide surface and ground water protection in the event of an accident.

Any bulkheads or docks removed or destabilized by dredging would be fully mitigated by replacing them in kind, and any slopes that are destabilized would be mitigated by slope restabilization after the dredging test is completed.

Mitigation and resource protection measures would address any the potential effects of spills in the dredge handling area at the WTP would by installing containment barriers and impermeable layers. The effects of spill in transport would be remediated by clean-up operations.

Speed limits and travel restrictions would be placed on roads used for dredge spoil transportation and disposal to reduce the potential for releases due to collisions and other accidents. These restrictions would need to be in place for at least six months based on current understanding (see Section 3.4.4).

Significant Unavoidable Impacts

The generation of large volumes of contaminated water and contaminated sediment requiring treatment prior to release could lead to significant effects on geology, soils, surface water, and groundwater in the project area if not properly contained and cleaned up. However, with implementation of the mitigation and resource protection measures described above, impacts to earth resources resulting from the proposed action would be **less than significant**.

3.3.1.4 No Action Alternative

Regulatory and Environmental Setting

There will be no use of or disturbance to earth resources for the No Action Alternative, and consequently no regulatory or environmental setting is applicable. A general description of the environmental setting is included under Action Alternative 2.

Potential Impacts, Mitigation Measures, and Significant Unavoidable Impacts

No potentially significant effects on geology, soils, or arising from geological hazards were identified. Therefore, no further consideration of this resource in relation to the alternatives is undertaken.

3.3.2 Air Quality and Greenhouse Gas

AIR QUALITY

This section considers how the proposed Tahoe Keys lagoon aquatic weeds control methods test and alternatives could potentially affect air quality and greenhouse gas (GHG) emissions. The analysis considers National Ambient Air Quality Standards, Lake Tahoe Federal and State Air Quality Attainment Designations, Lake Tahoe Air Basin Air Quality Data, compliance with the Basin Air Quality Plan, the potential for Cumulatively Considerable Net Increases of Criteria Pollutants, and exposure of sensitive receptors, primarily from engine exhaust emissions associated with project activities.

Methods and Assumptions

The general approach for evaluating air quality and greenhouse gases was to review potential emission sources associated with each alternative, compare the emissions to existing air quality conditions and emission sources, and determine whether project emissions have the potential to result in a significant impact or exceed established significance criteria. The following methods and assumptions were applied during the evaluation of specific air quality and greenhouse gas issues.

AQ-1: Compliance with the Basin Air Quality Plan. Emissions from the Proposed Project have the potential to temporarily affect air quality and compliance with air quality plans. Activities associated with each alternative were evaluated either qualitatively or quantitatively depending upon whether the emissions generated by the project were likely to exceed current background emissions in the area. For the Proposed Project and Action Alternative 1, it is assumed that boat traffic associated with the CMT will be less than the recreational boat traffic that would be expected during normal, background conditions due to restrictions on boat passage through the portions of the Keys being tested. Additionally, it is assumed that vehicle travel associated with the Proposed Project and Action Alternative 1 will occur for a limited duration and will represent an insignificant change in vehicle use when compared with overall transportation activities in the region. Therefore, emissions related to the implementation of the Proposed Project and Action Alternative 1 were not quantified. Similarly, emissions associated with the No Action Alternative were not quantified as they were considered unlikely to be large enough to impact compliance with air quality plans.

Action Alternative 2 includes the use of equipment that have the potential to result in an increase in emissions compared with normal, background conditions. Therefore, to evaluate air quality impacts, criteria pollutant emissions were calculated for all emission generating activities associated with Action Alternative 2. Emissions generated by off-road construction equipment, on-road haul trucks and worker commute trips were calculated using the latest version of the California Emissions Estimator Model (CalEEMod version 2016.3.2). Watercraft (work boats) emissions were calculated using emissions factors obtained from CARB guidance (CARB 2012). CalEEMod default values for emission inputs such as equipment horsepower and load factor are used since detailed design information for various project activities have yet to be prepared. For the purposes of estimating emissions, Action Alternative 2 activities are assumed to occur at one site at a time from April through September. The implementation of Action Alternative 2 is assumed to require the use of several types of construction equipment, including excavators, barges, small work boats, generators, and haul trucks. A detailed list of equipment, including assumed duration of use, number of haul truck trips, and haul truck trip distance, is provided in Appendix AQ.

AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants. Project activities were evaluated for their potential to result in cumulatively considerable net increase of a criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard.

Methods and assumptions used in evaluating project activities for this issue were similar to the methods and assumptions described above for Issue AQ-1.

AQ-3: Exposure of Sensitive Receptors. Due to the proximity of residences adjacent to areas where the CMT will occur, project activities have the potential to expose sensitive receptors to pollutants. The potential for exposure was evaluated for emission sources including off-road equipment, on-road vehicles, watercraft, and the application of volatile chemicals. Methods and assumptions used in evaluating project activities for this issue were similar to the methods and assumptions described above for Issue AQ-1.

GHG-1: Greenhouse Gas Emissions. Project activities were evaluated for their potential to generate greenhouse gas emissions. Emission sources were evaluated either qualitatively or quantitatively depending upon whether project activities were likely to generate increased greenhouse gas emissions over current background emission levels. As described above for AQ-1, emissions from on-road vehicle and watercraft engine exhaust were compared to the reduction in emissions from recreational watercraft during implementation of the Proposed Project and Action Alternative 1, and activities associated with the No Action Alternative were evaluated within the context of emissions generated by current aquatic weed control methods. For Action Alternative 2, GHG emissions generated by off-road construction equipment, on-road haul trucks, worker commute trips, and watercraft use were calculated. Methods and assumptions used for the calculation of GHG emissions were the same as were used to calculate criteria pollutant emissions.

3.3.2.1 Proposed Project (Control Methods Test)

Regulatory Setting

The Proposed Project is located in the eastern portion of El Dorado County, California, within the Lake Tahoe Air Basin (LTAB). Air quality in the project area is regulated by the U.S. Environmental Protection Agency (USEPA), California Air Resources Board (ARB), TRPA, and the El Dorado County Air Quality Management District (EDCAQMD). Each of these agencies develops rules, regulations, policies, and/or goals to comply with applicable federal, state, and local legislation. Although USEPA regulations may not be superseded, state and local regulations may be more stringent.

Federal

Criteria Pollutants

In accordance with the federal Clean Air Act (CAA), the USEPA has established National Ambient Air Quality Standards (NAAQS) for six principal pollutants considered harmful to public health and the environment (see Table 3.3.2-1). These “criteria” pollutants include carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). The NAAQS have been developed to protect human health and represent minimum acceptable concentrations of air pollution.

The CAA also required each state to prepare an air quality control plan referred to as a state implementation plan (SIP). The Federal Clean Air Act Amendments of 1990 (CAAA) added requirements for states with federal nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. USEPA is responsible for reviewing all state SIPs to determine whether they conform to the mandates of the CAA. This study area is not located in a federal nonattainment or maintenance area.

Hazardous Air Pollutants

USEPA has also promulgated air quality regulations for hazardous air pollutants (HAP). HAPs are pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. The USEPA has established National Emission Standards for Hazardous Air Pollutants (NESHAPs), as required by the CAAA. NESHAPs are stationary source regulations that limit allowable emissions of HAPs.

State

Criteria Pollutants

In California, the California Air Resources Board (CARB) is responsible for air quality management. CARB has established California Ambient Air Quality Standards (CAAQS) that are generally more stringent and include more pollutants than the NAAQS (see Table 3.3.2-1). Both the NAAQS and the CAAQS have been developed to protect human health and represent minimum acceptable concentrations of air pollution.

Table 3.3.2-1 Ambient Air Quality Standards.

Pollutant	Averaging Time	CAAQS [a]	NAAQS [b]		TRPA[e]
			Primary [c]	Secondary [d]	
Ozone	1 hour 8 hours	0.09 ppm 0.070 ppm	-- 0.075 ppm	-- 0.075 ppm	0.08 ppm --
Carbon monoxide (CO)	1 hour 8 hours	20 ppm 9.0 ppm	35 ppm 9 ppm	-- --	-- 6 ppm
Nitrogen dioxide (NO_2)	1 hour Annual Arithmetic Mean	0.18 ppm 0.030 ppm	0.100 ppm [e] 0.053 ppm	-- 0.053 ppm	-- --
Sulfur dioxide (SO_2)	1 hour 3 hours 24 hours Annual Arithmetic Mean	0.25 ppm -- 0.040 ppm --	0.075 ppm [f] -- 0.014 ppm 0.030 ppm	-- 0.5 ppm -- --	-- -- -- --
Particulate matter less than 10 microns (PM_{10})	24 hours Annual Arithmetic Mean	50 µg/m³ 20 µg/m³	150 µg/m³ --	150 µg/m³ --	50 µg/m³ 20 µg/m³
Particulate matter less than 2.5 microns ($PM_{2.5}$)	24 hours Annual Arithmetic Mean	-- 12 µg/m³	35 µg/m³ 15 µg/m³	35 µg/m³ 15 µg/m³	35 µg/m³ 12 µg/m³
Lead [g]	30-day Average Calendar Quarter Rolling 3-month Average	1.5 µg/m³ -- --	-- 1.5 µg/m³ 0.15 µg/m³	-- 1.5 µg/m³ 0.15 µg/m³	-- -- --
Visibility reducing particles (VRP) [g]	8 hours	[h]	--	--	Regional: Extinction coefficient of 25 Mm-1 (157 km, 97 miles) 50 percent of the year, 34 Mm-1 (115 km, 71 miles) 90 percent of the year. Subregional: 50 Mm-1 (48 miles) 50 percent of the year, 125 Mm-1 (19 miles) 90 percent of the year.
Sulfates	24 hours	25 µg/m³	--	--	--

Pollutant	Averaging Time	CAAQS [a]	NAAQS [b]		TRPA[e]
			Primary [c]	Secondary [d]	
Hydrogen sulfide (H_2S)	1 hour	0.03 ppm	--	--	--
Vinyl chloride	24 hours	0.01 ppm	--	--	--

Notes:
ppm = parts per million
μg/m3 = micrograms per cubic meter
Mm-1 = per megameter
-- = No standard has been adopted for this averaging time
[a] California Ambient Air Quality Standards for ozone, CO (except 8-hour Lake Tahoe), SO2 (1 and 24 hour), NO2, and particulate matter (PM_{10}, $PM_{2.5}$, and VRP), are values that are not to be exceeded. All others are not to be equaled or exceeded.
[b] National Ambient Air Quality Standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m3 is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.
[c] Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.
[d] Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
[e] To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.100 ppm.
[f] To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.075 ppm.
[g] CARB has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.
[h] Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70 percent.
Source: CARB 2019a

Toxic Air Contaminants (TACs)

California also regulates hazardous air pollutants but refers to them as toxic air contaminants (TACs). TACs in California are regulated primarily through the Tanner Air Toxics Act (Assembly Bill [AB] 1807, Chapter 1047, Statutes of 1983) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588, Chapter 1252, Statutes of 1987). AB 1807 sets forth a formal procedure for ARB to designate substances as TACs. This includes research, public participation, and scientific peer review before ARB can designate a substance as a TAC. To date, CARB has identified more than 21 TACs and adopted EPA's list of HAPs as TACs.

California identifies diesel particulate matter (DPM) as a TAC. DPM is emitted from on- and off-road vehicles that use diesel as fuel. Following identification of diesel particulate matter as a TAC in 1998, CARB worked on developing strategies and regulations aimed at reducing the emissions and associated risk from diesel particulate matter. The overall strategy for achieving these reductions is found in the Risk Reduction Plan to Reduce Particulate Matter from Diesel-Fueled Engines and Vehicles (CARB, 2000).

In addition, CARB has adopted Air Toxics Control Measures (ATCMs) for some sources that emit TACs. For TACs that have a safe threshold below which there is no toxic effect, ATCMs are designed to reduce exposure below the safe threshold. For TACs with no safe threshold, the ATCM incorporates Best Available Control Technology for TACs (T-BACT) to reduce emissions. CARB has adopted an ATCM applicable to off-road diesel equipment and portable diesel engines rated at 50 brake horsepower and greater. The purpose of this ATCM is to reduce emissions of particulate matter from engines subject to the rule by implementing particulate matter emission limitations and phasing out older engines on a fleet-averaged basis.

One additional ATCM adopted by CARB relevant to the Proposed Project limits diesel-fueled commercial motor vehicle idling. The rule applies to motor vehicles with gross vehicular weight ratings greater than 10,000 pounds that are licensed for on-road use. The rule restricts vehicles from idling for more than five minutes at any location, with exceptions for idling that may be necessary in the operation of the vehicle.

Attainment Status

The U.S. EPA and CARB designate regions that are meeting the air quality standard for a given pollutant as being in "attainment" for that pollutant. Regions that are not meeting the standard are designated as being in "nonattainment" for that pollutant. If a region is designated as nonattainment, emission reductions are mandated, and a plan must be developed to demonstrate how the standard will be attained. Where insufficient data exist to make a determination, an area is deemed "unclassified." Where a nonattainment area has achieved attainment or where an attainment area is at risk of becoming nonattainment, it can be classified as a "maintenance" area to initiate implementation of preventive measures. Table 3.3.2-2 lists the attainment status for the Lake Tahoe portion of El Dorado County.

Table 3.3.2-2 Lake Tahoe Federal and State Air Quality Attainment Designations.

Pollutant	State Designation (CAAQS)	Federal Designation (NAAQS)
Ozone (O_3)	Attainment	2015 O_3 Standard (70 ppb) Unclassified/Attainment
PM_{10}	Non-attainment	Unclassified
$PM_{2.5}$	Unclassified	2012 Annual Standard (12µg/m^3) Unclassified/Attainment
		2012 24-hour Standard (35µg/m^3) Unclassified/Attainment
CO	Attainment	Unclassified/Attainment
NO_2, SO_2, Pb, H_2S, visibility reducing particles, sulfates, and vinyl chloride	Unclassified/Attainment	Unclassified/Attainment

Local

El Dorado County Air Quality Management District

The El Dorado County Air Quality Management District (EDCAQMD) attains and maintains air quality conditions in El Dorado County and prepares plans for the attainment of ambient air quality standards, adopts and enforces rules and regulations concerning sources of air pollution, and issue permits for stationary sources of air pollution. EDCAQMD also monitors ambient air quality and meteorological conditions, and implements programs and regulations required by the CAA, CAAA, and CCAA.

EDCAQMD rules and regulations potentially applicable to the project include the following:

Rule 202—Visible Emissions. A person shall not discharge into the atmosphere from any single source of emission whatsoever any air contaminant for a period or periods aggregating more than three minutes in any one hour which is as dark or darker in shade as that designated as number 1 on the Ringelmann Chart, as published by the U.S. Bureau of Mines.

Rule 223-1—Fugitive Dust—Construction.

> A. PURPOSE: The purpose of this rule is to reduce the amount of particulate matter entrained in the ambient air as a result of anthropogenic (manmade) fugitive dust sources by requiring actions to prevent, reduce, or mitigate fugitive dust emissions.
>
> B. APPLICABILITY: The provisions of this rule are applicable to specified outdoor fugitive dust sources, such as land clearing, grubbing, scraping, travel on site, and travel on access roads. The definitions, exemptions, requirements, administrative requirements, recordkeeping requirements, and test methods set forth in this rule are applicable to Rules 223, 223-1 and 223-2 of the Rules and Regulations of the El Dorado County Air Quality Management District.

TRPA

TRPA has established a Regional Plan that provides a regulatory framework for development and environmental conservation in the Lake Tahoe region. The Regional Plan includes several initiatives and planning documents that contain goals and policies designed to achieve or maintain adopted environmental threshold carrying capacities. Air Quality is a subelement within the Land Use section of the Regional Plan.

TRPA has jurisdiction within the Lake Tahoe Air Basin (LTAB) portion of El Dorado County in regard to air quality. Therefore, the Air Quality subelement of the Regional Plan focuses on achieving the NAAQS and CAAQS as well as special TRPA-adopted regional and subregional visibility standards, and on reducing the deposition of nitrate from oxides of nitrogen (NOX) emitted by vehicles. TRPA's Code of Ordinances and Regional Transportation Plan contain specific measures designed to monitor and achieve the air quality objectives of the Regional Plan. These measures apply to sources of air pollution within the Lake Tahoe region, such as certain motor vehicles registered in the region, combustion heaters installed in the region, open burning and stationary sources of air pollution, idling combustion engines, and development that would result in an increase of more than 200 daily vehicle trips.

The following TRPA provision is potentially applicable to the project:

Section 65.1.8 Idling Restrictions. No person shall cause a diesel engine in a vehicle exceeding 10,000 pounds gross vehicle weight or a diesel engine in off-road self-propelled equipment exceeding 25 horsepower to idle more than five minutes within the portions of the region in California.

Environmental Setting

The Proposed Project is located in the southern portion of the LTAB, which is a depression within the Sierra Nevada mountain range. Lake Tahoe has a surface elevation of approximately 6,200 feet above sea level, and the mountain ridges surrounding the lake rise to over 10,000 feet above sea level. The LTAB includes the lake and the area between the lake and the surrounding rim of mountain ridges.

The climate of the LTAB features generally sunny, mild days in the summer and variable conditions during the winter that can include storms with large amounts of precipitation, fog, and cool sunny weather. Temperatures in the summer peak in the upper 70s and low 80s, and in the winter are often below freezing.

Criteria Pollutants

Concentrations of ozone, CO, NO_2, SO_2, PM_{10} and $PM_{2.5}$, and lead are used as indicators of ambient air quality conditions and are referred to as criteria air pollutants. Criteria air pollutants are air pollutants for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set.

A brief description of each criteria air pollutant, including health effects, source types, and future trends, is provided below.

Ozone

Ozone occurs both in the upper atmosphere and near ground level. Ozone found in the upper atmosphere (stratospheric ozone) shields the earth from harmful ultraviolet radiation from the sun and is not the subject of ambient air quality standards. Ground level ozone is a harmful pollutant that can cause a variety of health problems, particularly for children, the elderly, and people with asthma or other conditions that cause diminished lung capacity. Ground level ozone is not directly emitted by a source but is instead formed from chemical reactions between nitrogen oxides (NOx) and reactive organic gases (ROG) in the presence of sunlight. ROG are volatile organic compounds that are photochemically reactive. ROG emissions result primarily from incomplete combustion and the evaporation of chemical solvents and fuels. NOx are a group of gaseous compounds of nitrogen and oxygen that result from the combustion of fuels. Primary sources of the ozone precursors ROG and NOx in the LTAB include on-road vehicles, watercraft, residential fuel combustion, and solvent evaporation (CARB, 2005; CARB, 2006). Ozone concentrations within the LTAB can also be influenced by transport of ozone or ozone precursors from nearby areas with more substantial emissions. Overall, ozone concentrations in the LTAB have been decreasing (TRPA, 2016).

Carbon Monoxide

Carbon monoxide (CO) is a tasteless, odorless, and colorless gas that can affect human and animal health by reducing the amount of oxygen transported in the bloodstream to critical organs like the heart and brain. CO is released when a carbon-containing fuel is burned. Primary anthropogenic sources of CO are on-road vehicles, residential wood burning, motorized watercraft, and off-highway vehicles. Wildfires are a common natural source of CO. CO measurements at air quality monitoring sites around Lake Tahoe indicates an overall decreasing trend in CO concentrations within the LTAB (TRPA, 2016).

Nitrogen Dioxide

NO2 is a brownish, highly reactive gas that can irritate airways in the human respiratory system as well as impact the environment by contributing to acid rain. The majority of the NO2 in the atmosphere is the result of fuel combustion sources such as on-road and off-road vehicles, boilers, and gas turbines. Combustion devices emit primarily nitric oxide (NO), which reacts through oxidation in the atmosphere to form NO2. NO and NO2 are the two primary NOx compounds in the atmosphere. Overall, NOx concentrations in the LTAB have been decreasing (TRPA, 2016).

Sulfur Dioxide

SO2 is produced by such stationary sources as fossil-fuel power plants, industrial processes that extract metal from ore, and locomotives, ships, and other equipment that burn fuel with a high sulfur content. The major adverse health effects associated with SO2 exposure pertain to the upper respiratory tract. Short-term exposures to SO2 can cause respiratory irritation such as wheezing, shortness of breath, and chest tightness (CARB, 2020; EPA, 2020).

Particulate Matter

Particulate matter in the atmosphere varies widely in size, shape, and chemical composition. Both short-term and long-term exposure to small particles cause a variety of health problems. Respirable particulate matter with an aerodynamic diameter of 10 micrometers or less is referred to as PM_{10}. Fine particulate matter, referred to as $PM_{2.5}$, is a subgroup of PM_{10} that has an aerodynamic diameter of 2.5 micrometers or less. Health effects from PM_{10} and $PM_{2.5}$ depend on the composition of the particulate matter and the location of particle deposition within the lungs. Smaller $PM_{2.5}$ particles are more likely to travel farther and deposit deeper within the lungs. Exposure to PM_{10} and $PM_{2.5}$ has been associated with respiratory symptoms, the worsening of existing respiratory diseases, acute and chronic bronchitis, increased hospital admissions, and premature death especially in people who have chronic heart or lung diseases (CARB, 2020).

PM_{10} and $PM_{2.5}$ often have different chemical compositions and can be emitted from a wide variety of sources. The combustion of petroleum fuels and wood are common sources of $PM_{2.5}$. PM_{10} sources also include processes that emit particulate matter directly into the air, such as fugitive dust from construction operations and agriculture, smoke from wildfires, and natural windblown dust. Particulate matter can be emitted directly into the atmosphere or be formed by reactions between of gaseous precursors such as SO2, NOx, and a variety of organic compounds. Organic precursors can come from both natural sources such as trees and vegetation, or from man-made sources such as industrial processes and fuel combustion (CARB 2020).

Primary sources of PM_{10} in the LTAB include motor vehicles, pulverized road-traction abrasives, decomposed road surfaces, salt, fugitive dust from local sources and abroad, and smoke from residential burning, prescribed burning, and wildfires. Primary sources of $PM_{2.5}$ in the LTAB include residential burning, prescribed burning, wildfires, motor vehicles, and road dust. The maximum 24-hour average PM_{10} concentrations in the LTAB are showing little to no change, and the annual average PM_{10} concentration is showing a decreasing trend. For $PM_{2.5}$, both 24-hour average concentrations and annual average concentrations are showing little to no change (TRPA, 2016).

Lead

Lead is a soft and chemically resistant metal found naturally in the environment. Lead is present in the air as small particles. Once in the body, lead can accumulate in the bones and can cause a variety of health effects. High levels of lead in the body can adversely affect multiple organ systems and can cause reproductive problems, high blood pressure, kidney disease, digestive problems, nerve disorders, memory and concentration problems, and muscle and joint pain. The major sources of lead emissions have historically been mobile and industrial sources. As a result of the phase-out of leaded gasoline that began in the 1970s, lead emissions from vehicles have decreased dramatically. The current primary sources of lead emissions consist of ore and metals processing, waste incinerators, utilities, lead-acid battery manufacturers, and piston-engine aircraft operating on leaded aviation gasoline. Additionally, because lead was historically emitted in much higher levels, lead can be present in the soil where it can be resuspended into the air when disturbed (CARB, 2020; EPA, 2020).

Toxic Air Contaminants

TACs are defined as compounds that may cause or contribute to an increase in mortality or in serious illness, or that may pose a hazard to human health. The primary TAC relevant to the Proposed Project is DPM. DPM is also one of the most important TACs, as it is estimated to represent about 70 percent of the cancer risk related to air toxics in California. Studies show a link between DPM exposure and lung cancer. Additionally, since the majority of DPM is smaller than one µm, DPM also contributes to the same health effects as $PM_{2.5}$ such as premature death, the exacerbation of chronic heart and lung disease, increased respiratory symptoms, and decreased lung function in children (CARB, 2020e).

Major sources of DPM emissions include ships, trains, and heavy-duty trucks that operate within industrial areas and heavily traveled roadways. Elevated DPM concentrations are mainly a problem in urban areas, and a significant fraction of the DPM exposure for most people occurs during travel on roadways. CARB has passed regulations to reduce DPM emissions, such as the reformulation of diesel fuel to reduce emissions, instituting periodic inspection programs for heavy-duty vehicles, and stipulating emission standards for new diesel engines. Through these regulations, DPM levels in California dropped by 68 percent between 1990 and 2012 (CARB, 2020e).

Monitoring Station Data

Criteria air pollutant concentrations are measured at several monitoring stations in the LTAB. The South Lake Tahoe–Sandy Way and Tahoe City 221 stations are the closest monitoring stations to the study area with recent data for ozone and PM_{10}. In general, the ambient air quality measurements from these monitoring stations are representative of the air quality in the vicinity of the study area. Table 3.3.2-3 summarizes the air quality data from these stations for the 3 most recent years for which data are available (2016–2018).

Potential Impacts

Issue AQ-1: Compliance with the Basin Air Quality Plan. Emissions from the Proposed Project have the potential to temporarily affect air quality and compliance with air quality plans. Emissions that result in the exceedance of established standards found in federal, state, and local plans would be considered to have significant impacts.

Minor impacts would occur from on-road vehicle and watercraft engine exhaust, and the application of volatile chemicals. Emissions that occur during the CMT could cumulatively impact air quality and compliance with local air quality plans (see Chapter 4) but would not be expected to be of direct significance by themselves.

Activities associated with the Proposed Project that have the potential to generate emissions and impact air quality include the use of fuel burning equipment to implement the CMT.

The herbicides proposed to be used during the CMT have low vapor pressures and are quite water soluble, so they would not be expected to volatilize from treated water and drift through air following the application (EPA 2007; 2014; WDOE 2001). Additionally, herbicides will be applied below the surface of the water, which will eliminate the opportunity for drifting of herbicides onto bystanders or nearby residents during the application process (WDOE Undated).

Table 3.3.2-3 Summary of Lake Tahoe Air Basin Air Quality Data.

Tahoe City-211 Fairway Drive and South Lake Tahoe - Sandy Way Stations[a]			
	2016	2017	2018
Ozone[b]			
Maximum Concentration (1-hr/8-hr, ppm)	0.730/0.068	0.082/0.070	0.090/0.078
Number of days State standard exceeded (1-hr/8-hr)	0/0	0/1	0/10
Number of days National standard exceeded (1-hr)	0	0	0
Respirable Particulate Matter (PM_{10})[c]			
Maximum Annual Average Concentration (µg/m^3) (State)	35.0	94.8	116.7
Maximum Annual Average Concentration (µg/m^3) (National)	40.9	113.5	144.3
Number of days State standard exceeded	0	-	-
Number of days National standard exceeded	0	0	0

Notes: µg/m3 = micrograms per cubic meter; ppm = parts per million; – = data not available

a Carbon monoxide, nitrogen dioxide, sulfur dioxide, and fine particulate matter data not available for the Lake Tahoe Air Basin.

b Data from the Tahoe City – 211 Fairway Drive Station.

c Data from the South Lake Tahoe – Sandy Way Station.

Source: CARB 2020

A boat will be used to apply herbicides during the CMT. In-water activities associated with the CMT are expected to occur in May of the first year of testing. Any potential increase in emissions due to these activities however are expected to be more than offset by the reduction in emissions from recreational watercraft as turbidity curtains will be installed that will obstruct boat passage in large portions of the Keys (see Section 3.4.6, Recreation) during mobilization and testing and during the period when detection of herbicides and degradation products would exceed acceptable limits in receiving waters (up to 130 days). The implementation of the CMT will result in vehicle travel for workers (seven or fewer workers per day) performing the test. Project-related vehicle travel and consequent emissions will occur for a limited duration and are expected to result in an insignificant change in the overall pollutant emissions resulting from transportation activities in the region.

Based on the methods used to apply herbicides during the Proposed Project, and the limited amount of vehicle traffic associated with the project, it is anticipated that emissions associated with the Proposed Project will be less than significant with respect to the normal, background levels of emissions from vehicle and boat use in the Tahoe Keys that would occur if the Proposed Project were not to occur. Therefore, impacts affecting compliance with basin air quality plans are expected to be **less than significant**.

Issue AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants. Emissions from the Proposed Project have the potential to result in a cumulatively considerable net increase of a criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard. The proposed Project is located in the Lake Tahoe Air Basin, which is either in attainment or designated unclassified for all NAAQS but is designated a nonattainment area for PM_{10} for CAAQS. Activities associated with the Proposed Project that have the potential to generate PM_{10}

emissions include the use of fuel burning equipment to implement the CMT. Activities potentially generating emissions are described above for Issue AQ-1.

Based on the limited amount of vehicle and boat traffic associated with the project, it is expected that PM_{10} emissions associated with the Proposed Project will be insignificant with respect to the normal, background vehicle and boat use in the Tahoe Keys that would occur if the Proposed Project were not to occur. Therefore, the net increase in PM_{10} emissions from the Proposed Project is not cumulatively considerable and impacts are considered **less than significant**.

Issue AQ-3: Exposure of Sensitive Receptors. Emissions from the Proposed Project have the potential expose sensitive receptors to substantial pollutant concentrations. Additionally, the Proposed Project has the potential to result in emissions that could adversely affect a substantial number of people. Activities associated with the Proposed Project that have the potential to generate substantial pollutant concentrations or adversely affect a substantial number of people include on-road vehicle and watercraft engine exhaust and the application of volatile chemicals.

For the purposes of this assessment, sensitive receptors are defined as facilities that house or attract children, the elderly, people with illnesses, or others who are especially sensitive to the effects of air pollutants such as a school, day care facility, hospital or senior center. The nearest sensitive receptors are residences located directly adjacent to areas where the CMT will occur.

As noted above (Issue AQ-1), the herbicides proposed to be tested during the CMT would not volatilize and will be applied below the surface of the water, eliminating the potential for drift to affect bystanders or nearby residents during the test (WDOE Undated). Other activities generating emissions that could affect sensitive receptors are described above, in Issue AQ-1.

Based on the limited amount of vehicle and boat traffic associated with the project and the short duration of the project, it is expected that emissions associated with the Proposed Project will be less than significant with respect to the normal, background in the Tahoe Keys. There is the potential for the Proposed Project to generate odors from internal combustion engine exhaust, however this effect would be localized and would occur in an area with relatively low population density, and for a short duration. Therefore, the Proposed Project is not expected to expose sensitive receptors to substantial pollutant concentrations or result in emissions that could adversely affect a substantial number of people, and impacts are considered **less than significant**.

Mitigation and Resource Protection Measures

Since emissions associated with the Proposed Project are expected to be less than significant, no mitigation measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts to air quality are expected from the Proposed Project.

3.3.2.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory and Environmental Setting

The Regulatory Setting and Environmental Setting for Action Alternative 1 are the same as those described for the Proposed Project above.

Potential Impacts

The impacts of Action Alternative 1 would be the same as the Proposed Project for the non-herbicide components of the CMT. Any impacts associated with the testing of herbicides would be avoided (however, these were considered less than significant for the Proposed Project).

Mitigation and Resource Protection Measures

Since emissions associated with Action Alternative 1 are expected to be less than significant, no mitigation measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts related to air quality are expected from Action Alternative 1.

3.3.2.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory and Environmental Setting

The Regulatory Setting and Environmental Setting for Action Alternative 2 are the same as those described for the Proposed Project above.

Potential Impacts

Issue AQ-1: Compliance with the Basin Air Quality Plan. Action Alternative 2 has the potential to temporarily affect air quality and compliance with local air quality plans due to engine exhaust emissions generated by equipment used for dredging, pumping, material handling, haul trucks importing and exporting materials, and vehicle travel from workers. A description of the activities associated with Action Alternative 2 is provided in Section 2.5.

To evaluate potential air quality impacts, criteria pollutant emissions were calculated for project activities using assumed equipment types, duration of use, and vehicle miles traveled. Emissions generated by Project activities (excluding those from watercraft) are calculated using the latest version of the California Emissions Estimator Model (CalEEMod version 2016.3.2). Watercraft (work boats) emissions were calculated using emissions factors obtained from CARB guidance (CARB 2012). Since detailed design information for the various Project activities has not yet been prepared, CalEEMod default values for several emission inputs were used including equipment horsepower and load factor. As described in Section 2.5, dredging activities are expected to occur over a six-month period. For the purposes of estimating emissions, activities are assumed to occur at one site at a time from April through September.

A summary of project equipment, equipment duration of use, and emission calculations for Action Alternative 2 is provided in Appendix AQ. Estimated maximum daily emissions and EDCAQMD significance threshold levels are provided in Table 3.3.2-4.

Maximum daily emissions for Action Alternative 2 would be well below all significance thresholds for criteria pollutants. Dredging and spoil handling will be performed in accordance with all applicable regulations, including District Rule 223-1 for fugitive dust, statewide diesel equipment requirements, and TRPA restrictions on idling (see discussions in Section 3.3.4, Water Quality, and Section 3.3.1, Earth Resources). While much of the equipment used for Action Alternative 2 uses diesel fuel, the amount of fuel used is expected to result in an insignificant change in the overall diesel fuel use in the region and does not conflict with TRPA significance criteria regarding increased diesel fuel use. Therefore, the

Table 3.3.2-4 Estimated Maximum Daily Construction Emissions.

Criteria Pollutant	Significance Threshold for Construction (lbs/day)	Estimated Maximum Daily Project Construction Emissions (lbs/day)
Nitrogen Oxides (NOx)	82	22.1
Reactive Organic Gases (ROG)	82	3.0
PM_{10}*	80	1.6
* EDCAQMD has no established significance threshold for PM_{10}. Threshold cited is from SMAQMD.		

environmental effects on basin air quality plans associated with Action Alternative 2 activities are considered **less than significant**.

Issue AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants. Action Alternative 2 has the potential to result in a cumulatively considerable net increase of PM_{10}, which the Project region is non-attainment under a state ambient air quality standard. Activities associated with Action Alternative 2 that generate PM_{10} emissions include engine exhaust from construction equipment used for dredging, material handling, haul truck travel, and vehicle travel from construction workers. A description of the activities associated with Action Alternative 2 is provided in Section 2.5.

To evaluate potential air quality impacts, criteria pollutant emissions were calculated for construction activities using assumed construction equipment types, duration of use, and vehicle miles traveled. Methods used to estimate emissions generated by Action Alternative 2 are described above for Issue AQ-2.

Calculated PM_{10} emissions for Action Alternative 2 are well below applicable significance thresholds for criteria pollutants. Dredging and spoil handling will also be performed in accordance with all applicable regulations, including District Rule 223-1 for fugitive dust, statewide diesel equipment requirements, and TRPA restrictions on idling. Therefore, the net increase in PM_{10} emissions from Action Alternative 2 is not cumulatively considerable and impacts are considered **less than significant**.

Issue AQ-3: Exposure of Sensitive Receptors. The potential for exposure of sensitive receptors under Action Alternative 2 is the same as described above for the Proposed Project, but with an expanded list of activities that could result in emissions (such as those leading to odors) that could adversely affect a substantial number of people. These additional activities include engine exhaust from equipment used for dredging, material handling, haul truck travel, and vehicle travel from workers.

To evaluate potential impacts to sensitive receptors and people near work activities, criteria pollutant emissions were calculated for construction activities using assumed construction equipment types, duration of use, and vehicle miles traveled. Methods used to estimate emissions generated by Action Alternative 2 are described above for Issue AQ-2.

Construction activities would result in short-term emissions of diesel particulate matter (DPM). According to OEHHA guidance, human health risk from exposure to TACs such as DPM are based on both the concentration of the TAC and the duration over which exposure occurs at a given location. It is expected that four or fewer pieces off-road diesel equipment will be used at the same time, and that equipment used will be model year 1996 or newer. Based on the scope of activities associated with Action Alternative 2, the relatively short construction period at individual test sites (less than 4.5 months), and reductions in DPM emissions due to the use of newer construction equipment as required by EPA and CARB regulations, construction emissions would not expose sensitive receptors to substantial emissions of DPM.

Calculated criteria pollutant emissions for Action Alternative 2 are well below applicable significance thresholds. Construction will also be performed in accordance with all applicable regulations, including District Rule 223-1 for fugitive dust, statewide diesel equipment requirements, and TRPA restrictions on idling. Pollutants generated from internal combustion engine exhaust during construction would be localized and occur in an area with relatively low population density for a short duration. Therefore, the Proposed Project is not expected to expose sensitive receptors to substantial pollutant concentrations or result in emissions (such as those leading to odors) that could adversely affect a substantial number of people, and impacts are considered **less than significant**.

Mitigation and Resource Protection Measures

Analysis of the emissions potentially generated by the Action Alternative 2 indicate that no significant project-related impacts related to air quality are expected. Therefore, no mitigation measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts related to air quality are expected from Action Alternative 2.

3.3.2.4 No Action Alternative

Regulatory and Environmental Setting

The Regulatory Setting and Environmental Setting for the No Action Alternative are the same as those described for the Proposed Project above.

Potential Impacts

Issue AQ-1: Compliance with the Basin Air Quality Plan. Under the No Action Alternative, the CMT would not occur and the methods currently used to control aquatic weeds such as mechanical harvesting would continue. Boats, barges, and on-road vehicles used to transport aquatic weeds for disposal generate air emissions. As described in Section 2.6.1, mechanical harvesting methods have not been effective at reducing the aquatic weed population and have accelerated the weed infestation because the machines used produce weed fragments that can propagate new plants. Therefore, under the No Action Alternative, there is the potential for an increase in air emissions if current mechanical harvesting methods are used to address expanding coverage of aquatic weeds. However, based on limited amount of equipment used for mechanical harvesting, any increase in air emissions under the No Action Alternative is unlikely to be large enough to impact compliance with basin air quality plans. Therefore, impacts to basin air quality plans are considered **less than significant**.

Issue AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants. As described above for Issue AQ-1, current aquatic weed control methods and their associated air pollutant emissions, including emissions of PM_{10} for which the Project region is non-attainment, have the potential to increase in the future under the No Action Alternative. However, based on the limited amount of equipment used for mechanical harvesting, this potential increase in PM_{10} emissions is unlikely to be significant when compared to overall PM_{10} emissions generated by recreational watercraft and on-road vehicles in the Tahoe Keys area. Therefore, the No Action Alternative is not expected to substantially increase PM_{10} emissions, and impacts are considered **less than significant**.

Issue AQ-3: Exposure of Sensitive Receptors. As described above for Issue AQ-1, current aquatic weed control methods and their associated air pollutant emissions have the potential to increase in the future under the No Action Alternative. However, based on the limited amount of equipment used during mechanical harvesting, this potential increase in emissions is unlikely to be significant when compared to overall emissions generated by recreational watercraft and on-road vehicles in the Tahoe Keys area. Therefore, the No Action Alternative is not expected to expose sensitive receptors to substantial pollutant concentrations or result in emissions (such as those leading to odors) that could adversely affect a substantial number of people, and impacts are considered **less than significant**.

Mitigation and Resource Protection Measures

Under the No Action Alternative, potential project-related emissions in excess of current emissions generated within the project area are considered less than significant. Therefore, no mitigation measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts related to air quality are expected from the No Action Alternative.

GREENHOUSE GAS EMISSIONS

3.3.2.5 Proposed Project (Control Methods Test)

Regulatory Setting

Federal

The EPA is the federal agency responsible for implementing the CAA. The U.S. Supreme Court ruled on April 2, 2007, that CO_2 and other greenhouse gases (GHGs) are air pollutants as defined under the CAA and that EPA has the authority to regulate their emissions. To date there are no federal regulations or policies regarding GHG emissions applicable to the Proposed Project or alternatives under consideration. However, the EPA and other federal agencies have taken action to monitor or potentially reduce GHG emissions, which are summarized below.

Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, EPA issued a final rule for mandatory reporting of GHGs from large GHG emissions sources in the United States. In general, this national reporting requirement will provide EPA with accurate and timely GHG emissions data from facilities that emit 25,000 metric tons (MT) or more of CO2 per year. These publicly available data will allow sources to track their own emissions, compare them to similar facilities, and aid in identifying cost-effective opportunities to reduce emissions in the future. Reporting is at the facility level, except that certain suppliers of fossil fuels and industrial GHG emitters, along with vehicle and engine manufacturers, will report at the corporate level. An estimated 85 percent of the total U.S. GHG emissions, from approximately 10,000 facilities, are covered by this final rule.

National Program to Reduce Greenhouse Gas Emissions and Improve Fuel Economy for Cars and Trucks

In October 2012, EPA and the National Highway Traffic Safety Administration (NHTSA), on behalf of the Department of Transportation, issued final rules to reduce GHG emissions and improve corporate average fuel economy (CAFE) standards for light-duty vehicles for model years 2017 and beyond (77 FR 62624). NHTSA CAFE standards have been enacted under the Energy Policy and Conservation Act since

1978. This national program required automobile manufacturers to build a single light-duty national fleet that meets all requirements under both federal programs and the standards of California and other states.

On September 19, 2019, the NHTSA and EPA issued a final action titled the "One National Program Rule," which enabled the federal government to provide uniform, nationwide fuel economy and GHG standards for automobiles. The One National Program Rule finalized actions in the Safer, Affordable, Fuel-Efficient (SAFE) Vehicles Rule proposed in August 2018 that included new and amended fuel economy and GHG standards for model year 2021 to 2026 light duty vehicles. The Rule also withdrew a CAA preemption waiver that had been granted to California in January 2013 that allowed the state to set their GHG standards for vehicles and zero emission vehicle mandates (EPA, 2019).

State

California has enacted a number of statewide initiatives intended to reduce the state's GHG emissions. A summary of initiatives relevant to the Proposed Project is provided below.

- Executive Order S-3-05—Executive Order S-3-05, which was signed by Governor Arnold Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.
- Assembly Bill 32, California Climate Solutions Act of 2006—In September 2006, Governor Arnold Schwarzenegger signed AB 32, the California Climate Solutions Act of 2006 (Stats. 2006, Ch. 488, enacting Health and Safety Code, Sections 38500–38599.) AB 32 establishes regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and a cap on statewide GHG emissions. It requires California to reduce its GHG emissions to 1990 levels by 2020 and reduce emissions to 80 percent below 1990 levels by 2050.
- California Senate Bill 97—Senate Bill (SB) 97, signed August 2007 by Governor Arnold Schwarzenegger, acknowledges that climate change is a prominent environmental issue that requires analysis under CEQA (Stats. 2007, Ch. 185 (enacting Pub. Resources Code, Sections 21083.05 and 21097.) This bill directs the Governor's Office of Planning and Research (OPR) to prepare, develop, and transmit to the Natural Resources Agency guidelines for feasible mitigation of GHG emissions or the effects of GHG emissions, as required by CEQA, by July 1, 2009. The Natural Resources Agency was required to certify and adopt those guidelines by January 1, 2010. The California Natural Resources Agency adopted those guidelines on December 30, 2009, and the guidelines became effective March 18, 2010.
- Executive Order B-30-15 - On April 20, 2015 Governor Brown signed EO B-30-15 to establish a California GHG reduction target of 40 percent below 1990 levels by 2030. The Governor's EO aligns California's GHG reduction targets with those of leading international governments such as the 28-nation European Union, which adopted the same target in October 2014. California is on track to meet or exceed the target of reducing GHG emissions to 1990 levels by 2020, as established in the California Global Warming Solutions Act of 2006 (AB 32 of 2008, discussed above). California's new emission reduction target of 40 percent below 1990 levels by 2030 sets the next interim step in the State's continuing efforts to pursue the long-term target expressed

under Executive Order S-3-05 to reach the goal of reducing emissions 80 percent below 1990 levels by 2050. This is in line with the scientifically established levels needed in the U.S. to limit global warming below two degrees Celsius, the warming threshold at which major climate disruptions are projected, such as super droughts and rising sea levels.

- Senate Bill 32 and Assembly Bill 197 of 2016 - In August 2016, Governor Brown signed SB 32 and AB 197, which serve to extend California's GHG reduction programs beyond 2020. SB 32 amended the Health and Safety Code to include Section 38566, which contains language to authorize CARB to achieve a statewide GHG emission reduction of at least 40 percent below 1990 levels by no later than December 31, 2030. SB 32 codified the targets established by EO B-30-15 for 2030, which set the next interim step in the State's continuing efforts to pursue the long-term target expressed in EOs S-3-05 and B-30-15 of 80 percent below 1990 emissions levels by 2050.

Climate Change Scoping Plan

In December 2008, CARB adopted the first version of its Climate Change Scoping Plan, which contained the main strategies California will implement to achieve the mandate of AB 32 (2006) to reduce statewide GHG emissions to 1990 levels by 2020. In May 2014, CARB released and subsequently adopted the First Update to the Climate Change Scoping Plan to identify the next steps in reaching the goals of AB 32 (2006) and evaluate the progress made between 2000 and 2012. After releasing multiple versions of proposed updates, in 2017 CARB adopted the next version titled California's 2017 Climate Change Scoping Plan (2017 Scoping Plan) in December of that same year (CARB 2017a). The 2017 Scoping Plan indicates that California is on track to achieve the 2020 statewide GHG target mandated by AB 32 of 2006. It also lays out the framework for achieving the mandate of SB 32 of 2016 to reduce statewide GHG emissions to at least 40 percent below 1990 levels by the end of 2030 (CARB 2017a:9). The 2017 Scoping Plan identifies the GHG reductions needed by each emissions sector. The Scoping Plan does not include any information or guidance specific to motorized recreational watercraft or off-road recreational equipment.

The 2017 Scoping Plan also identifies how GHGs associated with proposed projects could be evaluated under CEQA (CARB 2017a:101-102). Specifically, it states that achieving "no net increase" in GHG emissions is an appropriate overall objective of projects evaluated under CEQA if conformity with an applicable local GHG reduction plan cannot be demonstrated. CARB recognizes that it may not be appropriate or feasible for every development project to mitigate its GHG emissions to zero and that an increase in GHG emissions due to a project may not necessarily imply a substantial contribution to the cumulatively significant environmental impact of climate change.

Local

El Dorado County Air Quality Management District

The El Dorado County Air Quality Management District (EDCAQMD) has not established thresholds of significance for GHGs.

TRPA

TRPA does not have any environmental thresholds pertaining to GHGs, and TRPA's Regional Plan does not include any goals or policies that address GHGs in the Tahoe Basin (TRPA 2012). However, TRPA's Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), which serves as the transportation element of the Regional Plan (TRPA 2012:3-1), includes a strategy to reduce GHGs generated by on-road vehicle travel in the California portion of the Tahoe Basin.

Environmental Setting

GHG play a critical role in regulating temperatures on the surface of the earth by absorbing infrared radiation that is emitted by earth. This radiation, which would otherwise escape into space, is instead "trapped," resulting in a warming of the earth's atmosphere. This phenomenon is known as the greenhouse effect. The amount of warming that occurs is proportional to the concentration of GHGs in the atmosphere.

Global climate change is the common nomenclature used to describe an increase in the average temperature of the Earth's atmosphere and oceans. The causes of global climate change have been linked to both natural processes and human actions, such as fossil fuel combustion. According to the Intergovernmental Panel on Climate Change (IPCC), increasing GHG concentrations have been largely responsible for human-induced global warming (IPCC 2007). GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern. Whereas most pollutants with localized air quality effects have relatively short atmospheric lifetimes (about one day), GHGs have long atmospheric lifetimes (one to several thousand years) and disperse around the globe.

The most common GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydroflourocarbons, perfluorocarbons, and sulfur hexafluoride. The potential heat trapping ability of each GHG varies. To account for these differences, GHGs are defined by their global warming potential (GWP). This assessment is based on GWP values of one for CO_2, 25 for CH_4, and 298 for N_2O (CalEEMod). In this analysis, GHGs are reported as carbon dioxide equivalents (CO_2e).

Potential Impacts

Issue GHG-1: Greenhouse Gas Emissions. Emissions from the Proposed Project have the potential to generate GHG emissions that may have a significant impact on the environment or conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs. Impacts would occur from on-road vehicle and watercraft engine exhaust that contain GHGs.

As noted above for Issue AQ-1, any potential increase in GHG emissions from on-road vehicle and watercraft engine exhaust is expected to be more than offset by the reduction in emissions from recreational watercraft during implementation of the Proposed Project.

Based on the limited amount of vehicle and watercraft traffic associated with the project, it is anticipated that emissions associated with the Proposed Project will be less than significant with respect to the normal, background levels of emissions from vehicle and boat use in the Tahoe Keys that would occur if the Proposed Project were not to occur. Implementation of the Proposed Project would not generate GHG emissions, either directly or indirectly, that would have significant impact on the environment, and would not conflict with an applicable plan, policy or regulation adopted for the purpose of reducing emissions of GHGs. Therefore, the Proposed Project's impacts related to GHGs are, overall, **less than significant**.

Mitigation and Resource Protection Measures

No mitigation measures to reduce project-related impacts from GHGs would be required for the Proposed Project.

Significant Unavoidable Impacts

No significant unavoidable impacts related to GHGs are expected from the Proposed Project.

3.3.2.6 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting and Environmental Setting

The Regulatory Setting and Environmental Setting for Action Alternative 1 are the same as those described for the Proposed Project above.

Potential Impacts

Issue GHG-1: Greenhouse Gas Emissions. The impacts of Action Alternative 1 would be the same as the Proposed Project for the non-herbicide components of the CMT. Any impacts associated with the testing of herbicides would be avoided (however, these were considered **less than significant** for the Proposed Project).

Mitigation and Resource Protection Measures

Analysis of the emissions potentially generated by the Action Alternative 1 indicate that no significant project-related impacts from GHGs are expected. Therefore, no mitigation measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts related to GHGs are expected from Action Alternative 1.

3.3.2.7 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting and Environmental Setting

The Regulatory Setting and Environmental Setting for Action Alternative 2 are the same as those described for the Proposed Project above.

Potential Impacts

Issue GHG-1: Greenhouse Gas Emissions. Emissions from the Action Alternative 2 have the potential to generate GHG emissions that may have a significant impact on the environment or conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs. Impacts would occur due to GHG emissions from engine exhaust from construction equipment used for dredging and material handling, haul trucks importing and exporting materials, and vehicle travel from construction workers. A description of the construction activities associated with Action Alternative 2 are provided in Section 2.5.

To evaluate potential impacts, GHG emissions were calculated for project activities using the same methods as were used to calculate criteria pollutants. Calculation methods and assumptions are described above in Action Alternative 2, Issue AQ-1.

A summary of project equipment, equipment duration of use, and emission calculations for Action Alternative 2 is provided in Appendix A. Annual GHG emissions from activities associated with Action Alternative 2 are estimated to be 200.8 $MTCO_2e$/yr. This value is well below the significance threshold provided in CARB guidance of 7,000 $MTCO_2e$/yr and the significance threshold adopted by SMAQMD of 1,100 $MTCO_2e$/yr. Although the project would be completed before 2030, to address consistency with California's 2030 GHG target of 40 percent below 1990 levels, GHG emissions were also compared to the SMAQMD threshold of 1,100 $MTCO_2e$/yr, adjusted downward by 40 percent to 660 $MTCO_2e$/yr. The annual GHG emissions associated with Action Alternative 2 are also well below this adjusted significance threshold. Therefore, implementation of Action Alternative 1 would not generate GHG emissions, either directly or indirectly, that would have significant impact on the environment, and would not conflict with an applicable plan, policy or regulation adopted for the purpose of reducing emissions of GHGs. Action Alternative 2's impacts related to GHGs are, overall, **less than significant.**

Mitigation and Resource Protection Measures

Analysis of the emissions potentially generated by the Action Alternative 2 indicate that no significant project-related impacts from GHGs are expected. Therefore, no mitigation measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts related to GHGs are expected from Action Alternative 2.

3.3.2.8 No Action Alternative

Regulatory Setting and Environmental Setting

The Regulatory Setting and Environmental Setting for the No Action Alternative are the same as those described for the Proposed Project above.

Potential Impacts

Issue GHG-1: Greenhouse Gas Emissions. As described above for Issue AQ-1, current aquatic weed control efforts have the potential to increase in the future under the No Action Alternative. An increase in mechanical harvesting would result in an increase in GHG emissions. However, based on the limited amount of equipment used during mechanical harvesting, this potential increase in GHG emissions is unlikely to be significant when compared to overall emissions generated by recreational watercraft and on-road vehicles in the Tahoe Keys area. Therefore, impacts related to GHG emissions are expected to be **less than significant.**

Mitigation and Resource Protection Measures

Under the No Action Alternative, potential emissions in excess of current emissions generated within the project area are considered less than significant. Therefore, no mitigation measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts related to GHGs are expected from the No Action Alternative.

3.3.3 Hydrology

This section considers how the proposed aquatic weeds CMT and alternatives could potentially influence hydrology of the Tahoe Keys lagoons. Our assessment, described in the sections below, relies on a water budget analysis that was developed using publicly-available topographic, hydrologic, and meteorological datasets for the South Lake Tahoe region. The analysis was also informed by groundwater models and subsurface mapping developed to inform a recent TMDL and long-term groundwater management plan and was tested using surface and groundwater data collected by ESA in 2019. The analysis considered potential effects in 2019, overlapping the period when surface and groundwater data were collected in the Tahoe Keys lagoons and surrounding hillslopes.

Methods and Assumptions

Among activities proposed in the CMT or Action Alternatives, only the possible discharge of treated sediment dewatering effluent under Action Alternative 2 has the potential of affecting hydrology by altering flow patterns. No other activities would reduce impervious surfaces, include consumptive water uses, or otherwise alter groundwater and surface water hydrology. The approach to evaluating hydrology was to (1) collect continuous rainfall, surface water and groundwater level measurements in and around the Tahoe Keys lagoons; (2) supplement the 2019 baseline data with publicly-available topographic, hydrologic, and meteorological datasets for the South Lake Tahoe region; and (3) develop a water budget analysis. The reasonableness of modeled water budget results was evaluated by comparisons to the measured change in water storage in each water body. The water budget analysis was also used to support the nutrient loading/cycling model described in Appendix E, and the evaluation of potential water quality impacts. Several key assumptions were used in the water budget analysis:

- There is no surface water connection between Lake Tallac and the West Lagoon except on rare occasions when a gate is lowered to relieve localized flooding upgradient from Lake Tallac.
- While Lake Tallac and Pope Marsh receive runoff from upgradient watersheds, the only surface runoff into the West Lagoon and East Lagoon is from property immediately surrounding these waterbodies. The Rational method was used to estimate seasonal peak runoff and surface/stormwater inflows to Lake Tallac and Pope Marsh. Surface/stormwater inflows to the West Lagoon and East Lagoon were assumed to be similar to direct precipitation of the contributing land area. Only minor rainfall occurred during the aquatic weed growing season so direct precipitation and storm turnoff were minor components of the water budget, as verified by water level measurements.
- Lake Tallac drains to Pope Marsh through a gate, and during high water levels Pope Marsh overtops Pope Beach and drains into Lake Tahoe.
- Surface water levels in the West Lagoon and East Lagoon are set by Lake Tahoe levels, as measured at the USGS Tahoe City gauge.
- Groundwater exchange between the West Lagoon and East Lagoon is negligible.
- Groundwater flow rates were calculated using Darcy's Law.
- Evaporation was estimated using monthly evapotranspiration data, considering that some transpiration loss would occur from floating coontail that was abundant in Lake Tallac in 2019.

3.3.3.1 Proposed Project (Control Methods Test)

Regulatory Setting

The Proposed Project does not reduce impervious surfaces, alter flow patterns, or include any consumptive water uses; therefore, there are no TRPA Regional Plan thresholds or other applicable regulatory requirements specific to potential hydrology impacts.

Environmental Setting

Issue HY-1: Disposal of Dewatering Effluent. Because no dewatering effluent would be produced under the Proposed Project and no other environmental effects on hydrology have been identified for the Proposed Project, the discussion of the environmental setting for project area hydrology is deferred to discussion under Action Alternative 2.

Potential Impacts

Issue HY-1: Disposal of Dewatering Effluent. Because no dewatering effluent would be produced under Action Alternative 1, and the proposed herbicide treatment, ultraviolet light treatment, LFA, and combination treatments proposed for the aquatic weed control methods test will not have any potential adverse or beneficial effects on groundwater or surface water hydrology, no potential impacts are identified for the Proposed Project. Since these tests are not expected to add or remove significant amounts of water at the test sites, and since they are not expected to influence local exchange between the water column and the underlying aquifer, we expect the exchange of water among the lagoons and Lake Tallac or Pope Marsh to be less than significant.

Mitigation and Resource Protection Measures

Since there are no potential adverse effects to hydrology resulting from the Proposed Project, there are no proposed mitigation measures described herein.

Significant Unavoidable Impacts

There are **no expected significant unavoidable impacts** to hydrology that would occur as a result of implementing the Proposed Project.

3.3.3.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting

Alternative 1 does not reduce impervious surfaces, alter flow patterns, or include any consumptive water uses; therefore, there are no TRPA Regional Plan thresholds or other applicable regulatory requirements specific to potential hydrology impacts.

Environmental Setting

Issue HY-1: Disposal of Dewatering Effluent. The environmental setting for Action Alternative 1 is deferred to Action Alternative 2, for the same reasons as the Proposed Project.

Potential Impacts

Issue HY-1: Disposal of Dewatering Effluent. Because no dewatering effluent would be produced under Action Alternative 1, and the proposed ultraviolet light treatment and LFA treatments proposed for Alternative 1 will not have any potential adverse or beneficial effects on groundwater or surface water hydrology, no potential impacts are identified for Action Alternative 1. Since these tests are not expected to add or remove significant amounts of water at the test sites, and since they are not expected to influence local exchange between the water column and the underlying aquifer, we expect the exchange of water among the lagoons and Lake Tallac or Pope Marsh to be less than significant.

Mitigation and Resource Protection Measures

Since there are no potential adverse effects to hydrology resulting Action Alternative 1, there are no proposed mitigation measures described herein.

Significant Unavoidable Impacts

There are **no expected significant unavoidable impacts** to hydrology that would occur as a result of implementing Action Alternative 1.

3.3.3.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

The Proposed Project does not reduce impervious surfaces, alter flow patterns, or include any consumptive water uses; therefore, there are no TRPA Regional Plan thresholds specific to potential hydrology impacts.

Action Alternative 2 would likely require a special permit agreement to discharge into the District sewer system, which could limit the quantities of treated effluent and concentrations of aluminum discharged to the sewer, specify pre-treatment requirements, and establish fees for discharge determined by the utility Board. Any disposal of treated effluent from the dewatering of dredge spoils to Lake Tallac would be regulated under Clean Water Act requirements as described for water quality in Section 3.3.4, including coverage under an individual NPDES permit.

Environmental Setting

Issue HY-1: Disposal of Dewatering Effluent. This section describes the existing conditions for hydrology in the project area, including the hydrologic connections between waterbodies, observations from monitoring water levels in 2019, and modeled baseline water budgets for 2019.

Hydrologic Connections

The hydrology of the Tahoe Keys West Lagoon and East Lagoon is influenced by direct connection to Lake Tahoe (and thus is directly affected by rising or falling lake levels), direct precipitation and evaporative losses, local runoff from areas immediately surrounding each lagoon, and groundwater exchange with the local aquifer.

Both lagoons are located within the Tahoe Valley South (TVS) groundwater sub-basin, which is comprised of Mesozoic granitic rocks at high elevation, and Quaternary-aged glacial deposits and alluvium at lower elevations near Lake Tahoe (Ludington et al. 2005). The aquifer beneath the lagoons has been mapped by a number of researchers for the purpose of understanding long-term groundwater movement (Einarson 2003; Fogg 2007), and numerical models have been developed recently by USACE (2003), Fogg (2007), and DRI (2016). A USACE (2003) study was developed to support a subsequent TMDL (LRWQCB and NDEP 2010).

In recent years, there have been no direct surface water runoff connections with the surrounding watershed which is separated from the West and East lagoons except during very high runoff events. Lake Tallac intercepts freshwater runoff draining from the Tahoe Island Park neighborhood and is separated from the West Lagoon by a weir and gate structure located immediately west of the intersection of Venice Drive with Lucerne Way, although groundwater exchange occurs between the two water bodies when water levels differ enough to drive a pressure gradient under Venice Drive (Figure 3.3.3-1). On rare occasions, the City of South Lake Tahoe temporarily opens the weir gate to relieve localized flooding upgradient from Lake Tallac. A second weir gate connecting Lake Tallac to Pope Marsh is low enough that seasonal exchange with the marsh effectively prevents the need in most years for Tallac waters to spill into the West Lagoon via the weir gate under Venice Drive. Apart from stormwater contributions and groundwater exchange with the local aquifer, Lake Tallac also periodically receives flood flows from the east when floods along the Upper Truckee River cause water to spill over Dover Drive and Tahoe Keys Blvd. The main outlet for Lake Tallac is via overtopping of a short weir that connects it to Pope Marsh to the west, between Venice Drive and Weir Way (Figure 3.3.3-1). This occurs during periods of snowmelt or heavy precipitation; at times, higher water levels in Pope Marsh can also cause flows to reverse into Lake Tallac. These surface water connections cause the water bodies to equilibrate (pers. comm. A. Kopania).

Pope Marsh drains a small watershed bounded by the northern slopes of Tahoe Mountain to the south and receives groundwater from the TVS aquifer. The marsh also has a groundwater connection to the West Lagoon via its western boundary, as well as to Lake Tahoe along its northern edge at Pope Beach. During relatively wet conditions, most recently in April of 2019, high water levels in the marsh cause overtopping of Pope Beach near Lighthouse Shores Drive, leading to the erosion of a notch in the beach and rapid draining of water trapped in the marsh. These 'breach' events typically last on the order of days to weeks before wave action from wind-waves on Lake Tahoe push sediment into the notch and restore the formation of the beach until the next high water event (pers. comm. A. Kopania). Figure 3.3.3-1 illustrates the hydrologic connections between the different water bodies at the site that were considered by the water budget.

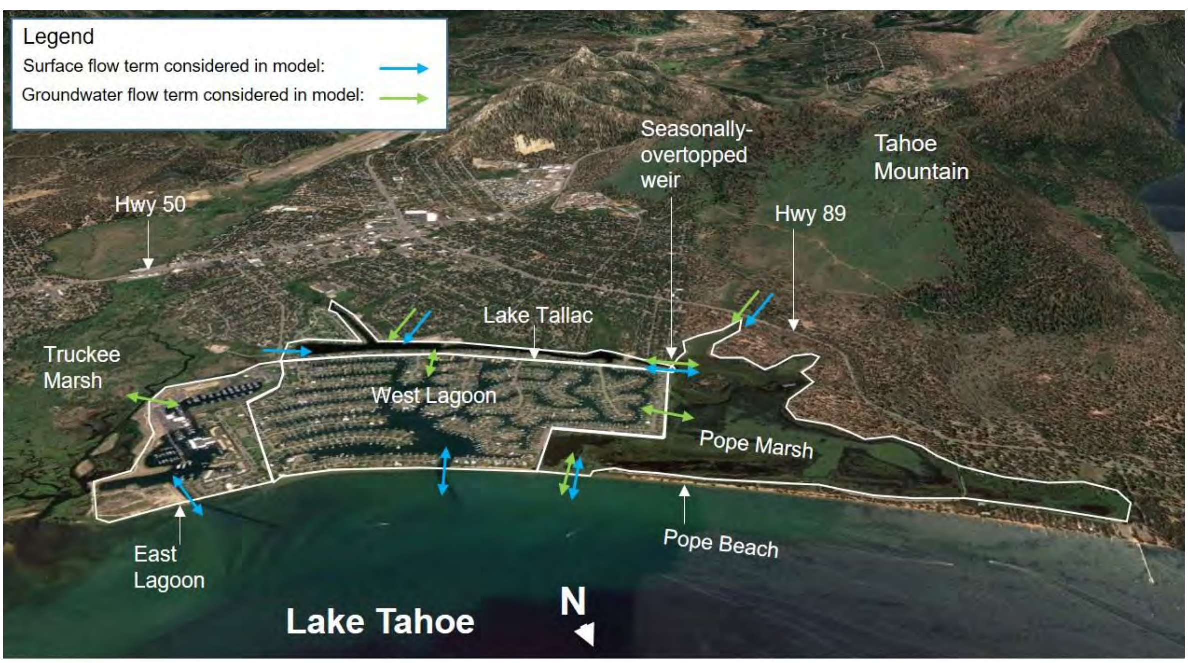


Figure 3.3.3-1 Schematic of the Water Budget Model of the Tahoe Keys Lagoons.

Observed Hydrologic Conditions

To evaluate the effects of the proposed alternatives on hydrology, we first evaluated baseline conditions in 2019 from May 17th to October 15th, the period when ESA surface and groundwater measurements in and around Tahoe Keys allow for testing of a water budget model. Conditions in 2019 were relatively wet, with much of the hydrology characterized by high amounts of snowmelt and high Lake Tahoe levels (Appendix WQ-1). The hydrology of the West and East Lagoons was dominated by the high Lake Tahoe levels, which were within 0 to 2 foot of the legal maximum limit (6,229.1 feet, regulated by the Bureau of Reclamation lake outlet dam at Tahoe City) during the entire period that data were collected. Lake Tallac and Pope Marsh varied throughout the period as snowmelt caused a large accumulation of surface water runoff, leading to peak water levels in June and July, followed by a slow decline from July through October. During this time, Pope Marsh was consistently lower than Lake Tallac by 0.5 to 1.5 feet. As water levels varied on Lake Tallac and Pope Marsh, the head gradient between these water bodies and the West and East Lagoons likely led to seasonal changes in groundwater exchange.

Modeled Baseline Conditions in 2017 and 2019

To model baseline conditions, we developed a water budget model in Matlab © that accounted for the measured and estimated inflow and outflow terms for each of the interconnected water bodies shown in Figure 3.3.3-1. To the extent possible, the model relied on direct measurements of surface or groundwater levels. Where data were unavailable, we supplemented the budget with estimates of flow terms and literature values. Table 3.3.3-1 below lists the major terms.

Groundwater flows into the West Lagoon are expected to come from Pope Marsh to the west and Lake Tallac to the south. In the East Lagoon, the main source of groundwater exchange is with the Upper Truckee River Marsh to the east. Both lagoons lie in the pathway for prevailing groundwater flows draining north to Lake Tahoe (USACE 2003). Since surface water levels in both the East and West

Table 3.3.3-1 Data Sources for the Water Budget Analysis.

	Groundwater Exchange	Surface/ Stormwater Inflows	Direct Precipitation	Evaporative Losses	Exchange with Lake Tahoe
West Lagoon	ESA surface gauges and piezometers	Assumed similar to direct precip over land area	SLT Airport[1] ESA rain gauge	CIMIS Markleeville[2]	USGS Tahoe City Gauge
East Lagoon	ESA surface gauge and USGS gauge # 10336610	Assumed similar to direct precip over land area	SLT Airport[1] ESA rain gauge	CIMIS Markleeville[2]	USGS Tahoe City Gauge
Lake Tallac	USACE (2003); Local groundwater gradient from monitored wells[3]	Rational method[4]	SLT Airport[1] ESA rain gauge	CIMIS Markleeville[2]	No exchange occurs
Pope Marsh	USACE (2003); Local groundwater gradient from monitored wells[3]	Rational method[4]	SLT Airport[1] ESA rain gauge	CIMIS Markleeville[2]	Groundwater exchange

1 https://wrcc.dri.edu/cgi-bin/rawWest.pl?caKTVL
2 https://cimis.water.ca.gov/WSNReportCriteria.aspx
3 http://wdl.water.ca.gov/waterdatalibrary/
4 Q = CiA where Q = peak flow, C = runoff coefficient, i = rainfall intensity, A = catchment area

Lagoons are set by Lake Tahoe levels, the head gradient between the lagoons is minimal, and groundwater exchange between the two water bodies is negligible. For the remaining flow sources, we estimated the flows from the adjacent water bodies by developing a water budget with a daily time step from May 17th to October 15th, 2019, treating each water body as interconnected and having fixed volumes. The reasonableness of the results was evaluated by comparing the observed and modeled change in storage of each water body. Since West and East Lagoon water levels are dominated by Lake Tahoe levels (LaPlante 2008), and since much of the external nutrient loading to these two lagoons is a result of groundwater inflows from Lake Tallac and Pope Marsh (LRWQCB and NDEP 2010), we focus here on the water budget results for the latter two, and aim to identify changes in groundwater flows toward the West Lagoon to support nutrient load modeling (Appendix WQ-2).

Within the water budget, Lake Tallac and Pope Marsh receive runoff from their surrounding watersheds. Runoff was estimated using the Rational Method, and was filtered in time to account for the lag between snowfall and melt. Although a number of methods exist for estimating snowmelt rates, the lack of snowpack extent and depth data for Tahoe Mountain would make it difficult to apply an analytical approach. We instead applied a moving 20-day average of precipitation for the first several months of the simulation to account for the fact that: (1) precipitation was observed to occur as snowfall in May, and (2) the peak in observed water levels was a result of eventual melting of the May snowfall. Soil types, land cover, soil permeabilities, and local shallow aquifer depths were based on information provided by regional groundwater model reports (e.g., USACE 2003; DRI 2016). Precipitation and evapotranspiration were applied by obtaining the product of locally measured rates with the surface area of each water body at a given time step.

All other inputs and outputs for the control volumes were modeled as groundwater flows, with the exception of the exchange between Lake Tallac and Pope Marsh, which included a weir overtopping term when water levels exceeded the weir height on either side. Groundwater flow rates were calculated using Darcy's Law (i.e., $Q = kA[dh/dL]$, where k is the saturated hydraulic conductivity [ft/s], A is area through which flow occurs [ft^{2}], and dh/dL [ft/ft] is the head gradient [Bear 2012]). This approach is consistent with USACE (2003) for basins that were not modeled numerically. Values for k were obtained from information provided by DRI (2016). Flow areas were represented as the length of the boundary between water bodies multiplied by the depth to the shallowest confinement layer in the subsurface aquifer system (Einarson 2003; Saucedo 2005). The head gradient was estimated using ArcMap GIS software in combination with ESA-installed wells and existing groundwater wells listed in the California Department of Water Resources (DWR) Water Data Library. We considered the fact that Venice Drive is likely underlain by compacted fill (Pers. comm. A. Kopania), which would have the effect of limiting the thickness of the porous sediment for groundwater to flow through along the West Lagoon.

The net change in storage for each day was combined with stage-storage curves (i.e., relationships between water surface elevations and the amount of stored water volume below each elevation) for each water body to obtain estimated water surface elevations at each time step. The stage-storage curves were developed in ArcMap using available Light Detection and Ranging (LiDAR) surface topography for the area. Note that because LiDAR is unable to penetrate the water surface, the actual bathymetry for Lake Tallac and Pope Marsh are unknown; thus, volumes listed in the results tables below are estimated changes in storage, rather than total storage.

Table 3.3.3-2 lists the results of the water budget for 2019, and Figure 3.3.3-2 shows a time series of the water level predictions. Lake levels in 2019 were near the legal limit throughout the months of May through October. ESA observations from 2019 were used to train the water budget model, by adjusting values of k within the estimated ranges provided by DRI (2016). In general, predicted water levels were within 0.2 foot of observations in Lake Tallac and Pope Marsh. Monthly changes in water storage for Lake Tallac and Pope Marsh were typically within ± 60 percent for most months between modeled and observed conditions, indicating the modeled volumes were reasonable approximations. Higher errors occurred in October in Lake Tallac and in June and October in Pope Marsh. This is likely a result of the simple method used here for combined runoff and groundwater flow, each of which may have complex hydrographs during late summer precipitation events, when the ground is less saturated. With the results in the tables below, and the understanding that the local aquifer varies in thickness and location of confinement layers across the site (Einarson 2003, Saucedo 2005), the flow terms shown here are generalized estimates.

Potential Impacts

Issue HY-1: Disposal of Dewatering Effluent. Potential hydrology effects from suction dredging are evaluated below both for the high-water conditions that were experienced in 2019, and also for low-water conditions such as those that occurred most recently in 2016. If the dewatering effluent from processing dredged sediment is treated and discharged to the sanitary sewer system, then there would be no potential impacts to hydrology. The following evaluation looks at the potential impacts to hydrology from discharging treated effluent into Lake Tallac, in the event that it cannot be discharged to the sanitary sewer.

2019 Conditions

As described in Chapter 2, the hydraulic dredging alternative would entail removing a slurry of bottom sediments from three test sites in the West Lagoon (including roughly 10 parts water per one part sediment), transporting the slurry via pipeline to the defunct water treatment plant south of Tallac, partial treatment for removal of fine sediments and aluminum at the treatment plant, and either transport of the partially treated water to the municipal sanitary sewer system or to Lake Tallac. The latter assumes that water added to Lake Tallac would eventually move to Pope Marsh, and then exit to Lake Tahoe via groundwater exchange with the lake.

Table 3.3.3-2 Comparison of Modeled and Observed Changes in Storage by Month from May 17 Through October 15, 2019.

	Lake Tallac		Pope Marsh	
	Observed Change in Storage (acre-feet)	**Modeled Change in Storage (acre-feet)**	**Observed Change in Storage (acre-feet)**	**Modeled Change in Storage (acre-feet)**
May 17 – 31	19.16	24.15	41.93	56.74
Jun 1 – 30	-43.61	-25.23	-22.15	-42.20
July 1 – 31	-27.10	-11.66	-18.72	-6.59
Aug 1 – 31	-16.30	-13.02	-36.40	-23.59
Sep 1 – 30	-8.78	-6.06	-50.12	-18.98
Oct 1 – 15	4.87	-11.05	-12.45	-24.83

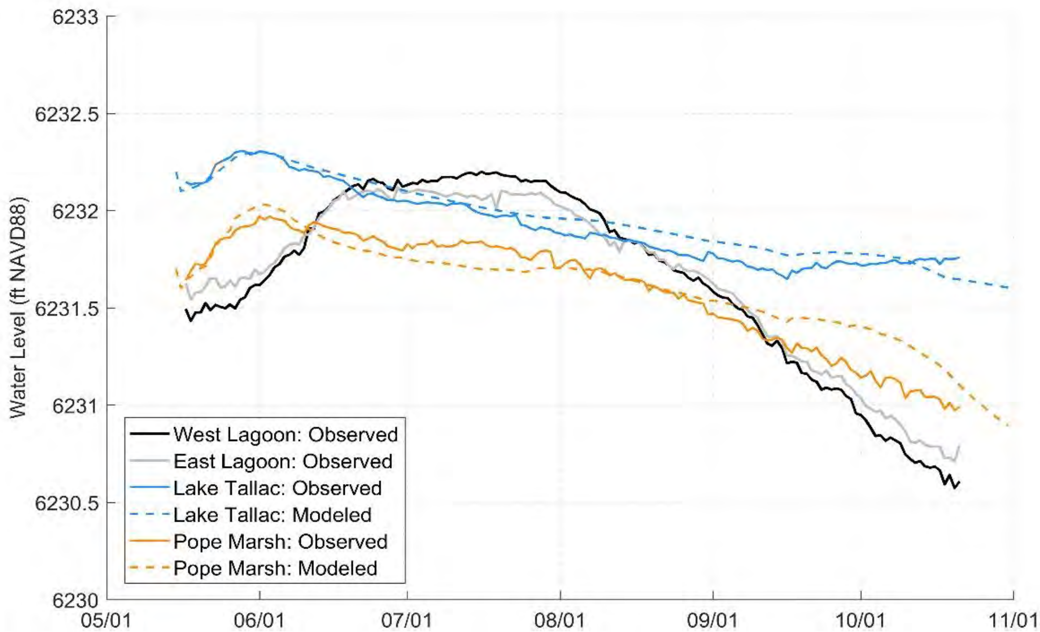


Figure 3.3.3-2 Water Budget Results for Baseline (No Project) Conditions for 2019.

The transport of dredged slurry to the treatment plant, and eventual delivery to Lake Tallac, is expected to take place over a four- to five-month period beginning in late spring. As described in Chapter 2 Table 2-6), the total water volume transported over this period of time is expected to be 36 million gallons, or about 110 acre-feet. We assumed this would be distributed evenly from June through October, for an average of 22 acre-feet per month.

To evaluate the option under which dredge spoils dewatering effluent is not discharged to the sanitary sewer, treated sediment dewatering effluent was included in the water budget by adding a source term to Lake Tallac, assuming all other input flow terms are the same as in 2019, and allowing the modeled water levels to dictate resulting changes to flows into Pope Marsh and eventually to the West Lagoon. Tables 3.3.3-3 and 3.3.3-4 show the results of the analysis for 2019. Using the area of each water body, the changes in water balance volumes (acre-feet) were converted to changes in water level (feet), for a more understandable indication of potential effects. The modeled discharge of treated dewatering effluent led to an increase in water levels of about 0.1 to 0.5 foot in Lake Tallac and about 0.1 to 0.2 foot in Pope Marsh. This led to an increase in seepage flows toward the West Lagoon during all months from May to October. The net change in groundwater flow toward the West Lagoon was an increase of about 35 percent from Lake Tallac and 66 percent from Pope Marsh. As expected, the alternative also led to a greater flow from Lake Tallac into Pope Marsh, and a greater loss of water to Lake Tahoe via seepage through Pope Beach.

2016 Conditions

Since 2019 was a relatively wet year with high Lake Tahoe levels, 2016 conditions were also modeled to better understand any effects of the dredging alternative during drier conditions, and when lake levels were lower. The same datasets were applied to populate boundary conditions for the model as shown in Table 3.3.3-1.

Table 3.3.3-3 Comparison of Modeled 2019 Water Balance Flows (acre-feet) By Month in Lake Tallac for Baseline and Alternative Conditions (negative values denote flow away from Lake Tallac).

Month	Surface and Storm-water Runoff	Watershed Ground-water Exchange	Ground-water Exchange with West Lagoon	Total Flow to Pope Marsh[1]	Evap.	Direct Precip.	Dredge Dewatering Discharge
Baseline Conditions							
May 15 – 31	60.5	10.9	-8.0	-25.8	-4.7	2.7	0.0
Jun 1 – 30	6.4	20.5	-7.3	-40.6	-14.0	0.0	0.0
July 1 – 31	1.0	21.1	-0.2	-29.7	-15.1	0.2	0.0
Aug 1 – 31	3.0	21.1	-3.7	-26.7	-13.2	0.2	0.0
Sep 1 – 30	21.0	20.5	-11.6	-31.1	-9.6	1.2	0.0
Oct 1 – 15	8.5	9.5	-8.9	-17.9	-3.3	0.0	0.0
Alternative (Suction Dredge Dewatering Discharge May 15 through October 15)							
May 15 – 31	60.5	10.9	-8.2	-31.5	-4.7	2.7	12.2
Jun 1 – 30	6.4	20.5	-8.3	-51.3	-14.0	0.0	21.6
July 1 – 31	1.0	21.1	-2.8	-38.3	-15.2	0.2	22.3
Aug 1 – 31	3.0	21.1	-7.3	-39.1	-13.3	0.2	22.3
Sep 1 – 30	21.0	20.5	-15.7	-44.8	-9.7	1.2	21.6
Oct 1 – 15	8.5	9.5	-11.0	-24.8	-3.3	0.0	10.1
Month	**Surface and Storm-water Runoff**	**Watershed Ground-water Exchange**	**Ground-water Exchange with West Lagoon**	**Total Flow to Pope Marsh1**	**Evap.**	**Direct Precip.**	**Dredge Dewatering Discharge**
Change from Baseline Conditions to Dewatering Effluent Discharge Scenario							
Net Change in Flow (Acre-feet)	0.0	0.0	-13.8	-58.0	-0.2	0.0	110.0

[1] Inclusive of both weir overtopping and groundwater exchange flows.

Since no water level data were available to test model accuracy, the model results for this scenario have a higher uncertainty, and are intended to understand the magnitude of the change in flow rates between different types of years.

Compared to 2019, Lake Tahoe levels (and thus West Lagoon and East Lagoon levels) were about four to five feet lower in 2016. Although the lower lagoon water levels would increase the head difference between water bodies, the drier conditions and overall lower resulting water levels in Lake Tallac and Pope Marsh would also be expected to increase the length of groundwater flow paths, which would reduce the effects of greater head difference. Available aerial images indicate that Pope Marsh was mostly dry during the summer of 2016, except for isolated pockets of standing water, whereas the surface area of Lake Tallac was only slightly smaller in 2016 than in 2019.

Tables 3.3.3-5 and 3.3.3-6 show the water budgets for Lake Tallac and Pope Marsh in 2016, respectively. In summary, drier conditions led to lower baseline water levels in both locations, which translated to a greater relative increase in water levels with the suction dredging scenario compared to the high-water conditions in 2019. In late summer, the model predicted an increase in water levels of about 0.3 to 0.5 foot in Pope Marsh and 0.5 to 1.0 foot in Lake Tallac resulting from the alternative. However, since the lower water levels in each water body led to greater distances between standing water and West

Table 3.3.3-4 Comparison of Modeled 2019 Water Balance Flows (acre-feet) By Month in Pope Marsh for Baseline and Alternative Conditions (negative values denote flow away from Pope Marsh).

Month	Surface and Storm-water Runoff	Watershed Ground-water Exchange	Total Exchange with Lake Tahoe1	Ground-water Exchange with West Lagoon	Ground-water Exchange with Lake Tallac2	Evap.	Direct Precip.
Baseline Conditions							
May 15 – 31	80.7	10.9	-32.3	-1.5	25.8	-35.0	19.4
Jun 1 – 30	8.6	20.5	-7.6	-0.4	40.6	-105.5	0.0
July 1 – 31	1.4	21.1	47.2	2.2	29.7	-109.8	1.2
Aug 1 – 31	4.1	21.1	14.9	0.7	26.7	-94.5	1.2
Sep 1 – 30	27.9	20.5	-40.3	-1.9	31.1	-66.0	7.8
Oct 1 – 15	11.3	9.5	-40.9	-1.9	17.9	-21.6	0.0
Alternative (Suction Dredge Operated May 15 through October 15)							
May 15 – 31	80.7	10.9	-32.9	-1.5	31.5	-35.0	19.4
Jun 1 – 30	8.6	20.5	-15.1	-0.7	51.3	-106.7	0.0
July 1 – 31	1.4	21.1	40.6	1.9	38.3	-111.0	1.2
Aug 1 – 31	4.1	21.1	6.5	0.3	39.1	-95.8	1.2
Sep 1 – 30	27.9	20.5	-50.6	-2.4	44.8	-67.2	8.0
Oct 1 – 15	11.3	9.5	-46.2	-2.2	24.8	-22.0	0.0
Change from Baseline Conditions to Dewatering Effluent Discharge Scenario							
Net Change in Flow (Acre-feet)	0.0	0.0	-38.8	-1.8	58.0	-5.5	0.2

[1] Groundwater flow to Lake Tahoe via seepage through Pope Marsh Beach.

[2] Inclusive of both weir overtopping and groundwater exchange flows.

Lagoon, the relative increase in groundwater flows toward the West Lagoon were small compared to 2019. Under the lower water level conditions present in 2016, the amount of groundwater flow from Pope Marsh toward the West Lagoon would increase about eight percent from dredge spoil dewatering discharge, and an increase of about 20 percent in groundwater flow from Lake Tallac to the West Lagoon would occur.

Based on the findings of the water budget assessment described above, discharge of treated dewatering effluent to Lake Tallac under the dredging alternative may have unavoidable impacts to the hydrology of Lake Tallac and Pope Marsh, ultimately leading to slightly higher water levels, and a greater resulting groundwater flux to the West Lagoon. During a low water year, water level increases were estimated to be 0.5 to 1.0 foot in Lake Tallac and 0.3 to 0.5 foot in Pope Marsh, which would not create any concerns for flooding or other adverse hydrologic effects. During a high-water year, water level increases were estimated to be 0.1 to 0.5 foot in Lake Tallac and 0.1 to 0.2 foot in Pope Marsh. The rates and timing of discharges could be adjusted to prevent flooding impacts from being significant (e.g., by storing treated dewatering effluent until Lake Tallac receded from the snowmelt runoff peak or ceasing discharges during storm events), and these hydrologic impacts could be completely avoided if the treated dewatering effluent were instead discharged to the sanitary sewer. Therefore, the impact to Issue HY-1 is considered **less than significant**. The potential for additional inflows under Action Alternative 2 to affect wetlands is evaluated in Section 3.3.6, and the potential for additional inflows to contribute to nutrient loading in the lagoons is evaluated in Section 3.3.4.

Table 3.3.3-5 Comparison of Modeled 2016 Water Balance Flows (acre-feet) By Month in Lake Tallac for Baseline and Alternative Conditions (negative values denote flow away from Lake Tallac).

Month	Surface and Storm-water Runoff	Watershed Ground-water Exchange	Ground-water Exchange with West Lagoon	Total Flow to Pope Marsh[1]	Evap.	Direct Precip.	Dredge Dewatering Discharge
Baseline Conditions							
May 15 – 31	44.5	10.9	-33.0	-8.9	-1.9	1.0	0.0
Jun 1 – 30	18.4	20.5	-57.6	-15.4	-5.4	0.0	0.0
July 1 – 31	0.0	21.1	-53.8	-17.5	-9.5	0.0	0.0
Aug 1 – 31	0.0	21.1	-43.9	-13.0	-8.5	0.1	0.0
Sep 1 – 30	6.7	20.5	-30.6	-5.1	-6.5	0.1	0.0
Oct 1 – 15	9.4	9.5	-14.7	-2.1	-1.9	2.2	0.0
Alternative (Suction Dredge Dewatering Discharge May 15 through October 15)							
May 15 – 31	44.5	10.9	-33.3	-9.3	-1.9	1.0	12.2
Jun 1 – 30	18.4	20.5	-60.1	-18.2	-5.4	0.0	21.6
July 1 – 31	0.0	21.1	-59.5	-23.6	-9.6	0.0	22.3
Aug 1 – 31	0.0	21.1	-56.0	-25.1	-8.7	0.1	22.3
Sep 1 – 30	6.7	20.5	-49.4	-19.9	-6.7	0.1	21.6
Oct 1 – 15	9.4	9.5	-22.7	-7.1	-1.9	2.2	10.1
Change from Baseline Conditions to Dewatering Discharge Scenario							
Net Change in Flow (Acre-feet)	0.0	0.0	-47.2	-41.4	-0.4	0.0	110.0

1 Inclusive of both weir overtopping and groundwater exchange flows.

Mitigation and Resource Protection Measures

The following mitigation measures would minimize impacts to the hydrology of Lake Tallac and Pope Marsh for both the dry (e.g., 2016) and wet (e.g., 2019) conditions, if treated dewatering effluent had to be discharged to Lake Tallac rather than the sanitary sewer system.

Exporting a fraction of the partially treated water stored from suction dredging to the sanitary sewer system would reduce impacts to the hydrology of the interconnected waterbodies. However, the sanitary sewer system experiences the highest loading during periods of spring and early summer melt and may not be available as discharge alternative. Therefore, as an alternative measure, the routing of treated dewatering effluent to Lake Tallac could be limited to the late summer – early fall months, reducing hydrologic impacts by discharging only when water levels tend to be lower and the risk of contributing to flood conditions would be negligible.

Significant Unavoidable Impacts

No significant unavoidable impacts to hydrology would occur.

3.3.3.4 No Action Alternative

Regulatory Setting

The No Action Alternative would not reduce impervious surfaces, alter flow patterns, or include any consumptive water uses; therefore, there are no TRPA Regional Plan thresholds or other applicable

Table 3.3.3-6 Comparison of Modeled 2019 Water Balance Flows (acre-feet) By Month in Pope Marsh for Baseline and Alternative Conditions (negative values denote flow away from Pope Marsh).

Month	Surface and Storm-water Runoff	Watershed Ground-water Exchange	Total Exchange with Lake Tahoe[1]	Ground-water Exchange with West Lagoon	Ground-water Exchange with Lake Tallac[2]	Evap.	Direct Precip.
Baseline Conditions							
May 15 – 31	59.3	10.9	-42.1	-2.5	8.9	-8.7	4.5
Jun 1 – 30	24.6	20.5	-73.8	-4.5	15.4	-24.0	0.2
July 1 – 31	0.0	21.1	-64.9	-3.9	17.5	-32.4	0.0
Aug 1 – 31	0.0	21.1	-54.6	-3.3	13.0	-16.7	0.1
Sep 1 – 30	9.0	20.5	-43.1	-2.6	5.1	-3.4	0.0
Oct 1 – 15	12.5	9.5	-21.2	-1.3	2.1	-0.5	0.4
Alternative (Suction Dredge Operated May 15 through October 15)							
May 15 – 31	59.3	10.9	-42.1	-2.5	9.3	-8.7	4.5
Jun 1 – 30	24.6	20.5	-74.1	-4.5	18.2	-24.1	0.2
July 1 – 31	0.0	21.1	-66.3	-4.0	23.6	-33.5	0.0
Aug 1 – 31	0.0	21.1	-58.7	-3.6	25.1	-19.7	0.1
Sep 1 – 30	9.0	20.5	-54.8	-3.3	19.9	-7.5	0.1
Oct 1 – 15	12.5	9.5	-27.7	-1.7	7.1	-1.4	1.3
Change from Baseline Conditions to Dewatering Discharge Scenario							
Net Change in Flow (Acre-feet)	0.0	0.0	-24.1	-1.5	41.4	-9.1	1.0

1 Groundwater flow to Lake Tahoe via seepage through Pope Marsh Beach

2 Inclusive of both weir overtopping and groundwater exchange flows

regulatory requirements specific to potential hydrology impacts. TKPOA would continue to manage stormwater under their WDR requirements described in the Nonpoint Source Water Quality Management Plan.

Environmental Setting

Issue HY-1: Disposal of Dewatering Effluent. The baseline hydrology for the No Action Alternative would be the same as described for Action Alternative 2.

Potential Impacts

Because no dewatering effluent would be produced under the No Action Alternative and no other environmental effects on hydrology have been identified for this alternative, the No Action Alternative is expected to have a less than significant impact on surface water or groundwater hydrology.

Mitigation and Resource Protection Measures

Since there are no potential adverse effects to hydrology resulting from the No Action Alternative, no mitigation measures are proposed.

Significant Unavoidable Impacts

The No Action Alternative would have **no significant unavoidable impacts** for hydrology.

3.3.4 Water Quality

Water quality impacts are a primary concern for the CMT, and include a variety of potential effects to physical, chemical, and biological components of the Tahoe Keys lagoons and Lake Tahoe. Determining what aquatic weed control methods will improve water quality of the lagoons is a goal of the project and addressing the aquatic weed problem in the Tahoe Keys is important for protecting the long-term water quality of Lake Tahoe. Although a total of only 24 percent of the lagoons are proposed to be treated during the Proposed Project, some beneficial effects on water quality constituents can be expected in and near treatment areas. There are also potential adverse impacts to water quality from implementing the Proposed Project or its alternatives. Importantly, most of these impacts are expected to be short term effects occurring during installation, removal, or performance of aquatic weed control tests. Because the volume of Lake Tahoe is approximately 58,000 times greater than the combined volume of the Tahoe Keys lagoons, potential changes in lagoon water quality from testing aquatic weed control methods are not expected to be measurable in the greater Lake Tahoe. Therefore, the focus of water quality evaluations is on receiving waters that must be protected within the lagoons. Protection of water quality within the lagoons is expected to minimize risks of potential water quality impacts in the lake from testing aquatic weed control methods.

Several potential water quality issues identified in antidegradation policies, Basin Plan water quality objectives, and TRPA threshold standards for water quality, overlap with other disciplines and are addressed elsewhere in this DEIR/DEIS. Toxicity, including potential effects of herbicide chemicals and aluminum in sediments, is addressed in Section 3.2, Environmental Health. Aquatic invasive species issues are addressed in Section 3.3.5, Aquatic Biology and Ecology.

Methods & Assumptions

Water quality evaluations are focused on receiving waters that must be protected within the lagoons. Protection of water quality within the lagoons is expected to minimize potential water quality impacts in Lake Tahoe where there would be much greater water circulation and dilution. Compliance with Basin Plan WQOs was evaluated for those water quality constituents of potential concern because they could be influenced by activities proposed as part of the CMT or Action Alternatives. Compliance with other WQOs was not evaluated because project activities would not have potential effects on them (e.g., radioactivity). TRPA environmental threshold standards for water quality that could be influenced by project activities were also evaluated. TRPA water quality standards that would not be directly affected by project activities, such as pollutant loading from tributaries or surface runoff, were not evaluated.

The general approach to evaluating water quality was to (1) implement an intensive baseline study to understand the spatial and temporal variability of water quality constituents and ecosystem dynamics between physical, chemical and biological components of the lagoon ecosystems, (2) supplement the baseline study with modeling of lagoon hydrology and nutrient loading/cycling, and (3) incorporate findings from other studies to inform expectations for how the lagoons might respond to proposed activities. Considerations included the timing, duration and spatial extent of activities. In many cases, mitigation measures were part of the evaluation, including the ability to monitor real-time and alter activities to maintain water quality protection. The following methods and assumptions were applied in evaluating specific water quality issues.

WQ-1: Water Temperature Effects. The WQO states that natural receiving water temperature shall not be altered unless it can be demonstrated that such an alteration does not adversely affect the water for beneficial uses; therefore, judgment was used in evaluating whether potential changes in water temperature would be harmful. Potential effects on thermal stratification were evaluated qualitatively. Two activities could directly add heat to the lagoon water and were evaluated quantitatively: operation of ultraviolet light arrays, and injection of hot water under bottom barriers. Based on the specific heat capacity of water, calculations were performed using the wattage of arrays and volumes of water to be treated with ultraviolet light. Similar calculations were performed for the expected temperature and volume of water that could be injected under bottom barriers.

WQ-2: Sediment Disturbance and Turbidity. Potential for turbidity impacts was evaluated for a few activities that might disturb sediments. For evaluating turbidity from LFA, monitoring data were available for the existing LFA test site in the West Lagoon. Only anecdotal observations of turbidity were available from past bottom barrier removal. The small scale and limited duration of proposed sediment-disturbing activities was an important consideration for turbidity effects, particularly from Group B methods. Monitoring data were available from testing of a hydraulic dredge at the Tahoe Keys marina in the mid-1990s, and these data were used in evaluating the potential for turbidity to exceed water quality criteria during test site dredging in the West Lagoon. Mitigation measures were significant factors in evaluating turbidity effects during dredging, replacement of substrate material, and discharge of treated sediment dewatering effluent.

WQ-3: Dispersal of Aquatic Weed Fragments. This issue was evaluated for suction dredging and addressed by qualitatively considering the expected effectiveness of mitigation measures.

WQ-4: Changes in pH. All activities were evaluated for potential pH changes. Baseline monitoring showed that high pH from plant photosynthesis commonly exceeds the WQO maximum criterion in the upper water column and low pH is present in deeper waters, so the approach was to qualitatively evaluate whether proposed activities could make pH conditions significantly worse. The pH of products proposed for herbicide testing were examined and baseline results for alkalinity (i.e., buffering capacity of lagoon water to resist changes in pH) were considered. The limited areas for testing was an important consideration regarding the significance of potential changes in pH from each activity. Breakup of stratification was the key assumption for LFA test sites. For injection of acetic acid under bottom barriers, published results of experiments helped inform expectations for pH effects, and the ability to monitor and adjust operations to protect lagoon water pH was assumed. For the suction dredging alternative, sediment pH was assumed to be near neutral based on 2019 baseline monitoring.

WQ-5: Changes in Dissolved Oxygen Concentrations. All activities were also evaluated qualitatively for potential DO changes. Based on information from product registration, it was assumed that there would be no concerns of direct DO effects from the chemical oxygen demand of herbicide products proposed for testing. Potential DO effects were focused on indirect oxygen demand from plant decomposition after dieback. Key assumptions for herbicide testing were that it would occur in late spring when plant biomass is minimal and aeration at test sites would prevent stratification from leading to oxygen depletion in the bottom waters during plant decomposition. Ultraviolet light treatments were assumed to stunt plant growth and limit the amounts of plant biomass decay following plant dieback, and it was assumed that aeration systems could be deployed to break up stratification during the plant decay period if real-time DO monitoring indicated excessive oxygen depletion in deep waters.

WQ-6: Increases in Total Phosphorus Concentrations. A conceptual model of nutrient loading and nutrient cycling was used to help understand how total phosphorus concentrations in the water column could be affected by project activities. This model was built on data collected during the 2019 baseline study, together with information from other studies for some nutrient sources. The methods and assumptions for this model are described in detail in Appendix E. Plant biomass estimates were based on Tahoe Keys macrophyte survey biovolumes and literature values, and the release rate of phosphorus from decaying plant tissue was based on a thesis study at Tahoe Keys. For LFA, it was assumed that the aeration system would not result in rapid dieback of aquatic plants and subsequent nutrient releases from decaying plant tissue. Sediment nutrient concentrations from the 2019 baseline study were used to help evaluate the potential for increased water column total phosphorus during suction dredging. The effectiveness of mitigation measures were key assumptions in evaluating nutrient release to lagoon water during the suction dredging and substrate replacement activities.

WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. The methods and assumptions for evaluating potential total nitrogen changes were essentially the same as those described for total phosphorus. The release rate of nitrogen from decaying plant tissue was assumed to be the same as reported for phosphorus in a thesis study at Tahoe Keys.

3.3.4.1 Proposed Project (Control Methods Test)

This section describes the regulatory and environmental settings for the Proposed Project, evaluates potential water quality effects from each control method proposed for testing (i.e., herbicide treatment, ultraviolet light treatment, LFA, and combined herbicide and ultraviolet light treatments), proposes mitigation measures to limit adverse effects, and identifies any significant unavoidable adverse impacts.

Regulatory Setting

This section describes in detail the specific requirements that apply to the potential water quality issues identified in Section 3.1.1 for the proposed CMT project.

Federal

Federal Clean Water Act (Public Law 92-500)

Section 303(d) of the Clean Water Act (CWA) requires states to compile a list of impaired water bodies that do not meet water quality standards, and establish total maximum daily loads (TMDLs) for such waters. The deep water transparency standard for Lake Tahoe is 29.7 meters, the average annual Secchi disk depth measured between 1967 and 1971 (LWB and NDEP 2010). Because of the decline in water transparency over the past five decades, Lake Tahoe is listed under Section 303(d) as impaired by input of nitrogen, phosphorus and sediment, the primary factors contributing to the decline. A TMDL was established with a plan to restore Lake Tahoe's deep-water transparency to 29.7 m annual average Secchi depth. The Lake Tahoe TMDL Implementation Plan is the most comprehensive water quality restoration effort underway in the Lake Tahoe Basin, and defines the highest priorities for water quality protection and improvement. NPDES permits issued by the states to regulate the discharge of pollutants under Section 402 of the CWA must be consistent with allocations prescribed in the TMDL.

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification for the discharge. The certification must be obtained from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over the affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the regional water quality control board (RWQCB) with local jurisdiction—in this case, the Lahontan Regional Board. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States. Federal government delegates water pollution control authority under Section 401 to the states. Expansion of bottom barriers beyond the currently permitted five-acre maximum would likely require a federal permit and would thus require a revised 401 Water Quality Certification permit modification.

State and USEPA Antidegradation Policies

The Tier Three designation of Lake Tahoe (including the West and East lagoons) under the federal Antidegradation Policy and related regulatory requirements are explained in detail in Section 1.4.1. This designation requires that states may allow some limited activities that result in temporary and short-term changes to water quality, but such changes should not adversely affect existing uses or alter the essential character or special uses for which Lake Tahoe was designated as an ONRW. The detectable presence of any introduced chemicals above background concentrations, or any lowering of water quality as a result of project activities for more than a short-term period (i.e., “weeks to months, not years”) is not allowed. The State Water Board established California’s antidegradation policy in State Water Board Resolution 68-16, which incorporates the requirements of the federal antidegradation policy. In addition to proposed aquatic herbicide products, injection of acetic acid under bottom barriers would be considered a chemical discharge subject to antidegradation policies.

State

Lahontan Region Basin Plan

The Basin Plan defines water quality standards for the surface and ground waters of the region, including designated beneficial uses of water and the narrative and numerical water quality objectives (WQOs) to protect those uses. Chapter 3 of the Basin Plan identifies WQOs that apply to all surface waters, and also water quality objectives specific to the Lake Tahoe hydrologic unit. Chapter 4 of the Basin Plan includes information on waste discharge prohibitions, including a prohibition on the use of aquatic pesticides, and the criteria for considering exemptions to the prohibition. Chapter 5 of the Basin Plan provides more information on water quality standards for the Lake Tahoe Basin, including direction on compliance with the WQOs. Table 3.3.4-1 is not a comprehensive list of WQOs that apply in the Tahoe Keys lagoons, but instead identifies those Basin Plan WQOs for water quality constituents of potential concern from activities proposed as part of the CMT.

The State Water Board established California’s antidegradation policy in State Water Board Resolution 68-16, which incorporates the requirements of the federal antidegradation policy. The requirements for an exemption to the prohibition apply both to proposed aquatic herbicide testing in the West Lagoon, which is part of the Tier Three designation of Lake Tahoe as an ONRW, and to herbicide testing in Lake Tallac, which has Tier Two protection under the antidegradation regulations. If approved for use, detectable concentrations of herbicide active ingredients and degradates above background would be allowed within treatment areas only for a short-term period (i.e., weeks to months, not years). This requirement is described in Section 1.4. In receiving waters outside of treatment areas, short-term detectable concentrations of herbicide active ingredients and degradates are only allowable if beneficial uses are protected and maintained.

Table 3.3.4-1 Basin Plan Water Quality Objectives for Water Quality Constituents of Potential Concern.

Temperature	Shall not be altered
Dissolved Oxygen	8.0 mg/L at all times
	9.5 mg/L 7-d mean minimum
	Shall not be depressed >10% saturation
	Shall not be <80% saturation
pH	Not depressed <7.0 nor raised >8.4
	Change no more than ±0.5 from ambient pH
Turbidity	Shall not exceed 3 NTUs
	Increases shall not exceed natural levels >10%
Aluminum	Site-specific acute criteria
	Site-specific chronic criteria
Total Phosphorus	Annual avg/90% max of 0.008 mg/L
Total Nitrogen	Annual avg/90% max of 0.15 mg/L
Floating Materials	Shall not cause nuisance or adversely affect beneficial uses
	Alternations shall not be discernable at the 10% significance level

Regional

TRPA Threshold Standards and Regional Plan

The TRPA Regional Plan includes policies to control or eradicate existing populations of non-native aquatic invasive species, and work to prevent the spread of invasive species. TRPA has established goals and policies that support the Lake Tahoe TMDL through the reduction of sediment and nutrients to the lake and the elimination or reduction of other pollutants, comprehensive water quality planning and coordination with public agencies and the private sector, and maximizing the efficiency and effectiveness of water quality programs. The TRPA Code of Ordinances contains requirements and standards intended to achieve water quality thresholds, goals and policies (TRPA 2016). The following Code section applies directly to the testing of aquatic herbicides proposed as part of the CMT:

> 60.1.7. Pesticide Use The use of insecticides, fungicides, and herbicides shall be consistent with the Handbook of Best Management Practices.
>
> > A. Pesticide Use Discouraged TRPA shall discourage pesticide use for pest management. Prior to applying any pesticide, potential users of pesticides shall consider integrated pest management practices, including alternatives to chemical applications, management of forest resources in a manner less conducive to pests, reduced reliance on potentially hazardous chemicals, and additional environmentally sound pest management tactics.
> >
> > B. Criteria for Pesticide Use The following criteria apply to pesticide use:
> >
> > 1. Only chemicals registered with the Environmental Protection Agency and the state agency of appropriate jurisdiction shall be used and only for their registered application;
> >
> > 2. Alternatives to chemical application shall be employed where practical; and
> >
> > 3. No detectable concentration of any pesticide shall be allowed to enter any stream environment zone, surface water, or ground water unless TRPA finds that

application of the pesticide is necessary to attain or maintain the environmental threshold standards.

TRPA has established Environmental Threshold Carrying Capacities (i.e., threshold standards) to set environmental standards for the Lake Tahoe Basin, as described in Section 1.3.1.1. The following identifies the thresholds that apply most directly to activities proposed in Tahoe Keys lagoons as part of the CMT. For example, while numerical water quality threshold standards are established to reduce suspended sediment loading to Lake Tahoe from tributaries and surface runoff, the Proposed Project and alternatives will not affect those sources. The turbidity standard is more applicable to aquatic weed control activities where there is a potential to impact water quality by re-suspending fine sediments that have accumulated in the Tahoe Keys lagoons.

- WQ3: Attain turbidity values not to exceed 3.0 NTU
- WQ4: Turbidity shall not exceed one NTU in shallow waters of the Lake not directly influenced by stream discharges
- WQ8: Prevent the introduction of new aquatic invasive species
- WQ9: Reduce the abundance of known aquatic invasive species
- W10: Reduce the distribution of known aquatic invasive species
- WQ11: Abate harmful ecological impacts resulting from aquatic invasive species
- WQ12: Abate harmful economic impacts resulting from aquatic invasive species
- WQ13: Abate harmful social impacts resulting from aquatic invasive species
- WQ14: Abate harmful public health impacts resulting from aquatic invasive species.

Local

Water Quality Certification and Waste Discharge Requirements for Tahoe Keys Property Owners Association

The objective of the WDRs issued by the LWB to TKPOA is to protect beneficial uses of receiving waters by requiring both water- and land-based management actions to reduce all potential sources of pollutants (LWB 2014). Water-based sources are covered primarily in the Integrated Management Plan (IMP, TKPOA 2018a). Land-based sources include: (1) stormwater discharges through shared stormwater collection and treatment facilities, which are maintained by TKPOA and covered by the City of South Lake Tahoe General Municipal Stormwater NPDES permit, and (2) surface flows and percolating groundwater that may flow directly to the Tahoe Keys lagoons. The WDRs require a Nonpoint Source Water Quality Management Plan to address land-based direct sources not captured by the stormwater system.

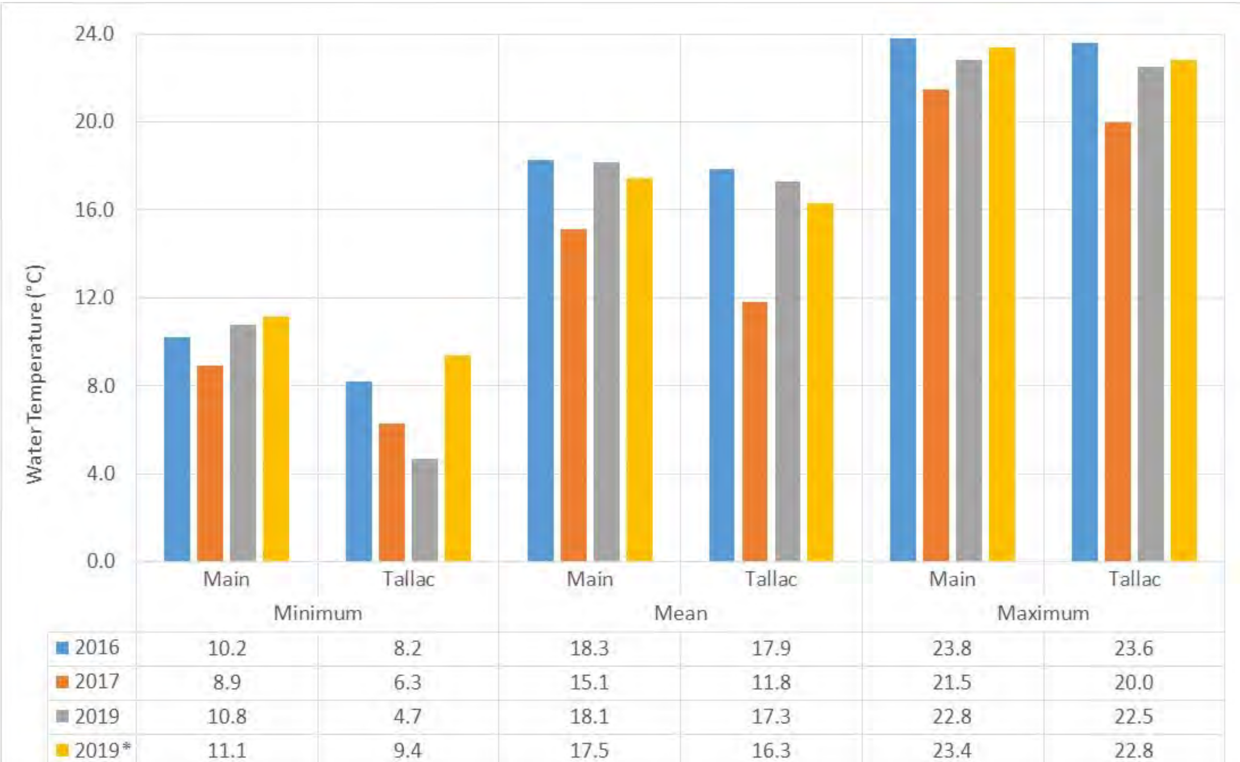
Environmental Setting

This section summarizes information on the existing conditions for water quality constituents in the Tahoe Keys lagoons. Section 3.2, Environmental Health, includes an environmental setting subsection that presents information on existing conditions for herbicides, aluminum, and cyanotoxins. Baseline conditions for aquatic invasive species and other biological components of the Tahoe Keys ecosystems protected by Basin Plan WQOs, TRPA water quality thresholds, and other water quality regulations are presented in Section 3.3.5, Aquatic Biology and Ecology.

Issue WQ-1: Water Temperature Effects. Water temperature can directly impact biological activity and growth in aquatic plants and animals. Aquatic plants and other organisms often have a preferred temperature range in which they thrive. Temperatures that fluctuate above or below the optimal range and the optimal magnitude and/or duration may lead to stress or mortality. Temporal (seasonal and/or diurnal) fluctuations in water temperature are expected in response to changes in thermal radiation, water depth, air temperature, and other physical features such as shading resulting from aquatic weed communities. The seasonal changes in water temperature are affected by the air temperature, daylight extent, and solar intensity which change over the months of the year, whereas diurnal water temperature fluctuations change between day and night. Warmer seasonal water temperatures coincide with longer periods of daylight and increased solar intensity during the summer. Daily water temperatures are highest in the mid-afternoon as heat builds up when the sun is highest in the sky and are lowest after the dark hours of night. Water temperatures are also typically warmer near the water surface from solar radiation and colder in deeper portions of the waterbody. Within areas of deeper water depth, thermal stratification can occur. The warmer, less dense water mass found near the surface resists mixing with the colder and denser water mass at depth.

Intensive measurements of temporal and spatial fluctuations in water temperature have been documented in the West Lagoon and Lake Tallac in 2019 and prior recent years. The mid-depth water temperatures from monitoring completed from April/May to October in 2016, 2017 and 2019 ranged from 8.9 to 23.8°C in the West Lagoon and 4.7 to 23.6°C in Lake Tallac (Figure 3.3.4-1; TKPOA 2017a, 2018b, 2019a; Appendix WQ-1). Inter-annual (between years) variations in mid-depth water temperatures were observed with the coolest mean temperatures recorded in 2017 (Figure 3.3.4-1). Mean and maximum temperatures were warmest in both lagoons in 2016, a relatively dry year with minimal snowmelt runoff and lower water levels compared to the three most recent years. Water temperatures were less variable within the West Lagoon between years compared to Lake Tallac. The inter-annual variability is driven by multiple external factors including weather events (e.g., rain, snow, heatwave), fluctuations in water level, and the cumulative hours of direct sunlight. Intra-annual (within a given year) variability in water temperature was documented at both the near-surface and near-bottom water depths for each lagoon in 2019 (Figure 3.3.4-2).

Overall, water temperatures increased from April/May into July/August as the seasons transitioned from spring to summer, coinciding with an increase in number of daylight hours and air temperatures. Declining water temperatures were then documented from July/August to October as summer transitioned to fall, and daylight hours shortened, and air temperatures declined. Near-surface monthly water temperatures were on average warmer than the corresponding near-bottom waters. Since water temperatures can be directly impacted by factors independent from Proposed Project actions, climatic and major weather events should be considered when evaluating changes in water temperatures within an individual lagoon.



	Minimum Main	Minimum Tallac	Mean Main	Mean Tallac	Maximum Main	Maximum Tallac
2016	10.2	8.2	18.3	17.9	23.8	23.6
2017	8.9	6.3	15.1	11.8	21.5	20.0
2019	10.8	4.7	18.1	17.3	22.8	22.5
2019*	11.1	9.4	17.5	16.3	23.4	22.8

Figure 3.3.4-1 Minimum, Mean and Maximum Mid-depth Water Temperature Values Reported by TKPOA from 2016, 2017 and 2019 and by ESA from 2019 Monitoring at Each Lagoon. Monitoring Extended from April/May to October Each Year.

Early morning and afternoon vertical profile measurements were collected as part of 2019 monitoring at multiple locations within each lagoon (Appendix WQ-1, TKPOA 2019a). Diurnal (daily) fluctuations in water temperature were observed within each of the lagoons, with the warmest water temperatures occurring in the mid-afternoon and coolest occurring prior to sunrise (Appendix WQ-1, Figures 3 and 4). Thermal stratification was frequently apparent in Lake Tallac where water depths were greater than 10-feet. The thermocline (water depth at which the water layers above and below are noticeably different) occurred between five- and 10-feet water depth during the morning and water temperatures exhibited a more immediate decline with depth in afternoons than during the early morning hours. Within the West Lagoon, water temperature remained relatively constant with increasing water depth; however, periods of thermal stratification were evident during the warmer months (June, July and August) near five-10 feet water depth. The deeper portions of the West Lagoon experienced more dramatic declines in water temperature as water depth increased. It should be noted that plants had not "topped out" in May or June and harvesting operations began in July, thus, the worst-case scenario for high surface water temperature variation was likely not observed in 2019. Surface water temperatures would have likely been greater had the plants been allowed to grow to the surface all season long.

Two of the three sites identified for LFA testing have been monitored with water temperature profile measurements. At the West Lagoon site (W4), thermal stratification was not observed in May 2019; however, weak stratification was measured in June and July (Figures 3.3.4-3 and 3.3.4-4). Conversely, the site in Lake Tallac (T12) was strongly stratified May through September and slightly less so in October. A third six-acre LFA site in the West Lagoon began operating in April 2019 with five locations

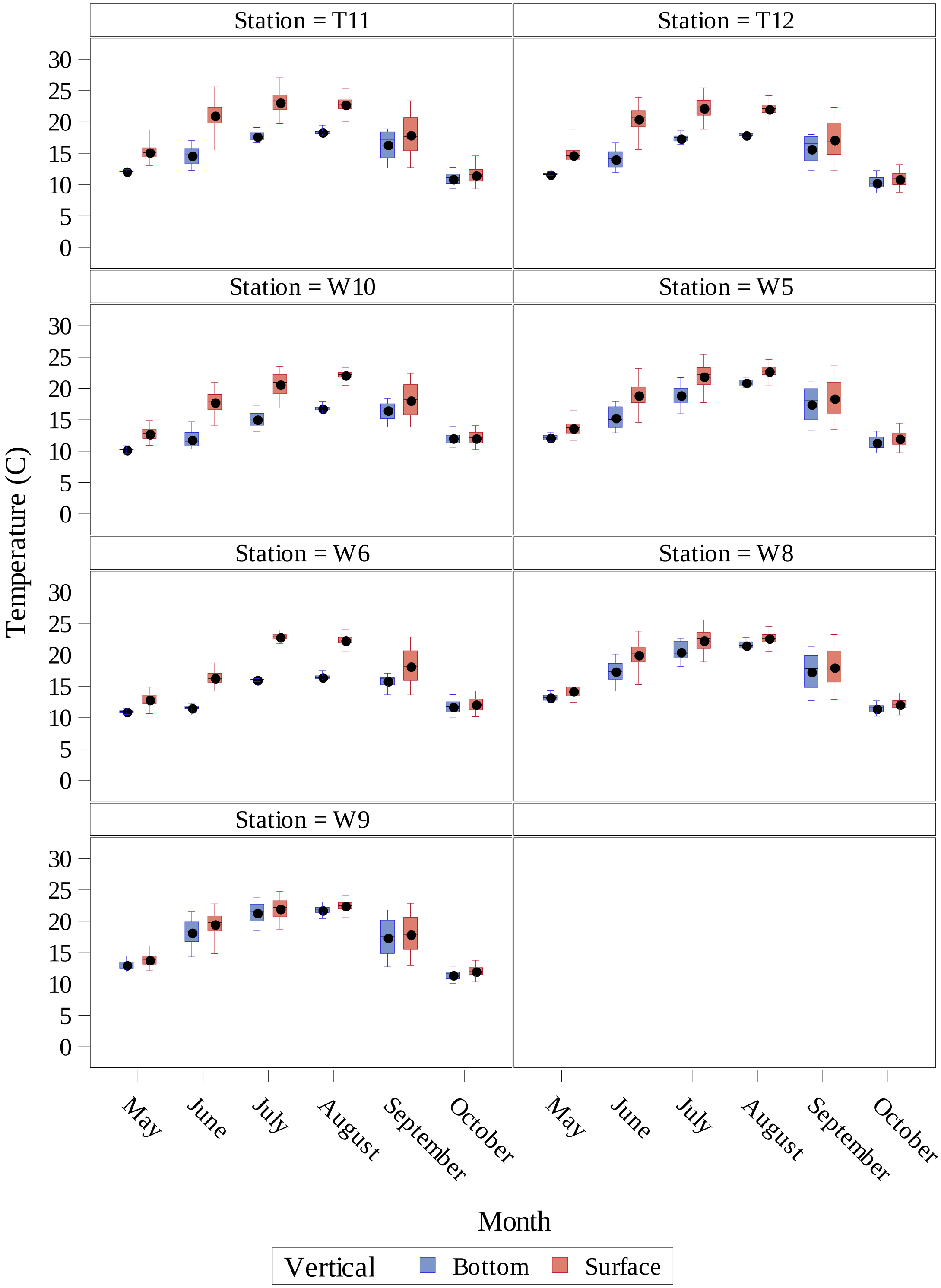


Figure 3.3.4-2 Continuous 15-minute Data: Water Temperature Monthly Box-and-whisker Plots for Near-surface and Near-bottom Depths at Each Tahoe Keys Monitoring Station in 2019 (dot denotes mean, black horizontal line denotes median, and whiskers indicate the 10th and 90th percentiles). Source: ESA 2019.

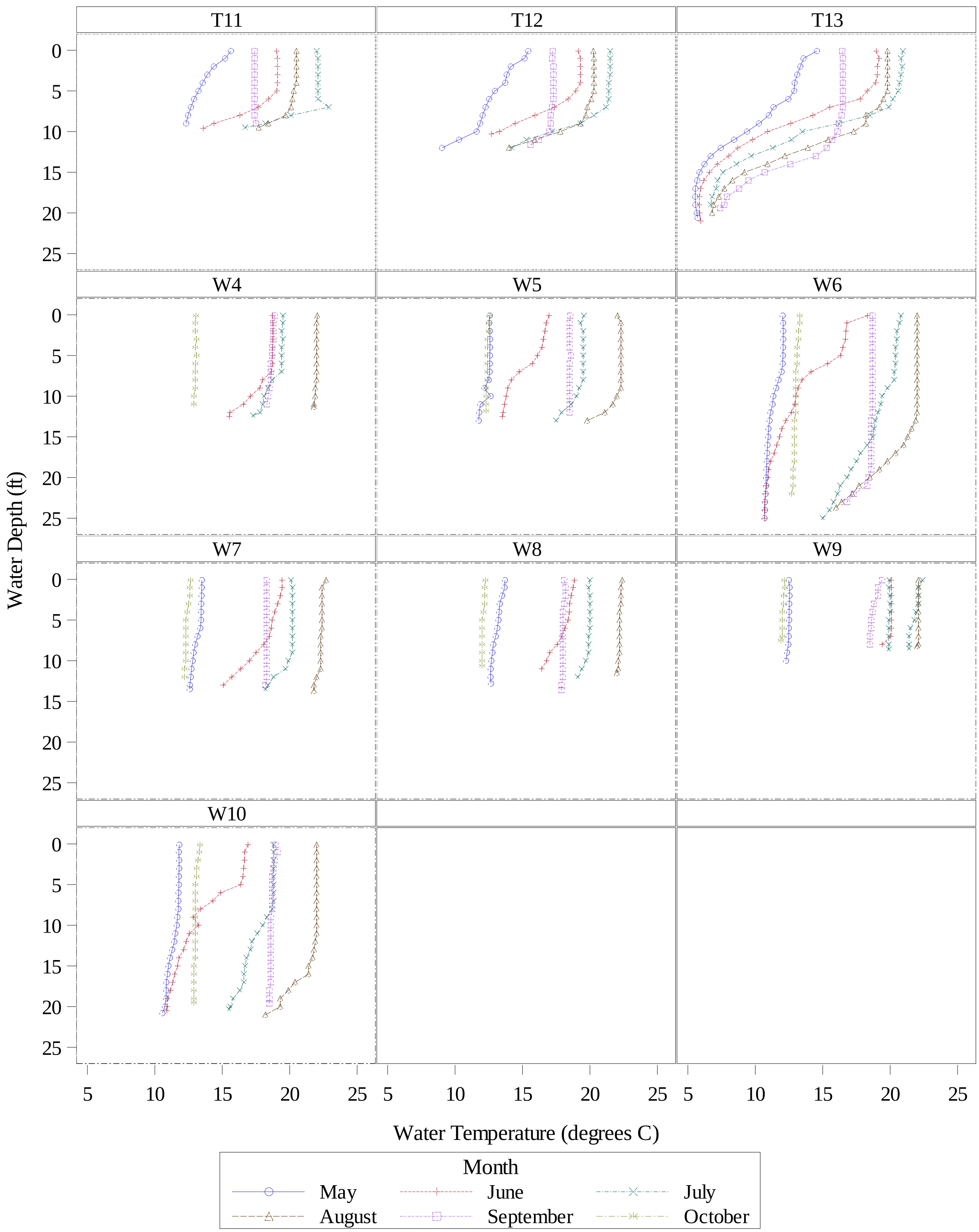


Figure 3.3.4-3 Vertical Profile Morning Water Temperature (^{o}C) Readings in Tahoe Keys Lagoons from May to October 2019. Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019.

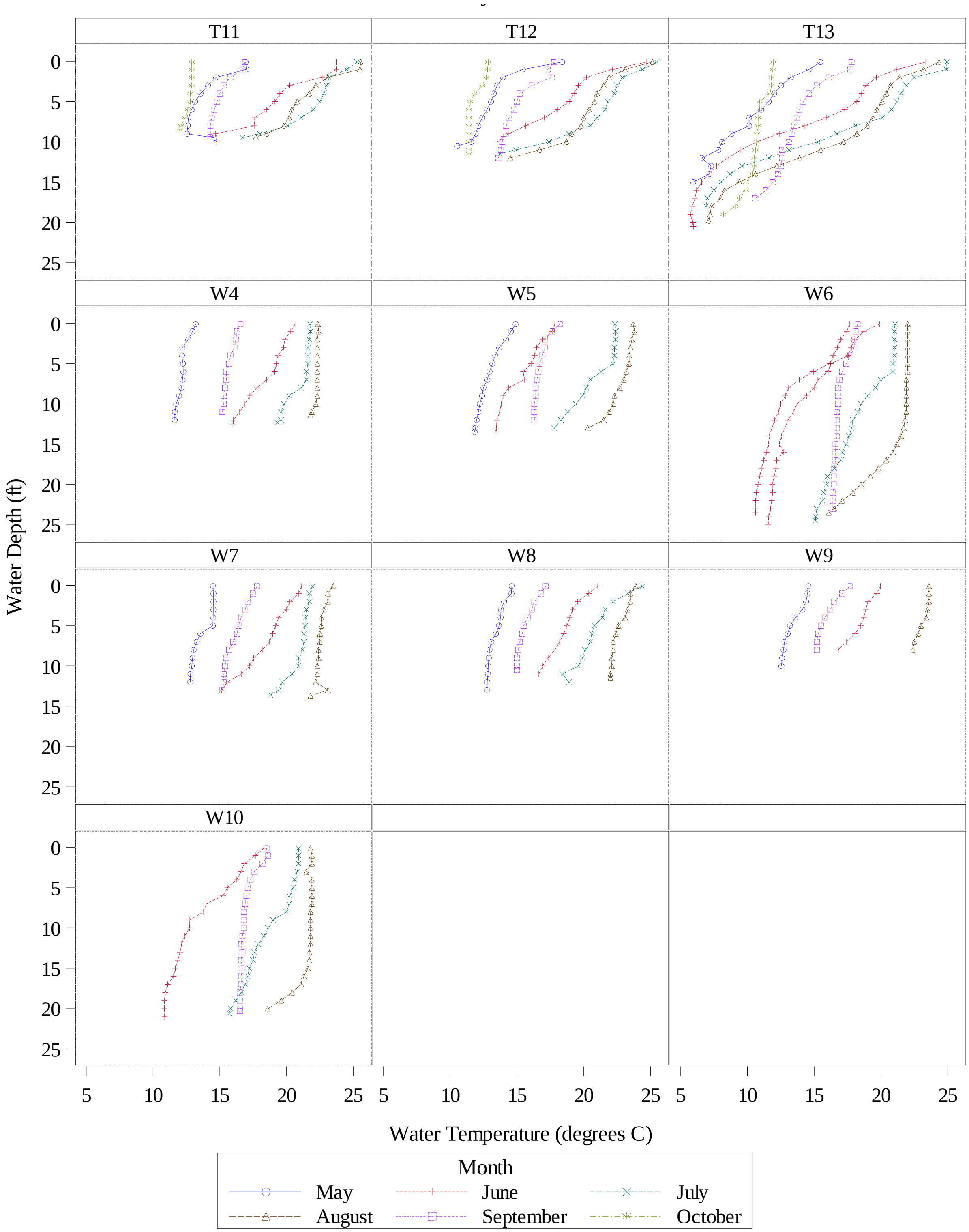


Figure 3.3.4-4 Vertical Profile Afternoon Water Temperature (°C) Readings in Tahoe Keys Lagoons from May to October 2019. Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019.

that were actively monitored into November 2019. In May, the two most northern monitoring sites were weakly thermally stratified. The three other sites had water temperatures of approximately 15°C throughout the water column. As summer progressed, this general trend continued as water column temperatures thermally stratified. The three other sites had water temperatures of approximately 15°C throughout the water column. As summer progressed, this general trend continued as water column temperatures seasonally increased. By August, temperatures across all LFA monitoring sites demonstrated a similar pattern of higher surface water temperatures (e.g., 23°C) and only slightly lower bottom temperatures (e.g., 21.5°C). By September, the trend was similar though surface temperatures had declined. These trends were generally consistent between the LFA monitoring sites, but also a control site of similar depth. It should be noted that most sites in the West Lagoon with similar maximum depths as the proposed LFA test sites did not exhibit strong thermal stratification.

Issue WQ-2: Sediment Disturbance and Turbidity. Secchi depth is not a meaningful measurement in most nearshore areas of Lake Tahoe because the bottom is visible; however, transparency is limited in the Tahoe Keys lagoons and baseline water quality monitoring in 2019 included Secchi depth measurements. Between May and October 2019, Secchi depth ranged from 3.6 to 17.5 feet in the West Lagoon and 3.6 to 7.8 feet in Lake Tallac (Appendix WQ-1). The comparative lack of water clarity in the lagoons can be attributed to resuspension of fine sediments accumulated from aquatic plant decomposition and stormwater, internal cycling of nutrients, shallower and warmer waters that support more algal growth, and limited circulation with and dilution from Lake Tahoe waters. Annual reports on the bottom barrier program implemented by TKPOA have documented that a layer of silt generally accumulates over four-month summer to early fall periods sufficient to support aquatic weed growth, with the silt deposits most likely arising from boat traffic disturbing the fine sediment layer (Hoover 2017, 2018a, 2018b). Removal of the barriers in the fall created a high level of local turbidity that took several hours to clear (Hoover 2017). City of South Lake Tahoe 2016 baseline stormwater modeling estimated fine sediment particle (FSP) loads of 56,700 lb/yr to the West Lagoon and 162,000 lb/yr to Lake Tallac (Burke 2019). In Lake Tallac water turns a dark copper color due to dissolved organic material (e.g., tannins) originating from wetland soils.

Baseline turbidity samples were collected from three depths (near-surface, mid-depth, and near-bottom) in the Tahoe Keys lagoons between June and October 2019 (Table 3.3.4-2). Turbidity sample measurements generally exceeded the 3.0 NTU water quality objective at all sampling sites and during multiple sampling events. Overall, turbidity increased with depth at all stations. 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 West Lagoon were variable, increasing slightly with water depth. In three years of monitoring turbidity at mid-depth locations in the Tahoe Keys lagoons, TKPOA reported generally lower levels compared to 2019 baseline survey results, with average turbidity less than the 3.0 NTU standard (TKPOA 2017a, TKPOA 2018b, TKPOA 2019a).

Issue WQ-3: Dispersal of Aquatic Weed Fragments. The Basin Plan water quality objective for floating materials states that waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect the water for beneficial uses. In the Tahoe Keys lagoons, floating materials that have reached nuisance concentrations or affected beneficial uses are: (1) aquatic plant fragments from mechanical harvesting, and (2) in recent years, surface scum from cyanobacteria booms.

Table 3.3.4-2 Turbidity (NTU) Measurements from Near-surface, Middle, and Near-bottom Depths of the Tahoe Keys Lagoons in 2019.

Area	Station	Date	Near Surface	Mid-Depth	Near Bottom
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
West 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
		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)

Methods currently approved for managing nuisance vegetation in the Tahoe Keys lagoons are identified in the *Integrated Management Plan for Aquatic Weeds for The Tahoe Keys Lagoons* (IMP, TKPOA 2018a). These methods include mechanical control (harvesting), hand-pulling, placement of bottom barriers, diver-assisted dredging or suction removal, and cultural controls (i.e., nonpoint source nutrient management) to manage infestations of Eurasian watermilfoil (*Myriophyllum spicatum*), curlyleaf pondweed (*Potamogeton crispus*), and coontail (*Ceratophyllum demersum*). Mechanical harvesting has been the primary method of managing nuisance aquatic vegetation in the Tahoe Keys Lagoons since the 1980s. One harvesting event has been shown to produce 2,500 to 4,000 fragments per acre, nearly 70 percent of which are within eight inches long (Anderson and Lind 2019) and of sufficient length to support further plant growth (Smart and Barko 1985; Wood and Netherland 2017; Mudge 2018).

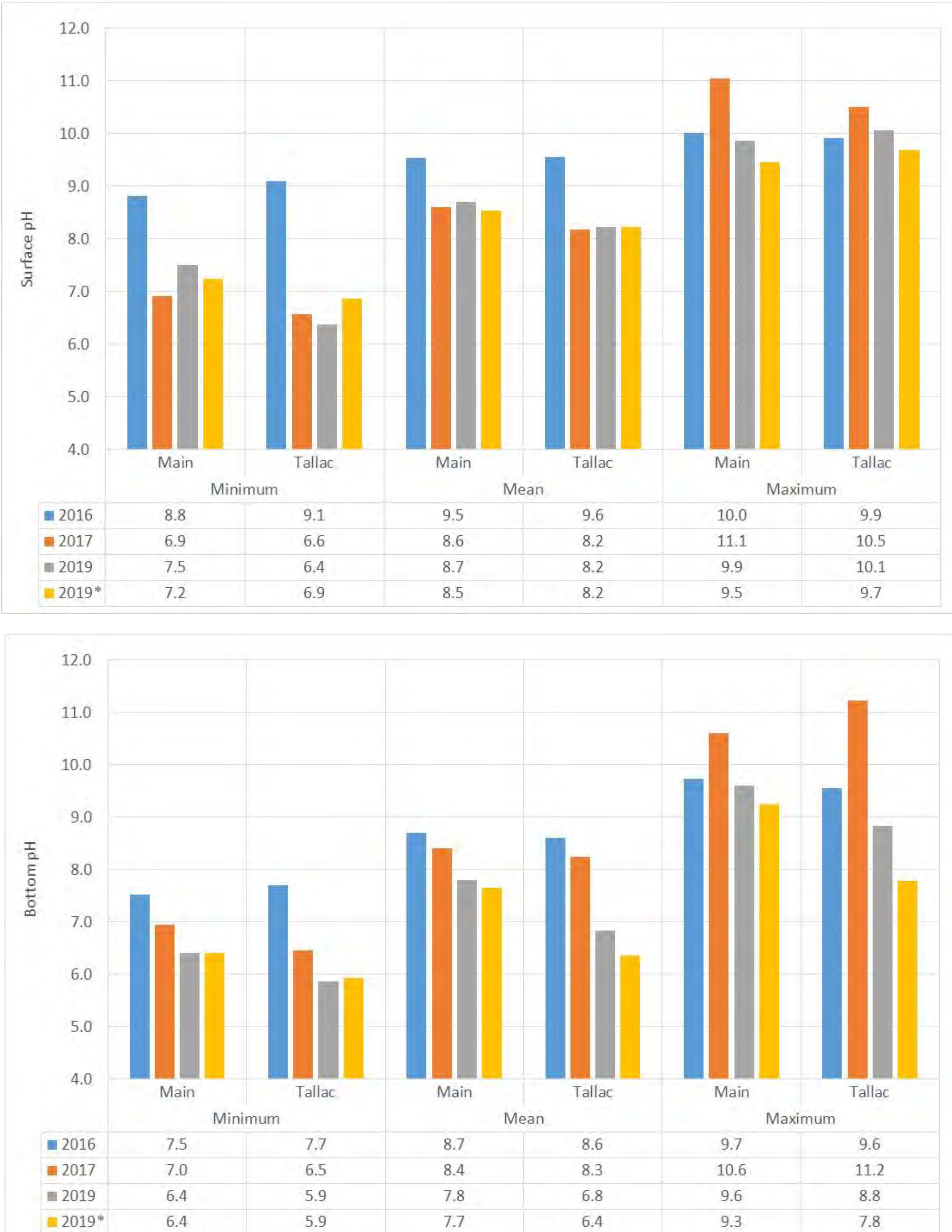
Harvesters are costly to run and maintain (estimated at $2,900 per acre for 145 acres during 2016), can cause fish mortality, and create additional plant fragments that can further spread nuisance vegetation (TKPOA 2018a).

Efforts to limit the spreading of fragments in the lagoons and prevent them from entering Lake Tahoe have increased greatly in recent years, including the use of modified rakes and manual net collectors that follow harvesters, back-up stations near the west channel of the Tahoe Keys Lagoons to dislodge fragments tangled in boat props, bubble curtains to prevent fragments from exiting the west channel, and SeaBins to collect fragments. TKPOA estimated that 159 cubic feet of plant fragments were prevented from entering Lake Tahoe in 2019 using the combined bubble curtain, SeaBins, and boat back-up station (TKPOA 2020a).

Issue WQ-4: Changes in pH. 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. Total alkalinity concentrations averaged 49 mg/L as $CaCO_3$ in the West Lagoon, with little variation between sites and only slightly higher concentrations in near-bottom samples compared to near-surface samples. Concentrations ranged from 42 to 55 mg/L in late May and mid-June. 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 West Lagoon.

pH is the measure of hydrogen ion concentrations (acidity) on a scale of 0 to 14. pH concentrations below 7.0 are acidic, indicating more free hydrogen ions (H^+) are available for chemical processes and reactions to occur. By contrast, pH concentrations greater than 7.0 are alkaline (basic) which means excess hydroxyl (OH^-) ions are present. A pH of 7.0 denotes a neutral solution, with a balance of hydrogen and hydroxyl ions. As it applies to aquatic ecosystems, the measure of pH can indicate chemical changes that are occurring, such as the solubility and biological availability of nutrients and heavy metals. The optimal pH range for aquatic life is 6.5 to 9.0; however, some organisms can survive in water outside this pH range. pH levels can be directly impacted by both natural and anthropogenic factors including meteorological events (e.g., rainfall or snowfall), the surrounding geology (e.g., presence of limestone) or biological processes (e.g., respiration).

Photosynthesis, respiration and decomposition all directly impact pH due to the influence on carbon dioxide (CO_2) levels. Elevated CO_2 levels will depress pH levels resulting in a more acidic environment. Diurnal fluctuations in pH are typically observed in aquatic ecosystems in response to biological activity with lower pH in the early morning (when respiration is most dominant) and higher pH in the mid-afternoon (when photosynthesis dominates). Additionally, pH can change with increasing water depth due to stratification in the water body, where CO_2 levels vary above and below the chemocline (i.e., gradient of separate chemical conditions). Typically, the upper water layer (above the chemocline)



	Minimum Main	Minimum Tallac	Mean Main	Mean Tallac	Maximum Main	Maximum Tallac
2016	8.8	9.1	9.5	9.6	10.0	9.9
2017	6.9	6.6	8.6	8.2	11.1	10.5
2019	7.5	6.4	8.7	8.2	9.9	10.1
2019*	7.2	6.9	8.5	8.2	9.5	9.7

	Minimum Main	Minimum Tallac	Mean Main	Mean Tallac	Maximum Main	Maximum Tallac
2016	7.5	7.7	8.7	8.6	9.7	9.6
2017	7.0	6.5	8.4	8.3	10.6	11.2
2019	6.4	5.9	7.8	6.8	9.6	8.8
2019*	6.4	5.9	7.7	6.4	9.3	7.8

Figure 3.3.4-5 Minimum, Mean, and Maximum Near-surface pH (top panel) and Near-bottom (bottom panel) Values Reported by TKPOA from 2016, 2017 and 2019 and by ESA from 2019 Monitoring at Each Lagoon. Monitoring Extended from April/May to October Each Year.

exhibits higher (more basic) pH concentrations due to active photosynthesis. In contrast, the lower water layer (below the chemocline) displays lower (more acidic) pH concentrations due to increased decomposition and a lack of photosynthesis where light is limited.

In the Tahoe Keys, the Basin Plan WQOs require that pH "*shall not be depressed below 7.0 nor raised above 8.4."* Based on limited data since 2007, pH levels in Tahoe Keys were routinely outside the WQO range (TKPOA 2018b). The minimum near-surface pH concentrations from monitoring efforts completed from April/May to October in 2016, 2017 and 2019 ranged from 6.9 to 8.8 in the West Lagoon and 6.4 to 9.1 in Lake Tallac (Figure 3.3.4-5; TKPOA 2017a, 2018b, 2019a, Appendix WQ-1). The average near-surface pH concentrations ranged from 8.5 to 9.5 in the West Lagoon and 8.2 to 9.6 in Lake Tallac (Figure 3.3.4-5; TKPOA 2017a, 2018b, 2019a, Appendix WQ-1). Based on these reported observations, both lagoons exhibited pH levels outside the WQO criteria over the three years of comprehensive monitoring (2016, 2017 and 2019). Highest mean pH levels occurring during the low-water conditions of 2016, as compared to the following high-water years, were consistent with the finding that higher DO concentrations in 2016 were likely attributable to greater photosynthetic activity.

Intra-annual variability in pH was documented at both the near-surface and near-bottom water depths for each lagoon (Figure 3.3.4-6). Near-surface pH levels were the highest during the period of highest productivity (June to September) within the lagoons, likely due to elevated photosynthesis. Near-surface water pH readings were consistently above the 8.4 maximum criterion during this season. In contrast, the bottom waters reported lower pH levels during the periods of highest productivity, most likely due to increased decomposition. Near-bottom pH readings were depressed below the 7.0 minimum criterion in Lake Tallac and isolated locations in the West Lagoon.

Early morning and afternoon vertical profile measurements were collected as part of 2019 monitoring at multiple locations within each lagoon (Appendix WQ-1, TKPOA 2019a). The vertical profiles were consistent with expected pH trends with depth within biologically productive lakes (Figures 3.3.4-7 and 3.3.4-8). The chemocline (i.e., where pH changes rapidly with depth) was present at approximately five-foot water depth in Lake Tallac and 10-foot water depth in the West Lagoon. As was previously discussed, higher pH levels were observed in the upper layer (above the chemocline) due to increased primary productivity (i.e., photosynthesis), whereas lower pH concentrations were measured below the chemocline where darkness limits photosynthesis and cellular respiration and decomposition are dominant.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Dissolved oxygen (DO) is a measure of the amount of oxygen that is in solution within the water column, and a requirement for most forms of aquatic life. Oxygen is weakly soluble in water, and water temperature and pressure (elevation or hydrostatic) directly impact the capacity of a water body to hold DO in solution. In the absence of effects from biological communities, lower DO values are observed when water temperatures are higher and DO is typically higher when water temperatures are lower. A waterbody at a higher elevation is capable of holding less DO than a waterbody at lower elevations due to differences in barometric pressure. Similarly, DO capacity increases with water depth due to greater hydrostatic pressure. In addition to these physical factors, aquatic biota reduce DO by utilizing it for natural processes (i.e., animal and plant respiration and organic material decomposition). Excessive nutrient loads (i.e., nitrogen and/or phosphorus) create algal blooms which produce high DO concentrations from photosynthetic activity in the upper water layers and also deplete the bottom water DO levels due to the respiration and

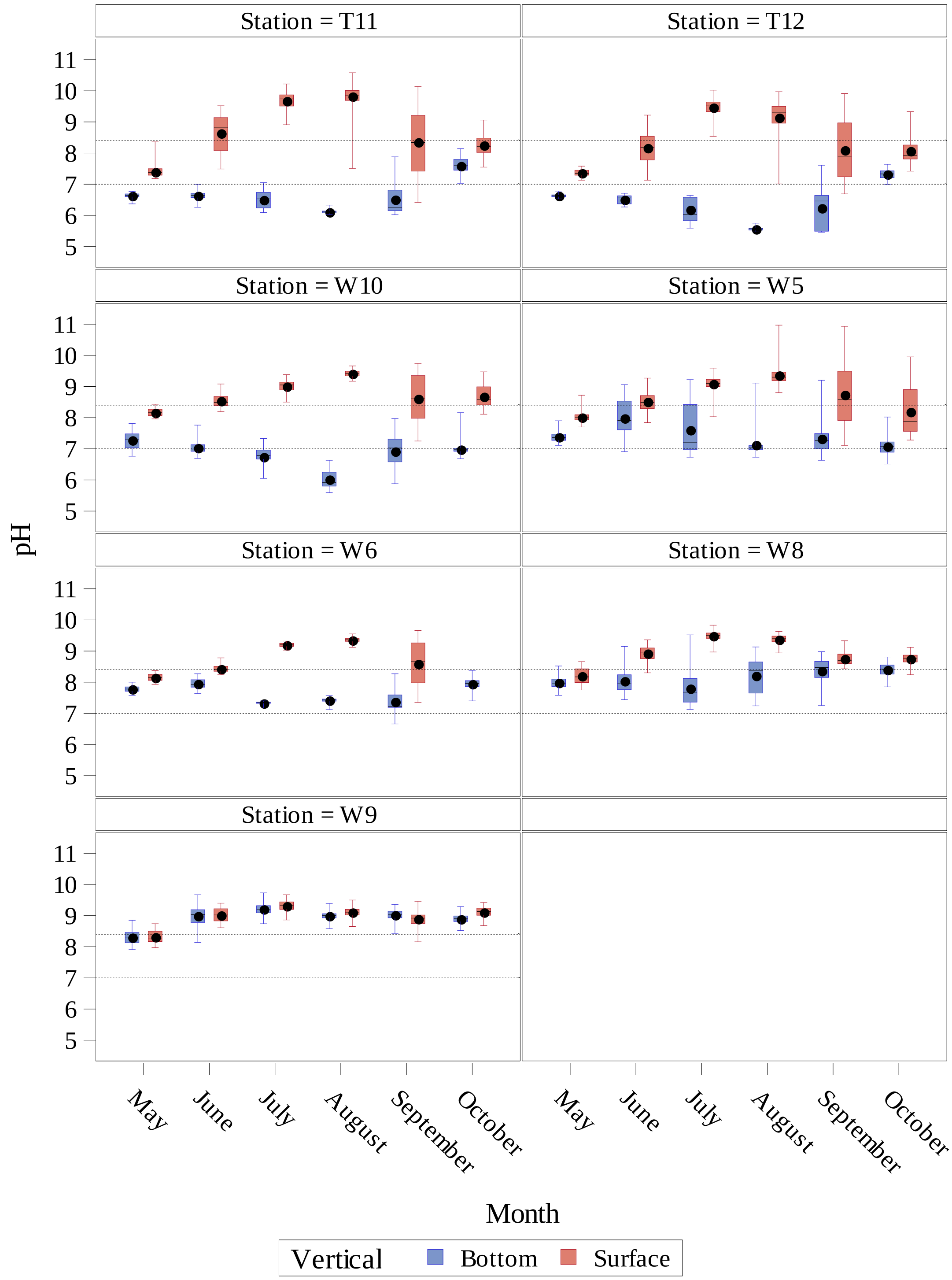


Figure 3.3.4-6 **Continuous 15-minute pH Measurements Monthly Box-and-whisker Plots for Near-surface and Near-bottom Depths in Tahoe Keys Lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal black dashed lines show the minimum criterion [8.0 mg/L]). Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019.**

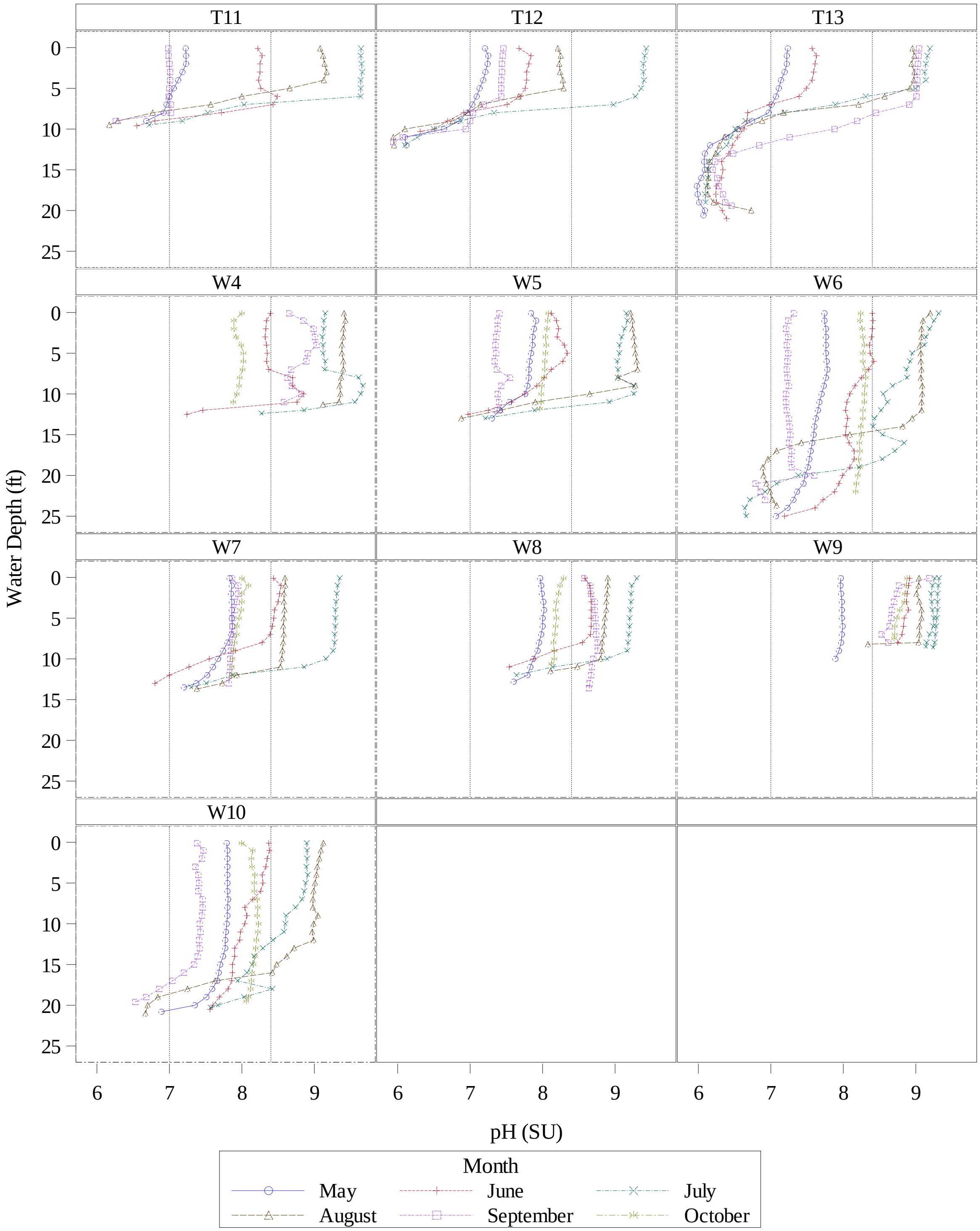


Figure 3.3.4-7 Vertical Morning pH Profiles in the Tahoe Keys Lagoons from May to October 2019 (vertical dash lines show lower [7.0] and upper criteria [8.4]). Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019.

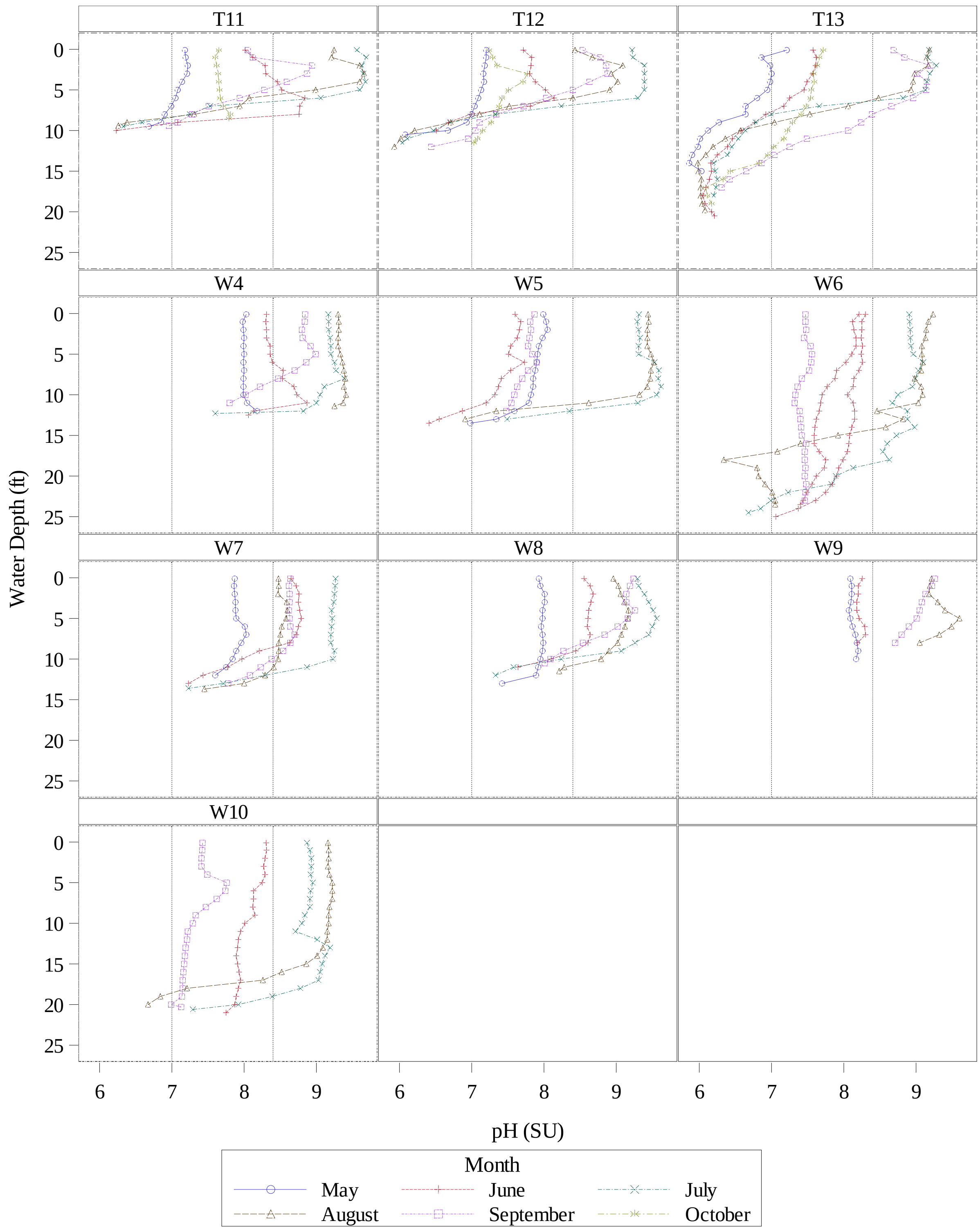


Figure 3.3.4-8 **Vertical Afternoon pH Profiles in the Tahoe Keys Lagoons from May to October 2019 (vertical dash lines show lower [7.0] and upper criteria [8.4]). Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019**.

decomposition of the organic material. Similarly, aquatic plants produce DO from photosynthesis during the day, while DO concentrations decline during the night as the oxygen-consuming processes of respiration and decomposition dominate. Hypoxic conditions (<2.0 mg/L DO) that persist for a prolonged period can be detrimental for many aquatic organisms as oxygen levels become insufficient to sustain some biological functions; these conditions are common in stratified lakes with limited mixing of well-oxygenated shallow waters with deeper waters. Additionally, hypoxic conditions at the sediment/water interface can facilitate the release of sediment-bound phosphorus into the overlying water column, resulting in a pulse of phosphorus available for uptake by phytoplankton or aquatic vegetation.

Inter-annual, intra-annual and diurnal fluctuations in DO are similar to what is observed with water temperature. Temporal and spatial fluctuations in DO have been observed within both lagoons. The minimum mid-depth DO concentrations from monitoring efforts completed from April/May to October in 2016, 2017 and 2019 ranged from 1.1 to 6.7 mg/L in the West Lagoon and 0.02 to 1.4 mg/L in Lake Tallac (Figure 3.3.4-9; TKPOA 2017a, 2018b, 2019a, Appendix WQ-1). Based on these reported observations, DO concentrations in both lagoons fell below the 8.0 mg/L minimum criterion within the three years of monitoring data reported (2016, 2017 and 2019).

Inter-annual (between years) variations in near-surface DO concentrations and percent saturation were apparent in each lagoon (Figure 3.3.4-9, Appendix WQ-1). The greatest mean annual DO concentrations were observed in 2016 with a declining trend in the West Lagoon for the subsequent years. Annual mean water temperatures did not follow a similar pattern and water pressure should have remained relatively constant at the near-surface locations; as such, biological influences (e.g., aquatic vegetation and/or phytoplankton abundance) might be more directly linked to the inter-annual changes in observed DO. It is likely that although mean and maximum water temperatures were higher during the low-water year of 2016, which in itself would result in lower DO concentrations; higher levels of photosynthetic activity produced higher DO concentrations in 2016 as compared to during the high-water years that followed.

Intra-annual variability in DO was documented at both the near-surface and near-bottom water depths at each lagoon (Figure 3.3.4-10). Overall, near-surface DO monthly trends mimicked those observed with water temperature with lower near-surface DO observed during periods of cooler water temperatures (late spring/early fall) when photosynthetic productivity was depressed. Near-surface DO increased during warmer water temperatures exhibiting super-saturation levels likely associated with increased photosynthetic productivity. At monitoring locations deeper than 10-feet, near-bottom DO results showed a different pattern. The greatest DO was observed during periods of cooler water temperatures (late spring/early fall) when the water column was mixed. Depressed DO and extended periods of hypoxia were recorded in the near-bottom waters during periods of warmer water temperature and thermal stratification (i.e., lack of vertical mixing) likely due to increased decomposition and respiration of aquatic vegetation. Near-surface monthly DO measurements were on average greater than the corresponding near-bottom waters. As described above, the West Lagoon and Lake Tallac exhibited periods of depressed DO concentrations and percent saturation in both near-surface and near-bottom waters when compared to the 8.0 mg/L and 80 percent saturation WQO criteria. Similar observations were made when comparing DO existing conditions to the seven-day average WQO criterion (9.5 mg/L; ESA 2019). Within both lagoons, the seven-day moving average DO concentrations at the near-surface locations fluctuated around 9.5 mg/L, sometimes dropping below this WQO criterion (Figure 3.3.4-11).

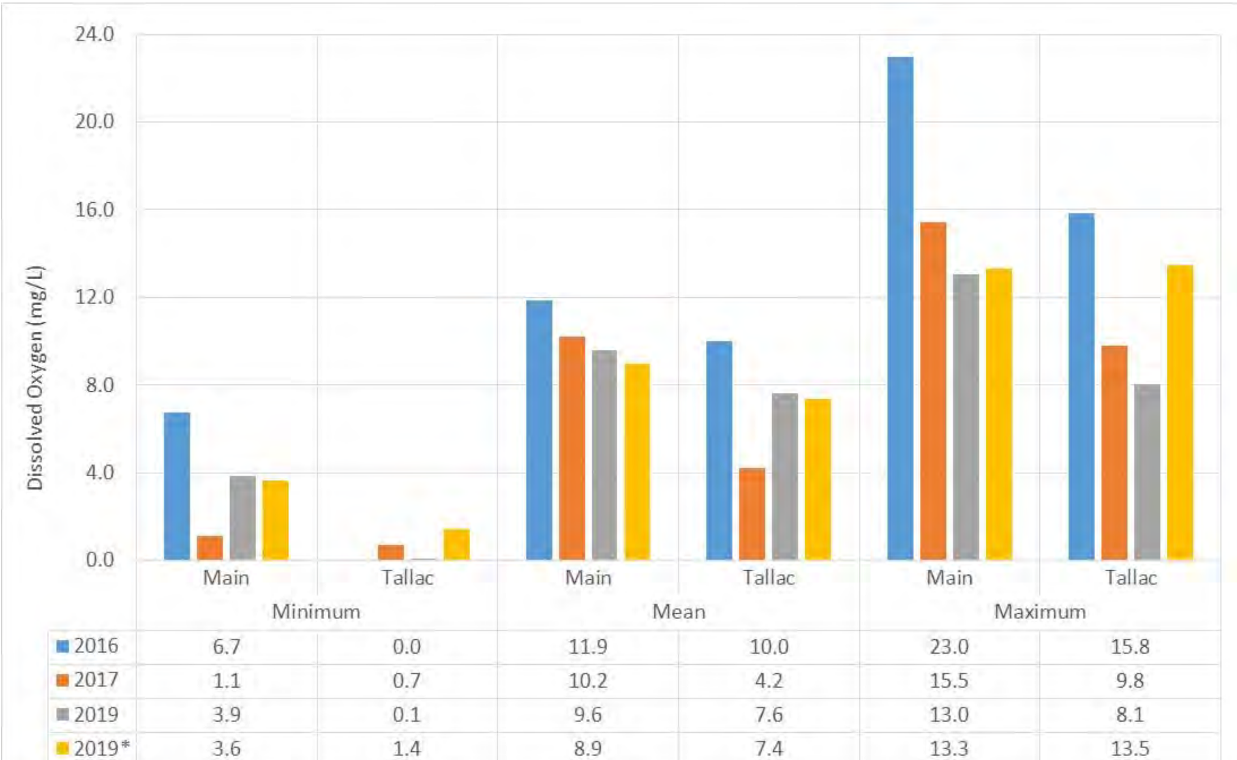


Figure 3.3.4-9 Minimum, Mean, and Maximum Mid-depth DO (mg/L) Values Reported by TKPOA from 2016, 2017 and 2019 and ESA from 2019 Monitoring Effort for Each of the Lagoons. Monitoring Effort Completed Over April/May to October in a Given Year.

The seven-day average measurements from near-bottom recorders were frequently below 9.5 mg/L, and at many locations depressed to anoxic (at or near zero mg/L DO) conditions, with occasional increases in DO attributed to mixing. Low DO concentrations near the water-sediment interface provide suitable conditions for phosphorus release into the overlying water column.

Early morning and afternoon vertical profile measurements were collected as part of 2019 monitoring at multiple locations within each lagoon (Appendix WQ-1, TKPOA 2019a). The vertical profiles were consistent with expected DO trends with depth in biologically productive lakes (Figures 3.3.4-12 and 3.3.4-13). Higher DO concentrations were observed in near-surface waters in which primary productivity (i.e., photosynthesis) was occurring, whereas lower DO concentrations were measured in the deeper, lower productivity waters where darkness limits photosynthesis and respiration is dominant. The water depths where declines in DO were most evident occurred around six feet in Lake Tallac and nine feet the West Lagoon, respectively.

Many areas within the lagoons reported increased DO (>10 mg/L) in the upper zone of the water column, likely associated with aquatic vegetation. DO concentrations were generally below 8.0 mg/L at water depths below 10 feet. Variability in the range of DO concentrations was observed throughout Lake Tallac and the West Lagoon over the 2019 monitoring season.

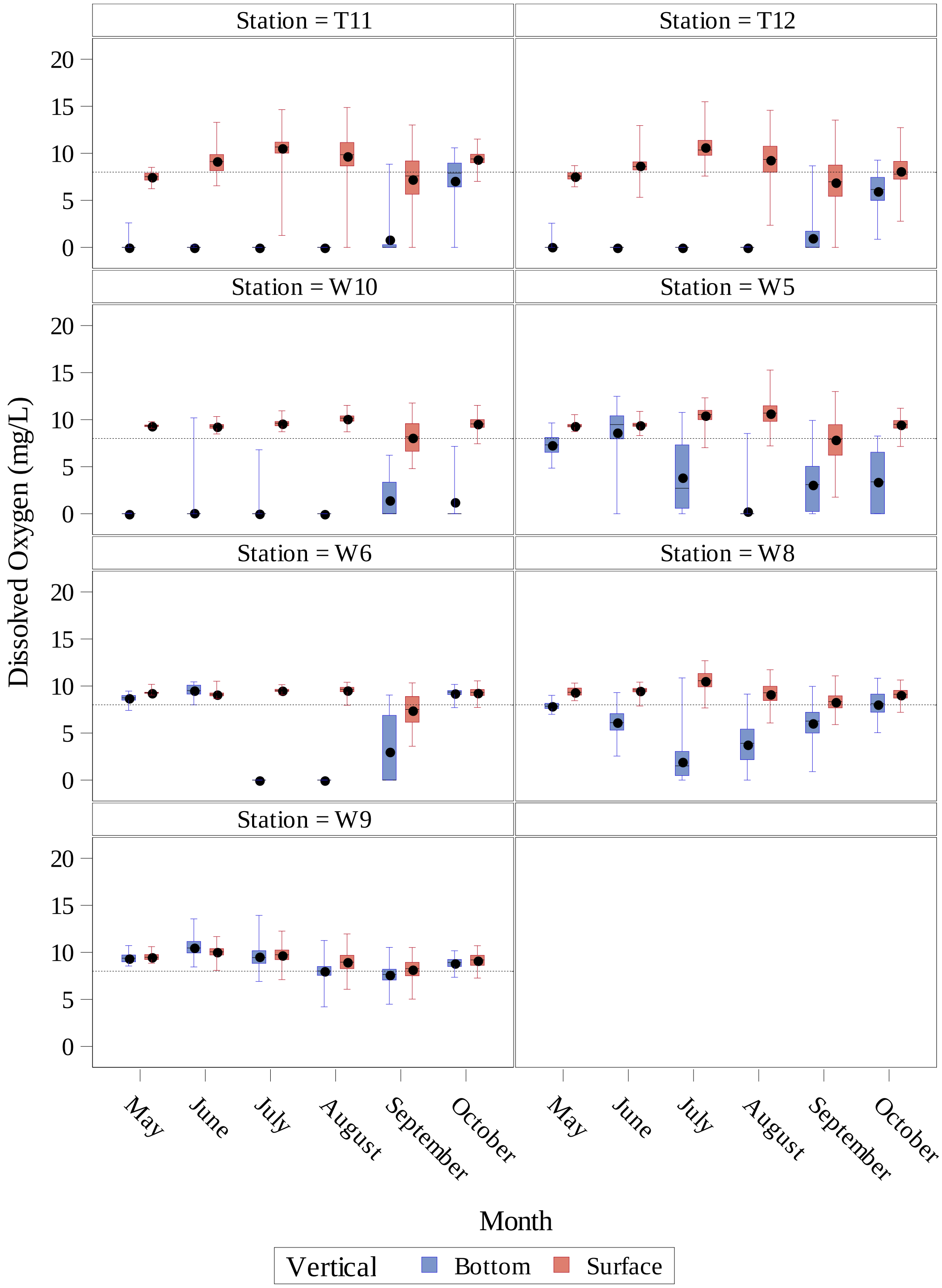


Figure 3.3.4-10 Continuous 15-minute DO (mg/L) Measurements Monthly Box-and-whisker Plots for Near-surface and Near-bottom Depths in Tahoe Keys Lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal black dashed lines show the minimum criterion [8.0 mg/L]). Lake Tallac (T Stations), West Lagoon (W Stations). Source: ESA 2019.

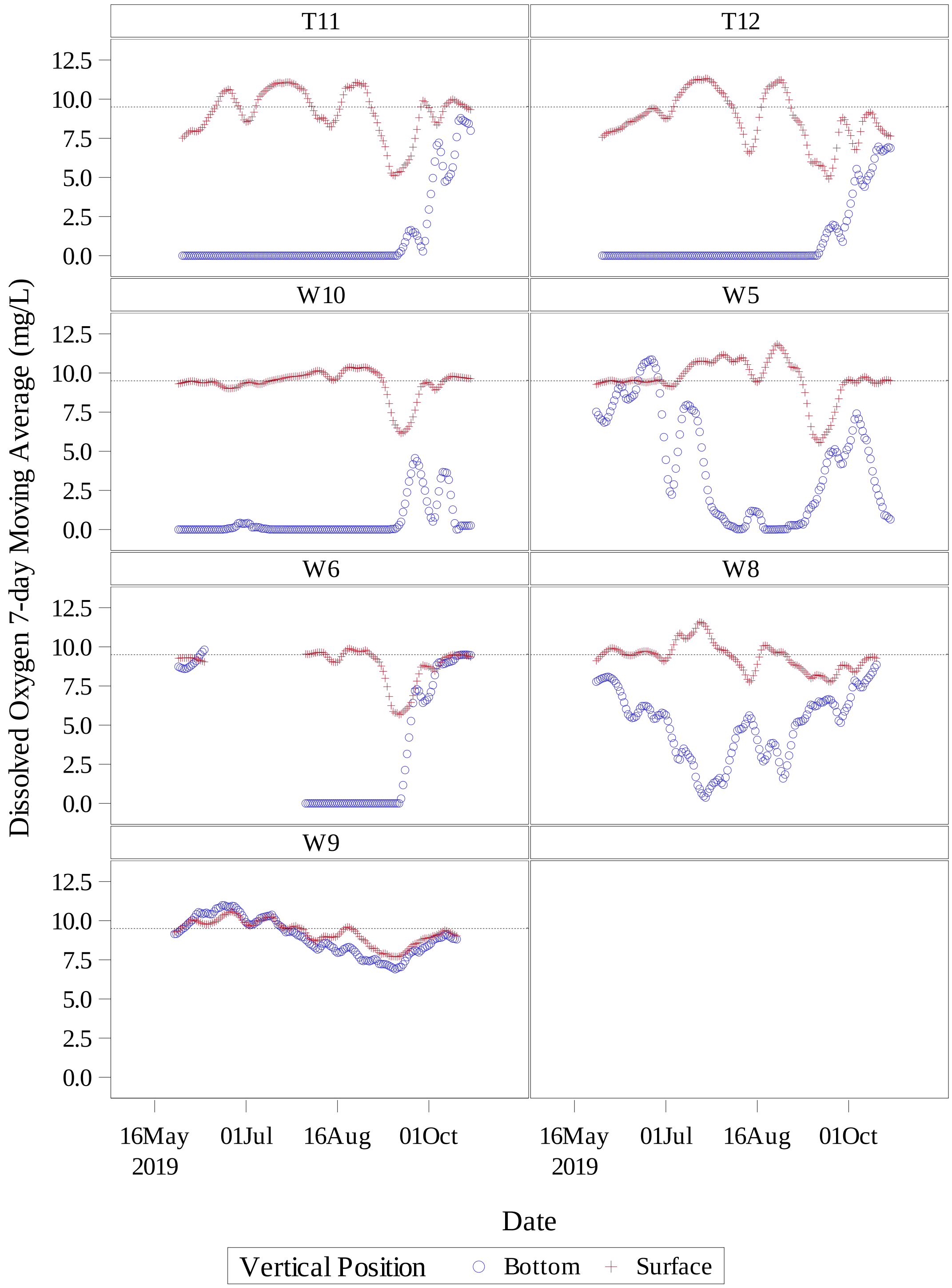


Figure 3.3.4-11 **Seven-day Moving Average DO (mg/L) Measurements Calculated from Continuous 15-minute Readings for Near-surface and Near-bottom Water Depths in the Tahoe Keys Lagoons in 2019 (horizontal black dashed lines indicate the seven-day mean minimum criterion [9.5 mg/L]). Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019**.

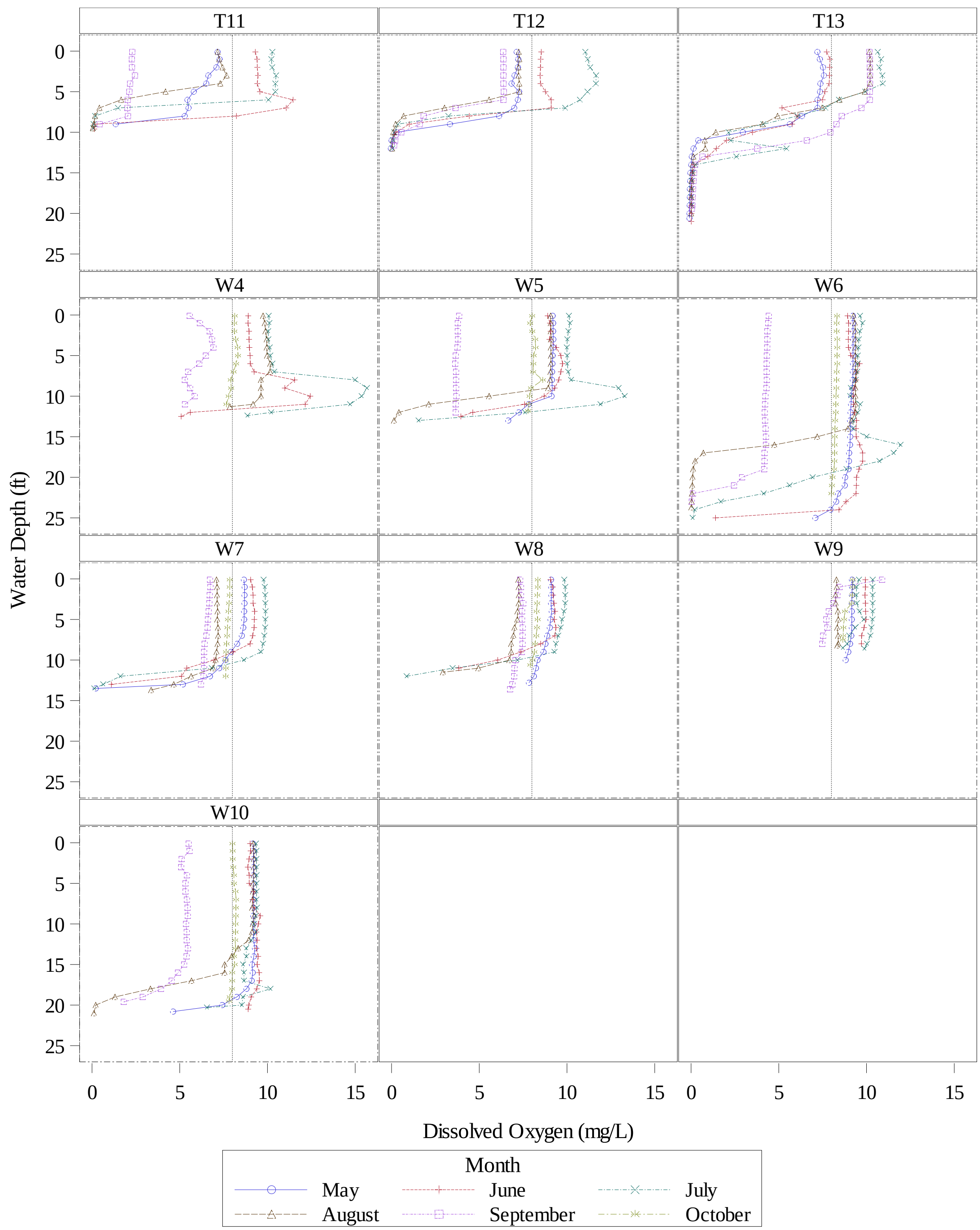


Figure 3.3.4-12 Vertical Morning DO (mg/L) Profile Measurements in the Tahoe Keys Lagoons from May to October 2019 (vertical dashed lines indicate the 8.0 mg/L minimum criterion). Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019.

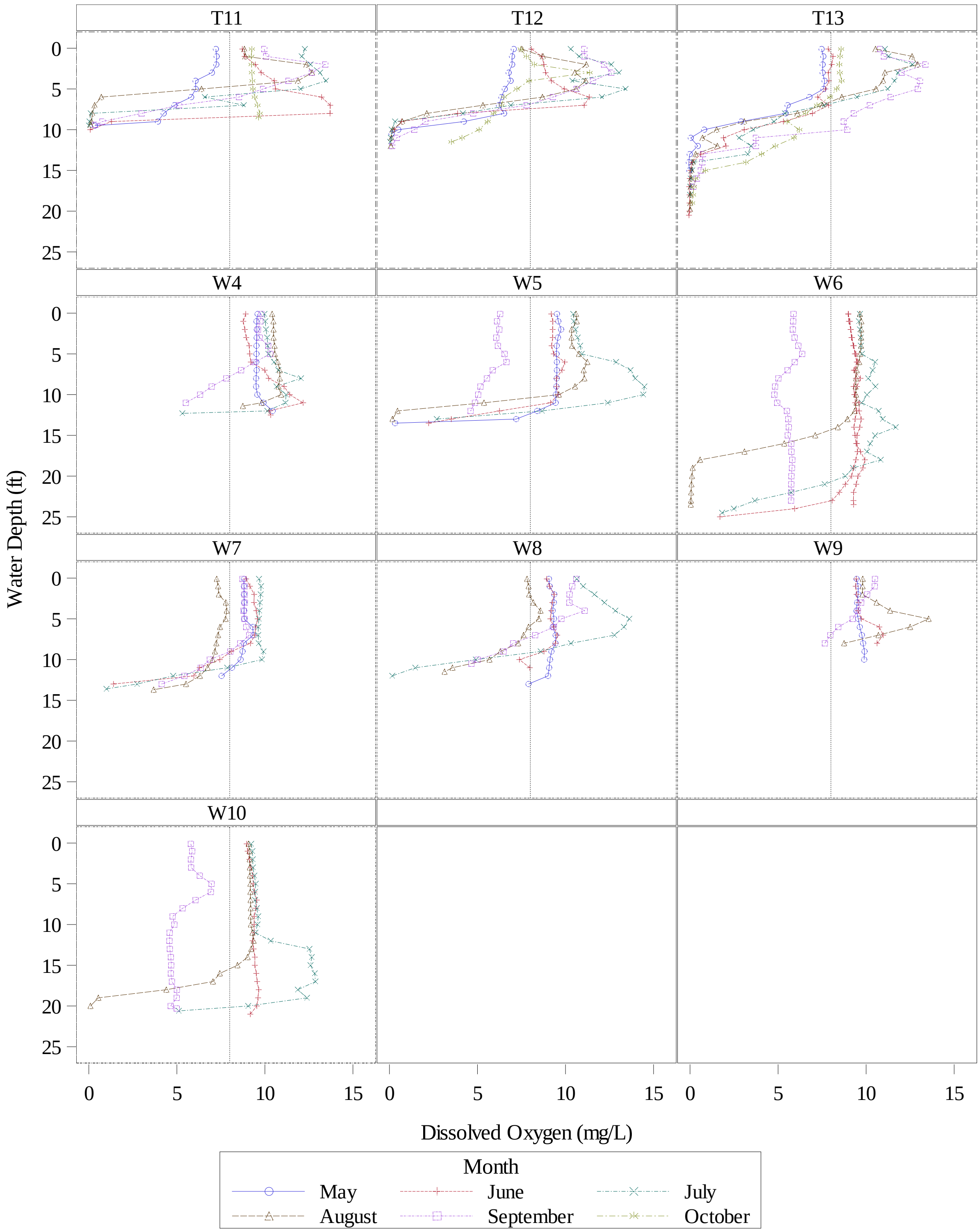


Figure 3.3.4-13 Vertical Afternoon DO (mg/L) Profile Measurements in the Tahoe Keys Lagoons from May to October 2019 (vertical dashed lines indicate the 8.0 mg/L minimum criterion). Lake Tallac (T Stations) and West Lagoon (W Stations). Source: ESA 2019.

Two of the three sites selected for LFA testing have been monitored for DO since 2016, with stratification and deep-water DO depletion and shallow-water oxygen supersaturation evident in the summer.

- At the West Lagoon site (W4), differences in DO concentrations between surface and bottom waters in May varied by less than one mg/L. By late June stratification was evident with increases in DO between five- and 10-feet depth in June and July, likely due to photosynthetic activity.
- Similar to temperature, DO profile results from the monitoring site nearest the proposed LFA test site in Lake Tallac (T12) exhibited strong stratification in May through October with a similar increase in DO between approximately five and 10 feet.

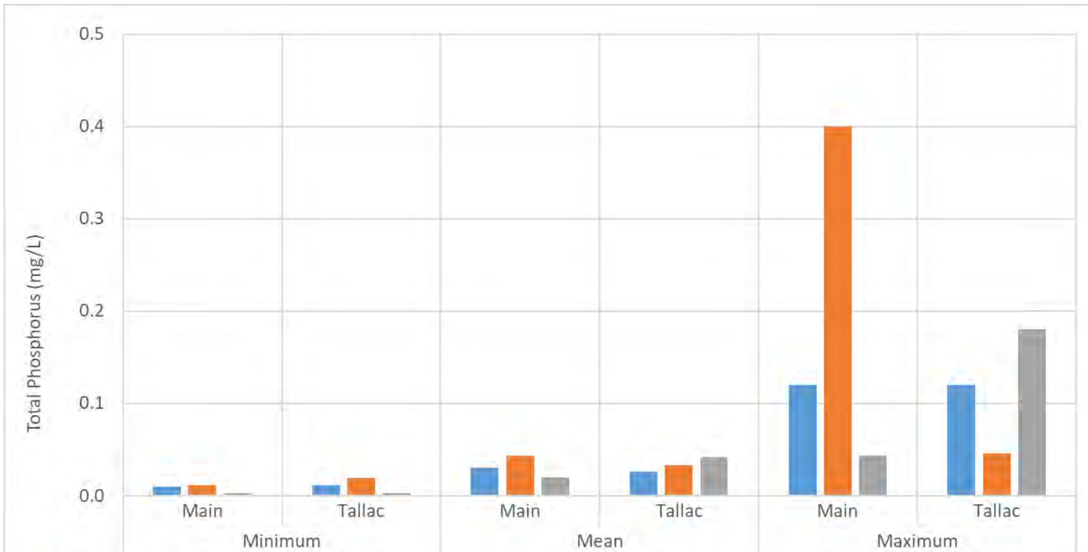
Issue WQ-6: Increases in Total Phosphorus Concentrations. Phosphorus is an important macronutrient necessary for plant and animal growth, but elevated concentrations can result in eutrophic conditions and impacts to water quality affecting beneficial uses. Anthropogenic eutrophication (i.e., excessive primary production due to nutrient supply from human activities) includes elevated phytoplankton production, which depletes the DO levels in the water column resulting in hypoxic conditions (i.e., low DO). Phosphorus is available in organic and inorganic (e.g., phosphate, ortho-phosphate) forms. 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. The primary external sources of phosphorus in Tahoe Keys were from stormwater/irrigation and groundwater inflow. The primary internal source and the overall dominant source of phosphorus was from submerged aquatic vegetation decomposition.

The primary Basin Plan WQO for TP states that concentrations should not be above 0.008 mg/L based on an annual average or 90th percentile and applies to both the West Lagoon and Lake Tallac. The TP concentrations from April/May to October monitoring in 2016, 2017 and 2019 ranged from 0.003 to 0.4 mg/L in the West Lagoon and 0.003 to 0.18 mg/L in Lake Tallac (Figure 3.3.4-14; TKPOA 2017a, 2018b, Appendix WQ-1). The mean TP concentrations in the West Lagoon and Lake Tallac ranged from 0.020 to 0.043 mg/L and 0.026 to 0.042 mg/L, respectively (Figure 3.3.4-14). These sample results were from mid-depths (TKPOA) and near-surface (ESA) depths at each station where light is sufficient to support algal productivity. In 2019, the majority of ambient water samples exceeded the TP WQO (0.008 mg/L) for near-surface and near-bottom waters in both the West Lagoon (76 and 88 percent) and Lake Tallac (78 and 83 percent, Appendix WQ-1).

Annual averages are not available from the TKPOA and ESA monitoring efforts as they were conducted over only a portion of the calendar year; as such, the 90th percentile metric was used to evaluate consistency with the WQO. In 2019, the 90th percentile values for near-surface and near-bottom water samples were 0.16 and 0.23 mg/L in Lake Tallac and 0.034 and 0.053 mg/L in the West Lagoon, well above the TP WQO criterion at both depths in each lagoon. Based on limited data since 2007, Tahoe Keys TP concentrations have exceeded the WQO annually (TKPOA 2018b).

A review of the phosphorus speciation (inorganic vs organic) present in the water column indicates that organic phosphorus (i.e., phosphorus not readily available for nutrient uptake for primary production) is



	Minimum Main	Minimum Tallac	Mean Main	Mean Tallac	Maximum Main	Maximum Tallac
2016	0.010	0.011	0.030	0.026	0.120	0.120
2017	0.011	0.019	0.043	0.033	0.400	0.046
2019*	0.003	0.003	0.020	0.042	0.043	0.180

Figure 3.3.4-14 Minimum, Mean, and Maximum TP Concentrations Reported by TKPOA from 2016 and 2017 and by ESA from 2019 Monitoring at Each Lagoon. Monitoring Extended from April/May to October Each Year.
Note: TKPOA data reported from mid-depth; ESA data reported from near-surface. Near-bottom ESA sample results are not included.

dominant. Ortho-phosphorus is the portion of phosphorus immediately available by phytoplankton and aquatic vegetation for primary production. Ortho-phosphorus concentrations were negligible with many values reported as below the minimum detection limit provided by certified laboratory analysis. The ortho-phosphorus concentrations from April/May to October monitoring in 2016, 2017 and 2019 ranged from 0.003 to 0.015 mg/L in the West Lagoon, and 0.002 to 0.020 mg/L in Lake Tallac (Figure 3.3.4-15; TKPOA 2017a, 2018b, Appendix WQ-1). These sample results were from mid-depths (TKPOA) and near-surface (ESA) depths at each station where light is sufficient to support algal productivity. The low concentrations suggest immediate assimilation of inorganic phosphorus for primary production as it becomes available; thereby, reducing the measurable concentrations within the water column.

One of the factors which drives primary production is nutrient availability. An evaluation of the ratio of nitrogen to phosphorus is a commonly accepted method to determine the limiting nutrient most directly influencing productivity. A nitrogen to phosphorus ratio of 16:1 (by moles) was established as a value suggestive of a shift from nitrogen limitation (below 16) to co-limitation or phosphorus limitation (above 16). This so-called Redfield ratio (Redfield 1958) was on a molar basis (i.e,, number of molecules rather than weight). 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 were 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 one. Consequently, weight-based TN:TP ratios of less than 7.2 in Lake Tahoe 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. Over the period of 2016 to

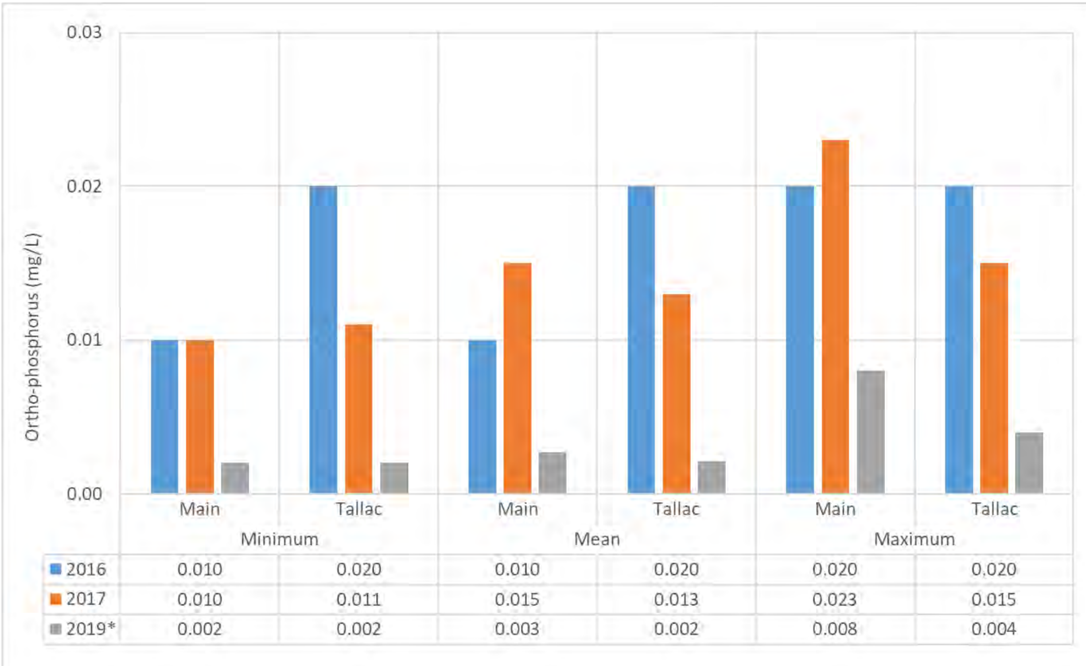


Figure 3.3.4-15 Minimum, Mean, and Maximum Ortho-phosphorus Concentrations Reported by TKPOA from 2016 and 2017 and by ESA from 2019 Monitoring at Each Lagoon. Monitoring Extended from April/May to October each year.
Note: TKPOA data reported from mid-depth; ESA data reported from near-surface. Near-bottom ESA sample results are not included.

2019, the TN:TP ratio ranged between 12 and 15 in the West Lagoon and 10 to 18 in Lake Tallac, suggesting co-limitation by both nitrogen and phosphorus.

In the Nutrient Loading and Nutrient Cycling Conceptual Model constructed for the Proposed Project (Tomasko 2019, Appendix WQ-2), statistically significant correlations were found between both TN and chlorophyll-a and TP and chlorophyll-a in the West Lagoon (Appendix WQ-2). These findings support the conclusion that algal populations in the West Lagoon are influenced by the availability of both TN and TP. In contrast, the model found no correlation between either nutrient and concentrations of chlorophyll-a in Lake Tallac. The basis for such a disconnect between nutrients and algal productivity is not certain, but could reflect the higher levels of colored dissolved organic matter (CDOM; e.g., tannins) that were observed in the waters of Lake Tallac. High levels of CDOM appear to moderate the response of phytoplankton to nutrient concentrations (Tomasko et al. 2016 and references therein).

The sediment TP and orthophosphate content were characterized in July 2019 (Appendix WQ-1). The mean dry-weight TP and ortho-phosphate concentrations were 864 mg/kg and 0.24 mg/kg in the West Lagoon, and 690 mg/kg and 0.24 mg/kg in Lake Tallac. When converted to the same units, the sediment TP contents found in the three lagoons are not particularly enriched from human sources, as compared to a study of sediment TP content from 50 lakes in the Sierra Nevada which found an average of 1.45 mg TP/gdw, equivalent to 1,450 mg TP/kg dry weight (Homyak et al. 2014) – a value higher than the averages for either the West Lagoon or Lake Tallac.

Water chemistry can directly influence the bottom sediments within an aquatic system, and pH and DO levels impact the sequestration within sediments or release of nutrients from the sediments to the overlying water column. Specifically, the periods of hypoxia documented near the bottom of the lagoons on DO (see discussion above for Issue WQ-5) are times when phosphorus was likely released from the sediments to the overlying water column.

Contributing sources of TP to the lagoons are both internal (e.g., aquatic plant decomposition, sediment flux) and external (e.g., stormwater/irrigation, groundwater inflow). Aquatic plant decomposition accounts for the dominant source (79 percent) of phosphorus loads the West Lagoon (Figure 3.3.4-16). In Lake Tallac, aquatic plant decomposition is estimate to account for 42 percent of all TP loads (Tomasko 2019). In Lake Tallac, stormwater runoff was identified as the most important TP loading source, at ca. 52 percent of total loads. In the West Lagoon, stormwater runoff accounted for approximately 13 percent of the TP load (Figure 3.3.4-16). It should be noted that the TP from decomposing aquatic plants is initially from sediments, as the nutrient pools of sediments are the primary source for all the aquatic plant species encountered, other than coontail.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Nitrogen is also a primary macronutrient essential for plant and animal growth. Nitrogen is available in both organic and inorganic (e.g., nitrate, nitrite, ammonium, and ammonia) forms. Examples of human sources of inorganic nitrogen include fertilizer, atmospheric deposition, and industrial or domestic discharges. Plants and phytoplankton readily uptake inorganic nitrogen from the water column.

The primary Basin Plan WQO for TN states that concentrations should not be above 0.15 mg/L based on an annual average or 90th percentile, applicable to both the West Lagoon and Lake Tallac. The TN concentrations from monitoring completed from April/May to October monitoring in 2016, 2017 and 2019 ranged from 0.03 to 1.60 mg/L in the West Lagoon and 0.11 to 0.83 mg/L in Lake Tallac (Figure 3.3.4-17; TKPOA 2017a, 2018b, Appendix WQ-1). The mean TN concentrations in the West Lagoon and Lake Tallac ranged from 0.31 to 0.60 mg/L and 0.36 to 0.53 mg/L, respectively (Figure 3.3.4-17). These sample results were from mid-depths (TKPOA) and near-surface (ESA) depths at each station where light is sufficient to support algal productivity. In 2019, most ambient water samples exceeded the TN WQO (0.15 mg/L) for near-surface and near-bottom waters in both the West Lagoon (79 and 86 percent) and Lake Tallac (94 and 100 percent, Appendix WQ-1).

Annual averages are not available from the TKPOA and ESA monitoring efforts as they were conducted over only a portion of the calendar year; as such, the 90th percentile metric was used to evaluate consistency with the WQO. In 2019, the 90th percentiles for near-surface and near-bottom water samples were 0.63 and 4.41 mg/L in Lake Tallac, and 0.59 and 0.70 mg/L in the West Lagoon, which exceeded the TN WQO. Based on limited data since 2007, Tahoe Keys TN concentrations have exceeded the WQO annually (TKPOA 2018b).

A review of the nitrogen speciation (inorganic vs organic) present in the water column indicates that organic nitrogen (i.e., nitrogen not readily available for nutrient uptake for primary production) is dominant (Seitzinger et al. 2002, Urgan-Demirtas et al. 2008, Bronk et al. 2006). Total Kjeldahl Nitrogen (TKN), a measure of organic nitrogen and ammonia that are not immediately available for primary production, was the major contributed nitrogen form in each lagoon (Figure 3.3.4-18). Inorganic nitrogen (nitrate and nitrite) concentrations were often negligible indicating a lack of nitrogen for uptake. Similar to phosphorus, the lack of inorganic nitrogen in the water column indicates a potential on primary production. Nitrogen and phosphorus co-limitations for algal productivity are discussed above under Issue WQ-6 on total phosphorus.

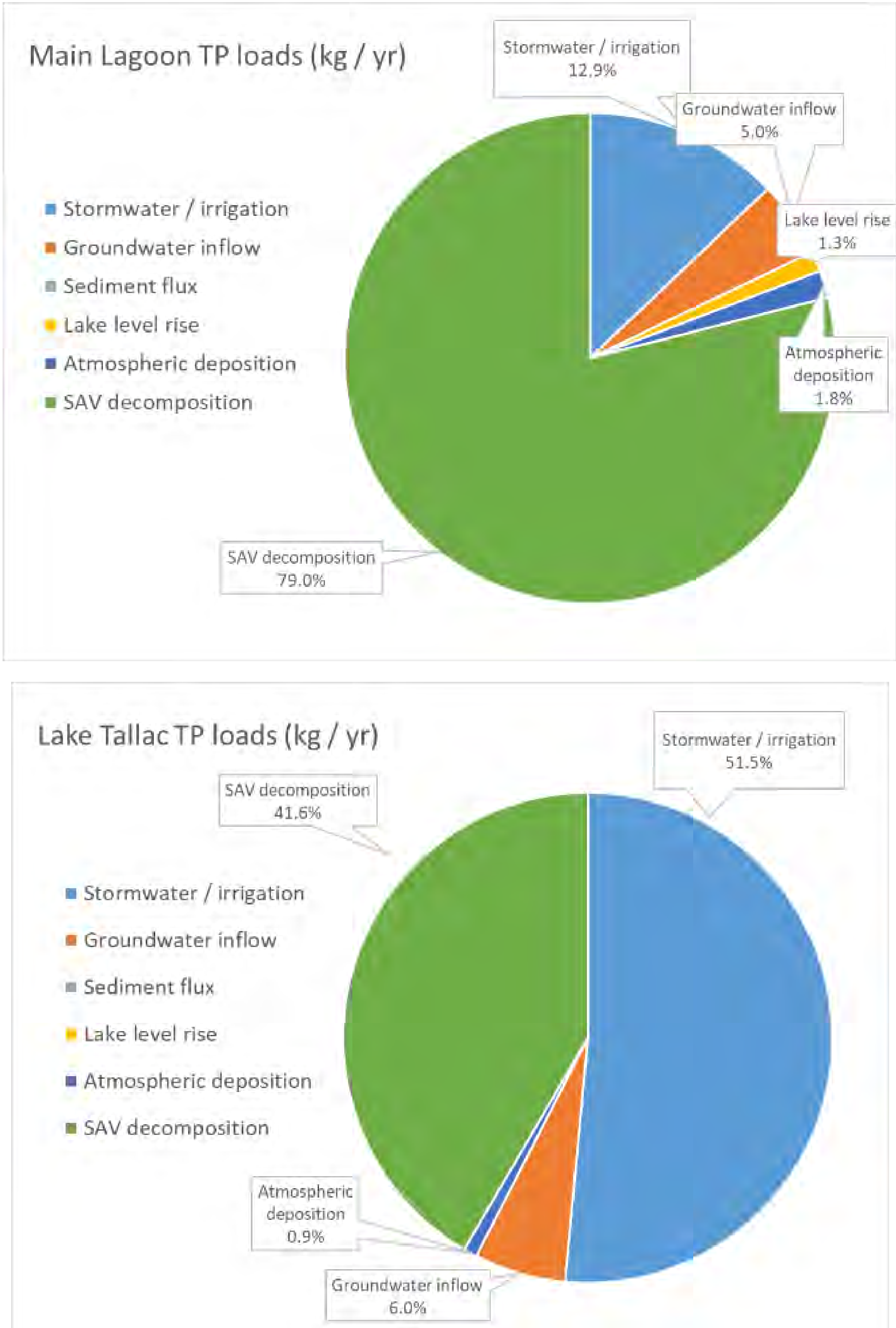
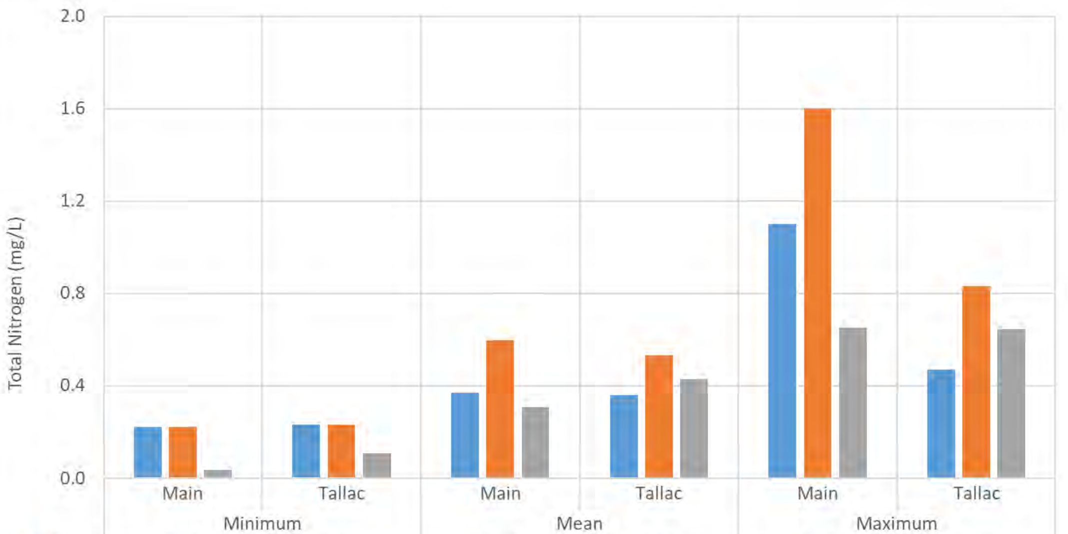
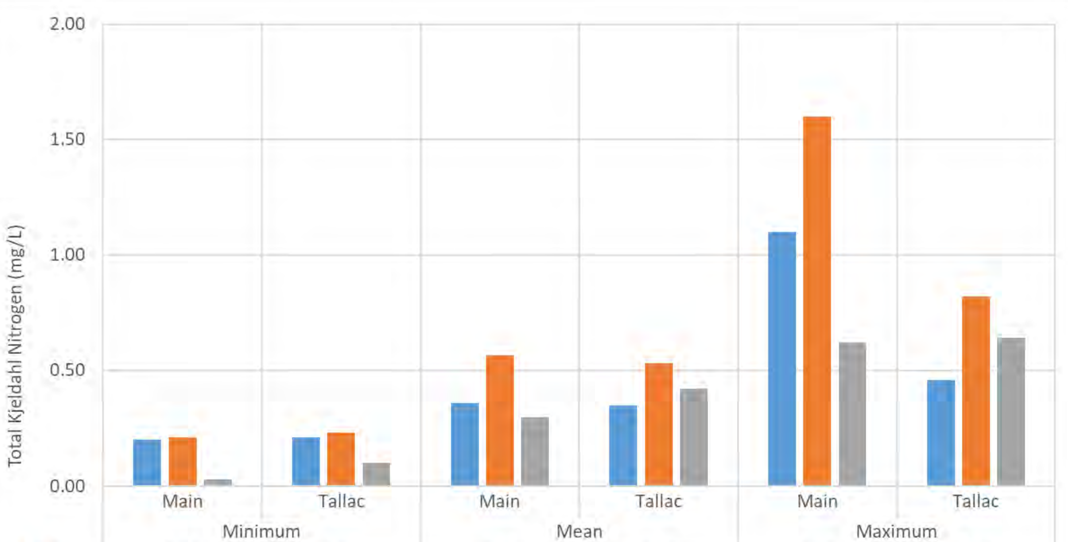


Figure 3.3.4-16 Estimates of TP Loads from Stormwater Runoff and Irrigation, Groundwater Inflow, Sediment flux, Lake Level Rise, Atmospheric Deposition, and Aquatic Plant Decomposition for West Lagoon (top panel) and Lake Tallac (bottom panel).



	Minimum Main	Minimum Tallac	Mean Main	Mean Tallac	Maximum Main	Maximum Tallac
2016	0.22	0.23	0.37	0.36	1.10	0.47
2017	0.22	0.23	0.60	0.53	1.60	0.83
2019*	0.03	0.11	0.31	0.43	0.65	0.65

Figure 3.3.4-17 Minimum, Mean, and Maximum TN Concentrations Reported by TKPOA from 2016 and 2017 and by ESA from 2019 Monitoring at Each Lagoon. Monitoring Extended from April/May to October each year.
Note: TKPOA data reported from mid-depth; ESA data reported from near-surface.



	Minimum Main	Minimum Tallac	Mean Main	Mean Tallac	Maximum Main	Maximum Tallac
2016	0.20	0.21	0.36	0.35	1.10	0.46
2017	0.21	0.23	0.57	0.53	1.60	0.82
2019*	0.03	0.10	0.30	0.42	0.62	0.64

Figure 3.3.4-18 Minimum, Mean, and Maximum TKN Concentrations Reported by TKPOA from 2016 and 2017 and by ESA from 2019 Monitoring at Each Lagoon. Monitoring Extended from April/May to October Each Year.
Note: TKPOA data reported from mid-depth; ESA data reported from near-surface.

Under the correct chemical conditions, sediment nutrients can be available for release to the overlying water column. As such, it is important to quantify the sediment TKN content to evaluate the potential nitrogen pool to support algal productivity. In July 2019, the mean dry-weight TKN concentrations were 523 mg/kg in the West Lagoon and 790 mg/kg in Lake Tallac (ESA 2019). The above-cited study of sediments from 50 lakes in the Sierra Nevada (Homyak et al. 2014) did not include information related to nitrogen, but did display results that indicated that the average TP content of sediments in those lakes was slightly lower than values found for the West Lagoon and Lake Tallac. If nitrogen enrichment follows a similar pattern to that for phosphorus enrichment in terms of lagoon sediments, it would suggest that the lagoon sediments may not be particularly enriched by human activities.

Similar to TP, contributing sources of TN can be both internal and external to the Tahoe Keys West Lagoon and Lake Tallac. The dominant TN source to the West Lagoon was internally derived through aquatic plant decomposition (66 percent) with groundwater inflows being the second largest source at 16 percent (Figure 3.3.4-19). External TN loads to the West Lagoon from stormwater runoff and atmospheric deposition were relatively minor in comparison, seven and eight percent, respectively. In Lake Tallac, more than half of the TN load was contributed through external sources, primarily groundwater (22 percent) and stormwater (33 percent; Figure 3.3.4-19). Aquatic plant decomposition (41 percent) is also an important source of nitrogen to Lake Tallac (Figure 3.3.4-19). It should be noted that the TN from decomposing aquatic plants originates from sediments, as the nutrient pools of sediments are the primary nutrient source for all the aquatic plant species encountered, except coontail which is a floating macrophyte that obtains nutrients primarily from the water column.

In the Nutrient Loading and Nutrient Cycling Conceptual Model (Tomasko 2019, Appendix WQ-2), statistically significant correlations were found between both TN and chlorophyll-a, and TP and chlorophyll-a in the West Lagoon. These findings support the conclusion that algal populations in the West Lagoon are influenced by the availability of both TN and TP. In contrast, the model found no correlation between either nutrient and concentrations of chlorophyll-a in Lake Tallac, as discussed above under issue WQ-6 for phosphorus.

Potential Impacts

Potential adverse and beneficial water quality effects are evaluated in this section for each of the Group A aquatic weed control methods to be tested in the Proposed Project: aquatic herbicides, ultraviolet light, and LFA. Potential effects from the following Group B methods are also evaluated: bottom barriers, impermeable bottom barriers with injection of hot water or acetic acid, diver assisted suction/hand pulling, and spot suction dredging. Generally, potential water quality effects from Group B methods are less than for Group A methods because Group B methods are spot treatments applied to limited areas compared to Group A methods that are applied to entire treatment sites. This section evaluates potential impacts to water quality parameters that could be affected by the Proposed Project, and for which WQOs have been established in the Basin Plan to protect existing or potential beneficial uses (Table 3.3.4-3). Further evaluations of impacts to protect beneficial uses are discussed for environmental health (i.e., municipal and domestic water supplies including drinking water, water contact recreation) in Section 3.2, for fish, benthic macroinvertebrates, and aquatic plants (i.e., cold freshwater habitat; sport fishing; migration of aquatic organisms; rare, threatened or endangered species; spawning, reproduction, and development) in Section 3.3.5, and wildlife habitat in Section 3.3.6.

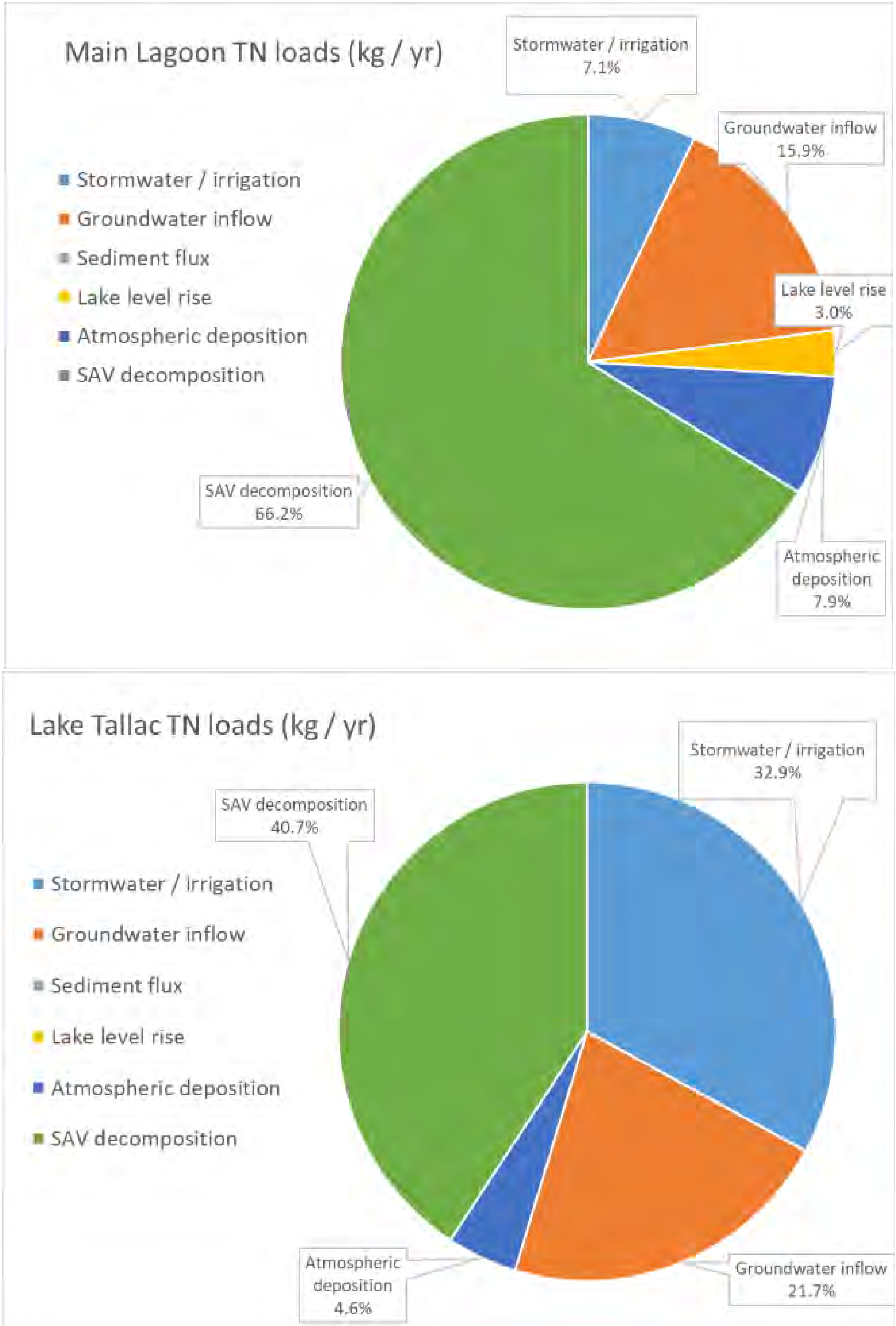


Figure 3.3.4-19 Estimates of TN Loads from Stormwater Runoff and Irrigation, Groundwater Inflow, Sediment Flux, Lake Level Rise, Atmospheric Deposition, and Aquatic Plant Decomposition for West Lagoon (top panel) and Lake Tallac (bottom panel).

Table 3.3.4-3 Basin Plan Existing and Potential Beneficial Uses for Lake Tahoe.

Code	Title of Beneficial Use
MUN	Municipal and domestic supply
AGR	Agricultural supply
GWR	Ground water recharge
NAV	Navigation
REC-1	Water contact recreation
REC-2	Noncontact water recreation
COMM	Commercial and sportfishing
COLD	Cold freshwater habitat
WILD	Wildlife habitat
BIOL	Preservation of biological habitats of special significance
MIGR	Migration of aquatic organisms
SPAWN	Spawning, reproduction and development

Herbicide Testing

Potential effects of proposed herbicide treatments on water quality include both the direct effects of introducing chemical products into the water column at test sites, and indirect effects on water quality constituents resulting from the mortality and decay of aquatic plants. The direct effects of herbicide chemical products are evaluated in the Environmental Health section. Herbicide testing is not expected to cause sediment disturbance and turbidity, or affect dispersal of aquatic weed fragments; therefore, Issues WQ-2 and WQ-3 are not discussed here.

Issue WQ-1: Water Temperature Effects. The Basin Plan Water Quality Objectives (WQOs) specify that the natural receiving water temperature shall not be altered unless it can be demonstrated to the satisfaction of the LWB that such an alteration does not adversely affect the water for beneficial uses. Submersed macrophytes provide an important role in ecosystem function, including habitat and shelter for fish, invertebrates and wildlife. Dense growths of macrophytes, however, reduce wind mixing and promote thermal stratification where surface waters may be substantially warmer than surrounding open water and water under the plant bed (Carpenter and Lodge 1986, Frodge et al. 1990). Increased water temperature can have direct impacts on coldwater biota; indirect effects include a decline in the solubility of dissolved oxygen (DO) available for aquatic organisms. Further, thermal stratification can lead to low DO conditions in deep waters and fluctuations in pH that exceed water quality objectives.

It would be expected that at sites with high plant densities, shallow warm water temperatures may be reduced following herbicide applications as surface waters would be more open and subject to increased wind mixing. However, significant changes in water temperatures have not been well demonstrated in monitoring at herbicide treatment sites in other parts of the country with similar size, target plant species, and selected herbicides. Following an application of the herbicide diquat to control curlyleaf pondweed in a lake in Connecticut, surface water temperatures were strikingly similar between a treated site and an untreated (and sparsely vegetated) site both before and over three weeks after treatment (Robb et al. 2014).

Based on previously described information from other studies, any measurable changes in lagoon water temperatures from herbicide applications would likely be restricted to within and adjacent to the treatment areas, and there would be **no effect** on temperatures in Lake Tahoe. Water quality improvement from reduced stratification in treated areas following herbicide applications is possible but expected to be a **less than significant** effect.

Issue WQ-4: Changes in pH. Herbicide products proposed for testing in the Tahoe Keys lagoons include endothall, which has close to a neutral pH and would not have no adverse effects to existing pH conditions. Safety data sheets (TKPOA 2018d, SePRO 2017) report a weak acid pH of 4.24 for ProcellaCOR EC (florpyrauxifen-benzyl), a pH of 7.4 for Cascade (i.e., endothall), and a weak base pH of 9.5 for Renovate 3 (i.e., triclopyr). Levels of total alkalinity in the West Lagoon and the east end of Lake Tallac (which ranged from 42 to 55 mg/L in late May and mid-June) indicate that buffering capacity can be expected to accommodate the relatively small quantities of herbicide products proposed to be tested without causing changes in lagoon pH that could be harmful to aquatic life. Because of the relatively small quantities of herbicide products applied, dilution within test sites, and buffering capacity of the water, changes in pH directly from herbicide products would be **less than significant**.

Similar to the spatial and diel (i.e., 24-hour cycle) changes in DO, levels of pH are affected by the productivity of aquatic plants and algae in the water. During photosynthesis, aquatic plants use energy from sunlight and consume carbon dioxide, which increases the pH of water. Aquatic plants release carbon dioxide to the water during respiration, which is converted to carbonic acid and lowers the pH. In dense weed beds, the changes in pH between daytime and nighttime can be striking and can have deleterious effects on aquatic organisms such as fish which are harmed when the pH is too low, but also when it is greater than 9.0 or 10 (EIFAC 1969). Carpenter and Lodge (1986) found significant differences in surface pH levels in open water (8.4) compared to a dense weed bed (10.2).

A reduction in aquatic plant biomass from an aquatic herbicide application could improve pH conditions by reducing large spatial and diurnal changes in pH that cause WQO exceedances; however, this beneficial effect would likely be **less than significant** overall for the lagoons given the relatively small areas proposed for herbicide testing.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Herbicide product formulations are proprietary, and information is not available on the chemical oxygen demand (COD) of products such as Renovate 3, ProcellaCOR EC, and Cascade. While COD information can be found for active ingredients, the active ingredients are often a small percentage of the product and may not reflect the COD concentrations of what would be applied. Although the information is not available for direct calculations of oxygen demand, none of the Safety Data Sheets, warning labels, fact sheets, or registration documents for the products proposed for herbicide testing indicate potential concerns for DO impacts directly from COD. Therefore, evaluation of potential DO effects is focused on the ecological response to oxygen demand indirectly from plant decomposition after dieback from herbicide treatment.

As previously mentioned, the amount of DO in water depends on several factors including water temperature, wind speed, atmospheric pressure, photosynthetic rates and other biological processes (Wetzel 2001). Dense growth of aquatic plants can substantially influence the vertical distribution of DO within the water column (Frodge et al. 1990). Differences can be measured not only between a plant bed and the open water, but diurnally within the plant bed. During the day when photosynthesis is occurring, DO levels can be saturated at the water surface, but near anoxic near the bottom (Frodge et al. 1990, Carter et al. 1991).

Biochemical oxygen demand (BOD) is the amount of DO needed for microorganisms to decompose organic material in water. Oxygen is required to support bacterial decomposition of aquatic plants and as decomposition increases, the BOD increases and DO decreases. Rapid decay of aquatic plants can contribute to increased BOD (Jewell 1971, Brooker and Edwards 1974, Carpenter and Greenlee 1981), particularly under conditions of high-water temperature and reduced wind mixing (Cragg and Fry 1986). The application of aquatic herbicides can result in rapid death of aquatic plants, and thus contribute to increased BOD in aquatic ecosystems during decomposition (Brooker 1974, Newbold 1975). Further, under normal growth conditions, respiration (the uptake of oxygen by plants) is compensated by daytime photosynthesis; however, this compensation does not occur once plants are treated and BOD further increases (Nichols 1991). The magnitude of oxygen depletion following an herbicide application is driven by factors such as water temperature, water depth, herbicide mode of action (e.g., contact herbicides result in more rapid plant death), plant biomass and species, and the availability of nitrogen to support decomposition processes (Brooker and Edwards 1975, Almazon and Boyd 1978, Carpenter and Greenlee 1981, Twilley et al. 1986).

Despite the research on the effects of plant decay on lake deoxygenation, there are few published studies that specifically evaluate pre- and post-treatment DO measurements, and none where conditions were similar to those found in the Tahoe Keys lagoons with the same plant species and proposed aquatic herbicides. A review of monitoring reports, as required by the Statewide General National Pollutant Discharge Elimination (NPDES) permit for algae and aquatic weed control applications, did not identify similar scenarios in California for comparison.

The total area proposed for testing of aquatic herbicides or a combination of herbicides/ultraviolet light in the West Lagoon is 13.9 acres (less than 13 percent of the West Lagoon surface area) and the total area proposed for aquatic herbicide treatment in Lake Tallac is 2.8 acres (approximately nine percent of the Lake Tallac surface area). Testing of aquatic herbicides is planned for early in the growing season when the target plants begin rapidly growing (e.g., when the water temperature is greater than 12°C). The first ESA temperature profile measurements collected in 2019 occurred on May 23 (Appendix WQ-1). At that time, all sample sites were at or near 12°C down to nine feet water depth. All proposed treatment sites in the West Lagoon were near nine feet deep in May 2019 (a high water year), and thus can be expected to be at or near 12°C throughout the water column during proposed herbicide testing. The first TKPOA assessment of plant biovolume in 2019 occurred on June 18 when surface water temperature was approximately 18°C. At that time, more than 70 percent of the surveyed area was covered with greater than 70 percent biovolume (West Lagoon only). Similarly, in June 2018, biovolume was more than 65 percent when water temperature was 17.4°C. A survey conducted April 20, 2018 at 9.91°C found just 10.7 percent biovolume. To date, no surveys have been reported for May, but based on water temperature alone it can be estimated that approximately 25 percent of peak seasonal biovolume could be present when the water temperature reaches 12°C and herbicides would be tested.

Baseline monitoring in 2019 documented that water quality is impaired by low DO concentrations in deeper waters throughout Lake Tallac and in many areas of the West Lagoon near sites proposed for herbicide testing, with concentrations well below the 8.0 mg/L minimum criterion and in some cases hypoxic (< 2.0 mg/L) or even anoxic (at or near zero, Appendix WQ-1). A temporary increase in BOD and reduction in DO in test areas is expected during the months when plants are decaying after herbicide treatment. Overall impacts to DO conditions in the lagoons are expected to be **less than significant** given the limited plant biomass in the late spring when aquatic plants would be killed, and the relatively small areas of the lagoons proposed for herbicide testing (i.e., <13 percent of the West Lagoon and about nine percent of Lake Tallac). Furthermore, the use of LFA or other aeration technology at each herbicide test site following plant dieback is expected to offset the effect of BOD from decaying plants and deliver oxygen and beneficial circulation that will improve the current conditions of hypoxia in deeper lagoon waters. An additional benefit is that by killing aquatic plants in the late spring, there would be much less plant biomass in the fall that would naturally die back and consume oxygen during decomposition, so overall the herbicide applications could result in less BOD from plant decay within test sites over the course of the year.

In the long-term, reduction in aquatic plant biomass from an aquatic herbicide application could improve DO conditions in treated areas by creating more open water that improves wind-mixing and reduces stratification. However, the long-term improvement in DO would likely be **less than significant** given the small portions of the lagoons proposed for herbicide tests. Based on previously described information from other studies, any measurable changes in lagoon DO from herbicide applications would likely be restricted to within and adjacent to the test sites, and no effect would be expected on DO in Lake Tahoe.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Increased TP in the water column within and adjacent to treatment areas is expected due to remineralization processes that are likely to occur concurrent with the decomposition of plants at test sites. While not all of the TP content of decomposing plants would be available in the water column, it is likely that perhaps 50 percent of the TP would transition into the water column during decomposition, with most of this remineralization likely occurring within the first 20 days after plant dieback (Walter 2000). These potential internal increases in TP would be a concern in the lagoons both for compliance with WQO criteria and also for increased productivity of phytoplankton and risk of HABs.

In the West Lagoon, increases in TP in the water column would likely occur, which would be expected to increase the abundance of phytoplankton in the water column. The degree of phytoplankton response is likely to correlate with the nutrient increases in the water column associated with plant decomposition and TP remineralization, and the amount of TP remineralization is expected to correlate with the amount of aquatic plant biomass that is treated at any given time. With herbicide treatments proposed to occur in the late spring when aquatic plants are early in their growth and biomass is minimal, and when the water is still cool from snowmelt runoff and low nighttime temperatures, the risk of nutrient uplift resulting in algal blooms (including HABs) can be minimized. In Lake Tallac, water quality data suggest a disconnect between nutrient concentrations and phytoplankton biomass, which indicates that concerns over the potential for triggering algal blooms might be less than is the case with the West Lagoon. As an important issue for environmental health, the potential for increased HABs is discussed in greater detail in Section 3.2.

A temporary increase in TP in the water column is expected during the weeks following aquatic plant dieback from herbicide treatment. Because treatments are scheduled for the late spring when aquatic plants are small and the water is still relatively cool, and because only small areas of the lagoons are proposed for testing, the effects of nutrient increases from decaying weeds are expected to have a **less than significant** effect in increasing HABs or otherwise causing adverse effects. If HABs occurrence does increase in test areas from the CMT, additional mitigation would be applied to address temporary TP releases to the water column and ensure that impacts are less than significant, such as adding a bentonite clay product to remove TP from the water column. Mitigation for potential increases in HABs is discussed further in Section 3.2.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Increased TN in the water column is expected due to remineralization processes that are likely to occur concurrent with the decomposition of plants at test sites. While not all of the TN content of decomposing plants would be available in the water column, it is likely that perhaps 60 percent of the TN would transition into the water column during decomposition, with most of this remineralization likely occurring in the first two to three weeks. In the West Lagoon, increases in TN in the water column would likely occur, and as a co-limiting nutrient with phosphorus, TN increases would be expected to increase the abundance of phytoplankton in the water column. The degree of phytoplankton response is likely to correlate with the amount of nutrient uplift associated with plant decomposition and TN remineralization, and the amount of TN remineralization is expected to correlate with the amount of aquatic plant biomass that is treated at any given time. With herbicide treatments proposed to occur in the late spring when aquatic plants are early in their growth and biomass is minimal, and when the water is still cool from snowmelt runoff and low nighttime temperatures, the risk of nutrient uplift resulting in algal blooms (including HABs) can be minimized. Similar to TP, the lack of correlation between TN concentrations and indicators of phytoplankton biomass in Lake Tallac suggests that an uplift in TN concentrations from plant decay presents less of a risk for algal blooms than in the West Lagoon.

A temporary increase in TN in the water column is expected during the weeks following aquatic plant dieback from herbicide treatment. Because treatments are scheduled for the late spring when aquatic plants are small and the water is still relatively cool, and because only small areas of the lagoons are proposed for testing, the effects of nutrient increases from decaying weeds are expected to have a **less than significant** effect in increasing HABs or otherwise causing adverse effects. If HABs occurrence does increase in test areas, additional mitigation may be necessary. Mitigation for potential increases in HABs is discussed further in Section 3.2.

Ultraviolet Light Treatment

Ultraviolet light treatments could directly affect water temperature by adding heat to the water, and indirect effects on water temperature could result from the dieback of aquatic plants. Other potential indirect effects could be changes in DO and pH, and the release of nutrients to the water column following plant dieback. ultraviolet light testing is not expected to cause sediment disturbance and turbidity, or affect dispersal of aquatic weed fragments; therefore, Issues WQ-2 and WQ-3 are not discussed here.

Issue WQ-1: Water Temperature Effects. In their final monitoring report on a pilot project testing ultraviolet light applications at Lakeside Marina and Beach in South Lake Tahoe, TRCD (2019) addressed the question of how ultraviolet light affects water temperature by reviewing the results of laboratory tests and in-situ monitoring. The 2,000-watt ultraviolet apparatus added to the water 6,820 BTU/hour. After four hours of ultraviolet light application in the laboratory test, a thermometer placed one inch away from the light array measured an increase of 0.9°C, and thermometers placed 12 and 24 inches away measured an increase of 0.3°C. No localized water temperature spikes were recorded in the vicinity of the ultraviolet light array during field testing. Based on a preliminary review of the climatic data and water temperature measurements collected throughout the pre-treatment, active treatment and post-treatment periods, TRCD (2019) concluded that localized water temperature was not affected by the ultraviolet light treatment at the marina and beach sites.

Specific sites proposed for ultraviolet light treatment in the West Lagoon have not been routinely monitored for temperature; however, given the estimated water depths and based on 2019 data, it is likely these sites will be thermally stratified from June through the remainder of the summer and could exhibit slight thermal stratification even into October. Ultraviolet light treatments are proposed for: (1) May/June when water temperatures are generally above 12°C and the plants are expected to be emerging, (2) again in July/August prior to the production of turions (i.e., buds that are dormant in the winter but capable of producing new plants) by curlyleaf pondweed, and (3) in September/October.

The conclusion that heat from ultraviolet light treatments would not significantly affect local water temperatures can be supported using basic physics, and calculations based on the assumed input of energy and the volume of water in a treatment area. The specific heat capacity of water is a fundamental physical property: 4,200 Joules of energy are required to raise the temperature of one kilogram of water by one °C. A 2,000-watt ultraviolet apparatus would add approximately 7.20 million Joules per hour. A one-acre treatment area (areas for ultraviolet testing sites range from 0.79 to 1.76 acres, Table 2-1) with an average depth of eight feet, would contain approximately 9,870 m^3 of water, which would equate to approximately 9.87 million kg of water – a mass of water that would require more than 41 trillion Joules to raise the temperature by one °C. If treating such a one-acre site took 68 hours of continuous ultraviolet light operations with a 2,000-watt array, then approximately 489 million Joules of energy would be added to the water, or a little more than one percent of the energy required to raise the average water temperature by one °C. Because the light array is used approximately eight to 36 inches above the lake bottom (Paoluccio 2020a), it can be expected that warmed water would circulate upward toward the surface and distribute the heat throughout the water column, and the increased water temperature at the test site would not be measurable. If a larger array 16 feet wide by 24 feet long is used, it may have a total of 54,720 watts (Paoluccio 2020a) and add approximately 200 million Joules per hour but be able to treat a one-acre site in half the time (i.e., 34 hours). That amount of energy added to a one-acre site by ultraviolet light radiation could be expected to raise the average water temperature at the site during treatment by less than 0.2°C, and the warming effect would likely dissipate rapidly. Ultraviolet light arrays will temporarily add heat to the water in test areas during the weeks of operation. If real-time monitoring shows water temperature increases that exceed permit limits, then the rate of ultraviolet light treatment would be reduced to ensure that water temperature impacts are **less than significant**.

Issue WQ-4: Changes in pH. Similar to temperature and DO, specific sites proposed for ultraviolet light treatment in the West Lagoon have not been routinely monitored for pH; however, given the estimated depth, it is it is likely these sites will be thermally stratified from June through the remainder of the summer and could exhibit slight thermal stratification even into October, particularly in deeper dead end channels. During the 2017 ultraviolet light treatments in Lake Tahoe, pH was similarly measured throughout the treatments. TRCD (2019) reported that in June, when treatments began, pH averaged 7.5 at approximately four feet below the vessel. This is within historic ranges of 7.3 to 8.8 as were subsequent monitoring months. Again, the reported values do not represent a complete pH water column profile, so the extent to which pH may have been outside the range of WQO criteria was not definitively determined.

Because the first treatments are proposed when standing biomass is low, it is anticipated that there will be a relatively low impact on pH compared to a treatment of "topped out" vegetation. It would be expected that at proposed ultraviolet light treatment sites in the West Lagoon with otherwise high plant densities, pH stratification would be reduced following treatment as surface waters would be more open and subject to increased wind mixing. Further, given the anticipated reduction in decaying biomass, the low pH levels in bottom waters could be slightly increased compared to existing conditions due to reduced plant decomposition. There could also be a lowering of pH due to plant decay after dieback in the fall. However, significant beneficial changes in water column pH profiles have not been well demonstrated in monitoring for other ultraviolet light treatment sites. Because ultraviolet light testing is expected to treat plants when they are small and is only proposed for a total of 11.84 acres (less than 11 percent of the West Lagoon area), including sites where ultraviolet light treatments are proposed to be combined with herbicide testing, effects on overall pH conditions in the West Lagoon are expected to be **less than significant**.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. As discussed above for temperature, specific sites proposed for ultraviolet light treatment in the West Lagoon have not been routinely monitored for DO; however, given the estimated depth it is likely these sites will be thermally stratified from June through the remainder of the summer and could exhibit slight thermal stratification even into October, particularly in deeper dead end channels. During the 2017 ultraviolet light treatments at Lakeside Marina and Lakeside Beach in South Lake Tahoe, DO was similarly measured throughout the treatments. TRCD (2019) reported that in June, when treatments began, DO averaged 7.9 mg/L at approximately four feet below the vessel. This is just slightly less than the reported historical range of 8.0 to 10.0 mg/L (TRCD 2019). Average July DO (10.76 mg/L) was slightly higher than historical ranges (8.0 to 10.0 mg/L), however, August and September were within historic ranges. Again, the reported values do not represent a complete DO water column profile nor do they include night or early morning measurements when DO may be depressed below WQO criteria. Therefore, monitoring data from Lakeside are not sufficient to draw conclusions about the potential effects of ultraviolet light treatment on DO.

A temporary increase in BOD and reduction in DO in test areas is expected during the weeks when plants are decaying after ultraviolet light treatment. Because ultraviolet light testing is expected to treat plants when they are small and is only proposed for a total of 11.84 acres, including sites where ultraviolet light treatments are proposed to be combined with herbicide testing, effects on overall DO conditions in the West Lagoon are expected to be **less than significant**. If real-time monitoring indicated that DO was not meeting permit requirements at a test site, an LFA or other aeration system could be deployed to aerate the water during the period of plant decay and ensure that DO impacts were not significant. And because plant biomass would be reduced earlier in the growing season, BOD from decaying plants would be reduced in ultraviolet light testing areas during the usual period of aquatic plant dieback in the fall. However, the significance of beneficial changes in water column DO profiles have not been well-demonstrated in monitoring at other ultraviolet light treatment sites, and because of the small scale of proposed testing the overall changes in West Lagoon DO conditions would be **less than significant**.

Issue WQ-6: Increases in Total Phosphorus Concentrations. As the biomass of treated aquatic plants is left *in situ* in the ultraviolet light treatment areas, increased TP in the water column is expected due to remineralization processes that are likely to occur concurrent with the decomposition of treated plants. Observations from a pilot test of ultraviolet light at the Lakeside Beach and Marina in South Lake Tahoe indicated that the plant decay and nutrient release processes may be substantially different from ultraviolet light as compared to herbicide treatments. Paoluccio (2020b) observed that treated plants took about 16 days to collapse and then a couple of more days to turn into a fine powder. He attributed these observations to the ultraviolet radiation destroying plant cells. Water quality monitoring during and after the pilot test at Lakeside did not include sampling of nutrients, chlorophyll *a*, or phytoplankton, so no information was available on the release of nutrients to the water column and response in algal productivity following aquatic plant treatments (TRCD 2019).

In the West Lagoon, increases in TP in the water column within and adjacent to test sites would likely occur following ultraviolet light treatments, which would be expected to increase the abundance of phytoplankton in the water column. The degree of phytoplankton response is likely to correlate with the amount of nutrient uplift associated with plant decomposition and TP remineralization, and the amount of TP remineralization is expected to correlate with the amount of aquatic plant biomass that is treated at any given time. These potential internal increases in TP would be a concern in the lagoons both for compliance with WQO criteria and also for increased productivity of phytoplankton and risk of HABs. As an important issue for environmental health, the potential for increased HABs is discussed in greater detail in Section 3.2.

While herbicides are expected to cause plant mortality in one or two days, a week or more of ultraviolet light treatment may be needed to accomplish the dieback of targeted aquatic weeds at each testing site. Similar to herbicide tests, ultraviolet light treatments are planned when plant biomass is limited. An initial round of ultraviolet light treatment in May/June would stunt the growth of plants, and plants are expected to be only a few feet tall during follow-up rounds in the summer and fall (Paoluccio 2020b). While this longer treatment plan could result in a more gradual and limited release of nutrients from remineralization compared to herbicide tests, test areas would be treated with ultraviolet light in the summer and fall when warmer water could increase the risk of HABs. By reducing the plant biomass through ultraviolet light testing, the amount of nutrients released after annual dieback in the fall would be less. In Lake Tallac, water quality data suggest a disconnect between nutrient concentrations and phytoplankton biomass, which indicates that concerns over the potential for triggering algal blooms might be less than is the case with the West Lagoon.

A temporary increase in TP in test areas is likely during the weeks when plants are decaying after ultraviolet light treatment. Because ultraviolet light testing is expected to treat plants when they are small and is only proposed for a total of 11.84 acres, the effects of nutrient increases from decaying weeds are expected to have a **less than significant** effect in increasing HABs or otherwise causing adverse effects. If HABs occurrence does increase in test areas, additional mitigation may be necessary to address temporary TP releases to the water column and ensure that impacts are not significant, such as adding a bentonite clay product to remove TP from the water column. Mitigation for potential increases in HABs is discussed further in Section 3.2.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. As the biomass of treated aquatic plants is left *in situ* in the ultraviolet light treatment, similar to herbicide treatments, increased TN in water column is expected due to remineralization processes that are likely to occur concurrent with the decomposition of treated plants. As described for phosphorus, observations from a pilot test of ultraviolet light at the Lakeside Beach and Marina in South Lake Tahoe indicated that the plant decay and nutrient release processes may be substantially different from ultraviolet light as compared to herbicide treatments. Paoluccio (2020b) observed that the plants took about 16 days to collapse and then a couple of more days to turn into a fine powder. He attributed these observations to the ultraviolet radiation destroying plant cells. Water quality monitoring during and after the pilot test at Lakeside did not include sampling of nutrients, chlorophyll *a*, or phytoplankton, so no information was available on the release of nutrients to the water column and response in algal productivity following aquatic plant treatments (TRCD 2019).

In the West Lagoon, increases in TN in the water column within and adjacent to test sites would likely occur following ultraviolet light treatments, which would be expected to increase the abundance of phytoplankton in the water column. The degree of phytoplankton response is likely to correlate with the amount of nutrient uplift associated with aquatic plant decomposition and TN remineralization, and the amount of TN remineralization is expected to correlate with the amount of plant biomass that is treated at any given time. These potential internal increases in TP would be a concern in the lagoons both for compliance with WQO criteria and also for increased productivity of phytoplankton and risk of HABs. As an important issue for environmental health, the potential for increased HABs is discussed in greater detail in Section 3.2.

A week or more of ultraviolet light treatment may be needed to accomplish the dieback of targeted aquatic weeds at each testing site. Similar to herbicide tests, ultraviolet light treatments are planned when plant biomass is limited. An initial round of ultraviolet light treatment in May/June would stunt the growth of plants, and plants are expected to be only a few feet tall during follow-up rounds in the summer and fall (Paoluccio 2020b). While this longer treatment plan could result in a more gradual and limited release of nutrients from remineralization compared to herbicide tests, test areas would be treated with ultraviolet light in the summer and fall when warmer water could increase the risk of HABs. By reducing the plant biomass through ultraviolet light testing, nutrients released after annual dieback in the fall would be less. In Lake Tallac, water quality data suggest a disconnect between nutrient concentrations and phytoplankton biomass, which indicates that concerns over the potential for triggering algal blooms might be less than is the case with the West Lagoon.

A temporary increase in TN in the water column is expected during the weeks when plants are decaying after ultraviolet light treatment. Because ultraviolet light testing is expected to treat plants when they are small and is only proposed for a total of 11.84 acres, the effects of nutrient increases from decaying weeds are expected to have a **less than significant** effect in increasing HABs or otherwise causing adverse effects. If HABs occurrence does increase in test areas, additional mitigation may be necessary. Mitigation for potential increases in HABs is discussed further in Section 3.2.

Laminar Flow Aeration

LFA has the potential to directly affect water quality by injecting air into bottom waters and the surface layer of sediments, breaking up thermal stratification of the water column, changing the occurrence of low DO/low pH in deep waters and high DO/high pH shallow waters that is present during stratification, changing conditions for the release and mixing of nutrients from the sediment, and disturbing sediments causing increased turbidity. LFA testing is not expected to affect dispersal of aquatic weed fragments; therefore, Issue WQ-3 is not discussed here.

Issue WQ-1: Water Temperature Effects. Three sites have been selected for LFA testing, two of which have been evaluated with water temperature profile measurements since 2016. Monitoring results suggest that the LFA treatment operated by TKPOA in 2019 reduced temperature stratification compared to a control site. A study by Balangoda (2014) measured temperature profiles in shallow (approximately 13 feet) and deep (approximately 30 feet) portions of a lake in North Dakota from June to October over a three-year period under aerated and non-aerated conditions. These study sites consistently exhibited weaker thermal stratification during periods of aeration.

Within and adjacent to LFA testing sites, increased water circulation and reduced thermal density stratification is expected to result in cooler water near the surface and warmer waters at depth. High water temperatures are a factor in promoting algal productivity, so reducing near-surface temperatures could help reduce the occurrence of HABs. Because LFA testing is only proposed for 10.11 acres in the West Lagoon (which includes the six-acre site monitored in 2019) and 2.72 acres in Lake Tallac, any effects on overall temperature conditions are expected to be **less than significant**.

Issue WQ-2: Sediment Disturbance and Turbidity. There is a potential for short-term increases in turbidity from disturbance of fine bottom sediments within and adjacent to new LFA test sites during installation of the air distribution hoses and diffusers that will lay on the bottom of the lagoons. The diffusers may sink into and become covered with fine sediment, resulting in more turbidity when the system is activated, and air bubbles circulate some of the sediment up into the water column. The greatest increases in turbidity would be expected in deeper waters. The amount and duration of any turbidity increases will depend in part on the amount of fine silt and clay in the disturbed sediments. While sand particles would settle in seconds and silt would settle in a few hours, clay particles may stay in suspension and contribute to elevated turbidity for several days.

Based on unpublished 2019 monitoring data from a six-acre LFA test site (Site 26 on Figure 2-4) installed in the West Lagoon in April 2019, mid-depth turbidity was minimally elevated during installation and start-up compared to the control site (TKPOA 2019a). Average turbidity was below the 3.0 NTU water quality objective for the first five days of monitoring sites within the LFA test area, and the maximum turbidity measurement was 4.5 NTU. These data indicate that adverse impacts to turbidity from LFA are likely to be **less than significant**. Turbidity monitoring during LFA installation and startup would be used to determine if any adjustments in methods were necessary to comply with turbidity limits.

LFA has the potential to result in long-term benefits in treatment areas, including a reduction in the amount of fine organic sediments that increase turbidity when they are re-suspended. TKPOA (2020b) reported that the reduction in “muck” thickness around LFA diffusers between April and October 2019 ranged from 0.43 to 2.53 feet; however, these measurements may have been influenced by the development of depressions around the diffusers and not representative of the overall six-acre site. Preliminary information from a pilot-scale test of LFA at Ski Run Marina indicates that the thickness of the “muck layer” was reduced from a range of 10.5 to 29 inches to a range of 5.0 to 8.5 inches in the treatment area. At Indian Lake in Michigan, average sediment thickness was reduced by 2.0 feet over a 16-month period in an area treated with LFA combined with bacterial augmentation (Jermalowicz-Jones 2012). The loss in sediment thickness was attributed to biochemical conversion of sediment organic matter ultimately to nitrogen gas, carbon dioxide, and methane that are released to the atmosphere. A long-term reduction in the amount of fine organic sediment in the bottom of the lagoons from LFA operation could result in less turbidity when sediments are disturbed by boat propellers, bottom-feeding fish, and wind-driven circulation.

Issue WQ-4: Changes in pH. Increased circulation is expected to moderate pH levels within and adjacent to LFA test areas that are at times very high near the surface and low near the bottom. During 2019 monitoring at monitoring site T12 near the proposed LFA test site in Lake Tallac, pH was above the maximum pH criterion (8.4) in the upper six to nine feet of the water column during the summer months, and also below the minimum pH criterion (7.0) in the deepest waters during this same period. In the West Lagoon, pH stayed above the minimum criterion in deep waters with only a few exceptions, but pH was well above the maximum criterion in the upper 10 feet of the water column at most monitoring sites during the summer of 2019. TKPOA measured pH profiles at five monitoring sites in their LFA test site in 2019, finding that pH decreased only slightly with depth and exceeded the 8.4 maximum temperature criterion within the upper 13 feet from June 25 through September 10. Measurements of pH in the control site, however, remained above 8.4 into early October. These results support the expectation that extremes in pH will be moderated by mixing shallow and deep waters in and adjacent to LFA test sites; however, pH will likely still exceed the 8.4 maximum criterion during the summer. Because LFA testing is only proposed for a small portion of the lagoons, the overall change in pH conditions is expected to be **less than significant**.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Direct evidence of how DO concentrations may change at proposed LFA test sites is available from results of DO monitoring by TKPOA in the six-acre LFA site in the West Lagoon in 2019. Results generally showed less summer oxygen depletion in deep waters compared to a control site and ESA monitoring sites of similar depth. By June, bottom DO at the TKPOA control site was down to 2.8 mg/L while DO at their LFA treatment site ranged from 10 to 12.7 mg/L throughout the water column. DO generally remained above 7.0 mg/L throughout the summer in the 2019 LFA test area. Based on these monitoring results from the active LFA monitoring site in the West Lagoon, it would be expected that proposed LFA treatments near W4 would similarly show less summer oxygen depletion. Treatments near T12, could demonstrate decreased oxygen depletion compared to existing conditions, albeit potentially less dramatic due to greater DO and temperature stratification.

As with temperature, these data are consistent with measurements from the shallow water site monitored by Balangoda (2014) where bottom DO under aerated conditions in one year was approximately 5.0 mg/L compared to nearer 1.0 m/L the following year under non-aerated conditions. Bottom DO in the deep water site between aerated and non-aerated years was 3.0 mg/L and 0 mg/L, respectively, indicating LFA treatments have the capacity to improve DO conditions in deep bottom waters during the summer. In addition to direct mixing of oxygenated surface waters with bottom water, LFA is likely reducing BOD and increasing aerobic bacteria and invertebrates for plant decomposition. While DO conditions are expected to improve in LFA test areas, because LFA testing is only proposed for 10.1 acres in the West Lagoon (which includes the six acres monitored in 2019) and 2.7 acres in Lake Tallac, any effects on overall DO conditions are expected to be **less than significant**.

Issue WQ-6: Increases in Total Phosphorus Concentrations. The impacts to water column nutrient concentrations from aquatic plant dieback and remineralization resulting from the use of LFA cannot be estimated with confidence, as compared to aquatic weed management via herbicide application and/or ultraviolet light treatment that have been demonstrated to kill targeted aquatic weeds. Cooke et al. (2005) did not specifically review LFA as a lake management technique; however, 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 aquatic weed management as their stated basis for implementation.

It is possible that there would be an increase in TP availability for algal blooms during initial LFA startup within and adjacent to LFA treatment areas, as nutrient-rich deep waters and sediment could be brought into the upper water column via mixing. These potential internal increases in TP would be a concern in the lagoons both for compliance with WQO criteria and also for increased productivity of phytoplankton and risk of HABs. However, LFA startup and installation is proposed to occur in the spring when the risk of HABs is not as great as in the summer when the water is warmer. In the existing West Lagoon LFA test area that was installed in the spring of 2019, HABs were not documented until late July (TKPOA 2019b). HABs were also present in areas outside the LFA treatment site. Factors leading to HABs occurring in this area are not well understood and may or may not be related to operation of the LFA system; however, preliminary monitoring results from 2019 indicate there is a risk that future HABs could occur in this and other proposed LFA test areas. As an important issue for environmental health, the potential for increased HABs is discussed in greater detail in Section 3.2.

A temporary increase in TP in test areas is possible after the startup of LFA systems. Because sediment sample TP concentrations were not particularly high in sediment samples from the West Lagoon and Lake Tallac, and because LFA startup would occur in the spring, potential short-term nutrient increases from water circulation are expected to have a **less than significant** effect in increasing HABs or otherwise causing adverse effects. If HABs occurrence does increase in test areas, additional mitigation may be necessary to address temporary TP releases to the water column and ensure that impacts are not significant, such as adding a bentonite clay product to remove TP from the water column. Mitigation for potential increases in HABs is discussed further in Section 3.2.

There is a potential for long-term reductions in phosphorus release from sediments to the water column that could occur with the reduction and/or elimination of anoxic bottom waters, as bottom water hypoxia is positively correlated with sediment TP fluxes. However, neither the West Lagoon nor Lake Tallac exhibited sufficiently high sediment TP concentrations to indicate that TP fluxes were a major source of internal nutrient loads, so it is uncertain whether a benefit would be realized in terms of reducing internal TP loading and this effect is considered **less than significant**.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Based on limited data, it is possible that there would be an increase in TN availability for algal blooms during initial LFA startup, as nutrient-rich deep waters and sediments could be brought into the water column via mixing. These potential internal increases in TN would be a concern in the lagoons both for compliance with WQO criteria and also for increased productivity of phytoplankton and risk of HABs. However, LFA startup and installation is proposed to occur in the spring when the risk of HABs is not as great as in the summer when the water is warmer. In the existing West Lagoon LFA test area that was installed in the spring of 2018, HABs were documented in the summer of 2019. Factors leading to HABs occurring in this area are not well understood, and there is a risk that future HABs could occur in this and other proposed HABs test areas. As an important issue for environmental health, the potential for increased HABs is discussed in greater detail in Section 3.2.

A temporary increase in TN in test areas is possible after the startup of LFA systems. Because sediment sample TN concentrations were not particularly high in sediment samples from the West Lagoon and Lake Tallac, potential short-term nutrient increases from water circulation are expected to have a **less than significant** effect in increasing HABs or otherwise causing adverse effects. If HABs occurrence does increase in test areas, additional mitigation may be necessary. Mitigation for potential increases in HABs is discussed further in Section 3.2.

There is a potential for long-term reductions in nitrogen release from sediments to the water column that could occur with the reduction and/or elimination of anoxic bottom waters, which could reduce the fraction of TN that is in the more problematic (for algal uptake) and/or toxic forms, such as ammonia and ammonium. Any increase in dissolved oxygen levels in bottom waters would likely increase the proportion of TN in the form of nitrate and/or nitrite, which are typically not capable of producing the same amount of algal growth response as occurs with ammonium, for example. However, neither West Lagoon nor Lake Tallac sediment samples contained sufficiently high TKN concentrations to indicate that nitrogen fluxes from sediment were a major source of internal nutrient loads, so it is uncertain whether aerating surficial sediments with an LFA system would produce a beneficial reduction in internal TN loading and this effect is considered **less than significant**.

Combined Herbicide and Ultraviolet Light Treatments

At test sites where a combination of herbicide applications and ultraviolet light treatment are proposed, impacts to water quality are expected to be a blend of the effects described above for each of these two treatment activities. Herbicides would be applied in approximately one-third of these areas, around the perimeter where access would be more difficult for operating the ultraviolet light array, and ultraviolet light treatments would be tested in approximately two-thirds of the combination test sites. As discussed above, water quality impacts from herbicide and ultraviolet light testing would be **less than significant** after mitigation.

Group B Methods

The evaluation of potential impacts for Group B weed control testing is limited to temperature increases from injecting hot water under bottom barriers, pH decreases from injecting acetic acid under bottom barriers, and increased turbidity within and adjacent to test areas where Group B methods are implemented. Testing Group B methods is not expected to affect dispersal of aquatic weed fragments, change DO concentrations, or increase nutrient concentrations; therefore, Issues WQ-3, WQ-5, WQ-6, and WQ-7 are not discussed here.

Issue WQ-1: Water Temperature Effects. The only Group B aquatic weed control method with the potential to change water temperatures is injecting hot water under bottom barriers. Barr and DiTomaso (2014) conducted bench- and mesocosm-scale experiments to investigate whether heated water circulated under insulated benthic bottom barriers has the potential to inhibit sprouting of curlyleaf pondweed turion propagules at or near the sediment surface. Heated-water exposures significantly inhibited turion sprouting at 50 and 60°C, and completely inhibited sprouting with exposure to 60°C for 300 seconds or 70°C for 60 seconds. To ensure adequate kill of curlyleaf pondweed turions could require a two- to five-minute exposure to 70°C, with an estimated 12.6 million joules of heat required to warm 50 liters of water under a 1.0 m^2 bottom barrier mat from 10 to 70°C (Barr and DiTomaso 2014). If a 10 X 10-meter spot treatment (i.e., 100 m^2 or 0.025 acre) was performed using this amount of heat under bottom barrier mats, an estimated 1.26 billion joules of heat would be injected. Based on the specific heat of water, approximately 0.42 billion joules of heat would raise the temperature of a 100 m^3 of overlying water (assuming all of the heat was assimilated by the water within one meter of the mats) by one °C, so the temperature of this volume of water could increase by as much as three °C. It may take several hours for all the injected heat to migrate from under the mats to the water column, resulting in greater dilution and less of a temperature increase; however, these calculations indicate that using hot water injected under bottom barriers has the potential to measurably increase temperatures in the overlying water. Concern for raising water temperatures could limit the extent to which this technology could be permitted. Injecting hot water under bottom barrier mats would cause localized and temporary increases in water temperature near the mats. If real-time monitoring of water temperature indicates that temperature increases are approaching project permit limits (e.g., 0.3 ºC increase in the receiving waters of the lagoon outside the designated treatment area compared to the nearest control site), then the rate of hot water injections would be reduced at that site to ensure that temperature impacts are **less than significant**.

Issue WQ-2: Sediment Disturbance and Turbidity. Group B aquatic weed control methods that have the potential to increase turbidity are bottom barrier installation and removal, diver-assisted suction/hand pulling, and spot suction dredging. Some turbidity may be induced during installation and removal of bottom barriers, which may complicate this work performed by divers or snorkelers (Mattson et al. 2004). Because sediment disturbance is less, in part because divers are careful not to cause excessive turbidity that would reduce visibility, turbidity impacts during bottom barrier placement would be **less than significant**. Previous use of bottom barriers in the West Lagoon have resulted in a layer of silt deposition on top of them after four months of deployment, allowing new weeds to root and grow on top of the barriers (Hoover 2017, 2018a, 2018b). The silt was presumed to be coming from boat traffic disturbing the layer of fine sediment on the bottom of the lagoon. Removal of the barriers also disturbed the lagoon bottom and created a high level of turbidity in the local vicinity, which took several hours to clear. Short-term impacts to turbidity are expected within and potentially adjacent to test sites during bottom barrier removal. Because the barrier removal would be limited to small areas, the temporary and localized increases in turbidity are expected to be **less than significant**. If real-time monitoring of turbidity indicates that project permit limits may be exceeded, the methods or pace of bottom barrier removal would be adjusted to ensure that turbidity impacts are **less than significant**.

Diver-assisted suction/hand pulling of aquatic weeds depends on adequate visibility for divers performing the work, so care would be taken to minimize sediment disturbance resulting in turbidity. If the water became turbid, work would have to cease and could not be resumed until the water was again adequately clear. Turbidity impacts are expected to be **less than significant** from diver-assisted suction/hand pulling as a spot treatment in test areas.

The potential turbidity impacts of spot suction dredging would be similar to those described for Action Alternative 2, but on a much smaller scale. This Group B activity would be limited to dredging small areas within treatment sites where residual fine organic sediment deposits supported patches of remaining aquatic weed growth following implementation of Group A treatment. A small cutter head suction dredge could be operated from a barge, with the relatively small quantity of dredge spoils piped to water-tight containers on the barge. The water-tight containers could be loaded from the barge onto trucks and hauled to the TKPOA treatment plant for dewatering. Temporary turbidity impacts would be expected within treatment sites from sediment disturbance during dredging, and risks of accidental spills of dredge spoils would be present during transport and handling. If dewatering effluent was not discharged to the sanitary sewer system, it would require treatment to meet water quality standards before discharge to Lake Tallac. Implementing the mitigation measures described for Action Alternative 2, these effects on turbidity in the lagoons would be **less than significant**.

Issue WQ-4: Changes in pH. The only Group B aquatic weed control method with the potential to change pH is injecting acetic acid under bottom barriers. Any disturbance of sediments from other Group B methods is not expected to affect pH in overlying waters because the sediment pH in West Lagoon samples is close to neutral.

Barr and DiTomaso (2014) conducted bench- and mesocosm-scale experiments of bottom barrier performance on sprouting of curlyleaf pondweed turions, including placing tapioca starch pearls soaked in 100 ml of dilute acetic acid on sediment containing turions and covering it with rubber mats. The starch pearls were used to facilitate slow release of the acetic acid over a two-week period. The pH of the dilute acetic acid measured a little less than three at the beginning of the experiment and increased to more than five over four hours. Complete inhibition of turion sprouting was observed at and above acetic acid concentrations of 83.3 mmol/L (0.5 percent by volume), and the authors concluded that these findings demonstrated the potential of acetic acid combined with impermeable benthic barriers as an effective method to control curlyleaf pondweed turion sprouting (Barr and DiTomaso (2014). Sufficient information was not included to be able to calculate the quantity of dilute acetic acid that might be used under a bottom barrier of specific dimensions; however, the slow release rate and relatively short degradation time (i.e., 10 to 14 days) indicates that with dilution in the water column measurable changes in pH in treatment areas would not likely result from spot treatments using this method. Real-time pH monitoring in the water would indicate early in the use of acetic acid injection under bottom barriers whether that operation needs to be curtailed to ensure that this impact was **less than significant**.

Mitigation and Resource Protection Measures

The primary measures to minimize potential adverse effects on water quality have to do with the timing and size of testing under the Proposed Project. Potential water quality concerns include lowered DO concentrations and releases of phosphorus and nitrogen to the water column during the decomposition of aquatic plants that are killed by herbicides or ultraviolet light. TKPOA will conduct spring aquatic plant surveys to ensure that late spring (i.e., late May or early June) herbicide treatments at the Tahoe Keys testing sites will occur when the plants are in their early stages of growth so that the volume of plant material that decays following treatments is minimized. With herbicide treatments proposed to occur in the late spring when aquatic plants are early in their growth and biomass is minimal, when the water is still cool from snowmelt runoff and low nighttime temperatures, the risk of nutrient releases from plant decomposition triggering algal blooms (including HABs) can be minimized. An initial round of ultraviolet light treatment in May/June would stunt the growth of plants, and plants are expected to be only a few feet tall during follow-up rounds in the summer and fall, which could result in a gradual and limited release of nutrients from remineralization of plant biomass. Furthermore, potential impacts to water quality from the Proposed Project will be limited by treating less than 13 percent of the West Lagoon and about nine percent of Lake Tallac with herbicides and treating less than 11 percent of the West Lagoon with ultraviolet light.

WQ1 Real-Time Temperature Monitoring and Adjustments to Treatment Rates: The only potential adverse impacts to water temperatures were from ultraviolet light testing and injection of hot water under bottom barriers, both aquatic weed control methods that directly apply heat within test sites. Although temperature effects from these methods are expected to be less than significant, real-time monitoring would inform operators if permit limits for water temperature (e.g., 3-day average water temperatures in lagoon receiving waters outside the treatment area ≥0.3 °C above 3-day average at control site) were exceeded and the rates of ultraviolet light application or injection of hot water under barriers would be reduced. After reducing the application rate, further monitoring would be used to demonstrate compliance with the water temperature limits. Water temperature monitoring could be performed by TKPOA water quality staff or their contractors, following all project monitoring requirements. LWB will review reports and do compliance follow-up as needed.

WQ2 Real-Time Turbidity Monitoring and Adjustments in Practices: Potential sediment disturbance and increased turbidity from implementation of the Proposed Project would be limited to short-term localized effects during: (1) installation, startup and removal of LFA systems, (2) installation and removal of bottom barriers, (3) diver-assisted suction/hand pulling, and (4) spot suction removal. Divers would automatically be minimizing sediment disturbance during most of these activities because underwater visibility is necessary to carry out the work, and work would have to cease if the water became turbid. Of these aquatic weed control activities, removal of bottom barriers would likely present the greatest potential for a short-term significant turbidity impact. If real-time monitoring of turbidity indicates that project permit limits (e.g., 1 NTU in the receiving waters of the lagoon outside the designated treatment area) may be exceeded, the methods or pace of bottom barrier removal or other activities would be adjusted until compliance with permit limits for turbidity was demonstrated. Turbidity monitoring could be performed by TKPOA water quality staff or their contractors, following all project monitoring requirements. LWB will review reports and do compliance follow-up as needed.

WQ4 Real-Time pH Monitoring and Adjustments to Treatment Rates: The reduction in aquatic weed biomass from testing control methods is generally expected to improve pH conditions at the test sites, and the only potential for adverse impacts to pH were identified for direct effects of herbicide applications and injection of acetic acid under bottom barriers. If real-time monitoring of pH indicates that permit limits (e.g., lagoon receiving waters outside the treatment area lowered ≥0.5 standard units below control site pH and below 7.0, measured one foot above the sediment surface) are exceeded due to these applications, the rates would be adjusted until compliance with permit limits for pH was demonstrated. Real-time pH monitoring could be performed by TKPOA water quality staff or their contractors, following all project monitoring requirements. LWB will review reports and do compliance follow-up as needed.

WQ5a, WQ6 and WQ7 Timing and Limited Extent of Testing: The reduction in aquatic weed biomass from testing control methods is generally expected to improve DO conditions in test sites, as hypoxia and anoxia have been documented in the deeper waters in many areas of the lagoons. However, dieback and decay of macrophytes from herbicide or ultraviolet light treatments have the potential to increase BOD and reduce DO in the bottom of the lagoons within and adjacent to test sites. Herbicide applications are designed to occur in the late spring when target weed species are in their early stages of growth and plant biomass is minimal, and the timing will be adjusted based on pre-application macrophyte surveys. Timing herbicide applications when the plants are small is expected to minimize the biomass of decaying vegetation, thus mitigating the full impacts of oxygen depletion and nutrient release that could occur from dieback of mature plants. Similarly, ultraviolet light applications will include an early-season treatment to stunt plant growth, expecting that the plants will be only a few feet tall when during the second treatment in the summer. Effects to the overall DO conditions in the lagoons will also be mitigated by the fact that only small portions of them will be treated during the testing.

The reduction in aquatic weeds from herbicide and ultraviolet light testing is also generally expected to reduce TP and TN releases to the water column in test areas because there would be less nutrient uptake from the sediments and plant biomass dieback in the fall. However, herbicide and ultraviolet light treatments have the potential to cause short-term increases in TP and TN when treated aquatic weeds decompose. Herbicide applications are designed to occur in the late spring when target weed species are in their early stages of growth and plant biomass is minimal, and the timing will be adjusted based on pre-application macrophyte surveys. Similarly, ultraviolet light applications will include an early-season treatment to stunt plant growth, expecting that the plants will be only a few feet tall during the second treatment in the summer. Effects to the overall nutrient concentrations in the lagoons will also be mitigated by the fact that only small portions of the lagoons will be treated during the testing.

WQ5b Aeration: LFA or other aeration systems will be deployed in herbicide test sites immediately after plant dieback not only to increase aerobic microbial degradation of the herbicides but also to offset the potential for BOD from plant decomposition that could cause low DO impacts. If real-time monitoring indicated that DO was not meeting permit requirements (e.g., DO saturation depressed by >10 percent in lagoon receiving waters outside an ultraviolet light treatment area, measured one foot above the sediment surface), an LFA system would also be deployed there to aerate the water during the period of plant decay and ensure that DO impacts were not significant. Water temperature monitoring could be performed by TKPOA water quality staff or their contractors, following all project monitoring requirements. LWB will review reports and do compliance follow-up as needed.

Significant Unavoidable Impacts

There would be **no significant unavoidable impact** to water quality from the Proposed Project. Temporary unavoidable impacts to water quality have been identified but are not expected to be significant after mitigation.

3.3.4.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

This section describes the regulatory setting and environmental setting for testing non-herbicide aquatic weed control methods, evaluates potential water quality effects from each control method proposed for testing (i.e., ultraviolet light treatment and LFA as Group A methods), proposes mitigation measures to limit adverse effects, and identifies any significant unavoidable adverse impacts. The same Group B methods described for the Proposed Project would be available for use under Alternative 1. Issue 3 is not discussed for Action Alternative 1 because dispersal of aquatic weed fragments by testing ultraviolet light treatment, LFA, or Group B methods is not a potentially significant concern.

Regulatory Setting

The regulatory setting for Action Alternative 1 is similar to that described for the Proposed Project. Although this alternative does not propose testing herbicides, a CWA Section 401 water quality certification would be required to: (1) evaluate potential water quality impacts of testing ultraviolet light and LFA treatments, and (2) specify permit conditions to protect beneficial uses. If acetic acid injection under bottom barriers were to be used as a Group B method, it would be considered a chemical discharge subject to NPDES permit coverage and antidegradation policies. Unlike the Proposed Project, compliance with the Basin Plan and antidegradation policies for the Action Alternative 1 would not require an exemption to the prohibition on the use of aquatic pesticides in the Lahontan Basin.

Environmental Setting

The environmental setting for Action Alternative 1 is the same as that described for the Proposed Project.

Issue WQ-1: Water Temperature Effects. Existing water temperature conditions for Action Alternative 1 are the same as those described for the Proposed Project.

Issue WQ-2: Sediment Disturbance and Turbidity. Existing turbidity and water clarity conditions for Action Alternative 1 are the same as those described for the Proposed Project.

Issue WQ-4: Changes in pH. Existing pH conditions for Action Alternative 1 are the same as those described for the Proposed Project.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Existing DO conditions for Action Alternative 1 are the same as those described for the Proposed Project.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Existing total phosphorus conditions for Action Alternative 1 are the same as those described for the Proposed Project.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Existing total nitrogen conditions for Action Alternative 1 are the same as those described for the Proposed Project.

Potential Impacts

Issue WQ-1: Water Temperature Effects. Potential effects of Action Alternative 1 on water temperature are the same as those evaluated for ultraviolet light testing, LFA, and Group B aquatic weed control methods under the Proposed Project. ultraviolet light arrays and/or injection of hot water under bottom barriers would temporarily add heat to the water in test areas during the weeks of operation; however, temperature increases are not expected to be significant in test areas overall. If real-time monitoring shows water temperature increases that exceed permit limits, then the rate of ultraviolet light treatment and/or hot water injection would be reduced to ensure that water temperature impacts are **less than significant**.

Issue WQ-2: Sediment Disturbance and Turbidity. Potential effects of Action Alternative 1 on sediment disturbance and turbidity are the same as those evaluated for ultraviolet light testing, LFA, and Group B aquatic weed control methods under the Proposed Project. Sediment disturbance and short-term localized increased turbidity could occur during implementation of LFA systems or some Group B methods, particularly during the removal of bottom barriers. If real-time monitoring of turbidity indicates that project permit limits may be exceeded, the methods or pace of bottom barrier removal or other sediment-disturbing activities would be adjusted to ensure that turbidity impacts are **less than significant**.

Issue WQ-4: Changes in pH. Potential effects of Action Alternative 1 on pH are the same as those evaluated for ultraviolet light testing, LFA, and Group B aquatic weed control methods under the Proposed Project. Direct impacts on pH from injection of acetic acid under bottom barriers was the only potential adverse impact identified for Action Alternative 1 activities. Because of the relative small quantities of acetic acid that would be applied, dilution within test sites, and buffering capacity of the water, changes in pH directly from acetic acid would be **less than significant**.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Potential effects of Action Alternative 1 on DO are the same as those evaluated for ultraviolet light testing, LFA, and Group B aquatic weed control methods under the Proposed Project. Among Action Alternative 1 activities, only testing of ultraviolet light has the potential for adverse effects on DO conditions. Because ultraviolet light treatments would be timed to cause mortality of target aquatic plants when they are small, and because of the limited area of the three sites proposed for ultraviolet light testing, the potential effects on overall DO conditions in the West Lagoon are expected to be **less than significant**.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Potential effects of Action Alternative 1 on total phosphorus are the same as those evaluated for ultraviolet light testing, LFA, and Group B aquatic weed control methods under the Proposed Project. A temporary increase in TP in test areas is likely during the weeks when plants are decaying after ultraviolet light treatment. Because ultraviolet light testing is expected to treat plants when they are small and is only proposed for three small sites in the West Lagoon, the effects of nutrient increases from decaying weeds are expected to have a **less than significant** effect.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Potential effects of Action Alternative 1 on total nitrogen are the same as those evaluated for ultraviolet light testing, LFA, and Group B aquatic weed control methods under the Proposed Project. A temporary increase in TN in the water column is expected during the weeks when plants are decaying after ultraviolet light treatment. Because ultraviolet light testing is expected to treat plants when they are small and is only proposed at three small sites in the West Lagoon, the effects of nutrient increases from decaying weeds are expected to have a **less than significant** effect.

Mitigation and Resource Protection Measures

The mitigation and resource protection measures described for ultraviolet light, LFA testing, and Group B aquatic weed control methods under the Proposed Project would be the same as the Proposed Project under Action Alternative 1. However, mitigation or resource protection measures for herbicide testing would not be necessary for this alternative.

Significant Unavoidable Impacts

There would be **no significant unavoidable impacts** to water quality as a result of Action Alternative 1. Temporary unavoidable impacts to water quality have been identified but are not expected to be significant after mitigation.

3.3.4.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

This section describes the regulatory setting and environmental setting for an alternative that would test suction dredging and replacement of substrate as the proposed Group A aquatic weed control method. The same Group B methods described for the Proposed Project would be available for use under Action Alternative 2. This section also evaluates potential water quality effects, proposes mitigation measures to limit adverse effects, and identifies any significant unavoidable adverse impacts from these activities. Issue 1 is not discussed under Action Alternative 2 because suction dredge and substrate replacement tests do not have the potential to significantly affect water temperature.

Regulatory Setting

The applicable water quality regulations for the Proposed Project also apply to the suction dredging and substrate replacement alternative. This section describes additional regulations that: (1) include provisions for water quality protection, and (2) could apply to the handling of dredge spoils and discharge of dewatering effluent.

State

Solid Waste Regulations

California Code of Regulations Title 27 includes Division 2 addressing solid waste, and Subdivision 1 that codifies consolidated regulations for treatment, storage, processing or disposal of solid waste (CDRRR

2019). Subdivision 1 includes a waste classification system which applies to solid wastes that cannot be discharged directly or indirectly into waters of the state and which therefore must be discharged to waste management units for treatment, storage or disposal. Waste classifications are based on an assessment of the potential risk of water quality degradation associated with each category of waste.

Solid waste from dredge spoils would likely occur at a compost or landfill facility in Nevada which are closer to the project site than California facilities; as such, disposal of these wastes would likely be regulated under Nevada Regulatory Statute 444 and Nevada Administrative Code 444 (NDEP 2020). Testing requirements for acceptance of the material at disposal facilities would likely include pH and aluminum, given the elevated aluminum concentrations that have been detected in Tahoe Keys sediments.

Suction Dredge Permitting Program

California Senate Bill 637 amended Fish and Game Code section 5653 and added section 13172.5 to the Water Code, effectively banning the use of suction dredging in rivers, streams or lakes to recover minerals (CDFW 2019). Thus, the California Department of Fish and Wildlife is currently prohibited from issuing any permits for suction dredging under the Fish and Game Code. However, this project alternative is designed to test suction dredging as an environmental restoration method and there will be no attempt at mineral recovery, so the ban on suction dredging for mining does not apply.

Regional

TRPA Code of Ordinances

TRPA Code §33.3.2 states that direct discharges to the waters of the region of solid or liquid waste materials, including soil, silt, clay, sand, or other organic or earthen materials, are prohibited unless approved by TRPA. This prohibition would apply to substrate replacement at suction dredge testing sites, and also discharge of treated dewatering effluent from dredge spoils.

TRPA Code 60.1.3 provides standards and prohibitions that apply to discharges to surface waters and ground waters. The following maximum pollutant concentration limits apply to surface runoff discharges, at the 90th percentile:

Dissolved Inorganic Nitrogen as N	0.5 mg/L
Dissolved Phosphorus as P	0.1 mg/L
Dissolved Iron as Fe	0.5 mg/L
Grease and Oil	2.0 mg/L
Suspended Sediment	250 mg/L

Waters infiltrated into soils shall not exceed the following maximum pollutant concentrations:

Total Nitrogen as N	5 mg/L
Total Phosphate as P	1 mg/L
Iron as Fe	4 mg/L
Turbidity	200 NTU
Grease and Oil	40 mg/L

Under Action Alternative 2 dredge spoils from suction dredging at test sites would be transported for processing at the TKPOA treatment plant on the south side of Lake Tallac. Dredge spoil processing operations, including dewatering spoils and treating dewatering effluent, and stockpiling and loading solid wastes from dredge spoils, would require containment to prevent infiltration into soils and surface runoff into Lake Tallac. Containment could include liners to prevent infiltration, storage tanks, and perimeter berms.

TRPA Best Management Practices (BMP) Handbook

The TRPA BMP Handbook provides technical and planning guidance to landowners, private businesses, agencies, and jurisdictions for water quality improvement projects. The Handbook is offered to help meet the standards set forth in the TRPA Code of Ordinances and for reducing pollutants of concern identified in the Lake Tahoe TMDL. The Handbook chapter 8 on shorezone protective structures and BMPs includes sections on dredging and turbidity curtains.

Dredging is generally prohibited by TRPA, with the exception of maintenance dredging, defined as the excavation of areas that have been previously dredged to maintain authorized lake bottom elevations for boat navigation. Maintenance dredging may be permitted in order to continue an existing use, especially if required for navigational safety. BMPs for hydraulic dredging include managing cutter-head rotation and swing speed, limiting sediment removal in maximum lifts equal to 80 percent or less of the cutter-head diameter. Mitigation and monitoring are required to protect water quality and biological resources.

Turbidity curtains are required to control dispersion of re-suspended sediment during dredging and other construction activities. They promote the settling of suspended sediments from the water column in a controlled area, thus minimizing the potential transport of fine sediment out of the project area. BMPs for turbidity curtains include design and installation considerations, and inspection and maintenance practices.

Local

Wastewater Treatment Plant Requirements

Local regulations applicable to the discharge of treated sediment dewatering effluent to the sanitary sewer system are specified in the South Tahoe Public Utility District Administrative Code (STPUD 2019). This project would likely require a special permit agreement to discharge into the District sewer system, which could limit the quantities of treated effluent and concentrations of aluminum discharged to the sewer, specify pre-treatment requirements, and establish fees for discharge determined by the utility Board.

Environmental Setting

Issue WQ-2: Sediment Disturbance and Turbidity. Existing turbidity and water clarity conditions for Action Alternative 2 are the same as those described for the Proposed Project. Additional information is provided below regarding sediment characteristics.

Samples from the upper 10cm of bottom sediment were collected with a petit Ponar grab sampler in July and September 2019 (Appendix WQ-1). Sediments from the West Lagoon samples were generally black and predominantly silt. Both samples from the West Lagoon were characterized as gelatinous.

Field observations of the sediment samples are summarized in Table 3.3.4-4. While none of these samples were collected at Sites 28-30, they provide generalized information about the surficial sediment layer in the West Lagoon.

Table 3.3.4-4 Field Observations of Tahoe Keys West Lagoon Surficial Sediment Samples.

Area	Station	Water Depth (ft)	Sediment Descriptions
West 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

In summary, sediments to be dredged from the West Lagoon test sites are expected to be predominantly silt and sandy silt, much of it with a gelatinous character that is typical of sediments formed from anaerobic decomposition of plant materials.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. The discussion regarding floating materials, specifically aquatic plant fragments presented under the Proposed Project applies to Action Alternative 2.

Issue WQ-4: Changes in pH: Existing lagoon water pH conditions for Alternative 2 are the same as those described for the Proposed Project. Additional information is provided below regarding sediment characteristics. Physical and chemical properties of 2019 baseline sediment samples are summarized in Table 3.3.4-5.

In summary, sediments to be dredged from the West Lagoon test sites are expected to have a high water content and relatively neutral pH.

Table 3.3.4-5 Physical and Chemical Properties of Tahoe Keys West Lagoon Surficial Sediment Samples.

Area	Station	Moisture (%)	pH	Organic Matter (%)
West 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

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

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Existing lagoon water DO conditions for Action Alternative 2 are the same as those described for the Proposed Project.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Existing lagoon water total phosphorus conditions for Action Alternative 2 are the same as those described for the Proposed Project. To support conceptual modeling of nutrient cycling in the lagoons, sediment samples were analyzed for total phosphorus (TP) and orthophosphate. On average, TP was 795 mg/kg-dry weight, orthophosphate was 0.2 to 0.5 mg/kg-wet weight. These sample concentrations may underestimate actual concentrations in West Lagoon sediments because some of the samples were diluted with site water during sample collection. Sediment nutrient concentrations are not particularly high, with TP concentrations less than the 1,450 mg/kg-dry weight average reported from 50 Sierra Nevada lakes (Homyak et al. 2014).

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Existing lagoon water total nitrogen conditions for Alternative 2 are the same as those described for the Proposed Project. To support conceptual modeling of nutrient cycling in the lagoons, sediment samples were analyzed for total Kjeldahl nitrogen (TKN; i.e., organic nitrogen plus inorganic nitrogen in ammonia and ammonium forms). On average, TKN was 572 mg/kg-wet weight.

Potential Impacts

Issue WQ-2: Sediment Disturbance and Turbidity. Several mechanisms can cause sediment resuspension and turbidity during operation of a rotating cutter head suction dredge: (1) rotation of the cutter head exerts centrifugal forces onto the cut material which is then thrown out of reach of the suction-intake forces, (2) excess material is released to the surroundings whenever excavation production exceeds the suction capacity of the pump system, (3) sediment disturbance can release gases that cause enhanced resuspension, and (4) mechanical mixing by the rotating cutter head contributes to resuspension (Dearnaley et al. 1996). Optimizing the cutter head speed and movement with suction capacity, using a moveable shield around and above the cutter head, and using silt curtains are all methods to reduce resuspension.

The severity and duration of turbidity caused by the suction dredging operation depends on the amount of clay and fine silt particles in the sediment, and the amount of sediment that is resuspended. Surficial sediments samples collected from Lake Tallac and the West Lagoon in the summer of 2019 were described as predominantly silt, and in many areas had a gelatinous mud character that typically forms from anaerobic digestion of peat materials. The percentage of clay and fine silt in the samples was not quantified; however, these sediments are expected to be susceptible to causing high levels of turbidity where they are disturbed and resuspended in the water. Laboratory experiments have shown that turbidity values for silt and silt-clay particles decrease substantially in 12 hours, but clay-sized particles maintained a constant high turbidity over 24 hours suggesting these particles stay in suspension for long periods (Holliday et al. 2003). Where the Tahoe Keys sediments contain substantial quantities of clay-size particles, elevated turbidity from suction dredging could last for several days. Performance specifications for sand or fine gravel used for substrate replacement would require testing prior to placement to ensure that the material did not contain excessive amounts of fine particles.

Turbidity was sampled near the surface, at mid-depth, and near the bottom during testing of a hydraulic dredge at the Tahoe Keys Marina, using different engine speeds and auger pressures (Hackley et al. 1996). Sediments in this area were found to be 44 percent silt and clay particles. Turbidity samples were collected at locations 10 ft ahead of the left and right sides of the cutter head, and 10 ft perpendicular to the cutter head. Mean turbidity at the lower auger pressure (i.e., 400 PSI) was 6.0 NTU, regardless of engine speed. Mean turbidity ranged from 12 to 13 NTU at a more normal auger pressure (i.e., 700 PSI). The results of the dredge test showed that operator skill can have a large role in minimizing the levels of turbidity, while maximizing efficiency.

The turbidity measured during suction dredge testing at the Tahoe Keys Marina is likely the most representative information available to predict the turbidity that could be generated during the testing of suction dredging in the West Lagoon. Turbidity within test areas can be expected to exceed the 3.0 NTU maximum specified as a Basin Plan water quality objective and TRPA threshold standard, during and up to several days following the dredging operation. The sand or fine gravel material used for substrate replacement would need to meet material specifications before it is placed in the test areas, and those specifications would include limits on the amount of fine particles so that turbidity is minimized during placement. Therefore, the potential for temporary high turbidity during substrate material placement is expected to be less than during dredging of the existing organic silt. Turbidity curtains that adhere to TRPA standards outlined in the BMP Handbook §8.10 are expected to confine this temporary impact to test areas such that turbidity impacts to the West Lagoon would be **less than significant**.

Turbidity and short-term loading of fine sediment particles could also occur from any spills of dredge spoils, runoff from the dredge spoils processing area, or discharge of treated dewatering effluent. Spill control and containment plans would be developed to guide the response and minimize impacts from any accidental spills. These plans would also include provisions for adequate storage to safely handle dredge spoils during processing. If any dewatering effluent were to be discharged into Lake Tallac, it would first have to meet treatment requirements to remove solids so that water quality standards would be met, including discharge standards in TRPA Code §60.1.3 and water quality objectives for turbidity in receiving waters. If rigorous implementation of spill control and containment plans and treatment of any dredge spoil dewatering effluent meets turbidity limits, these potential impacts are expected to be **less than significant** with mitigation.

To the extent that the suction dredging removes fine sediments from test areas, which total approximately 5.54 acres or five percent of the West Lagoon area, after the project there would be an incremental reduction in the amount of fine sediment that creates turbidity when it is disturbed by boat traffic, wind-driven currents, bottom-feeding fish. The sand remaining after dredging would create much less turbidity when disturbed. However, the improvement in water clarity in dredged areas is unlikely to last more than one or two seasons before fine sediments and turbidity are transported in from adjacent areas. The relatively small amount of fine organic sediment removed during the suction dredging test is not expected to have a noticeable long-term effect on reducing turbidity and improving water clarity in the West Lagoon as a whole. Therefore, the potential beneficial long-term effect of reducing future turbidity by removal of fine organic sediments in test areas and replacing them with coarser grained sediment would be **less than significant**.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. The operation of a suction dredge to remove organic sediment accumulations and plants from test areas would be expected to break up and dislodge plant fragments, with some fragments floating to the surface. Sand or fine gravel fill material used to replace substrate would be screened to ensure that it did not contain floatable materials before it was placed in the lagoon test areas. Turbidity curtain barriers would contain the floating materials within test areas where they could be skimmed from the surface before the barriers are removed; therefore, floating materials from suction dredging operations are expected to be a **less than significant** impact.

Any spill of dredge spoils during transport from the test areas to the processing area, or during the dewatering and handling of dredge spoils at the processing area, has the potential to discharge floating materials to the West Lagoon or Lake Tallac. It is expected that the proposed spill control and containment plans would guide the response and minimize impacts from any accidental spills, resulting in a **less than significant** impact.

Issue WQ-4: Changes in pH. The resuspension of sediment is not expected to result in short-term changes in water column pH during suction dredging because the West Lagoon surficial sediments were found to have near-neutral pH (i.e., 6.8 to 7.3) in 2019 samples. To the extent that suction dredging removes aquatic plants that would otherwise affect pH through photosynthesis, respiration, and decomposition, those processes would be reduced at test sites. The common occurrence of pH exceeding the 8.4 maximum criterion at many of the West Lagoon sites in 2019 is expected to be improved at suction dredging sites that would no longer have high rates of photosynthesis in dense aquatic weed beds. However, because only a limited area would be tested with suction dredging, the overall effects on pH conditions in the West Lagoon are expected to be **less than significant**.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. The resuspension of sediment discussed above for turbidity impacts could also result in short-term decreases in water column oxygen levels when oxygen-demanding sediments are mixed with the overlying water. Decreased DO during hydraulic dredging of a hypereutrophic lake in Oklahoma, particularly in deeper waters, was attributed to the oxygen demand of resuspended sediments (Grimshaw et al. 1987). Any effects on DO during suction dredging are expected to be limited to within and adjacent to suction dredging test sites, and not last beyond the period when turbidity is elevated. Overall effects on DO conditions in the West Lagoon are expected to be **less than significant**.

To the extent that suction dredging removes aquatic plants that would otherwise affect DO through photosynthesis, respiration, and decomposition, those processes would be reduced at test sites. The common occurrences of hypoxia in deep waters and DO below the 9.5 mg/L minimum criterion documented at many of the West Lagoon sites in 2019 is expected to be improved at suction dredging sites. However, because only a limited area would be tested with suction dredging, the overall effects on DO conditions in the West Lagoon are expected to be **less than significant**.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Suction dredging could remove a substantial mass of nutrients from plants and bottom sediments, which differs from the results of the actions undertaken with herbicide application and/or ultraviolet light treatment. However, in their review of more than a dozen completed sediment removal (i.e., suction dredging) projects, Cooke et al. (2005) concluded that such projects had “mixed results” in terms of water quality improvement. In addition, Cooke et al. (2005) suggested that sediment removal could be effective for aquatic weed control only if the resulting water depth was below the depth limit at which the weeds could achieve sufficient light for growth and reproduction. Dredging to such depths is not proposed under Action Alternative 2. For suction dredging to be able to sustainably reduce the problem of nutrient cycling, the newly dredged bottom depths would have to exceed the deepest depth to which aquatic weeds grow in the Tahoe Keys, otherwise such an approach may only bring about a temporary reduction in aquatic weed biomass.

Suction dredging has the potential, over the short-term, to substantially increase TP concentrations in the water column within and adjacent to dredged areas due to mixing of nutrient-rich sediments with the overlying water column. Sand or fine gravel used for substrate replacement in test areas would be required to meet performance specifications to ensure it did not contain excessive amounts of organic material that could contain phosphorus. Because the short-term increase in TP would be confined by turbidity curtains to one site at a time, and because the three sites make up only a small portion of the West Lagoon, the overall increases in TP in the lagoon are expected to be **less than significant**.

Over a longer period of time, if suction dredging was done to a depth that reduced the potential for regrowth of aquatic weeds, TP concentrations could decrease in the water column if dredging is sufficiently deep that fewer decaying plants are supported, affording less biomass for nutrient remineralization. However, this project does not propose dredging to sufficient depths to expect sustainable reductions in TP cycling and this potential benefit would not be expected.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Suction dredging has the potential, over the short-term, to substantially increase TN concentrations in the water column within and adjacent to dredged areas due to mixing of nutrient-rich sediments with the overlying water column. Sand or fine gravel used for substrate replacement in test areas would be required to meet performance specifications to ensure it did not contain excessive amounts of organic material that could contain nitrogen. Because the short-term increase in TN would be confined by turbidity curtains to one site at a time, and because the three sites make up only a small portion of the West Lagoon, the overall increases in TN in the lagoon are expected to be **less than significant**.

Over a longer period of time, if suction dredging was done to a depth that reduced the potential for regrowth of aquatic weeds, TN concentrations could decrease in the water column if dredging is sufficiently deep that fewer decaying plants are supported, affording less biomass for nutrient remineralization. However, this project does not propose dredging to sufficient depths to expect sustainable reductions in TN cycling and this potential benefit would not be expected.

Mitigation and Resource Protection Measures

Issue WQ-2: Sediment Disturbance and Turbidity. The primary resource protection measures to minimize short-term water quality impacts from suction dredging are to minimize resuspension of the sediments in the water column by optimizing the cutter head speed and movement with suction capacity and using a moveable shield around and above the cutter head. Turbidity monitoring would indicate when engine speeds or auger pressures would need to be adjusted to minimize sediment resuspension. Minimizing sediment resuspension would also minimize the release of nutrients from disturbed sediment into the water column where it could become more available for algae blooms and minimize the release of aluminum in sediments to the lagoon water. Silt curtains that adhere to requirements outlined in the Shorezone chapter of TRPA's BMP Handbook would be used to confine water quality impacts to within test sites during dredging and substrate replacement. Performance specifications for sand or fine gravel used for substrate replacement would require testing prior to placement to ensure that the material did not contain excessive amounts of fine particles that could cause turbidity. Spill control and containment plans would be developed to guide the response and minimize impacts from any accidental spills of dredge spoils. These plans would also include provisions for adequate storage to safely handle dredge spoils during processing.

Suction dredging and replacement of substrate with sand or fine gravel would temporarily increase turbidity within test areas. If real-time monitoring determined that turbidity did not meet project permit limits at the point of compliance, adjustments to the dredging operation may be necessary to ensure that turbidity impacts are not significant. Similarly, if monitoring determined that turbidity limits were not met during substrate replacement, it may be necessary to adjust the rate and method of placement or use material that contained less fine-grained sediment to ensure that turbidity impacts are not significant.

No discharge of dewatering effluent would be allowed until monitoring has demonstrated that treatment systems reduced turbidity sufficiently to meet standards, as required by contract performance specifications. Treatment system designs could include settling and flocculation in batches stored in tanks for testing before discharge to the sanitary sewer system or Lake Tallac.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. Performance specifications for sand or gravel used for substrate replacement would require testing prior to placement to ensure that the material did not contain excessive amounts of organic matter that could increase amounts of floating materials.

Issue WQ-4: Changes in pH. Adverse impacts to pH are not expected and no mitigation measures are proposed for pH.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Suction dredging may result in a short-term oxygen demand and decrease in DO when organic sediments are resuspended into the water column. Overall impacts to DO conditions in the lagoons are not expected to be significant given the relatively small areas of the lagoons proposed dredging (i.e., about five percent of the West Lagoon). If real-time monitoring indicated that DO was not meeting permit requirements at a point of compliance, adjustments to the dredging operation may be necessary to ensure that turbidity impacts are not significant.

Issues WQ-6 and WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Suction dredging may also result in short-term increases in TP and TN when organic sediments are resuspended into the water column. It is expected that measures to meet project permit limits for turbidity would also be effective in controlling nutrient entrainment in the water column from sediment resuspension to the extent that nutrient impacts would not be significant.

No discharge of dewatering effluent would be allowed until monitoring has demonstrated that treatment systems reduced phosphorus and nitrogen sufficiently to meet standards, as required by contract performance specifications. Treatment system designs could include settling and flocculation in batches stored in tanks for testing before discharge to the sanitary sewer system or Lake Tallac.

Mitigation and resource protection measures for Group B methods under Alternative 2 would be the same as those described for the Proposed Project.

Significant Unavoidable Impacts

There would be **no significant unavoidable impacts** to water quality as a result of Action Alternative 2. Temporary unavoidable impacts to water quality have been identified but are not expected to be significant after mitigation.

3.3.4.4 No Action Alternative

This section describes the regulatory and environmental settings for the No Action alternative by describing the status quo for aquatic weed control activities and summarizes potential water quality effects that could result from continuing trends in aquatic weed proliferation in the Tahoe Keys lagoons and the greater Lake Tahoe.

Regulatory Setting

The water quality regulations described for the Proposed Project would also apply to the No Action Alternative, except that there would be no testing of aquatic herbicides and therefore: (1) an exemption to the prohibition on aquatic pesticides would not be required, and (2) there would be no discharges requiring a CWA 401 certification. This assumes that use of bottom barriers would continue to be limited to no more than the 5-acre maximum covered by TKPOA's existing WDRs.

Environmental Setting

The environmental setting described for the Proposed Project in the Tahoe Keys characterizes the initial water quality conditions under the No Action Alternative. These conditions include exceedances of WQOs for DO, pH, TP, TN and turbidity, in part attributed to the proliferation of aquatic weeds.

In Lake Tahoe, the No Action Alternative assumes that hand-pulling (including diver-assisted hand removal) and limited use of benthic bottom barriers would continue to be the primary methods of controlling the density of targeted aquatic plants, with ongoing testing of ultraviolet light and LFA technologies. Currently Lake Tahoe is not meeting standards for water quality and a TMDL plan is under implementation to reduce watershed sources of sediment, phosphorus and nitrogen. As with Tahoe Keys, aquatic plant survey information from the greater Lake Tahoe shows ongoing trends of increasing aquatic weed density and spread of curlyleaf pondweed, with the Keys identified as the highest priority but not only source of aquatic weeds spreading to other parts of the lake. Because the reader is referred to the Environmental Conditions information for the Proposed Project for existing water quality conditions for each of the issues, the following information is focused primarily on existing conditions for water quality in greater Lake Tahoe.

Issue WQ-1: Water Temperature Effects. Existing water temperature conditions in the Tahoe Keys for the No Action Alternative are the same as those described for the Proposed Project. Average water temperatures in Lake Tahoe, derived from measurements from the bottom to the surface of the lake, have increased by nearly one full degree Fahrenheit since 1970, at an average rate of 0.02 °F per year (TERC 2019, OEHHA 2020). The surface of the lake has warmed about twice as much as the overall temperatures over the same period, or about 0.02 °F per year (OEHHA 2020). And in the last four years Lake Tahoe's waters warmed at a rate about 10 times faster than the long-term rate. The maximum daily summer surface temperature was 77.5 °F on August 6, 2018, one of the highest in the past 10 years (TERC 2019). Repeated measurements at a nearshore index station showed that surface water warmed from June into November to a depth of about 40 meters. Cold water from the surface mixes downward each winter, with the deepest mixing typically occurring in between February and March, extending down as much as 80 to 450 meters below the surface (TERC 2019). Surface waters warm rapidly in the spring and the lake becomes thermally stratified by early summer. Overall the season of thermal stratification has increased by 29 days since 1968, with the stratified period lasting 209 days in 2018.

Issue WQ-2: Sediment Disturbance and Turbidity. Existing turbidity and water clarity conditions in the Tahoe Keys for No Action Alternative are the same as those described for the Proposed Project. Water clarity and transparency in Lake Tahoe are influenced by many factors, including natural lighting, properties of water molecules, lake mixing, colored dissolved organic matter, and particulate material in the water (LWB and NDEP 2010). Material in the water includes inorganic particles (i.e., soil or sediment) and organic particles (e.g., live algae, suspended detritus, or dead organic plant or animal material), and a combination of particulates that form aggregations around an organic matrix mediated by bacterial excretions. Lake clarity varies seasonally, with lowest levels in May through June during peak suspended sediment loading from watershed runoff, and an annual high in February (TRPA 2002).

Transparency is commonly measured by lowering a circular plate into the water on a tape measure (i.e., Secchi disk) until it is no longer visible. Continuous long-term evaluation of water quality in Lake Tahoe documented a decline of water transparency from an annual average of 31.2 meters in 1968 to 21.4 meters in 2007 (LWB and NDEP 2010). The 29.7-meter minimum standard has not been met since its adoption and the deep water transparency has continued to decline due to light scatter by fine sediment particles and light absorption by phytoplankton. Fine sediment particles account for roughly two thirds of the lake's water clarity impairment. Light scattering and absorption by inorganic particles is the dominant factor in determining Lake Tahoe transparency, mostly by fine sediment particles less than 10 µm in diameter (Coker 2000, Swift et al. 2006). Light scattering by organic particles and light absorption by water molecules contribute most of the remaining light attenuation. Phytoplankton and other forms of algae are the dominant source of suspended organic particles.

Nearshore water quality in Lake Tahoe has been historically indicated by turbidity (LWB and NDEP 2010), an optical measurement of cloudiness in the water that reduces clarity, expressed as nephelometric turbidity units (NTU). Stormwater, including spring snowmelt and summer thunderstorm runoff, carries water from uplands into Lake Tahoe tributaries and directly into nearshore waters. Taylor et al. (2003) showed that while nearshore turbidity is typically less than 0.15 NTU, it can range as high as 20 NTU. They defined high turbidities to be above 0.25 NTU, and found that less than five percent of the Lake Tahoe shoreline had high turbidity during a runoff event, with most of these areas directly influenced by runoff from developed areas. In three years of monitoring nearshore Lake Tahoe turbidity near and between the connecting channels to the Tahoe Keys, TKPOA mid-depth measurements ranged from zero to 2.37 FNU (units roughly equivalent to NTU), with an average turbidity of 0.31 NTU (TKPOA 2017a, TKPOA 2018b, TKPOA 2019a). Taylor et al. (2003) stated that scientists did not understand how nearshore turbidity affected deep water transparency.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. Existing information on floating materials in the Tahoe Keys, specifically aquatic plant fragments, presented under the Proposed Project also apply to the No Action Alternative. Excessive floating materials has not been identified as a water quality impairment or issue of concern for greater Lake Tahoe in the CWA §303(d) list (LWB and NDEP 2010) or TRPA water quality thresholds (TRPA 2016), and no monitoring information is available on lake-wide conditions for floating materials.

Issue WQ-4: Changes in pH. Existing pH conditions for No Action Alternative are the same as those described for the Proposed Project in the Tahoe Keys. Water quality impairment by pH has not been identified as an issue of concern for greater Lake Tahoe in the CWA §303(d) list (LWB and NDEP 2010) or TRPA water quality thresholds (TRPA 2016), and limited monitoring information is available on lake-wide pH conditions. At a mid-lake station in August 1973, pH measurements ranged as low as 7.7 in deep waters to 8.1 in the upper approximately 40 meters (Imboden et al. 1977). Alkalinity ranged from approximately 211 to 216 mg/L during this same survey, indicating a high buffering capacity throughout the water column and therefore an ability to neutralize acids and bases and maintain a stable pH level. In monitoring between May and October 2019, TKPOA measured pH ranging from 7.0 to 8.2 in Lake Tahoe nearshore areas close to the Tahoe Keys (TKPOA 2019a).

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. Existing DO conditions for No Action Alternative are the same as those described for the Proposed Project in the Tahoe Keys. Similar to pH, water quality impairment by DO has not been identified as an issue of concern for greater Lake Tahoe in the CWA §303(d) list (LWB and NDEP 2010) or TRPA water quality thresholds (TRPA 2016), and limited monitoring information is available on lake-wide DO conditions. At a mid-lake station in August 1973, DO measurements ranged 7.9 to 10.8 mg/L, with the lowest measurement near the surface and the highest measurement at approximately 40 meters depth (Imboden et al. 1977). Similarly, in 2006 TERC found the highest DO concentrations up to 10.9 mg/L were at a depth of 100 to 150 feet during the summer and fall, due to oxygen production by algae (TERC 2007). The lowest DO concentrations down to 7.2 mg/L were near the surface during the summer and fall due to reduced oxygen solubility in the warmer surface layer. In monitoring between May and October 2019, TKPOA measured DO ranging from 6.4 to 11.8 mg/L in Lake Tahoe nearshore areas close to the Tahoe Keys (TKPOA 2019a). The highest concentrations were in late spring when colder water has the capacity to hold higher concentrations of oxygen in solution, and the lowest DO measurements were in the fall after breakup of thermal stratification mixed low-oxygen bottom waters up through the water column.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Existing total phosphorus conditions for No Action Alternative are the same as those described for the Proposed Project in the Tahoe Keys. Lake Tahoe water quality is listed under CWA §303(d) as impaired by phosphorus because this nutrient can stimulate phytoplankton productivity and reduce the water clarity and transparency of the lake. Jassby et al. (1995) calculated the average total phosphorus concentration for Lake Tahoe to be 6.3 µg/L, generally indicative of oligotrophic (i.e., nutrient poor) conditions that support low levels of phytoplankton, and clear water. Phosphorus concentrations are very dynamic in that: (1) high levels can be quickly reduced by algal uptake, with an apparent inverse relationship between the nutrient and algal productivity, and (2) organic phosphorus mineralized in lake sediments can be recycled to fuel algal growth (Heyvaert et al. 2013).

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. Existing total nitrogen conditions for No Action Alternative are the same as those described for the Proposed Project in the Tahoe Keys. Lake Tahoe water quality is also listed under CWA §303(d) as impaired by nitrogen because this nutrient has at times been a co-limiting factor with phosphorus in the phytoplankton productivity that has reduced water clarity and transparency of the lake. Atmospheric deposition provides most of the nitrogen in the annual nutrient load, and increased amounts of atmospheric nitrogen have caused a shift from phytoplankton being co-limited by nitrogen and phosphorus to persistent phosphorus limitation (Jassby et al. 1994, LWB and NDEP 2010). Like phosphorus, nitrogen concentrations can also be very dynamic and quickly reduced by algal uptake (Heyvaeret et al. 2013).

Potential Impacts

Curlyleaf pondweed is capable of surviving and thriving at greater depths and cooler habitats than Eurasian watermilfoil (Heiskary and Valley 2012, TKPOA 2019c), and it has been suggested that curlyleaf pondweed may pose a greater ecological threat to Lake Tahoe proper than Eurasian watermilfoil (Wittmann and Chandra 2015). The effects on water quality of the continued spread of all target species in shallow nearshore areas, coupled with the presumed spread of curlyleaf pondweed to deeper water habitats, has not been well documented in Lake Tahoe proper. Water quality effects from aquatic weed infestations in shallow nearshore areas of Lake Tahoe could be similar to those observed near the Tahoe Keys lagoons connecting channels where mixing with lake water dilutes water quality effects compared to the dead-end channels that make up most of the lagoons.

Issue WQ-1: Water Temperature Effects. If curlyleaf pondweed continues to spread, thermal stratification patterns currently observed in the deeper water stations of Lake Tallac (e.g., T13, T12) could occur in areas such as north-central portions of the West Lagoon, which is relatively deep (e.g., 20 to 25 feet). Plants are unlikely to “top out” in these areas (due in part to depth but also harvesting operations), thereby limiting the likelihood of higher near-surface temperature. Long-term potential impacts of continued spread of aquatic weed species could include increased occurrence of thermal stratification and warming of near-surface waters in shallow zones of Lake Tahoe, though these effects would be less pronounced where there is more mixing from lake currents compared to the lagoons. If the spread of aquatic weeds continues in Lake Tahoe, increasingly the impacts to water temperature would become **potentially significant**.

Issue WQ-2: Sediment Disturbance and Turbidity. Continued dense growth of aquatic weeds in the Tahoe Keys lagoons under the No Action Alternative would increase the buildup of fine organic sediments from plant decay that can lead to increased turbidity and decreased water clarity. To the extent that aquatic weed infestations spread to other areas of Lake Tahoe, long-term potential impacts include a similar buildup of fine organic sediments and potentially a measurable contribution to increased turbidity and decreased water clarity in nearshore areas when those sediments are disturbed by wave action, currents, boats, swimmers, or bottom-dwelling organisms. While localized impacts on water clarity may be significant, these contributions would be a small fraction of overall sediment loading to Lake Tahoe and may not have a measurable impact in the pelagic zone of the lake. Internal cycling of nutrients from decomposing macrophytes and organic sediments could also lead to increased phytoplankton productivity and also negatively impact water clarity. Nearshore Lake Tahoe studies have found that in nearshore areas, both at the mouth of the Upper Truckee River and the Tahoe Keys channel entrances, turbidity measurements were consistently the highest recorded around the lake (Taylor 2002, Taylor et al. 2004). These results indicate that in addition to the fine sediments coming from the river, conditions in the West Lagoon and East Lagoon have contributed to the decline of water clarity in Lake Tahoe. If the spread of aquatic weeds continues, the impacts to water clarity in nearshore areas of Lake Tahoe increasingly would become **potentially significant**.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. TKPOA has taken important steps to increase their collection of floating aquatic weed fragments and limit their spread from the lagoons through the West Channel and East Channel into Lake Tahoe; however, it will not be possible under the No Action Alternative to achieve complete control of aquatic weed fragment migration into the lake. This will also be the case whether the Proposed Project or one of the Action Alternatives is implemented, because extensive mechanical harvesting will continue to be needed in the Tahoe Keys until aquatic weed control has been successful in eliminating the need. Although mechanical harvesting is not currently being performed at aquatic weed beds in other areas of Lake Tahoe, some fragments are broken off and dispersed by boat propellers, swimmers, fishing gear, etc. If the spread of aquatic weeds continues, dispersal of aquatic weed fragments would increasingly become a **potentially significant impact**.

Issue WQ-4: Changes in pH. WQO exceedances for pH would likely continue in the Tahoe Keys Lagoons under the No Action Alternative. These exceedances could become more widespread if curlyleaf pondweed continues moving into deeper water. If curlyleaf pondweed continues to spread, plants are unlikely to "top out" in these areas (due in part to depth but also harvesting operations), thereby limiting the likelihood of higher near-surface pH during periods of high photosynthetic activity. Long-term spread of aquatic weed species could also cause localized excursions of pH WQO criteria during periods of photosynthesis in shallow zones of Lake Tahoe, though these effects would be less pronounced where there is more mixing from lake currents compared to the lagoons. If the spread of aquatic weeds continues, the impacts to pH in nearshore areas of Lake Tahoe increasingly would become **potentially significant** with more widespread exceedances of WQO criteria.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. WQO exceedances for DO would likely continue in the Tahoe Keys Lagoons under the No Action Alternative. These exceedances could become more widespread, particularly if curlyleaf pondweed continues moving into deeper water. If curlyleaf pondweed continues to spread, thermal and DO stratification patterns currently observed in the deeper water stations of Lake Tallac (e.g., T13, T12) could similarly occur in areas such as north-central portions of the West Lagoon which are relatively deep (e.g., 20 to 25 feet). Plants are unlikely to "top out" in these areas (due in part to depth but also harvesting operations), thereby limiting the likelihood of higher near-surface DO during periods of high photosynthetic activity. However, increased decomposing plant biomass each year would increase BOD, potentially contributing to an increased occurrence of hypoxia in lagoon bottom waters that is currently limited to the most productive summer months of June, July, August. Long term potential impacts of continued spread of aquatic weed species include localized DO excursions from WQO criteria in other shallow areas of Lake Tahoe with aquatic weed infestations, though these effects would be less pronounced where there is more mixing from lake currents compared to the lagoons. If the spread of aquatic weeds continues, the impacts to DO in nearshore areas of Lake Tahoe increasingly would become **potentially significant** with more widespread exceedances of WQO criteria.

Issue WQ-6: Increases in Total Phosphorus Concentrations. WQO exceedances for TP would also likely continue in the Tahoe Keys Lagoons under the No Action Alternative. These exceedances could become more widespread, particularly if curlyleaf pondweed continues moving into deeper water. Curlyleaf pondweed is generally known to exhibit a unique life cycle with very early spring growth and summer die-back (Sastroutoma 1981). This life history pattern has the potential to increase internal loading of TP (James et al. 2003, James et al. 2007) that could contribute to summer algae blooms. Long-term continued spread of aquatic weeds in nearshore areas of greater Lake Tahoe would lead to increased internal cycling of nutrients from decomposing macrophytes and organic sediments, with the potential for localized exceedances of the WQO phosphorus criterion and increased phytoplankton productivity. This would become an increasingly **significant** effect.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. WQO exceedances for TN would also likely continue in the Tahoe Keys Lagoons under the No Action Alternative. These exceedances could become more extensive if curlyleaf pondweed continues moving into deeper water within the lagoons. In nearshore areas of Lake Tahoe, long-term continued spread of aquatic weeds would lead to increased internal cycling of nutrients from decomposing macrophytes and organic sediments, with the potential for localized exceedances of the WQO nitrogen criterion and increased phytoplankton productivity. This would become an increasingly **significant** effect.

Mitigation and Resource Protection Measures

No additional mitigation measures are assumed to occur under the No Action Alternative beyond existing programs. It is assumed that current efforts to control aquatic weed fragments and manage water quality in the Tahoe Keys lagoons would continue. It is further assumed that water quality management and mitigation efforts around Lake Tahoe would continue under the TMDL implementation plan and other programs. Although additional aquatic weed control efforts and other measures would be necessary to address significant adverse water quality effects identified in this EIR/EIS for the No Action Alternative, it is beyond the scope of this document to develop those mitigations.

Significant Unavoidable Impacts

The 2015 Lake Tahoe AIS Implementation Plan lists the 172 acres of the Tahoe Keys lagoons as the highest priority areas for AIS control in Lake Tahoe, with all other lake-wide infestations amounting to approximately 20 acres combined (Wittman and Chandra 2015). The control of aquatic weeds has been prioritized in part because they are considered a growing threat to the water quality of Lake Tahoe (TRPA 2014, Wittman and Chandra 2015). The potential impacts to water quality from the continued spread of aquatic weeds under the No Action Alternative described above are expected to be **significant and unavoidable**. Without the testing and development of new approaches for controlling and reducing the existing aquatic weed infestations in the Tahoe Keys, sufficient mitigation measures are not likely to be available to curtail adverse water quality impacts.

Continued dispersal of aquatic weed fragments, potentially spreading infestation throughout the Keys and in Lake Tahoe is expected to be an ongoing **significant and unavoidable** impact.

Potential ongoing local excursions of pH WQO, phosphorus and nitrogen would be a potentially **significant and unavoidable** impacts.

3.3.5 Aquatic Biology and Ecology

This section addresses impacts to non-target aquatic plant species (aquatic macrophytes), aquatic benthic macroinvertebrates (BMI), and fish; changes in community composition; and the potential for competitive exclusion of native aquatic macrophytes by target aquatic weeds.

Some potential aquatic biology and ecology issues identified in antidegradation policies, Basin Plan objectives, and TRPA threshold standards overlap with other disciplines and are addressed elsewhere in this DEIR/DEIS. Aquatic toxicity, including potential effects of herbicide applications and mobilization of existing aluminum in sediments, is addressed in Section 3.2, Environmental Health. Water quality issues are addressed in Section 3.3.4, Water Quality. Terrestrial biological resource issues are addressed in Section 3.3.6, Wildlife Biology.

Methods & Assumptions

Evaluations of potential impacts to the aquatic biology and ecology of the lagoons and subsequently greater Lake Tahoe were considered at the species and community composition scales. That is, potential direct impacts resulting from the proposed CMT or Action Alternatives on species composition for aquatic macrophytes, benthic macroinvertebrates (BMIs), and fish were evaluated as well as impacts to habitat conditions that could indirectly lead to changes in species composition. These evaluations looked at compliance with federal, state, and regional regulations aimed at protecting beneficial uses and protecting and enhancing aquatic habitats for vegetation, fish, and wildlife, including invertebrates.

The approach to evaluating potential impacts to the aquatic biology and ecology of the lagoons relied on existing peer-reviewed studies, recent surveys and reports characterizing conditions in the lagoons and similar habitats, and professional judgement of the technical authors. Evaluations of potential changes in species composition for aquatic macrophytes resulting from the proposed CMT or Action Alternatives were based largely on results from recent evaluations on the use of UV light, LFA, and bottom barriers to control target aquatic weeds in the lagoons and/or other areas of Lake Tahoe. Since no herbicide applications have occurred at Lake Tahoe, evaluations of potential biological responses from this proposed aquatic weed control method relied on existing peer-reviewed information, manufacturer's labels, and independent evaluations (e.g., WDOE 2017).

Information on existing aquatic macrophyte conditions included TKPOA macrophyte surveys in the lagoons in 2009, 2011, and annually from 2014 to 2019 to measure presence and absence of plant species (composition) and area cover. The most recent surveys have also included hydroacoustic scanning to determine the percent area of each lagoon covered by aquatic macrophytes, and the average plant biovolume within the water column. Surveys of aquatic macrophytes in greater Lake Tahoe have occurred since 1988 with subsequent surveys being less consistent and comprehensive since that time; however, a detailed lake-wide survey was conducted in 2019. Surveys of the fish and aquatic BMI community in the lagoons were conducted as part of this project in 2019 (Appendix F).

Considerations of aquatic biology and ecology impacts included the timing, duration and spatial extent of proposed activities. Aquatic macrophyte surveys prior to implementation of the proposed CMT or Action Alternatives would be used to adjust test site locations and timing of treatments to focus on target species and avoid/minimize impacts to non-target native species. The following methods and assumptions were applied in evaluating specific aquatic biology and ecology issues.

AQU-1: Effects on Non-Target Aquatic Macrophyte Species and AQU-4: Changes in Aquatic Macrophyte Community Composition. Existing information on the selectivity of the proposed aquatic herbicides, including manufacturer's labels and peer reviewed literature, was used to evaluate their potential to impact non-target aquatic plants. The use of UV light and bottom barriers can also be non-selectively lethal to non-target aquatic plants and result in changes to community composition; however site-specific evidence of this is limited. Assumptions regarding impacts of UV light on non-target aquatic macrophytes and changes to community composition relied on information from testing conducted in other areas of Lake Tahoe in 2018 (TRCD 2019). For bottom barriers, impact assessment was largely based on the small size of the fragments and limited information on barrier effectiveness in the lagoons using homeowner self-reporting (TKPOA 2020b). For all treatment approaches, it was assumed that pre-treatment surveys would be used to exclude sensitive plant species and communities of non-target aquatic macrophytes within the final boundaries of treatment areas.

AQU-2: Competitive Exclusion of Aquatic Macrophytes Due to Increased Growth of Curlyleaf Pondweed. Based on manufacturer's labels, only one of the three aquatic herbicides being considered for the CMT (endothall), is labeled for the control of curlyleaf pondweed. However, other studies suggest that florpyrauxifen-benzyl can also control curlyleaf pondweed (Anderson 2020, Heilman per. Comm.; Heilman and Getsinger 2018). Application of herbicides that are not effective in controlling curlyleaf pondweed (e.g., triclopyr) could provide this invasive species with a competitive advantage and result in its increased growth within treatment areas. Recent surveys by TKPOA have found that curlyleaf pondweed is growing at deeper depths in the lagoons. This information was used to evaluate how control measures might result in increased growth of curlyleaf pondweed, in particular, by applying herbicides that may not selectively target the species. It was assumed that pre-treatment surveys would be effective in selecting the appropriate herbicide based on species composition, and reduce the likelihood that curlyleaf pondweed density could increase due to competitive exclusion.

AQU-3: Effects on Sensitive Aquatic Macrophyte Species. An evaluation of the presence of special status aquatic macrophyte species in the project area and potential impacts to their density and distribution were considered. The TRPA Code of Ordinances (TRPA 2013) and aquatic macrophyte surveys (TKPOA 2020; TRPA 2019) were used to determine whether TRPA-listed sensitive macrophytes are in the lagoons or greater Lake Tahoe. The California Native Plant Society (CNPS) Inventory of Rare Plants was also reviewed to determine if any California Rare Plant Ranked (CRPR) species occur in the lagoons or Lake Tahoe (CNPS 2019). Methods used to evaluate the potential impacts to CRPR ranked species included TKPOA survey data and best professional judgement from applicators experienced in the use of aquatic herbicides.

AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Potential direct and indirect effects to the BMI community were evaluated based on an assessment of existing habitat conditions and the BMI community within the lagoons, and review and evaluation of studies and reports documenting BMI response to activities similar to those in the proposed CMT and Action Alternatives, while also considering the timing, duration and spatial extent of proposed activities and the sensitivity of the exiting community to degradation and change. This evaluation included an analysis of herbicide toxicity effects on BMIs, which is described in detail in Section 3.2, Environmental Health (see Issues EH-4 and EH-2).

AQU-6: Effects on Special-Status Fish Species. Potential direct and indirect effects to special-status fish species were evaluated based on an assessment of existing habitat conditions within the lagoons, habitat suitability requirements for special-status fish species present in the Lake Tahoe Basin, and the potential for their presence in the lagoons. Potential effects were also assessed based on review and evaluation of studies and reports documenting fish species response to activities similar to those in the proposed CMT and Action Alternatives, while also considering the timing, duration and spatial extent of proposed activities and the sensitivity of species to degradation and change. This evaluation included an analysis of herbicide toxicity effects on fish, which is described in detail in Section 3.2, Environmental Health (see Issues EH-4 and EH-2).

AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. Potential direct and indirect effects on fish movement that would block access to spawning habitat were evaluated based on an assessment of existing habitat conditions within, upstream, and immediately adjacent to the lagoons, life history and habitat suitability requirements for fish species present in the Lake Tahoe Basin, and the potential for activities in the proposed CMT and Action Alternatives to block access to spawning habitat. Consideration was given to the timing, duration and spatial extent of proposed activities relative to movement corridors to upstream and adjacent habitat, and the sensitivity of species to degradation and change.

AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. Potential direct and indirect effects on suitability of habitat for native or recreationally important game fish species were evaluated based on an assessment of existing habitat conditions within the lagoons and habitat suitability requirements for native or recreationally important game fish species present in the Lake Tahoe Basin, and the potential for activities in the proposed CMT and Action Alternatives to effect habitat. Consideration was given to native and nonnative species interactions and review and identification of recreationally important game fish species in the Lake Tahoe Basin.

AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. The federal Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990 and Chapter 63.4.1 of the TRPA Code were used to assist in evaluating the potential for the introduction of AIS or further spread of existing AIS. In particular, the TRPA Code prohibits the transport or introduction of AIS into the Lake Tahoe region. Mechanisms for introduction or further spread due to the proposed CMT or Action Alternatives include launching of contaminated watercraft or use of contaminated equipment or gear. All watercraft are inspected by TRPA or a designee thus introduction via watercraft is less likely; however, equipment or gear that is not subject to typical watercraft inspection protocols has the potential to not only introduce AIS but to transport AIS between different areas of the lagoons and potentially to greater Lake Tahoe.

3.3.5.1 Proposed Project (Control Methods Test)

This section describes the regulatory setting and environmental setting for the Proposed Project, evaluates potential impacts to non-target macrophytes, aquatic BMI, and fish; changes in community composition, and potential for competitive exclusion of non-target native plants by target aquatic weeds from testing each proposed Group A treatment (i.e., herbicides, ultraviolet light, LFA, and combined herbicide and ultraviolet light treatments) and Group B treatment (i.e., bottom barriers, impermeable bottom barriers with injection of hot water or acetic acid, diver assisted suction/hand pulling, and spot suction dredging), proposes mitigation and resource protection measures to limit adverse effects, and identifies any significant unavoidable adverse impacts.

Regulatory Setting

Federal

Federal Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) are charged with oversight of species designated as threatened or endangered under the federal Endangered Species Act (ESA) of 1973, as amended (16 U.S. Code [USC] 1531 et seq.). The act prohibits "take" of species listed as threatened or endangered. To "take" a species means to "*harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.*" Habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns also constitutes take. USFWS administers the ESA for terrestrial and freshwater species.

Where a proposed project has a federal nexus, compliance with the ESA is through a process described by Section 7 of the ESA. Section 7(a)(2) of the ESA requires federal agencies to consult with USFWS to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species. Regulations issued by USFWS guide the consultation process.

Clean Water Act Section 404

The federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), provides for the restoration and maintenance of the physical, chemical, and biological integrity of the nation's waters. Section 404 of the act prohibits the discharge of fill material into waters of the United States, including wetlands, except as permitted under separate regulations by the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA). Section 404 requires projects to receive authorization from the Secretary of the Army, acting through USACE, to discharge dredged or fill material into waters of the United States, including wetlands, whether the discharge is temporary or permanent. Waters of the United States are generally defined as "*waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; territorial seas and tributaries to such waters.*" Section 404 is generally applicable to projects for which fill material would be placed within or below the ordinary high-water mark of a water body. In conjunction with USACE's CWA Section 404 permits, CWA Section 401 requires that water quality certifications or waivers be issued by the USEPA, the states, or both (see below).

Clean Water Act Section 401

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification for the discharge. The certification must be obtained from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over the affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the regional water quality control board (RWQCB) with local jurisdiction—in this case, the Lahontan Regional Board. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States. Federal government delegates water pollution control authority under Section 401 to the states.

Clean Water Act and Environmental Protection Agency – Antidegradation Policy

The CWA and USEPA antidegradation policy requirements are summarized in Sections 3.2.1. and 3.3.4. These requirements address the protection of beneficial uses that include preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates; and the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened or endangered. Further, the federal Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990 compels state and federal agencies and public entities to prevent damage to valuable aquatic habitats by controlling the spread of aquatic invasive species. NANPCA defines a nonindigenous species as any species or other viable biological material that enters an ecosystem beyond its historic range. Nonindigenous species are further defined as those that threaten the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters. Executive Order 13751 defines "invasive species" as a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health. Aquatic invasive species (AIS) are invasive species that occur in freshwater, estuarine, or marine waters.

State

California Endangered Species Act

The California Endangered Species Act (CESA) was written to protect plant and animal species. Species are listed as endangered or threatened when their continued existence in California is in jeopardy. CESA and Sections 2050 and 2097 of the California Fish and Game Code prohibit activities that would result in "take" of State-listed and candidate species without prior authorization from the California Department of Fish and Wildlife (CDFW). Under CESA, "take" is defined as an activity that would directly or indirectly kill an individual of a species. Unlike under the federal ESA, the CESA definition of "take" does not include "harming" or "harassing"; therefore, habitat modification is not necessarily considered take under CESA.

California Fish and Game Code Section 1602—Lake and Streambed Alterations

Section 1602 of the California Fish and Game Code requires that a streambed alteration agreement be granted before any action is conducted that may divert or obstruct natural channel flow; substantially change the bed, channel, or bank of any river, stream, or lake designated by CDFW; or use any material from the streambed of a CDFW-designated waterway. Implementing the Proposed Project would require a streambed alteration agreement from CDFW for work in the Tahoe Keys lagoons.

California Native Plant Society Rare Plant Program

The California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants directly guides rare plant protection, conservation planning, and land acquisition and management in California. Individuals preparing environmental documents under the California Environmental Quality Act (CEQA) review inventory to determine the potential for resource conflicts and to develop project-specific lists of rare plants to target during botanical surveys. The California Rare Plant Rank (CRPR) system describes a plant's distribution, where CRPR 1A indicates a plant that is presumed extirpated in California and either rare or extinct elsewhere; CRPR 1B are plant that are rare, threatened, or endangered in California and elsewhere; CRPR 2A are plants presumed extirpated in California but common elsewhere; CRPR 2B are plants rare, threatened, or endangered in California but more common elsewhere; CRPR 3 are on a review list pending additional information; CRPR 4 are plants on a watch list with limited distribution. CRPR 1A, 1B, 2A, and 2B plants meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and are eligible for state listing. Impacts to these species or their habitat must be analyzed during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA, as they meet the definition of Rare or Endangered under CEQA Guidelines §15125 (c) and/or §15380. Further, threat ranks are assigned from 0.1 to 0.3, indicating the percentages of threatened occurrences (CNPS 2020).

Regional

Tahoe Regional Planning Agency Thresholds

Aquatic Invasive Species

The TRPA aquatic invasive species (AIS) threshold is a management standard that states that TRPA must "*[p]revent the introduction of new aquatic invasive species into the region's waters and reduce the abundance and distribution of known aquatic invasive species*" and "*[a]bate harmful ecological, economic, social and public health impacts resulting from aquatic invasive species*." The standards include one management standard with a numerical target, and six management standards without numerical targets.

Fisheries

The goal of TRPA-adopted threshold standards for fisheries resources is to improve aquatic habitat important for the growth, reproduction, and perpetuation of existing and threatened fish resources in the Lake Tahoe Basin. TRPA has adopted four indicator reporting categories in the fisheries threshold category, three numerical standards for stream habitat condition, one management standard for instream flow and Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*) (LCT).

Lake Habitat

The lake habitat threshold standard is a management standard with a numeric target to achieve the equivalent of 5,948 acres of "prime" fish habitat within the nearshore of Lake Tahoe - defined by substrate size. Prime fish habitat includes spawning habitat and feed and cover habitat. The indicator for lake habitat showed that the status is "at or somewhat better" than the adopted management targets with an "unknown" trend. Analysis of remotely sensed data collected in August 2010 and 2015 estimated that there are about 6,135 acres of "prime" fish habitat in Lake Tahoe's nearshore/littoral zone (O'Neil-Dunne et al. 2016), suggesting that TRPA is meeting the adopted management target of 5,948 acres.

Tahoe Regional Planning Agency Goals and Policies

The following describes goals and policies of the TRPA Regional Plan that relate to protection of water quality and aquatic species potentially affected by the Proposed Project:

GOAL FI-1: seeks to improve aquatic habitat essential for the growth, reproduction, and perpetuation of existing and threatened fish resources in the Lake Tahoe Region.

- Policy FI-1.2: Unnatural blockages and other impediments to fish movement shall be prohibited and removed, wherever appropriate.
- Policy FI-1.4: Standards for boating activity shall be established for the shallow zone of Lake Tahoe.
- Policy FI-1.5: Habitat improvement projects are acceptable practices in streams and lakes.
- Policy FI-1.9: Prohibit the release of nonnative aquatic invasive species in the region in cooperation with public and private entities. Control or eradicate existing populations of these species and take measures to prevent accidental or intentional release of such species.

Tahoe Regional Planning Agency Code of Ordinances

Chapter 63, "Fish Resources," of the TRPA Code of Ordinances (TRPA Code), includes provisions to ensure the protection of fish habitat and to provide for the enhancement of degraded habitat. The chapter applies to all projects and activities that could interfere with the health of fish populations in Lake Tahoe, its tributaries, and other lakes in the region. Provisions for the protection or enhancement of fish habitat shall be included for all new uses, projects and activities within fish habitat as identified by TRPA fish habitat maps or a qualified biologist. Fish habitat consists of a complex set of elements, such as spawning and nursery areas, food supply, and escape cover.

Lake habitat is protected in Chapter 63.3.1. Projects and activities conducted in the shorezone may be prohibited, limited, or otherwise regulated in prime habitat areas, or in areas and/or at times found by TRPA to be vulnerable or critical to the needs of fish.

Chapter 63.4, "Aquatic Invasive Species," discusses that AIS pose a serious threat to the waters of the Tahoe Region and can have a disastrous impact on the ecology and economy of the region. The following provisions are necessary to prevent the introduction and spread of AIS. Chapter 63.4.1 prohibits the transport or introduction or AIS into the Tahoe Region; the launching of any watercraft or landing of any seaplane contaminated with AIS into the waters of the region; the launching, or attempting to launch, of any motorized watercraft into the waters of the region without an inspection by TRPA or its designee, to detect the presence, and prevent the introduction of, AIS (nonmotorized watercraft and seaplanes are subject to inspection and are included in this provision if determined necessary by TRPA or its designee); the provision of inaccurate or false information to TRPA or persons designated to conduct inspections; and the alteration, modification or unauthorized use of any inspection seal or other device used by TRPA or its designee to indicate that a watercraft or seaplane last entered the waters of the Tahoe Region.

Environmental Setting

This section summarizes information on the existing conditions for aquatic biology and ecology of the Tahoe Keys ecosystems and is organized into subsections for non-target macrophytes, aquatic BMI, and fish.

Aquatic Macrophytes

Nearly two decades of mechanical harvesting have not controlled the spread of aquatic weeds in the lagoons, including Eurasian watermilfoil, curlyleaf pondweed, and coontail. TKPOA reports that the biovolume of aquatic weeds harvested from the lagoons increased from 100 cubic yards in 1984 to 6,274 cubic yards in 2019 (TKPOA 2020b). Plant surveys of the Tahoe Keys lagoons have been conducted in 2009, 2011, and annually from 2014 to 2019. Surveys since 2015 have included point-intercept sampling to determine percent composition by species and hydroacoustic sampling to determine presence of plant species, plant height, and biovolume (TKPOA 2019c and TKPOA 2020d). Biovolume refers to the percentage of the water column taken up by vegetation where vegetation exists. Areas that do not have any vegetation are not taken into consideration.

Inter-annual variation in the frequency of occurrence and biovolume of target aquatic weeds has been reported. For example, the occurrence frequency of Eurasian watermilfoil has ranged from 36 to 72 percent in the West Lagoon and between 21 and 61 percent in Lake Tallac (TKPOA 2020b). The frequency of coontail occurrence has similarly ranged from 37 to 70 percent in the West Lagoon and 83 to 95 percent in Lake Tallac. Most striking has been the steady increase in occurrence frequency of curlyleaf pondweed in the West Lagoon, up from three to 18 percent in early surveys, up to 48 percent in 2019 (TKPOA 2020d). The frequency of curlyleaf pondweed in Lake Tallac has been much more variable over the years, ranging from no occurrences in 2015 up to 29 percent in 2017 and only eight percent in 2019. Biovolume has fluctuated between 48 and 57 percent between 2015 and 2019 (excluding 2017) (TKPOA 2020b). These variations could be due to a number of factors including environmental, physiological, and the direct effects of harvesting.

Harvesting operations at the Tahoe Keys lagoons remove aquatic weeds between five and ten feet below the water surface (TKPOA 2020b). Elsewhere, environmental conditions associated with denser Eurasian watermilfoil growth coincided with lower water years, when water temperatures were higher and run-off was less (thus turbidity was lower and light penetration greater) (Smith and Barko 1990). However, based on data collected over time, TKPOA (2020d) has not found that increased water volume results in lower aquatic weed biovolume. Changes in coontail biovolume could be attributed to harvesting practices, but are also due to the fact that coontail is not rooted and can be moved by wind. Further, the prevalence and relative abundance of curlyleaf pondweed has increased and is now found in areas up to 20 feet deep, with recent data indicating that curlyleaf pondweed could potentially become the dominant aquatic plant in the lagoons (TKPOA 2018a).

Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species, and **AQU-4: Changes in Aquatic Macrophyte Community Composition.** The application of aquatic herbicides can directly result in short-term impacts to non-target aquatic macrophytes due to: (1) direct contact with the herbicide within the designated treatment site or (2) drift from the treatment site to adjacent receiving waters. The use of ultraviolet light to control curlyleaf pondweed, and Eurasian watermilfoil has also been shown to be non-selective and cause mortality of native Richard’s pondweed (*Potamogeton richardsonii*) and leafy pondweed (*P. foliosus*) at test locations at Lakeside Marina and Beach in South Lake Tahoe (TRCD 2018). Placement of bottom barriers could also adversely impact non-target macrophytes. Early results from testing LFA as an aquatic weed control method at Ski Run Marina and the Tahoe Keys West Lagoon have been inconclusive in determining effects on controlling target aquatic weeds and no specific information is available yet on impacts to non-target macrophytes (Singer 2019, TKPOA 2020).

Non-target macrophytes in the West Lagoon include leafy pondweed, nitella (*Nitella* sp., a macroalga), elodea (*Elodea canadensis*), and Richard's pondweed (TKPOA 2020d). American pondweed (*Potamogeton nodosus*) and Andean watermilfoil (*Myriophyllum quitense*) have also been reported in previous surveys (Anderson and Lind 2011). Since 2014, the frequency of leafy pondweed and Richard's pondweed has remained somewhat steady, ranging from five to 28 percent and three to five percent, respectively (TKPOA 2020d). The frequency of nitella and elodea has demonstrated wider fluctuations, ranging from seven to 39 percent and six to 41 percent, respectively (TKPOA 2020d). In addition to the non-target macrophytes described in the West Lagoon, non-target macrophytes in Lake Tallac also include watershield (*Brasenia schreberi*). The degree of inter-annual variation has been somewhat less pronounced; overall the frequency of all non-target macrophytes is much lower, with the exception of watershield which has ranged from six to 32 percent (TKPOA 2020d). Focusing on the most recent survey in 2019, elodea was the most frequently observed non-target macrophyte in the West Lagoon, followed by nitella, leafy pondweed, and Richard's pondweed. In Lake Tallac, watershield was the most frequently observed non-target macrophyte, followed by elodea. No other non-target macrophytes were reported in Lake Tallac from the 2019 survey, including nitella which reached up to 13 percent cover in 2017 (TKPOA 2020d).

Issue AQU-2: Competitive Exclusion of Aquatic Macrophytes Due to Increased Growth of Curlyleaf Pondweed. Given the widespread presence of target aquatic weeds, depth is likely the factor most limiting to increased plant coverage; however, surveys indicate a substantial increase in the frequency of occurrence of curlyleaf pondweed, up from 10 percent in 2014 to 34 percent in 2018, and 39 percent in 2019 (TKPOA 2020d) (Figure 3.3.5-1). Further, establishment at deeper depths (up to 20 feet deep) has also been reported (TKPOA 2018a). Of the three aquatic herbicides being considered for the CMT, florpyrauxifen-benzyl and triclopyr are known to be selective for Eurasian watermilfoil. If curlyleaf pondweed is present in treatment areas where these products are used, there could be an increase in curlyleaf pondweed. This increase could occur due to the weed's greater tolerance to colder (and deeper) water and the production of vegetative turions that are capable of sprouting again in late summer or persisting for several years in the sediment before sprouting when conditions are favorable (Sastroutomo 1981).

Issue AQU-3: Effects on Sensitive Aquatic Macrophyte Species. No non-target macrophytes that are identified by TRPA as sensitive, or which are listed under Federal or State ESA or CESA, respectively, are known to occur in the vicinity of the Tahoe Keys lagoons. However, watershield occurs in Lake Tallac and is the only known CRPR species confirmed in the project area, ranked CRPR 2B.3. Plants ranked 2B are considered rare, threatened or endangered in California but more common elsewhere, and plants with a threat rank of 3 are considered "not very threatened in California" (CNPS 2020). Frequency of occurrence of watershield has fluctuated since surveys began in 2015, ranging from six to 32 percent, with only six percent in 2019 (TKPOA 2020d). Further, a limited number of special status species have also been identified as potentially occurring in Lake Tahoe (TRCD 2014), and thus could potentially occur in the West Lagoon or Lake Tallac.

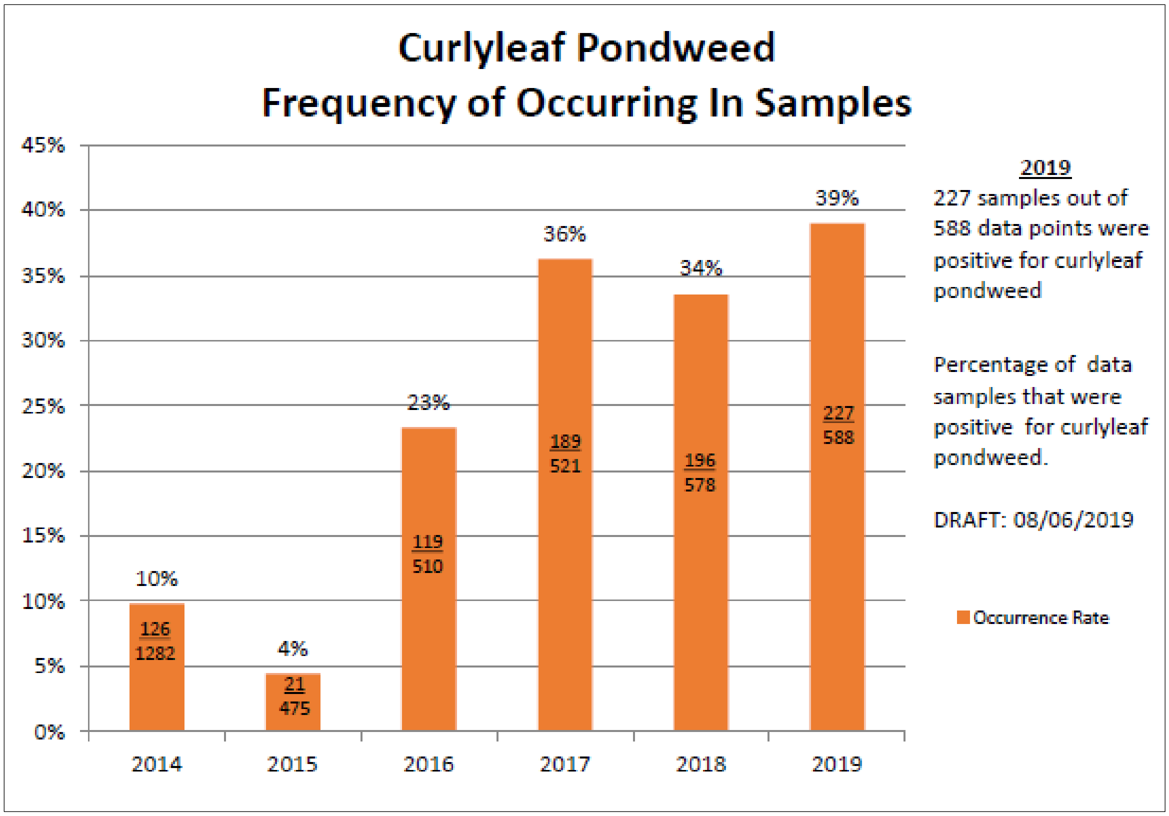


Figure 3.3.5-1 Curlyleaf Pondweed Frequency of Occurrence. (TKPOA 2020d)

Aquatic Benthic Macroinvertebrates

Aquatic BMI are common inhabitants of the aquatic environment. Insects are the main types present in streams, and commonly include mayflies, stoneflies, caddisflies, and true flies. Non-insect macroinvertebrates include snails, leeches, worms, and scuds, which tend to be more common in aquatic environments with slower moving water and with increased organic materials present (e.g., aquatic vegetation, fine sediments). Aquatic BMI are central to the proper ecological functioning of aquatic environments. They consume decomposing organic matter (e.g., detritus, wood and leaf debris) and attached algae, and in turn become an important food resource to fish and birds. In addition to their role in the food web, aquatic BMI have varying degrees of ability to withstand environmental degradation; thus they may be used as indicators of water quality and habitat condition. For example, sediments from erosion and/or pollutants from runoff may decrease the variety of BMI that are able to survive, which may indicate a degradation of biological health. Tolerance/intolerance measures are specific metrics that reflect the relative sensitivity of the community (group of taxa) to aquatic disturbances. Although the taxa used are usually “pollutant tolerant” or “intolerant,” they are not specific to the type of stressor. For example, these metric values typically also vary with increasing fine particulate organic matter and sedimentation.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Based on sampling conducted in 2019, the current aquatic BMI assemblage within the Tahoe Keys lagoons is comprised primarily of Copepods (crustaceans), Ostracods (crustaceans), and Chironomids (midges or lake flies). These taxa are generally categorized as tolerant to environmental disturbance and/or degradation (see

Appendix F; ESA 2020). The soft, fine sediment in the lagoons is rich with organic materials, which contributes to higher biological oxygen demand and lower dissolved oxygen levels, limiting its suitability to more intolerant (sensitive) and diverse taxa.

Native aquatic BMI have received special attention in the Tahoe Basin due to marked declines throughout North America. The western pearlshell mussel (*Margaritifera falcata*) is known to be a highly sensitive indicator species (Nedeau, Smith, and Stone 2005; CDFW 2011) and is known to occur within the lower reaches of the Upper Truckee River (California Tahoe Conservancy 2007). However, the soft, fine, organic-rich sediments in the Tahoe Keys lagoons do not provide suitable habitat conditions for the mussel and none were not observed in the 2019 aquatic macroinvertebrate sampling at the Tahoe Keys lagoons.

The Great Basin rams-horn (*Helisoma newberryi*) is a U.S. Forest Service sensitive species that is known to occur in Lake Tahoe. These snails utilize areas that have well oxygenated but soft substrate and clear, cold, slowly flowing water in larger lakes and spring-fed streams. Again, the organic-rich sediments in the Tahoe Keys Lagoons do not provide suitable habitat conditions for the rams-horn and none were observed in the 2019 BMI sampling.

The Lake Tahoe benthic stonefly (*Capnia lacustra*) is a USFWS species of concern and is ranked as a species of concern by the Nevada Natural Heritage Program. This species is known to occur in Lake Tahoe at depths of 95 to 400 feet. Tahoe Keys lagoons do not provide suitable habitat conditions for the Lake Tahoe benthic stonefly and none were not observed in the 2019 BMI sampling.

Fish

Eight native fish species are known to occur in the Tahoe Basin (Murphy and Knopp 2000, Moyle 2002, Dill and Cordone 1997, Schlesinger and Romsos 2000) (Table 3.3.5-1). The general abundance of the native fish community has declined considerably since the arrival of the first Euro-Americans in the Tahoe Basin in the 1840s. Several factors are believed to have contributed to the decline or extinction of native fish and the degradation of fish habitat in the Upper Truckee River as well as throughout the greater Tahoe Basin. Logging, water diversions, grazing, commercial harvest, road building, and the introduction of nonnative fish and other aquatic organisms have cumulatively contributed to the change in the Tahoe Basin’s fisheries composition and degradation of fish habitat (Murphy and Knopp 2000). At present, 23 fish species occur in Lake Tahoe and at least 13 (Table 3.3.5-1) are known to occur in the Tahoe Keys lagoons (Murphy and Knopp 2000, Moyle 2002, Dill and Cordone 1997, Schlesinger and Romsos 2000, ESA 2020; see Appendix F).

Fish surveys were conducted in Tahoe Keys lagoons in 2019 in support of characterizing conditions for this environmental analysis and an antidegradation analysis. A total of 13 different fish species were sampled (captured) during the surveys, consisting of four native species, two cold-water introduced species, and seven warm-water introduced species. A total of 1,731 individual fish were captured; 49 individuals were native species, four were cold-water introduced species (all Rainbow Trout) and 1,678 were warm-water introduced species (Table 3.3.5-1).

Issue AQU-6: Effects on Special-Status Fish Species. Two special-status fish species occur in the Tahoe Basin and have the potential to occur in the Tahoe Keys lagoons, Lahontan Cutthroat Trout (LCT) and Lahontan Lake Tui Chub (*Siphateles bicolor* [*pectinifer* and *obesa*]); each is described below.

Table 3.3.5-1 Native and Introduced Fish Species Currently Found in Lake Tahoe.

Common Name	Scientific Name	Status[1]	2019 Surveys
Native			
Lahontan Cutthroat Trout	*Oncorhynchus clarkii henshawi*	FT	Absent
Lahontan Redside Shiner	*Richardsonius egregious*	—	Present
Lahontan Speckled Dace	*Rhinichthys osculus robustus*	—	Absent
Lahontan Lake Tui Chub	*Siphateles bicolor (pectinifer* and *obesa*)	SSC	Present
Mountain Sucker	*Catostomus platyrhynchus*	—	Present
Mountain Whitefish	*Prosopium williamsoni*	SSC	Absent
Paiute Sculpin	*Cottus beldingi*	—	Absent
Tahoe Sucker	*Catostomus tahoensis*	—	Present
Warm-water Introduced			
Black Bullhead	*Ameiurus melas*	—	Present
Black Crappie	*Pomoxis nigromaculatus*	—	Present
Bluegill	*Lepomis macrochirus*	—	Present
Brown Bullhead	*Ameiurus nebulosus*	—	Present
Common Carp	*Cyprinus carpio*	—	Absent
Goldfish	*Carassius auratus*	—	Present
Golden Shiner	*Notemigonus crysoleucas*	—	Present
Largemouth Bass	*Micropterus salmoides*	—	Present
Smallmouth Bass	*Micropterus dolomieu*	—	Absent
Western Mosquitofish	*Gambusia affinis*	—	Absent
Cold-water Introduced			
Brook Trout	*Salvelinus fontinalis*	—	Absent
Brown Trout	*Salmo trutta*	—	Present
Kokanee (Sockeye Salmon)	*Oncorhynchus nerka*	—	Absent
Lake Trout (Mackinaw)	*Salvelinus namaycush*	—	Absent
Rainbow Trout	*Oncorhynchus mykiss*	—	Present

Notes:
[1] Status Codes:
FT = federally listed as threatened.
SSC = California Department of Fish and Wildlife Species of Special Concern.
"—": no special-status designation.
Source: Moyle 2002, Dill and Cordone 1997, Schlesinger and Romsos 2000, Caltrout 2017, ESA 2020; data compiled by ESA in 2020.

Lahontan Cutthroat Trout (LCT) is an inland cutthroat trout subspecies endemic to the physiographic Lahontan basin in northern Nevada, eastern California, and southern Oregon. Once widespread throughout the basin, LCT was the top predator in Lake Tahoe's aquatic ecosystem (TRPA 2016a). However, the species now occupies a fraction of its historical habitat. In 1970, LCT were listed as endangered under the federal ESA, but in 1975, the listing was downgraded to threatened to allow for more flexible management.

LCT were extirpated from Lake Tahoe due to overfishing, habitat degradation, and the introduction of nonnative aquatic species (TRPA 2016a). Moyle (2002) reported that LCT remained abundant in Lake Tahoe and its tributary waters until the early 1930s, but by 1939 the species was extirpated from the lake. Others suggest that extirpation occurred earlier. TRPA (2016a) reported that extirpation occurred around1860. Efforts to reintroduce LCT into the Tahoe Basin, including Lake Tahoe, are currently underway. CDFW has successfully reintroduced LCT into the headwaters of the Upper Truckee River, which provides spawning and rearing habitat for LCT, and this population is now the only self-sustaining population in the Tahoe Basin. In 2011, the Nevada Department of Wildlife stocked approximately 22,000 LCT into Lake Tahoe as part of an effort to restock native species for recreational anglers. LCT population dynamics, seasonal habitat utilization, growth rates, and interactions with nonnative species in Lake Tahoe remain unknown (TRPA 2016a). No additional information is available regarding the persistence of these introduced fish. Thus, this impact assessment is conducted to consider impacts if reintroduction efforts result in a persistent population of LCT or if future monitoring confirms the presence of the species from the 2011 stocking effort.

LCT are open water fish and typically remain in the pelagic (open water) zone of lakes. LCT require temperatures below 22°C, pH values of 6.5 to 8.5, and dissolved oxygen greater than 8.0 milligrams per liter (Moyle 2002). Large LCT feed pelagically on small fish, especially Tui chubs, but tend to stay close to the bottom. Smaller LCT feed on insects from the water's surface or on zooplankton. However, if neither is abundant they would feed on benthic insect larvae, crustaceans, and snails (Moyle 2002). Like other cutthroat trout, LCT is a stream spawner which spawns between February and July (USFWS 2014).

LCT typically return to the same stream from where they hatched and spawn in gravel riffles. Although each fish may spawn up to five times, most females spawn only once or twice. Spawning behavior is similar to that of rainbow trout, with females digging redds and then depositing eggs into the red as the eggs are fertilized by attending males. Embryos hatch in six to eight weeks, then fry emerge and begin feeding within two weeks of hatching (Moyle 2002). No LCT were observed in the Tahoe Keys lagoons and habitat conditions are generally unfavorable for this species.Lake Tahoe's <u>Lahontan Lake Tui Chub</u> population is declining. It is thought that the numerous physical and chemical changes related to the introduction of excess nutrients, sediments and pollutants entering the lake from surrounding developments, water diversions, wastewater treatment, and wetlands destruction have adversely affected the Lake Tahoe Tui Chub population. The introduction of Kokanee and Mysis also have depleted zooplankton populations, an important food source to the chubs (Moyle 2002). Largemouth Bass (*Micropterus salmoides*) also have contributed to the Tui Chub decline by preying on juveniles in nearshore rearing areas (Moyle 2002). Although actual abundances remain unknown, the population is likely small relative to historic numbers. The Lahontan Lake Tui Chub is a California Species of Special Concern because of the uncertain, but potentially declining status of the Lake Tahoe population (UC Davis 2017).

Lake Tahoe supports two subspecies of the Lahontan Lake Tui Chub; the pelagic form (*pectinifer*) that schools well off the bottom and the benthic form (*obesa*) that utilizes bottom waters (Moyle 2002). The benthic population feeds primarily on benthic invertebrates, whereas the pelagic population relies on zooplankton and small terrestrial insects (Moyle 2002). Tui Chub spawning occurs at night, primarily in

May and June, but can continue until the end of July (Moyle 2002; UC Davis 2017). Females are serial spawners, with high fecundities (Moyle 2002). Lake Tahoe Tui Chubs spawn in nearshore shallow waters (i.e., less than five feet deep) over sandy bottoms or in the mouths of streams (Moyle 2002; UC Davis 2017). Spawning activity includes large swirling aggregations, with multiple males surrounding each female (Moyle 2002). Eggs adhere to aquatic vegetation or the substrate and embryos hatch within three to six days. Larvae seem to concentrate in shallow, weedy nursery areas. As they grow, Tui Chubs spread out along the shore over both rock and sandy areas. Young-of-year Tui Chubs of both subspecies remain in shallow water throughout the summer (Moyle 2002) then migrate into deeper waters offshore in the winter (UC Davis 2017). Tui Chub were observed in the Tahoe Keys lagoons during surveys; however, the presence of nonnative predatory fish species limits their local viability in these habitats.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat, and
Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species.

Native minnows, suckers, sculpin, and trout are still found in Lake Tahoe (Table 3.3.5-2). These native, nongame species are important to the function of aquatic ecosystems. These species generally have a low probability of occurrence in the Tahoe Keys due to limiting habitat conditions and presence of nonnative predatory fish species (Table 3.3.5-2).

A variety of nonnative warmwater game fish species were illegally introduced in the mid-1970s to late-1970s and again in the late-1980s (Reuter and Miller 1999). More recently, in the Tahoe Keys, Smallmouth Bass (*Micropterus dolomieu*) were discovered in 2011 and Common Carp (*Cyprinus carpio*) were found in 2012 (Wittmann and Chandra 2015). Additionally, warmwater nongame fish species, including Golden Shiner (*Notemigonus crysoleucas*) and Western Mosquitofish (*Gambusia affinis*), also are found in the lake.

The most common nonnative warmwater species in Lake Tahoe generally, and Tahoe Keys specifically are Largemouth Bass and Bluegill (*Lepomis macrochirus*). Control efforts have been implemented to reduce nonnative warmwater fish species, but generally they continue to persist (Wittmann and Chandra 2015). Nonnative warmwater fishes primarily occur in the Tahoe Keys lagoons. However, snorkel surveys show satellite populations of Bluegill and Largemouth Bass occur in other areas of the lake (Chandra et al. 2009, Kamerath et al. 2008). The extent of warmwater fishes in areas outside of the Tahoe Keys remains unclear, but research suggests suitable habitat has increased due to warming water temperatures and the expansion of aquatic weed beds (Kamerath et al. 2008, Chandra et al. 2009, Ngai et al. 2013). Although suitable spawning habitat for warmwater fish is available in a number of areas around the lake, the south shore provides the most overall suitable spawning habitat followed by the east shore, north shore, and west shore (Chandra et al. 2009).

Nonnative warmwater fish feed on a variety of food types. Top predators such as bass feed on native minnows (family Cyprinidae) and trout. Bass also feed on juvenile Tui Chub when they are rearing in nearshore areas (Moyle 2002). Brown Bullhead are bottom feeders that feed on mollusks, insects, leeches, crustaceans, fish and fish eggs (USFS 2017). Common carp also scavenge bottom sediments, grubbing for zooplankton, crayfish and benthic worms. The diet of black crappie consists of zooplankton, insects, larvae, and small fish (USFS 2017). The diet of bluegill and golden shiner overlaps with native

Table 3.3.5-2 Life History of Native Fishes of the Tahoe Basin and Potential for Occurrence in Tahoe Keys Lagoons.

Common Name	Scientific Name	Status[1]	Potential for Occurrence	Migration	Spawning	Incubation	Habitat Preference: Fry	Habitat Preference: Juvenile	Habitat Preference: Adults
Minnows									
Lahontan Speckled Dace	*Rhinichthys osculus robustus*		Low		June - July	6 days	Warm shallow waters, between cobbles w/interstitial space	Warm shallows near large rocks	Pools with abundant cover (rocks, vegetation)
Lahontan Redside	*Richardsonius egregius*		Low	May - June	May - August	3 to 6 days	Along stream margins or in backwater areas	Along stream margins or in backwater areas	High velocity water at the heads of deep pools
Lahontan Lake Tui Chub	*Gila bicolor pectinifer*	CSC	Low		April - July	3 to 6 days	Near shore sandy bottoms or in mouths of streams with dense vegetation	Near shore sandy bottoms with dense vegetation	Near shore sandy bottoms with dense vegetation
Lahontan Stream Tui Chub	*Gila bicolor obesa*		Low		April - July	3 to 6 days	Sandy bottoms or in mouths of streams with dense vegetation	Sandy bottoms with dense vegetation	Sandy bottoms with dense vegetation
Suckers									
Tahoe Sucker	*Catostomus tahoensis*		Medium	April - May	March – June	3 to 6 days	Gravel riffles with a few large rocks	Shallow areas w/slow currents	Pools and runs
Salmonids									
Lahontan Cutthroat Trout	*Oncorhynchus clarkii henshawi*	FT/ TRPA	Low	April to May	April - July	6 to 8 weeks	Stream margins with shallow water, low flows	Lake dwelling	Lake dwelling
Mountain Whitefish	*Prosopium williamsoni*		Low	unknown	October - December	6 to 10 weeks	shallow backwaters	Rivers and creeks and lake bottom habitats in upper portions of the lake	Benthic habitats in larger rivers and in lakes
Sculpins									
Paiute Sculpin	*Cottus beldingi*		Low		May - August, peaks May through July		Gravel bottoms, crevices under rocks	Stream margins, lake margins (algae beds)	Streams (gravel substrate)

Source: Moyle 2002; data compiled by ESA in 2020.
[1] Special Status Codes:
FT = Federal Threatened
FSS = Forest Service Sensitive
CSC = California Species of Concern
TRPA = TRPA Threshold Special-Status Species

fish species and they feed primarily on mollusks, plant material, and invertebrates (Chandra et al. 2009). Western mosquitofish also compete with native species for food and are wide spectrum omnivores.

Based on the 2019 surveys, the lagoons appear to be dominated by Bluegill, Largemouth Bass, and Brown Bullhead with little abundance of native and cold water species. The lack of mixing between the lagoons and greater Lake Tahoe, in combination with increased water temperatures in the lagoons facilitates the growth of aquatic weeds which has the potential to substantially alter aquatic habitat function in favor of nonnative fish species.

Aquatic Invasive Species

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. Potential effects could occur from the introduction and establishment of other AIS taxa (including other invasive aquatic weeds) associated with equipment and personnel implementing the Proposed Project. Information on the infestations of aquatic weeds and the dominance of non-native fish species is summarized earlier in this environmental setting section for the Propose Project. In addition to the previously described invasive aquatic weeds and fish, other AIS are known to occur in the Tahoe Keys lagoons and/or greater Lake Tahoe. Examples are Asian clams (*Corbicula fluminea*), signal crayfish (*Pacifastacus leniusculus*), gill maggot (*Salmincola califoriensis*), mysid shrimp (*Mysis relicta*), and American bullfrog (*Rana catesbeiana*) (Wittmann and Chandra 2015). TRPA (2014) identifies a number of AIS of grave concern for introduction to Lake Tahoe, including invertebrates: zebra/quagga mussels (*Dreissena polymorpha* and *D. rostriformis bugensis*, respectively), New Zealand mudsnails (*Potamopyrgus antipodarum*), and spiny waterflea (*Bythotrephes longimanus*) and aquatic plants: Brazilian elodea (*Egeria densa*), hydrilla (*Hydrilla verticillata*), South American spongeplant (*Limnobium laevigatum*), and water chestnut (*Trapa natans*). There is also concern about the spread of established species including Asian clams (*Corbicula fluminea*), signal crayfish (*Pacifastacus leniusculus*), gill maggot (*Salmincola califoriensis*), and mysid shrimp (*Mysis relicta*).

Potential Impacts

Potential adverse and beneficial aquatic biology and ecology effects are evaluated in this section for each of the Group A aquatic weed control methods to be tested in the Proposed Project: aquatic herbicides, ultraviolet light, and LFA. Potential effects from the following Group B methods are also evaluated: bottom barriers, impermeable bottom barriers with injection of hot water or acetic acid, diver assisted suction/hand pulling, spot suction dredging, and spot treatment with ultraviolet light.

Issue AQU-1: Effects on Non-Target Macrophyte Species, and **AQU-4: Changes in Aquatic Macrophyte Community Composition.** Native aquatic plants provide important structure and function to freshwater ecosystems and the organisms that rely on them (Carpenter and Lodge 1986). Potential direct and indirect effects to the non-target macrophyte community could occur as the result of the Proposed Project (Control Methods Test, Group A and Group B methods). The threshold of significance for this issue area would be a substantial change or reduction in the diversity or distribution of the non-target macrophyte community.

Group A Methods

Herbicides

Aquatic herbicides can directly impact the non-target macrophytes found in the West Lagoon and Lake Tallac due to: (1) direct contact with the herbicide within the designated treatment site, or (2) drift from the treatment site to adjacent receiving waters. As a non-selective herbicide, endothall has the greatest potential to not only reduce the presence of target aquatic weeds but of non-target macrophytes within the treatment site. Specifically, native leafy pondweed, nitella, elodea, and Richard's pondweed could be impacted in the West Lagoon and leafy pondweed, nitella, and watershield in Lake Tallac. Drift from target sites could also impact non-target macrophytes in areas adjacent to test sites that are not isolated by double turbidity curtains or other barriers. Results from Rhodamine dye studies suggest that dead end channels would be far less likely to experience herbicide drift compared to open water sites (Anderson 2012). The active ingredients florpyrauxifen-benzyl and triclopyr are selective to Eurasian watermilfoil and are not reported to have lethal effects on the non-target macrophytes known to occur in the lagoons (Ecology 2017).

Information on species composition from Spring 2021 macrophyte surveys would facilitate necessary adjustments to treatment locations to avoid non-target macrophytes. If it is necessary to relocate treatment sites, areas would be selected that are of similar size and depth and that maximize the percent cover of target aquatic weeds with minimal non-target macrophytes. Any adjustments to the treatment locations would be proposed by the project proponent after spring macrophyte survey data are compiled, and require approval by LWB and TRPA staff before herbicides are tested. Surveys from 2019 indicate elodea is the most widespread non-target macrophyte in the West Lagoon, followed by the macroalgae nitella. Richard's and leafy pondweeds were found in distinct patches in the West Lagoon as were watershield and water smartweed (*Persicaria amphibia*) in Lake Tallac (TKPOA 2020d).

The extent of herbicide-only sites is 13.3 acres, or 7.7 percent of the lagoons, of which 8.2 acres or less than five percent are proposed for application of endothall. The anticipated duration of impacts to non-target macrophytes would be on the order of months until propagules move into and recolonize the sites. In summary, although mortality of individual non-target macrophytes is expected, a **less than significant** impact to aquatic macrophyte community composition as a result of herbicide testing is expected, as changes are expected to be temporary and limited to within or adjacent to treatment sites that comprise a small portion of the lagoons.

Ultraviolet Light

The use of ultraviolet light is not species-specific and is likely to impact non-target macrophytes within treatment sites. Based on preliminary results from ultraviolet light treatments at Lakeside Marina and Lakeside Beach, percent cover and frequency of occurrence of both native and non-native macrophytes were impacted immediately following treatment; however, native plants showed promising recovery as soon as one-year post-treatment (Figure 3.3.5-2 and Figure 3.3.5-3) (TRCD 2019). It should be noted that coontail, a target aquatic weed in the Proposed Project, was counted as a native macrophyte in that evaluation. In sites where ultraviolet light treatment is proposed, impacts to Richard's pondweed, nitella,

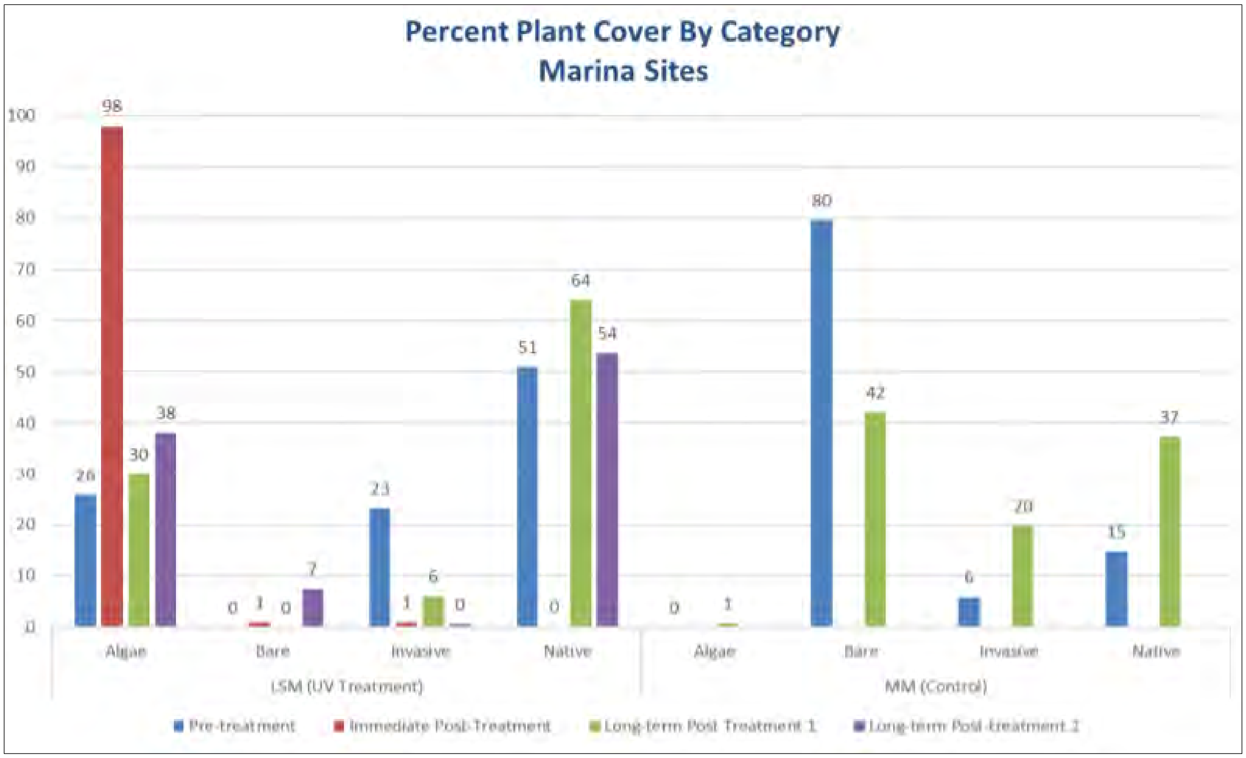
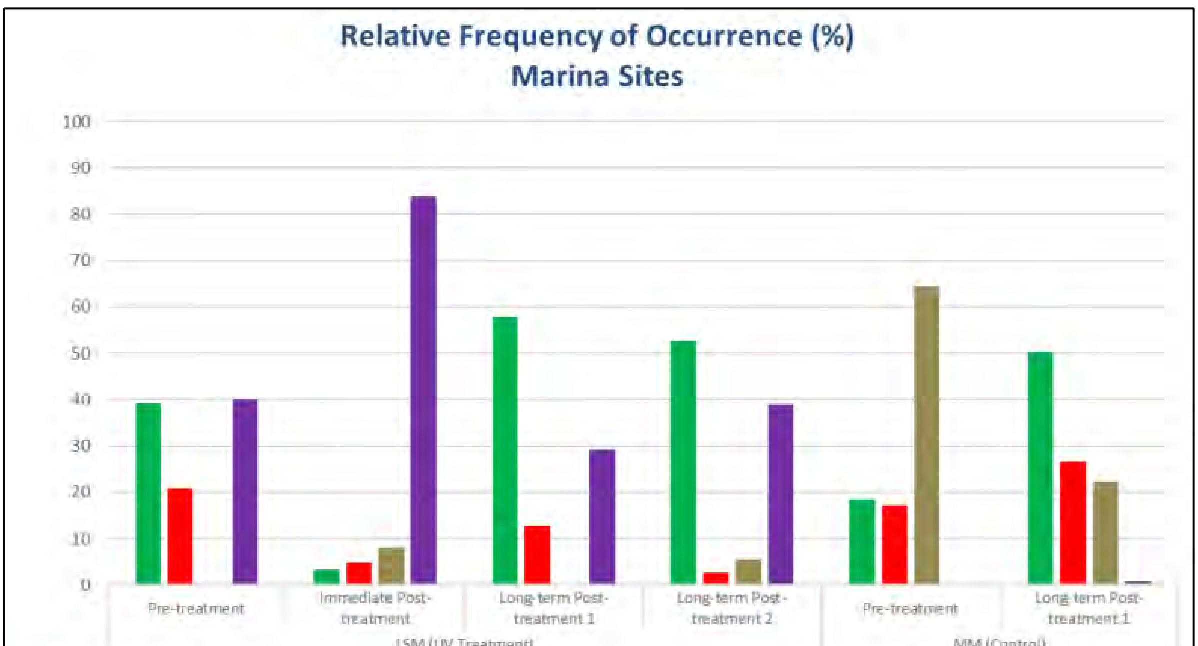


Figure 3.3.5-2 Mean Percent Cover Measured at Ski Run Marina Sites Treated with Ultraviolet Light, as Presented by Category (TRCD 2019).



	Pre-treatment	Immediate Post-treatment	Long-term Post-treatment 1	Long-term Post-treatment 2	Pre-treatment	Long-term Post-treatment 1
Native	39	3	58	53	18	50
Invasive	21	5	13	3	17	27
Bare	0	8	0	5	64	22
Algae	40	84	29	39	0	1

Figure 3.3.5-3 Relative Frequency of Occurrence by Category for Ski Run Marina Sites Treated with Ultraviolet Light (TRCD 2019).

and elodea would likely occur if they are found directly under the treatment array. Again, recent survey data should facilitate adjustments to treatment sites to avoid impacts to these species and, if it is necessary to relocate treatment sites, areas would be selected that are of similar size and depth and that maximize the percent cover of target aquatic weeds with minimal non-target macrophytes. Any adjustments to the treatment locations would be proposed by the project proponent after spring macrophyte survey data are compiled, and require approval by LWB and TRPA staff before ultraviolet light testing begins. The extent of ultraviolet light-only testing is 4.9 acres or 2.9 percent of the lagoons. The anticipated duration of impacts to non-target macrophytes would be on the order of months as ultraviolet light treatments are planned throughout the summer. The anticipated duration of impacts to non-target macrophytes would be on the order of months as propagules move into the sites. Similar to the effects of herbicide testing, some mortality of individual non-target macrophytes is expected; however, a **less than significant** impact would occur, as any adverse changes to aquatic macrophyte community composition from ultraviolet light testing would be temporary and limited to within test sites that comprise a small portion of the lagoons.

Combined Ultraviolet Light/Herbicides

Based on previously described individual impacts to non-target macrophytes, the combined use of ultraviolet light and the application of aquatic herbicides to control target aquatic weeds can result in direct and indirect short-term impacts to non-target macrophytes. This could result from direct mortality from non-selective herbicides (e.g., endothall), drift of herbicide outside the treatment areas, and non-selective impacts from ultraviolet light. In combination sites, ultraviolet light treatment impacts would occur in the central open water portions of the site and herbicide testing would affect nearshore areas including under and around docks and other structures. The total area proposed for combination herbicide/ultraviolet light testing is 10.4 acres or six percent of the lagoons. Although the extent of weed control would be larger than sites where individual treatments occur and the duration of the combination treatments would be somewhat longer due to multiple ultraviolet light treatments within a season, the impact would be **less than significant**.

Laminar Flow Aeration (LFA)

LFA has had very limited testing as an aquatic weed control method, and the mechanisms by which LFA reduces target aquatic weeds are not well understood; however, likely possibilities include: (1) the conversion of nitrogen to forms less readily available to rooted aquatic plants, and (2) the reduction in sediment organic matter that is hospitable to rooting. It is generally accepted that rooted aquatic plants obtain nitrogen from the sediments and that ammonium is the preferred form for the most efficient nutrient uptake (summarized in Barko et al. 1991). Preliminary and limited results of LFA testing at one site in Ski Run Marina indicated encouraging declines in total plant cover between a pre-treatment survey in 2018 and a post-treatment survey in 2019 (Singer 2019). Aquatic plant cover was reduced to varying degrees in different portions of the marina where testing occurred and reduction in the muck layer (i.e., organic sediments) ranged from five to 23 inches.

LFA testing was also conducted in the West Lagoon in 2019. Muck layer reduction ranged from 0.43 to 2.43 feet; however, TKPOA reported that "*based on hydroacoustic scans, the LFA testing to date appeared to make no discernable difference in weed density*" (TKPOA 2020d).

The limited area proposed for LFA testing is 12.8 acres or 7.4 percent of the lagoons, and any adverse effects on aquatic plant community composition are expected to be temporary. It is not anticipated that effects from LFA testing would extend more than a few feet from the test sites in the West Lagoon and Lake Tallac. The documented change in sediment nutrient availability, particularly ammonium, may in the short term limit the establishment of some aquatic plants; however, information on the long-term effect of LFA on sediment nutrients is limited and generally only applies to rooted plants as it is unclear how LFA could differentially affect non-rooted vascular plants such as coontail. Moreover, it is expected that changes to sediment composition would return to current conditions within a year or two after the LFA system is turned off. Because it has not yet been clearly demonstrated that LFA is effective in reducing aquatic macrophyte densities over a three-year period as proposed for the CMT, the potential effects on non-target macrophytes are uncertain.

Only a small portion of the overall Tahoe Keys lagoons would be treated using Group A methods as part of the CMT. Further, as discussed in Chapter 2, TKPOA would conduct pre-treatment aquatic plant surveys in the spring to adjust the locations of test sites as needed to ensure that: (1) the target aquatic weeds are present for each herbicide application, ultraviolet light test, LFA test, and combined herbicide/ultraviolet light test, (2) areas dominated by non-target macrophyte communities are avoided, and (3) the most appropriate herbicides are selected to maximize efficacy in treating target aquatic weeds, while minimizing impacts to non-target macrophytes. By limiting the size of proposed aquatic weed control test sites and taking advantage of adjusting test site locations to avoid areas dominated by native macrophytes, effects on non-target macrophytes and community composition would be expected to be small. Further, recolonization of test sites with native macrophyte species from adjacent areas in combination with reduced competitive pressure from target aquatic weeds, could result in beneficial effects on populations of native macrophytes and overall community composition. This impact would be **less than significant**.

Group B Methods

Generally, potential effects to non-target macrophytes from Group B methods are less than for Group A methods because Group B methods are spot treatments applied to limited areas compared to Group A methods that are applied to entire treatment sites. Impacts to non-target macrophyte species are expected primarily from bottom barriers, which non-selectively cover an area. Impacts to non-target macrophytes from diver handpulling and diver assisted suction could occur to the extent that short-term turbidity could make it difficult for divers to differentiate species. Group B follow-up methods would be tested in subsequent years as smaller spot treatments within sites where target species remain, providing a competitive advantage to recovery of test sites by native macrophytes. The anticipated duration of impacts to native macrophytes would be on the order of months as propagules move into the site and Group B methods deter re-growth of target aquatic weeds. Anticipated benefits of managing the target aquatic weeds include reduction in competitive pressure on native macrophytes and an increase in their occurrence (Wersal et al. 2010). Recovery of native macrophytes would likely result in improved habitat conditions for aquatic BMI and discourage use by non-native warmwater fishes (Kamerath et al. 2008, Chandra et al. 2009; summarized in Wittmann and Chandra 2015).

Use of Group B methods would be temporary (within season) and occur in localized areas where impacts would be minor and only slightly perceptible. Implementation of Group B methods would not be expected to result in substantial change or reduction in the diversity or distribution of non-target macrophytes or a substantial change in the overall aquatic macrophyte community composition. As stated above for Group A methods, macrophyte surveys would also be used to guide the selection and location of Group B methods to focus on remaining target aquatic weeds and avoid impacts to native macrophytes, including watershield. This impact would be **less than significant**.

Issue AQU-2: Competitive Exclusion of Aquatic Macrophyte Due to Increased Growth of Curlyleaf Pondweed. There is a potential for competitive exclusion of non-target macrophytes due to the increased growth of curlyleaf pondweed as the result of aquatic herbicide treatments conducted as part of Group A methods associated with the Proposed Project. The application of aquatic herbicides can indirectly affect non-target macrophytes by favoring the increased growth of more competitive nuisance weeds. The threshold of significance for this issue would be a substantial change or reduction in the diversity or distribution of the non-target macrophyte community as a result of increased growth of curlyleaf pondweed.

Group A Methods

<u>*Herbicides*</u>

At sites testing the aquatic herbicide florpyrauxifen-benzyl (or combination ultraviolet light/florpyrauxifen-benzyl), reductions in the target weed Eurasian watermilfoil can be expected; however, anticipated impacts to other target aquatic weeds are less conclusive. Florpyrauxifen-benzyl is not labeled for control of curlyleaf pondweed, yet there is evidence that it can limit shoot production from turions (Anderson 2020) and suppress growth of mature plants under static conditions (Heilman per. Comm.; Heilman and Getsinger 2018). Control of coontail is indicated on the manufacturer's label; however, preliminary post-treatment data indicate inconsistent results that could be site- or rate-specific (Heilman and Getsinger 2018). Thus, reductions in Eurasian watermilfoil could open up additional habitat for spread of curlyleaf pondweed or coontail if the treatments are not lethal to those species and there is sufficient propagule pressure (e.g., from curlyleaf pondweed stems or turions). If florpyrauxifen-benzyl is not approved for use, areas treated with triclopyr (or combination ultraviolet light/triclopyr) could result in increases in curlyleaf pondweed and coontail as this product is not labeled for their control. Where herbicide tests are not successful in reducing all three of the target aquatic weeds, there is a risk that surviving propagules would have a competitive advantage in recolonizing the test areas. Given the evidence available, the application of florpyrauxifen-benzyl (or combination ultraviolet light/florpyrauxifen-benzyl) has the potential to control curlyleaf pondweed while triclopyr is only expected to target Eurasian watermilfoil. If florpyrauxifen-benzyl is not approved for use as part of the CMT, the use of non-selective endothall could be used in sites dominated by curlyleaf pondweed thus reducing the likelihood of competitive exclusion from increased growth of curlyleaf pondweed, thus this impact would be **less than significant**.

<u>*Other Group A Methods*</u>

The testing of ultraviolet light alone has the potential for short term and localized impacts to non-target macrophytes. Unlike herbicides or combined ultraviolet light/herbicide treatments, its impacts are limited to the area directly beneath the light array. Where repeated ultraviolet light testing could continue into October when curlyleaf pondweed turions are sprouting, the method could reduce the competitive pressure it exerts the following spring. No competitive exclusion impacts to non-target macrophytes are anticipated from the testing of LFA.

As described above for issue AQU-1, pre-treatment macrophyte surveys would be implemented. It is anticipated that these measures would reduce the potential for non-target macrophytes to be included within the final treatment area boundaries and ensure the most appropriate treatments are applied to reduce the opportunity for survival of target aquatic weeds, particularly curlyleaf pondweed. The intent is to reduce the competitive advantage that target aquatic weeds would have the following spring as native macrophytes recover and propagules move into the treatment areas. It is intended that new surveys prior to the CMT implementation inform the location of final test site boundaries to avoid native macrophyte communities. The combined area of impacts from all Group A methods is 41.4 acres or 24 percent of the Tahoe Keys lagoons (or 28.6 acres or 16.6 percent if LFA sites do not impact non-target macrophytes). Pre-treatment surveys would help focus the test sites on target species, thus implementation of Group A methods is expected to reduce the competitive pressure exerted by curlyleaf pondweed. Given the limited area of Group A methods in the lagoons, their use is not expected to result in substantial changes or reduction in the diversity or distribution of the non-target macrophyte community or result in increased growth of curlyleaf pondweed. This impact would be **less than significant**.

Group B Methods

As described above, Group B methods do not include herbicide treatments.; thus, **no significant impacts** to non-target native plants would result due to competitive exclusion favoring increased growth of curlyleaf pondweed.

Issue AQU-3: Effects on Sensitive Macrophyte Species. As previously mentioned, watershield (a 2B.3 CRPR sensitive species) is known to occur in Lake Tallac where endothall treatments are proposed. There is the potential for impacts to watershield due to drift of aquatic herbicides as part of Group A methods associated with the Proposed Project. The threshold of significance for this issue area would be a substantial reduction in watershield biovolume in Lake Tallac below levels measured in the most recent pre-CMT surveys.

Group A Methods

Under the Proposed Project, herbicide testing would occur in Lake Tallac using endothall, a non-selective herbicide. In the most recent survey, watershield occurred approximately 1,500 feet from the most westerly proposed treatment site (TKPOA 2020d). Published literature and anecdotal evidence from field projects suggests that watershield would not be substantially impacted by endothall drift (Skogerboe and Getsinger 2002, C. Smith pers. comm. 2020). As mentioned under AQU-1, LFA testing is also proposed for 2.7 acres in Lake Tallac where watershield is known to occur. Again, LFA testing conducted in the West Lagoon in 2019 did not result in appreciable declines in overall biovolume, thus it is unlikely that LFA testing would result in a decline in watershield in Lake Tallac.

Although the drift of endothall from the treatment sites in Lake Tallac may contact watershield, there is no published evidence that it would cause substantial adverse effects. Pre-treatment surveys described for AQU-1 would be implemented. These measures to avoid watershield in Lake Tallac, are expected to avoid effects on sensitive macrophyte species resulting from Group A methods, and this impact would be **less than significant**.

Group B Methods

Implementation of Group B methods would focus on target species remaining after Group A methods are tested, thus impacts to sensitive aquatic macrophytes would be **less than significant**.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Potential direct and indirect effects to the BMI community could occur as the result of the Proposed Project (Control Methods Test, Group A and Group B methods). The threshold of significance for this issue area would be a substantial change or reduction in the size (e.g., number or density of individuals), diversity, or distribution of aquatic BMI community.

As described above, based on surveys conducted in 2019, the aquatic BMI community in the Tahoe Keys lagoons is dominated by taxa that are tolerant to environmental disturbance and/or degradation (ESA 2020). The soft, fine sediment in the lagoons is rich with organic materials, which contributes to higher biological oxygen demand and lower dissolved oxygen levels, limiting the suitability to more intolerant and less diverse taxa. Habitat conditions in the lagoons are generally unsuitable for special-status BMI and none were present during the 2019 surveys.

Group A Methods

Potential direct adverse effects may occur as a result of exposure to ultraviolet light, as well as combined herbicide and ultraviolet light treatments. As discussed in Chapter 2, aquatic herbicides proposed by TKPOA were selected following research and consultation with aquatic weed control specialists from government agencies and academia, to target aquatic weed species in Tahoe Keys lagoons and minimize potential effects to non-target plants, animals, and people.

<u>Herbicides</u>

The USEPA classifies pesticides according to their acute toxicity responses (WDOE undated). Acute toxicity describes the adverse effects of a substance that result from a single exposure or from multiple exposures in a short period of time. Acute endpoints are typically reported as EC50[1] or LC50[2] values. Compounds with acute values >100 ppm are classified as "Practically non-toxic" (best rating), while compounds with acute values of 10-100 ppm are classified as "Slightly toxic" (second best classification). A full analysis of herbicide toxicity effects on BMI and fish is provided in Section 3.2, Environmental Health (see Issues EH-4 and EH-2). Summary results from the analysis are presented below for each of the herbicides being proposed for use in the Tahoe Keys lagoons.

<u>Triclopyr</u>

Overall, the evidence from toxicity studies conducted with rainbow trout, bluegill, fathead minnow, and water fleas (*Daphnia* sp.), indicates that triclopyr's acute toxicity values are ~100 ppm or greater for most invertebrate and vertebrate species, indicating that a collective "Practically non-toxic" rating is most appropriate as a generic classification (WDOE undated). Even the LC50 of the most sensitive species used in toxicity testing, the fathead minnow, is ~18 times higher than the maximum allowable application concentration of 2.5 ppm for triclopyr (TKPOA 2018a), so acute effects would not be

[1] Concentrations at which 50 percent of test organisms exhibit a response such as immobilization

[2] Concentration at which 50 percent of test organisms exhibit a lethal response

expected. The USEPA has determined that triclopyr would have **no significant acute or chronic impact** on fish or freshwater invertebrates when recommended rates are used (WDOE undated).

Endothall

Toxicity tests conducted with rainbow trout, bluegill, channel catfish, and water fleas, indicate that, on an acute basis, the dipotassium salt of endothall proposed for use in the Tahoe Keys is slightly toxic to practically non-toxic to freshwater fish and invertebrates (EPA 2005a). Like triclopyr, the USEPA has determined that endothall would have **no significant acute or chronic impact** on fish or freshwater invertebrates when recommended rates are used (EPA 2005a).

Florpyrauxifen-benzyl

Toxicity tests conducted with rainbow trout, fathead minnow, water fleas, amphipods (*Gammarus* sp.), and snails (*Lymnaea* sp.) indicate that florpyrauxifen-benzyl is not toxic to these species (EPA 2017a; WDNR 2018). As was the case for triclopyr and endothall, the USEPA has determined that florpyrauxifen-benzyl would have **no significant acute or chronic impact** on fish or freshwater invertebrates when recommended rates are used (WDNR 2018).

Ultraviolet Light

The use of ultraviolet light as a plant control method has been recently tested in Lake Tahoe (Ultraviolet-C Light Plant Control Pilot Project). The final monitoring report for the pilot project indicated that ultraviolet light impacts may occur to aquatic BMI species above the sediment-water interface, but that there would be limited to no impact to flora and fauna that live below the surface because ultraviolet light is rapidly attenuated (decreases penetration) in the presence of organic material (TRCD 2019). Comparison of pre-treatment to immediate post-treatment results showed that changes were minor with total taxa richness, total abundance, and sensitive taxa richness and abundance increasing at treatment sites just a few weeks following ultraviolet light treatment. In summary, major impacts to the BMI communities were not measured at the treatment sites as a result of ultraviolet light applications, as the benthic community recolonized as expected (TRCD 2019; Wittmann et al. 2011). Further, long-term post-treatment monitoring results did not indicate concerning trends in ecological health or sustained impairment of the BMI community in aquatic environments (e.g., marina and littoral sites) as a consequence of the successful removal of aquatic invasive weeds. The impact of ultraviolet light to the aquatic benthic macroinvertebrate community is considered **less than significant**.

Laminar Flow Aeration (LFA)

As described in Section 3.3.4, Water Quality, LFA has the potential to directly affect water quality by circulating oxygenated water into bottom waters and the surface layer of sediments, breaking up thermal stratification of the water column, reducing the occurrence of low DO/low pH in deep waters and high DO/high pH shallow waters that is present during stratification, changing conditions for the release and mixing of nutrients from the sediment, and disturbing sediments causing increased turbidity.

Increased circulation is expected to moderate extremes in pH levels, bringing them closer to neutral pH within and adjacent to LFA test areas that are seasonally (during the summer, when high densities of aquatic weeds occur) very high near the surface and low near the bottom, and potentially limiting the BMI community under existing conditions. Nevertheless, because LFA testing is only proposed for a small portion of the lagoons, the overall benefit of changes in pH conditions is expected to be small.

DO concentrations would be expected to increase throughout the water column, especially in localized areas where LFA diffusers are deployed. Increases in DO concentrations at the lower layers of the water column could benefit the BMI community; however, because LFA testing is proposed only for a small portion of the lagoons, the overall beneficial change in DO conditions is expected to be small.

As discussed above, toxicity tests indicate that the herbicides proposed for use in the Tahoe Keys lagoons are not toxic to fish and BMI species and the USEPA has determined that the herbicides would have no significant acute or chronic impact on fish or freshwater BMI when recommended rates are used (WDOE undated; USEPA 2005a; WDNR 2018). Ultraviolet light treatments could result in temporary effects on the BMI community in the immediate treatment areas; however, based on evaluation of past ultraviolet treatments, adverse effects would be expected to be temporary (TRCD 2019; Wittmann et al. 2011). LFA would be expected to generally improve water quality, which could result in beneficial, albeit small, effects to the BMI community. All treatments would be temporary and localized. Implementation of Group A methods would not be expected to result in a substantial change or reduction in the diversity or distribution of the aquatic BMI community, and impacts to the aquatic benthic macroinvertebrate community would be **less than significant**.

Group B Methods

Potential direct adverse effects of Group B methods on BMI could occur as the result of placement of bottom barriers, which could also include the injection of hot water and/or acetic acid under the barriers, and/or the use of diver-assisted suction/hand pulling or spot-treatments using ultraviolet light or suction dredging. The potential effects associated with these methods is described below.

Bottom Barriers

Although the use of bottom barriers (including the injection acetic acid and/or hot water) could suffocate BMI or make conditions unsuitable for the BMI community, studies on the impact of barriers to BMI in Lake Tahoe have shown no apparent long-term impacts to BMI communities. Findings from the Tahoe Keys Aquatic Plant Management Research Project (TRCD 2015), reported densities of tolerant BMI to be higher in the Tahoe Keys marina (with no endemic taxa detected) as compared to greater Lake Tahoe. The authors concluded that the lack of a significant difference in invertebrate responses observed between control and treatment plots indicated that a BMI community dominated by tolerant taxa could persist under synthetic barriers or could rapidly recolonize treatment plots. Moreover, the study found that removing aquatic invasive weeds may benefit BMI communities that may not prefer vegetated areas (TRCD 2015). Rather, BMI densities in treatment plots, which contained no plants seven- and 50-days post-removal, were often higher than in adjacent control plots containing plants. The study determined that the distribution and density of BMI in the Tahoe Keys treatment and control sites were likely driven by taxon-specific substrate preferences or tolerances rather than by treatment effects. The density differences between plots also seemed to be related to differences in dominant plant type. Densities of midges and scuds, as well as the overall invertebrate assemblage, were greater in samples that contained aquatic invasive weeds than in samples containing native coontail or no plants at all. These results suggest that the assemblage of BMI communities in the Tahoe Keys is altered and dominated by tolerant taxa that occupy habitats containing aquatic invasive weeds.

Based on the results presented above from similar tests in the Tahoe Keys marina, the use of bottom barriers as part of Group B methods tests would result in **less than significant** impacts to the BMI community. Short-term losses of aquatic BMI could occur in the localized areas where bottom barriers are placed; however, these test sites likely would be rapidly re-colonized aquatic BMI after the tests are concluded.

Diver-assisted Suction/Hand Pulling or Spot Suction Dredging

Use of diver-assisted suction/had pulling or spot suction dredging could result in adverse impacts to the BMI community where equipment operations disturb the benthic sediment habitat that the BMI occupy, and would entrain and remove some BMI from treated areas. Suction dredging targeting Asian clam infestations in open areas of Lake Tahoe has been shown to disrupt BMI community structure (Wittmann et al. 2012) through the removal of non-target macroinvertebrate species. However, the purpose of suction dredging for the Proposed Project would be to target aquatic weeds rather than BMI, which would be expected to result in less disturbance to benthic habitats and BMI. Additionally, as described above, all treatment methods, including the use of diver-assisted suction/hand pulling and suction dredging, would be temporary and occur in localized areas. As a result, substantial changes or reductions in the diversity or distribution of the aquatic BMI community would not be expected beyond the small areas treated within test sites, and the impact would be **less than significant**.

Ultraviolet Light Spot Treatment

The potential impacts of using ultraviolet light for spot treatment of residual target aquatic weeds within test sites would be similar to those described for ultraviolet light above under Group A methods, although spot treatments would be on a much smaller scale.

As discussed above, studies on the impact of bottom barriers to BMI communities in Lake Tahoe have shown no apparent long-term impacts to BMI densities. Spot suction dredging could result in adverse impacts to the BMI community; however, as described above, all treatment methods, including the use of diver-assisted suction dredge, would be temporary and occur in localized areas. As a result, substantial changes or reductions in the diversity or distribution of the aquatic BMI community resulting from Group B methods would not be anticipated, and this impact would be **less than significant**.

Issue AQU-6: Effects on Special-Status Fish Species. Potential direct and indirect effects to special-status fish species could occur as the result of aquatic weed control methods testing. Potential direct effects include deterioration of fish health, and/or injury or mortality as a result of exposure to ultraviolet light, and/or through entrainment associated with suction dredging. Potential indirect effects could result from short-term water quality degradation associated with vegetation decomposition. The threshold of significance for this issue area would be a substantial reduction in numbers or reduced viability of special-status fish species.

As described above, two special-status fish species occur in the Tahoe Basin and have the potential to occur in the Tahoe Keys lagoons, LCT and Lahontan Tui Chub. However, existing habitat conditions are generally unfavorable for these species because the lagoons lack important constituent elements for these species as described in the environmental setting above. Additionally, nonnative, warm-water predatory fish species dominate the fish community in the lagoons, limiting the local viability of LCT and Tui Chub in these habitats. No LCT and a total of six Tui Chub were observed in the Tahoe Keys lagoons during 2019 surveys.

Proliferation of the aquatic weeds targeted by the Proposed Project results in the deterioration of natural habitats that support native aquatic species (TRCD 2014; TRPA 2014; Wittmann and Chandra 2015; ESA 2020). The presence of these aquatic weeds degrades habitat for cold-water fish species and in Lake Tahoe has been linked to the increased abundance and distribution of nonnative warm-water fish. The presence of warm-water fish species in Lake Tahoe poses a significant threat to native fisheries and to the potential recovery of LCT and Tui Chub. Therefore, removal and control of aquatic invasive weeds throughout Lake Tahoe's nearshore environment, including the Tahoe Keys lagoons, would have a beneficial effect on lake habitat for LCT and Tui Chub and would reduce existing threats to species recovery.

Group A Methods

Potential direct adverse effects to LCT and Tui Chub as a result of exposure to ultraviolet light, as well as combined herbicide and ultraviolet light treatments and LFA, are described below. The significance of all Group A methods is summarized below the discussion of each method below.

Herbicides

As described above for BMI, the USEPA classifies pesticides according to their acute toxicity responses (WDOE undated). Acute toxicity describes the adverse effects of a substance that result from a single exposure or from multiple exposures in a short period of time. A full analysis of herbicide toxicity effects on fish is provided in Section 3.2, Environmental Health (see Issues EH-4 and EH-2). Summary results from the analysis are presented above under Issue AQU-5 for each of the herbicides being proposed for use in the Tahoe Keys lagoons. As discussed above, toxicity tests indicate that the herbicides proposed for use in the Tahoe Keys lagoons are not toxic to fish species and the USEPA has determined that the herbicides would not have substantial acute or chronic adverse effects on fish when recommended rates are used (WDOE undated; USEPA 2005a; WDNR 2018).

Ultraviolet Light

The use of ultraviolet light as an aquatic weed control method has been recently tested in Lake Tahoe (Ultraviolet-C Light Plant Control Pilot Project); however, treatment effects on fish were not directly evaluated (TRCD 2019). Nevertheless, with the successful removal of aquatic invasive weeds, the aquatic environments (e.g., marina and littoral sites) did not exhibit concerning trends in ecological health or significant or sustained impairment as seen in long-term post-treatment monitoring results.

The use of ultraviolet light as a weed control method is being proposed in relatively small areas within the lagoons. While unlikely, based on habitat conditions and 2019 survey results, if special-status fish species are present in the lagoons, they would be expected to quickly sense and move away from the treated areas. Because the treatment areas are relatively small and treatments would be temporary, fish would have adequate space to move away and prolonged avoidance to exposure would not occur.

Laminar Flow Aeration (LFA)

As described above for BMI and in Section 3.3.4, Water Quality, LFA has the potential to directly affect water quality by injecting air into bottom waters and the surface layer of sediments, breaking up thermal stratification of the water column, reducing the occurrence of low DO/low pH in deep waters and high DO/high pH shallow waters that is present during stratification, changing conditions for the release and mixing of nutrients from the sediment, and disturbing sediments causing increased turbidity.

As discussed above, increased circulation would be expected to moderate pH levels within and adjacent to LFA test areas that are at times very high near the surface and low near the bottom, potentially limiting the fish community under existing conditions. Nevertheless, because LFA testing is only proposed for a small portion of the lagoons, the overall change in pH conditions is expected to be small.

DO concentrations would be expected to increase throughout the water column within localized areas where LFA diffusers are deployed. Increases in DO concentrations at the lower layers of the water column could benefit the fish community, including special-status species; however, because LFA testing is only proposed for a small portion of the lagoons, the overall change in DO conditions is expected to be small.

Group A Methods Summary

As discussed above, toxicity tests indicate that the herbicides proposed for use in the Tahoe Keys lagoons are not toxic to fish and BMI species and the USEPA has determined that the herbicides would have no significant acute or chronic impact on fish or BMI when recommended rates are used (WDOE undated; USEPA 2005a; WDNR 2018). Ultraviolet light treatments could result in temporary effects on special-status fish if they are present in the immediate treatment areas; however, fish would be expected to quickly move away to avoid exposure. LFA would be expected to generally improve water quality, which could result beneficial, albeit small, effects to fish species. All treatments would be temporary and localized. Implementation of Group A methods would not be expected to result in a substantial reduction in numbers or reduced viability of special-status fish species and this impact would be **less than significant**.

Group B Methods

Potential direct adverse effects could occur as the result of placement of bottom barriers, which could also include the injection of hot water and/or acetic acid under the barriers, and/or the use of diver-assisted suction dredge or spot treatments with ultraviolet light. The potential effects associated with these methods are described below.

Bottom Barriers

Bottom barriers could adversely impact special-status fish species if they became trapped under the barriers during placement. However, LCT would not be expected to be present and Tui Chub would only be expected to occur as a small number of individuals, if at all. Nevertheless, both species would be expected to sense the barrier being deployed and avoid being trapped under the barrier. Reductions aquatic weeds that may result from placement of the bottom barriers may benefit the species; however, any potential effects would be small.

Diver-assisted Suction/Hand Pulling

Use of diver-assisted suction dredge could result in adverse impacts to special-status fish because the suction dredge could disturb habitat and/or entrain fish where the dredge is used, if they are present. However, similar to the discussion above for bottom barriers, LCT would not be expected to be present and Tui Chub would only be expected to occur as a small number of individuals, if at all. Both species would be expected to sense the suction dredge and avoid temporary habitat disturbance and/or being entrained. Reductions in aquatic weeds may benefits the species; however, any potential effects would be small.

Ultraviolet Light Spot Treatment

The potential impacts of using ultraviolet light for spot treatment of residual target aquatic weeds within test sites would be similar to those described for ultraviolet light above under Group A methods, but spot treatments would be on a much smaller scale. Again, if special-status fish species were present in the lagoons, they would be expected to sense and quickly move away from the ultraviolet light spot treatment operations.

Group B Methods Summary

Use of bottom barriers, diver-assisted suction dredge, or spot treatments with ultraviolet light could adversely impact special-status fish if they are present in the immediate areas during treatment. However, LCT would not be expected to be present and Tui Chub would only be expected to occur as a small number of individuals, if at all. Both species would be anticipated to sense the treatment activity (i.e., disturbance) and move away to avoid becoming trapped, entrained, and/or affected by temporary habitat disturbance, as long as adequate habitat space is available for their movement. Temporary reductions in aquatic weeds may benefit the species; however, any potential effects would be small. Implementation of Group B methods would not be expected to result in a substantial reduction in numbers or reduced viability of special-status fish species, and this impact would be **less than significant**.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. Potential direct and indirect effects on fish movement that could block access to spawning habitat could occur as the result of aquatic weed control methods testing if spawning and rearing habitat is present in Tahoe Keys lagoons. Potential effects would result from fish movement delays or barriers as a result of aquatic herbicide treatments (including physical barriers associated with turbidity curtains), through the placement of bottom barriers on potential spawning substrate, through entrainment associated with suction dredging, and/or from short-term localized water quality degradation associated with vegetation decomposition that could repel fish from lagoon channels (e.g., hypoxia). The threshold of significance for this issue area would be a substantial reduction or blocking of access to spawning habitat.

Tahoe Keys lagoons are highly modified habitats that do not provide specialized spawning or rearing habitat for native fish, including special-status species. Further, the Tahoe Keys lagoons do not serve as a migratory pathway to upstream spawning or rearing habitat. As described above, proliferation of the aquatic weeds targeted by the Proposed Project, often result in the deterioration of natural habitats that support native aquatic species. The presence of these weeds degrades habitat for cold-water fish species and in Lake Tahoe has been linked to the increased abundance and distribution of nonnative warm-water fish. The presence of warm-water fish species in Lake Tahoe and specifically the Tahoe Keys lagoons poses a significant threat to native fisheries and to the potential recovery of LCT and Tui Chub. Therefore, removal and control of aquatic invasive weeds throughout Lake Tahoe's nearshore environment, including the Tahoe Keys lagoons, would have a beneficial effect on the native fish community.

Group A and B Methods

Potential adverse effects on fish movement that would block access to spawning habitat would not occur as a result of exposure to either Group A or Group B methods, because the highly modified habitats of the Tahoe Keys lagoons do not provide spawning or rearing habitat for native fish, including special-status species. This impact would be **less than significant**.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. Potential effects to the suitability of habitat for native or recreationally important game fish species include short-term degradation of habitat resulting from herbicide treatments, ultraviolet light, the placement of bottom barriers, increases in turbidity associated with suction dredging, and changes in submerged aquatic vegetation, which provides important habitat structure for certain fish species. The threshold of significance for this issue area would be a substantial reduction in the suitability of habitat for native or recreationally important game fish species.

As described above, native or recreationally important species and the existing deterioration of their habitat have a low probability of occurrence. Further, the presence of nonnative warm-water fish species in Lake Tahoe and specifically, the Tahoe Keys lagoons, poses a significant threat to native fisheries. Therefore, removal and control of aquatic invasive weeds throughout Lake Tahoe's nearshore environment, including the Tahoe Keys lagoons, would have a beneficial effect on the native fish community insofar as they disadvantage these invasive fish species.

Removal and control of target aquatic weeds throughout the Tahoe Keys lagoons could adversely affect warm-water fish species, including Largemouth Bass and Bluegill via the same mechanisms (e.g., conversion of nonnative habitat to native habitat), adding to the potential beneficial effect on native species. While Largemouth Bass and Bluegill are considered recreational species in many locations, they are not recognized as recreationally important species by CDFW[3] or Nevada Division of Wildlife.[4] Aquatic habitat conditions in the Tahoe Keys lagoons are generally not suitable for other species considered recreationally important, including Kokanee Salmon, Brown Trout, Lake Trout, and Rainbow Trout. Of

[3] https://apps.wildlife.ca.gov/sportfishingregs/
[4] http://www.ndow.org/Bodies_Of_Water/Lake_Tahoe/

these species, only a single Rainbow Trout individual was captured in the lagoons during the 2019 surveys (ESA 2020).

Group A Methods

Implementation of Group A methods would not be expected to result in substantial reduction in the amount or suitability of habitat for native or recreationally important game fish species. Since removal and control of target aquatic weeds in Tahoe Keys lagoons could have a beneficial effect on the native fish community and recreationally important nonnative fish species are generally not present in the lagoons, there would be a **less than significant** impact to this issue.

Group B Methods

As discussed above for Issue AQU-6, use of bottom barriers and diver-assisted suction/ hand pulling could adversely affect fish, if they are present in the immediate areas during treatment. However, the Tahoe Keys lagoons are dominated by nonnative fish species; at most only a small number of natives would be expected to occur. All species would be expected to sense the treatment activity and avoid becoming trapped, entrained, and/or affected by temporary habitat disturbance. Reduction in aquatic weeds may benefit native fish; however, potential effects would be small. Implementation of Group B methods would not substantially reduce the suitability of habitat for native or recreationally important game fish species. Since, as described above for Group A, removal and control of aquatic weeds in Tahoe Keys lagoons would have a beneficial effect on the native fish community and recreationally important nonnative fish species are generally not present in the lagoons, there would be a **less than significant** impact to this issue.

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. Biological material such as seeds, spores, eggs, or adult organisms can be transported in areas of standing water or moist conditions, and could be introduced and established within the Tahoe Keys lagoons and spread to greater Lake Tahoe. The likelihood of invasive fish species being introduced into standing water or by equipment that would be routinely used under the Proposed Project is very low; however, introductions of very small organisms, eggs, spores, seeds, or weed fragments could occur in the absence of appropriate decontamination protocols. The threshold of significance for this issue area would be further introduction or establishment of AIS, particularly invertebrates or aquatic weeds, resulting in ecological impacts.

Group A Methods

All Group A methods could introduce AIS through contaminated equipment. Examples include live organisms attached to or hidden in the bilge, anchors, or ballast systems of watercraft used for herbicide application, or deployment of LFA equipment or ultraviolet light arrays. All watercraft, including those used for all Group A methods under the Proposed Project, are required to stop at one of six inspection stations strategically located around major points of entry to Lake Tahoe, including the Tahoe Keys lagoons.

Given the rigorous inspection program at Lake Tahoe, it is unlikely that AIS would be introduced via watercraft. Protocols for inspecting and cleaning all in-water work equipment, such as that used by divers to deploy the LFA system, would be included in the permit conditions for the Proposed Project. Therefore, there would be a **less than significant** impact to this issue.

Group B Methods

The use of all Group B methods could result in the introduction of AIS through contaminated equipment such as dive gear or reusable bottom barriers. While AIS could be introduced in the course of implementing Group B methods, protocols for inspecting and cleaning all in-water work equipment would be included in the permit conditions for the Proposed Project. Therefore, there would be a **less than significant** impact to this issue.

Mitigation and Resource Protection Measures

Following Spring 2021 macrophyte surveys, the project proponent may propose adjustments to the aquatic weed control testing to better target dense beds of target species and avoid native plant communities. Any adjustments to the treatment locations would be proposed by the project proponent after spring macrophyte survey data are compiled, and require approval by LWB and TRPA staff before herbicide or ultraviolet light testing begins. No other mitigation or resource protection measures are proposed for aquatic macrophytes, aquatic BMI, fish, or AIS, as no potentially significant impacts are expected to occur.

Significant and Unavoidable Impacts

No significant and unavoidable impacts to non-target aquatic macrophytes, aquatic BMI, fish, or AIS would occur.

3.3.5.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

This section describes the regulatory setting and environmental setting for an alternative that would employ only non-herbicide aquatic weed control methods, evaluates potential effects to non-target macrophytes from each control method proposed for testing (i.e., ultraviolet light treatment and LFA as Group A methods), proposes mitigation and resource protection measures to limit adverse effects, and identifies any significant unavoidable adverse impacts. The same Group B methods described for the Proposed Project would be available for use under Alternative 1.

Regulatory Setting

The regulatory setting for Action Alternative 1 is similar to that described for the Proposed Project. Although this alternative does not propose testing herbicides, a CWA Section 401 water quality certification would be required to specify permit conditions to protect beneficial uses, including biological uses.

Environmental Setting

The environmental setting for Action Alternative 1 is the same as described for Issues AQU-1, AQU-4, and Issues AQU-5 through AQU-8 under the Proposed Project. Issues AQU-2, and AQU-3 do not apply to Action Alternative 1 as no herbicides would be introduced to the lagoons

Potential Impacts

Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species, and **AQU-4: Changes in Aquatic Macrophyte Community Composition**. The potential impacts for AQU-1 under Action Alternative 1 are the same as those presented for the Proposed Project, except there would be no impacts to non-target aquatic plants from direct herbicide exposures. Given the small areas proposed for testing aquatic weed control methods that are non-selective (i.e., ultraviolet light and some Group B methods), the ability to adjust test site locations to avoid areas dominated by native plant communities, expectations for recolonization of test sites with non-target macrophytes from adjacent areas, and reduced competitive pressure from target aquatic weeds, effects on non-target macrophytes and community composition under Action Alternative 1 are expected to be small. Further, as described in Chapter 2 and above, TKPOA would conduct pre-treatment aquatic plant surveys in the spring to adjust the locations of test sites as needed to ensure that potential adverse impacts are minimized. Therefore, there would be a **less than significant** impact to this issue.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. The potential impacts for AQU-5 under Action Alternative 1 are the same as those presented for the Proposed Project. Similarly, implementation of Group A or Group B methods would not be expected to result in a substantial change or reduction in the diversity or distribution of the aquatic BMI community. Therefore, there would be a **less than significant** impact to this issue.

Issue AQU-6: Effects on Special-Status Fish Species. The potential impacts for AQU-6 under Alternative 1 are the same as those presented for the Proposed Project. As with the Proposed Project, implementation of Group A or Group B methods would not be expected to result in a substantial reduction in numbers or reduced viability of special-status fish species. Therefore, there would be a **less than significant** impact to this issue.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. The potential impacts for AQU-7 under Action Alternative 1 are the same as those presented for the Proposed Project, except Action Alternative 1 would not include any herbicide testing. Potential direct adverse effects on fish movement that would block access to spawning habitat as a result of ultraviolet light testing or as a result of implementing Group B methods would not occur because the Tahoe Keys lagoons are highly modified habitats that do not provide specialized spawning or rearing habitat for native fish, including special-status fish species. Therefore, there would be a **less than significant** impact to this issue.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. The potential impacts for AQU-8 under Action Alternative 1 are the same as those presented for the Proposed Project. Recreationally important nonnative fish species are generally not present in the lagoons. Therefore, there would be a **less than significant** impact to this issue.

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. The potential impacts for AQU-9 under Action Alternative 1 are the same as those presented for the Proposed Project, except there would be fewer watercraft involved due to the exclusion of aquatic herbicide applications. Therefore, there would be a **less than significant** impact to this issue.

Mitigation and Resource Protection Measures

No mitigation or resource protection measures are proposed for aquatic macrophytes, aquatic BMI, fish, or AIS.

Significant and Unavoidable Impacts

No significant and unavoidable impacts to non-target native plants, aquatic BMI, fish, or AIS would occur from Action Alternative 1.

3.3.5.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

This section describes the regulatory and environmental settings for an alternative to test suction dredging and replacement of substrate as a Group A aquatic weed control method, evaluates potential effects to non-target macrophytes, proposes mitigation and resource protection measures to limit adverse effects, and identifies any significant unavoidable adverse impacts from these activities. Group B methods are not included under Action Alternative 2.

Regulatory Setting

Under Alternative 2, no herbicides would be tested; however, other applicable regulations under the Proposed Project would apply. Specifically included are those regulations that address the protection of beneficial uses, including preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates; and the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened or endangered.

Environmental Setting

The environmental setting for Action Alternative 2 is the same as for the Proposed Project regarding the existing conditions of aquatic macrophyte communities in the Tahoe Keys. However, issues AQU-2 and AQU-3 do not apply to Action Alternative 2 as no herbicides, LFA, ultraviolet light, or Group B methods would be tested in the lagoons, and actions described under Alternative 2 would not occur in Lake Tallac where a sensitive plant species is known to occur.

Issue AQU-1: Effects on Non-Target Macrophyte Species and Issue AQU-4: Changes in Aquatic Macrophyte Community Composition. The environmental setting associated with the potential effects on non-target macrophytes is the same as described for the Proposed Project; however, approximately two feet of upper sediments in the proposed dredge testing sites would be removed and replaced with coarse backfill of sand or gravel.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. The environmental setting associated with the potential effects on the aquatic BMI community is the same as described for the Proposed Project.

Issue AQU-6: Effects on Special-Status Fish Species. The environmental setting associated with the potential effects on special-status fish species is the same as described for the Proposed Project.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. The environmental setting associated with the potential effects on fish movement that would block access to spawning habitat is the same as described for the Proposed Project.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. The environmental setting associated with the potential effects on the suitability of habitat for native or recreationally important game fish species is the same as described for the Proposed Project.

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. The environmental setting associated with the potential effects of introduced AIS is the same as described for the Proposed Project.

Potential Impacts

Issue AQU-1: Effects on Non-Target Macrophyte Species. Suction dredging and substrate replacement would be a non-selective aquatic weed control method. Testing this method would entail the direct removal and mortality of non-target macrophytes present in the suction dredge areas. Group B methods would be implemented to reduce recolonization with target aquatic weeds; however, there would be a period of time before the non-target macrophytes reestablish themselves in the vacant niches on new substrate (ENSR Corporation 2007). During that period, the aquatic macrophyte communities within treatment areas would be reduced in size, and habitat function can be expected to be locally reduced (ENSR Corporation 2007). The total area proposed for suction dredging where plant mortality is 5.5 acres, or less than four percent of the Tahoe Keys lagoons. Further, the long-term benefit to native aquatic macrophyte communities from the control of target aquatic weeds would likely outweigh any short-term negative impacts to native macrophytes from suction dredging. Recolonization of these small treatment sites with aquatic plants from adjacent areas would likely occur in the first year following treatment. For these reasons, the unavoidable mortality and other adverse effects to non-target macrophytes are expected to present a **less than significant** impact to non-target macrophytes in the Tahoe Keys lagoons.

Issue AQU-4: Changes in Aquatic Plant Community Composition. Dredging fine organic sediment and replacing it with coarser substrate could have indirect effects on the composition of the aquatic plant community. The replacement material could be sand separated from the dredge spoils or outsourced pea gravel or drain rock that are considered less subject to rapid recolonization by aquatic weeds. Barko and Smart (1986) evaluated the growth of Eurasian watermilfoil and hydrilla (*Hydrilla verticillata*) on sediments of varying levels of organic matter and density. They reported poor growth on inorganic sediments with a sand fraction exceeding 75 percent dry sediment mass. However, they attributed reduced plant growth to complex relationships involving nutrient availability for both sand and organic sediments. While it is intended that the coarse substrate replaced in the West Lagoon would be less hospitable for colonization by target aquatic weeds, these same species are known to colonize areas in Lake Tahoe where the sediments are predominantly sand. Aquatic plant density and sediment particle size analysis were measured from five sites at Lake Tahoe, including a site in the West Lagoon (Walter 2000). Results indicated sand comprised between 87 and 96 percent of the sediment and the percent cover of aquatic plants in the nearshore was near 100 percent, the vast majority being Eurasian watermilfoil. Further, there is evidence that, within a single season, substantial fine organic sediment deposition rapidly accumulates on bottom barriers, followed by the establishment of target aquatic weeds. Taken together, results from other studies and observations in the West Lagoon and Lake Tahoe indicate uncertainty as to how plant community composition might change after suction dredging and substrate replacement. However, because the total area for dredging and substrate replacement would be limited to approximately 5.5 acres or three percent of the lagoons and substantial Group B methods would be implemented, the overall impact to aquatic plant community composition at Tahoe Keys is expected to be **less than significant**.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Potential impacts under Action Alternative 2 would be limited to suction dredging and replacement of substrate. Suction dredging would include the direct removal and mortality of non-target BMI specimens present in the substrate within the test areas. Compared to the Proposed Project (described above), suction dredging and the replacement of substrate as part of Action Alternative 2 test methods would be expected to result in increased disturbance of the benthic habitat and potentially prolong the period until the area is recolonized by BMI. In the longer term (e.g., months to years), replacing the existing organic-rich sediments with a more coarse, mineral substrate could increase aquatic BMI diversity, because the existing community is dominated by a relatively small diversity of taxa that are tolerant of the current, degraded conditions. BMI would be expected to recolonize the localized test areas and substantial, long-term changes or reductions in the diversity or distribution of the aquatic BMI community would not be expected. Therefore, this impact would be **less than significant**.

Issue AQU-6: Effects on Special-Status Fish Species. The potential impacts for AQU-6 under Action Alternative 2 would be similar to those presented for the Proposed Project. Replacement of substrate would disturb the benthic habitat, but LCT would not be expected to be present and Tui Chub would only be anticipated to occur as a small number of individuals, if at all. Both species would be expected to sense the suction dredge and placement of substrate, and avoid temporary habitat disturbance and/or being entrained. Similar to that for the Proposed Project, any reductions in aquatic weeds may benefit these species; however, any potential effects would be small. This impact would be **less than significant**.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. The potential impacts for AQU-7 under Action Alternative 2 would be similar to those presented for the Proposed Project. The Tahoe Keys lagoons do not serve as a migratory pathway to upstream spawning or rearing habitat. Implementation of Alternative 2 would not result in a substantial reduction or blocking of access to spawning habitat. Therefore, there would be a **less than significant** impact to this issue.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. The potential impacts for AQU-8 under Action Alternative 2 would be similar to those presented for the Proposed Project. Implementation of Action Alternative 2 would not result in a substantial reduction in the suitability of habitat for native or recreationally important game fish species. Therefore, there would be a **less than significant** impact to this issue.

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. The potential impacts for AQU-9 under Action Alternative 2 are the same as those presented for the Proposed Project. Therefore, there would be a **less than significant** impact to this issue.

Mitigation and Resource Protection Measures

No mitigation or resource protection measures are proposed for aquatic macrophytes, aquatic BMI, fish or AIS.

Significant and Unavoidable Impacts

No significant unavoidable impacts would occur to aquatic macrophytes, aquatic BMI, or fish from Action Alternative 2.

3.3.5.4 No Action Alternative

This section describes the regulatory and environmental setting for the No Action Alternative where only methods currently permitted as of 2019 would be used to control target aquatic weeds in the Tahoe Keys lagoons. This section further summarizes potential effects to non-target macrophytes that could result from continuing trends in aquatic weed proliferation in the Tahoe Keys lagoons and greater Lake Tahoe.

Regulatory Setting

Under the No Action Alternative, it is assumed that only methods currently approved in the *Lake-wide Aquatic Invasive Plant Control Project* (TRCD 2014) would be implemented for the foreseeable future to control the abundance and distribution of aquatic weeds in the greater Lake Tahoe. These methods include hand-pulling (including diver-assisted suction/hand pulling), limited use of bottom barriers, and approved LFA and ultraviolet light testing. Only methods approved in the *Integrated Management Plan for Aquatic Weeds for the Tahoe Keys Lagoons* (TKPOA 2020) would be implemented in Tahoe Keys. These methods are limited use of bottom barriers, mechanical harvesting, and approved LFA testing.

Environmental Setting

Under the No Action Alternative, the baseline environmental setting of the lagoons described for the Proposed Project would be the same; however, in the absence of long-term management, aquatic weeds would continue to spread both within the lagoons as well as greater Lake Tahoe. Issue AQU-2 would not apply because there would be no active control of other target species that could potentially provide a competitive advantage for curlyleaf pondweed. Issue AQU-3 would not apply as there is no evidence that currently approved methods to control aquatic weeds are impacting the population of watershield in Lake Tallac.

Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species, and Issue AQU-4: Changes in Aquatic Macrophyte Community Composition. Mechanical harvesters have been the primary method to control target aquatic weeds in the Tahoe Keys Lagoons. These operations contribute to the dispersal of fragments from the target aquatic weeds as well as turions from curlyleaf pondweed. A study in 2011 assessed the species composition and size classes of fragments collected pre- and post-harvesting from four locations in the West Lagoon (Anderson and Lind 2011). Post-harvesting, it was found that over 50 percent of the fragments were Eurasian watermilfoil and over 30 percent were coontail. The mean fragment lengths ranged from just over six inches up to nine inches, which is sufficient for establishing new plants. Less than five percent of the fragments were curlyleaf pondweed; however, the density of that species was far less at that time compared to recent surveys. Anderson and Lind (2011) concluded that harvesting operations impact native plants, particularly elodea and leafy pondweed. Since that time, TKPOA has implemented measures to substantially reduce the number of fragments released due to harvesting operations, including skimmer boats that capture fragments post-harvesting and boat back-up stations in conjunction with seabins to limit the spread of fragments to greater Lake Tahoe. In addition to mechanical harvesting, bottom barriers and testing of LFA are ongoing activities in the Tahoe Keys lagoons that have the potential to adversely impact non-target aquatic macrophytes and cause changes in macrophyte community composition.

The frequency of occurrence in target aquatic weeds has steadily increased in the lagoons since routine assessments began in 2014 (TKPOA 2020d). In particular, curlyleaf pondweed has not only increased in frequency, but is also spreading to deeper waters of the lagoons. There are a limited number of native plants in the lagoons and, on average, their frequency of occurrence has been substantially less than the target aquatic weeds since 2014; however, while their occurrences have fluctuated, there has been a general decline in native plants with the notable exception of increases in watershield in Lake Tallac (TKPOA 2020d).

Aquatic weeds known to occur in greater Lake Tahoe similarly include Eurasian watermilfoil, curlyleaf pondweed, and coontail with substantial evidence that these species have also been expanding in the lake since 1995 (Anderson 2006, Shaw et al. 2016, Mooney et al. 2019). In 2018, over 50 transects in marinas and embayments, major tributaries, marshes, and open-water nearshore areas of Lake Tahoe and the Tahoe Keys lagoons were surveyed for aquatic plants (Mooney et al. 2019). Comparing these results with data presented by Anderson (2006), it does not appear that curlyleaf pondweed has expanded from populations in the south and southeastern portions of Lake Tahoe; however, previous data were presented as presence/absence without information on percent cover. Curlyleaf pondweed and Eurasian watermilfoil have previously been documented in Emerald Bay (Shaw et al. 2016); however, neither species were reported in the 2018 survey. This is likely due to aggressive management efforts (Shaw et al. 2016; TRCD 2014) but may be due to the limited number of transects surveyed in 2018 within or adjacent to Emerald Bay. In addition to the native macrophytes reported in the lagoons, common bladderwort, *Chara* sp., *Najas* sp., northern milfoil, quillwort, and variable-leaved milfoil are also found in greater Lake Tahoe though their coverage is generally quite low in the open-water nearshore areas and higher in the marinas and embayments (Mooney et al. 2016).

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. The environmental setting associated with the potential effects on the aquatic BMI community is the same as described for the Proposed Project. In addition to Tahoe Keys lagoons, the setting would also include portions of greater Lake Tahoe.

Issue AQU-6: Effects on Special-Status Fish Species. The environmental setting associated with the potential effects on special-status fish species is the same as described for the Proposed Project. In addition to Tahoe Keys lagoons, the setting would also include portions of greater Lake Tahoe.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. The environmental setting associated with the potential effects on fish movement that would block access to spawning habitat is the same as described for the Proposed Project. In addition to Tahoe Keys lagoons, the setting would also include portions of greater Lake Tahoe.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. The environmental setting associated with the potential effects on the suitability of habitat for native or recreationally important game fish species is the same as described for the Proposed Project. In addition to Tahoe Keys lagoons, the setting would also include portions of greater Lake Tahoe.

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. The environmental setting associated with the potential effects of introduced AIS is the same as described for the Proposed Project. Under the No Action alternative there is no potential for AIS to be introduced via additional equipment and personnel that would be used to implement the CMT; however, aquatic weeds could continue to spread from the Tahoe Keys to other areas of Lake Tahoe without the development and testing of new methods to control the infestation in the lagoons.

Potential Impacts

Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species.

Issue AQU-4: Changes in Aquatic Macrophyte Community Composition. Under the No Action Alternative, it would be expected that target aquatic weeds would continue to spread within the lagoons and greater Lake Tahoe into areas not currently infested. Although TKPOA has implemented several fragment control methods during mechanical harvesting, these methods do not completely contain and remove fragments that can propagate new plants. Ongoing use of bottom barriers could also adversely impact non-target macrophytes if barriers are placed in areas that include native macrophytes. Under the No Action Alternative, ongoing testing of LFA would also continue and no specific information is available yet on impacts to non-target macrophytes resulting from previous testing (Singer 2019, TKPOA 2020).

The limited number of native aquatic plant species in the Tahoe Keys lagoons would likely continue to decline in both frequency of occurrence and biovolume. Curlyleaf pondweed would likely continue its trajectory of infesting deeper waters and potentially becoming the dominant aquatic weed due to its tolerance to colder (and deeper) water and prolific production of turions (TKPOA 2018, TKPOA 2020d). Given that the biovolume of combined macrophytes in the West Lagoon is on the order of 70 percent, with greater than 90 percent areal coverage, deep water areas are most likely to be colonized, particularly by curlyleaf pondweed. The intensity of the infestation in the lagoons would be substantial and likely to adversely impact non-target macrophytes which currently represent, on average, less than 30 percent occurrence for the most common native species (elodea) and four to 14 percent for other native pondweeds (TKPOA 2020d). Thus, the continued spread of curlyleaf pondweed has the potential to further change the plant community composition in deeper water areas of the lagoons, and also further spread in nearshore areas of greater Lake Tahoe. Potential habitat for colonization in Lake Tahoe has been estimated at as much as 11,000 acres based on bathymetry alone (TRPA 2014), though a number of factors such as wind and sediment type would be strongly limiting (Wittmann et al. 2015). Continuing the status quo aquatic weed control efforts, including mechanical harvesting, in the Tahoe Keys is expected to lead to expansion of aquatic weed growth in the lagoons and in other nearshore areas of Lake Tahoe, particularly with continued spread of curlyleaf pondweed infestations. These changes in macrophyte community composition would be **significant**.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Under the No Action Alternative, the continued proliferation of target aquatic weeds and associated degradation of benthic habitats would continue to limit the BMI community in the Tahoe Keys lagoons. Additionally, as described above for AQU-4, continued spread of aquatic invasive weeds has the potential to further change the plant community composition in deeper water areas of the lagoons, and also further spread in nearshore areas of greater Lake Tahoe. Similar to benthic conditions in the Tahoe Keys lagoons, expansion of aquatic invasive weeds into other areas, including relatively shallow nearshore environments, would result in increased organic-rich sediments, degrading benthic habitats and limiting the aquatic BMI community to more tolerant, less diverse taxa.

As described above in the environmental setting section for the Proposed Project, the western pearlshell mussel is known to occur within the lower reaches of the Upper Truckee River and the Great Basin rams-horn is a snail that utilizes areas that have well oxygenated but soft substrate and clear, cold, slowly flowing water in larger lakes and spring-fed streams. These species could be adversely impacted by further expansion of aquatic invasive weeds into the Upper Truckee River, and potentially other tributaries to the Lake where suitable habitat may exist. The Lake Tahoe benthic stonefly is known to occur in Lake Tahoe at depths of 95 to 400 feet and, as a result, this species would not be impacted by expansion of aquatic weeds in the nearshore environment.

If the continued spread of aquatic invasive weeds goes unchecked, the resulting changes to nearshore benthic habitats and the associated BMI community composition (i.e., size, diversity, and/or distribution) would be **significant**.

Issue AQU-6: Effects on Special-Status Fish Species. Under the No Action Alternative, proliferation of aquatic invasive weed species and associated degradation of natural habitats that support native aquatic species would continue. As stated above, the presence of target aquatic weeds degrades habitat for cold-water fish species and has been linked to the increased abundance and distribution of nonnative warm-water fish. The presence of warm-water introduced fish species in Lake Tahoe poses a significant threat to the native fish community and to the potential recovery of LCT and Tui Chub. As described above for AQU-4, continued spread of aquatic invasive weeds has the potential to further change the plant community composition in deeper water areas of the lagoons, and also further spread in nearshore areas of greater Lake Tahoe. This would be expected to further degrade conditions for special-status fish, similar to that for the Tahoe Keys lagoons.

As described above in the environmental setting section for the Proposed Project, CDFW has successfully reintroduced LCT into the headwaters of the Upper Truckee River, which provides spawning and rearing habitat for LCT, and this population is now the only self-sustaining population in the Tahoe Basin. LCT present in the Upper Truckee River do not require access to Lake Tahoe to complete their life history; however, any LCT that enter Lake Tahoe from the Upper Truckee River would require access back into the river to spawn. Additionally, Tui Chub spawn in nearshore shallow waters (i.e., less than five feet deep) over sandy bottoms or in the mouths of streams (Moyle 2002; UC Davis 2017) and young-of-year remain in shallow water throughout the summer (Moyle 2002) then migrate into deeper waters offshore in the winter (UC Davis 2017).

If the continued spread of aquatic weeds goes unchecked and substantially expands into the mouths of the Upper Truckee River, LCT access could become limited due to physical blockage from dense stands of weeds, and/or due to increases in predatory fish and predation risk. Additionally, expansion of aquatic weeds into nearshore areas could degrade important habitat for Tui Chub. The resulting effects on LCT and Tui Chub would be **significant**.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. Tahoe Keys lagoons are highly modified habitats that do not provide specialized spawning or rearing habitat for native, including special-status fish species. Further, the Tahoe Keys lagoons do not serve as a migratory pathway to upstream spawning or rearing habitat. However, as described above for AQU-4, continued spread of aquatic invasive weeds has the potential to further change the plant community composition in deeper water areas of the lagoons, and also further spread in nearshore areas of greater Lake Tahoe. This would be expected to further degrade aquatic habitat conditions, including potentially at or near the mouth of the Upper Truckee River and/or Trout Creek, immediately adjacent to the Tahoe Keys, and other tributaries, which provide spawning habitat for several native fish species. If the continued spread of aquatic weeds goes unchecked and substantially expands into the mouths of the Upper Truckee River, Trout Creek, or other tributaries, access to spawning habitat could become limited due to physical blockage from dense stands of weeds, and/or due to increases in predatory fish and predation risk. However, high spring flows associated with runoff would seasonally scour and clear any aquatic weed growth that may accumulate over the summer months. Further, most native fish that would access these tributaries are spring spawners (Table 3.3.5-2); therefore, their movement timing would coincide with the same period when access would be temporarily restored. While conditions could become seasonally degraded, they would not be expected to degrade to a point that would result in substantial effects on fish movement that would block access to spawning habitat. As a result, this impact would be **less than significant**.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. Under the No Action Alternative, the continued proliferation of aquatic invasive weed species and associated degradation of benthic habitats would continue to limit habitat suitability for native fish species. As described above for AQU-4, continued spread of aquatic invasive weeds has the potential to further change the plant community composition in deeper water areas of the lagoons, and also further spread in nearshore areas of greater Lake Tahoe. As described in AQU-6 and AQU-7, this would be expected to further degrade habitat conditions for native fish species, similar to that for the Tahoe Keys lagoons.

As described under AQU-7 for the Proposed Project, aquatic habitat conditions in the Tahoe Keys lagoons are generally not suitable for recreationally important game species, including Kokanee Salmon, Brown Trout, Lake Trout, and Rainbow Trout; therefore, continued proliferation of aquatic invasive weeds would not substantially change conditions for these species in the lagoons. Further spread of aquatic invasive weeds in nearshore areas of greater Lake Tahoe would not be expected to substantially affect Lake Trout because they are pelagic (open water) species that do not utilize nearshore environments. Kokanee Salmon, Brown Trout, and Rainbow Trout also utilize pelagic habitat for foraging; however, they all require creeks or rivers for spawning (Moyle 2002). If the continued spread of aquatic weeds goes unchecked and substantially expands into the mouths of the Upper Truckee River, Trout Creek, or other tributaries (e.g., Taylor Creek for Kokanee Salmon), access to spawning habitat for these species could become limited, similar to that described under AQU-6, above. As a result, if the continued spread of aquatic invasive weeds goes unchecked, the resulting changes to habitat for native or recreationally important game fish species would be **significant**.

Issue AQU-9: Effects Associated with the Introduction or Spread of Aquatic Invasive Species. The potential impacts for AQU-9 under the No Action Alternative are less than those presented for the Proposed Project because there would be no additional boats or equipment entering the Tahoe Keys lagoons to conduct methods testing and monitoring. Current measures to prevent the introduction of new AIS to greater Lake Tahoe would continue, including inspection (and potential decontamination) of all watercraft entering Lake Tahoe (including the lagoons). Boat back-up stations, skimmers, and seabins in the lagoons would continue to be used to minimize weed fragments from entering greater Lake Tahoe from Tahoe Keys. In spite of these efforts, without the testing and development of methods that are effective in controlling aquatic weeds in the lagoons, the Tahoe Keys would continue to be a significant source of aquatic weed fragments spreading to other areas of the lake. The establishment of other AIS could also result in long-term deleterious impacts to the Lake Tahoe ecosystem, including increases in ambient nutrient levels that contribute to algae blooms, facilitating the invasion of other AIS, displacement of native species, and reductions in ecosystem services (Wilcove et al. 1998, Pejchar and Mooney 2009, Wittmann et al. 2013). If prevention measures are not successful, the introduction, establishment, and continued spread of AIS would be **significant.**

Mitigation and Resource Protection Measures

No additional mitigation or resource protection measures are included under this alternative for non-target macrophytes, aquatic BMI, or fish. It is assumed that current efforts to control aquatic weed fragments and manage water quality in the Tahoe Keys lagoons would continue. Similarly, the current watercraft inspection program and other AIS prevention programs would continue to serve in preventing the introduction of additional AIS to the Tahoe Keys lagoons and greater Lake Tahoe. Although additional aquatic weed control efforts and other measures would be necessary to address significant adverse aquatic biological effects identified in this EIR/EIS for the No Action Alternative, it is beyond the scope of this document to develop those mitigations.

Significant and Unavoidable Impacts

The No Action Alternative is expected to lead to expansion of aquatic weed growth in the lagoons and in other nearshore areas of Lake Tahoe, particularly with continued spread of curlyleaf pondweed infestations. Therefore, **significant and unavoidable** impacts would be expected (1) in aquatic macrophyte community composition, (2) in the expansion of curlyleaf pondweed, (3) to further degrade habitat conditions for the larger aquatic BMI community, similar to that for the Tahoe Keys lagoons, and (4) to further degrade habitat conditions for special status fish species and native or recreationally important game fish species, potentially blocking access to spawning habitat.

3.3.6 Terrestrial Biology and Ecology

This section describes the terrestrial wildlife, terrestrial vegetation, and wetland resources that are known or have the potential to occur in the test sites and the project vicinity. These resources include common terrestrial vegetation, terrestrial wildlife, and sensitive habitats; special-status plant and animal species; and wetlands. Aquatic resources are discussed in Section 3.3.5.

WILDLIFE

3.3.6.1 Proposed Project (Control Methods Test)

Regulatory Setting

Federal

The following federal laws related to terrestrial wildlife are relevant to the proposed alternatives. Permit requirements and compliance are described in Section 1.4 and Chapter 6.

- Federal Endangered Species Act (ESA)
- Migratory Bird Treaty Act (MTBA)
- The Bald and Golden Eagle Protection Act (Eagle Act)

State

The following state laws related to terrestrial wildlife are relevant to the proposed alternatives. Permit requirements and compliance are described in Section 1.4 and Chapter 6.

- California Fish and Game Code Section 2050 – 2116 – California Endangered Species Act (CESA) of 1984
- California Fish and Game Code Section 3503 – 3503.5, 3800, 3513 – Protection of Bird Nests and Raptors
- California Fish and Game Code Section 4700 – Fully Protected Species
- California Environmental Quality Act.

Lake Tahoe Region

Tahoe Regional Planning Agency

The following Tahoe Regional Planning Agency (TRPA) goals and policies related to terrestrial wildlife are relevant to the proposed alternatives:

The TRPA Threshold Standards (Amended 04/24/19) set numerical standards for special interest species, including a minimum number of population sites and metrics for disturbance zones around those population sites for key avian species (TRPA 2019). For example, the region must provide at least four osprey population sites and activities must provide a 0.25-mile disturbance buffer and a 0.6-mile influence zone for any population of Osprey.

The TRPA Regional Plan (Amended 04/24/19) Conservation Element (Chapter Four) establishes ten sub-elements aimed to address resources impacted by the preservation, development, utilization and management decisions made for the Region (TRPA 2019). Specific policies are listed for each of the sub-elements to aid in the decision-making process.

Wildlife is listed in Sub-element Two, where the following goals are established;

- Goal WL-1: Maintain suitable habitats for all indigenous species of wildlife without preference to game or non-game species through maintenance and improvement of habitat diversity.
- Goal WL-2: Preserve, enhance, and where feasible, expand habitats essential for threatened, endangered, rare or sensitive species found in the region.

The TRPA Code of Ordinances (Amended 08/25/19) list provisions regarding terrestrial wildlife. Chapter 62 of the TRPA Code of Ordinances covers "Preserving and Managing Wildlife Habitats" with the intent to protect and enhance the existing diverse wildlife habitats (TRPA 2012b). The Chapter places special emphasis on protecting or increasing habitats of special significant. Wildlife habitat, including movement and migration corridors (Section 62.3.2) are to be protected through an understanding of how creeks and major drainages link islands of habitat, and where deer migration areas occur. Critical Habitat is addressed in Section 62.3.3 with the guidance that "*any element of the overall habitat for any species of concern that could reduce the existing population or impair the stability or viability of the population if the habitat is diminished shall be considered critical habitat*." Critical habitat is extended to the nesting habitat of raptors and waterfowl or fawning deer habitat. Due to the ability of wildlife to utilize Snags and Coarse Woody Debris, these habitat features are to be protected and retained per the standards listed in Section 62.3.4. Special Interest, Threatened, Endangered, and Rare Species are addressed in Section 62.4 where special status species and TRPA special interest species are to be protected from habitat disturbance from conflicting land uses.

City of South Lake Tahoe General Plan

The following City of South Lake Tahoe (SLT) goals and policies listed in SLT's General Plan Policy Document (Final 05/17/11) are related to terrestrial wildlife and are relevant to the proposed alternatives. Goal NCR-3 lists that polices have the mandate "*to protect, restore, and enhance biological habitats and wildlife species in South Lake Tahoe*" (City of South Lake Tahoe 2011).

Tahoe Valley Area Plan/Specific Plan

TRPA developed the Tahoe Valley Area goals and policies listed in the Area Plan/Specific Plan (final 07/22/15). Those related to terrestrial wildlife and relevant to the proposed alternatives include the Natural and Cultural Resources section which lists goals related to designing structures to complement the natural environment and protect the Stream Environment Zone (SEZ) (TRPA 2015).These goals and policies were written to be a supplement to the Natural Resources and Cultural Resources Element of the City of South Lake Tahoe General Plan and the Conservation Element of the TRPA Regional Plan.

Environmental Setting

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species.

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species.

To document the existing vegetation communities, animal species, potential for special-status species and Tahoe Regional Planning Association (TRPA) critical habitat within the test sites and project vicinity, TRC biologists performed an assessment which included the following scope of work:

- Desktop research and review of relevant information including;
- Aerial imagery via Google Earth (Google Earth 2019)
- California Native Plant Society's (CNPS) online Inventory of Rare and Endangered Vascular Plants of California v8-03 0.39 (CNPS 2019)
- CDFW California Natural Diversity Database (CNDDB) including CDFW's Spotted Owl Observation Database (CDFW 2019)
- Emerald Bay, California, USGS 7.5-minute quadrangle (USGS 2015)
- Natural Resources Conservation Service (NRCS) Web Soil Survey – Last modified 04/09/2019 (NRCS 2019)
- Personal communications with TKPOA residents anecdotally about terrestrial wildlife viewed in the Tahoe Keys lagoons area during the June 2019 site visit
- South Lake Tahoe, California, USGS 7.5-minute quadrangle (USGS 2012)
- Tahoe Keys West Lagoon Integrated Control Methods Test Joint TRPA Initial Environmental Checklist and CEQA Initial Study (TRPA and LRWQCB 2018)
- USFWS Information for Planning and Consultation (IPaC) report (USFWS 2019b)
- USFWS Critical Habitat Portal (USFWS 2019a)
- USFWS National Wetlands Inventory Mapper (USFWS 2019c)
- Reconnaissance level ground survey of the test sites and project vicinity to determine;
    - Terrestrial plant distribution, abundance and cover type,
    - Terrestrial wildlife distribution, abundance and habitat type
- Characterization of terrestrial wildlife movement.
- Preparation of a Terrestrial Biological Technical Report (posted on the TRPA website identified in Section 1.5.3).

Based on the desktop review, a list of terrestrial wildlife species with potential to occur in or within the test sites and the project vicinity was generated in preparation for the field survey. Special-status species are those that are legally protected or otherwise listed by federal or state wildlife groups. For the purposes of this assessment, these species are defined as terrestrial plants or wildlife species that:

- Have been designated as either rare, threatened, or endangered by the California Department of Fish and Wildlife (CDFW) or the United States Fish and Wildlife Service (USFWS), and are protected under either the California Endangered Species Act (CESA) or the federal Endangered Species Act (ESA);
- Are candidate species being considered or proposed for listing under these same acts;
- Are fully protected by the California Fish and Game Code, Sections 3511, 4700, 5050, or 5515;
- Are monitored by the California Natural Diversity Database (CNDDB) or the California Native Plant Society (CNPS) and are those of greatest conservation need;
- Are identified as a Threshold Species by TRPA; and/or
- Are of expressed concern to resource and regulatory agencies, or local jurisdictions.

The habitat preferences and distributional range of each species from the database queries were compared against existing information to determine the potential for each species to occur in the test sites and project vicinity. If required habitat for a species was lacking from the test sites and project vicinity, and/or the test sites are outside of the known distribution or elevation range for a species, the species was “presumed absent.” Sensitive species identified in the area by the desktop review or for which suitable habitat occurs in the project vicinity were assessed for potential to occur within the test sites and project vicinity based on the following guidelines:

- **Present:** Species is known to occur within the test sites and project vicinity.
- **High:** Highly suitable habitat (including soils and elevation factors) for the species occurs within the test sites, and/or the species is known to occur in the vicinity.
- **Moderate:** Suitable habitat for the species occurs within the test sites, and/or the species is known to occur in the vicinity.
- **Low:** Potential habitat for the species within the test sites is sub-marginal, and/or the species is known to occur in the vicinity.
- **None:** The species is not known to occur and has no potential to occur in the test sites or project vicinity based on surveys, lack of suitable habitat, or the test sites are outside the known range of the species.

Methodology

A terrestrial biological resources assessment field survey (survey) was conducted on June 17-19, 2019. The survey consisted of walking meandering transects through all accessible areas of the test sites and project vicinity as practical. A protocol level survey and delineation of the waterways and wetlands per USACE standards was not performed as part of the survey. The survey of the test sites and project vicinity included the following:

- Recording plant and animal species observed;
- Mapping of distinct plant communities and terrestrial wildlife habitat;
- Mapping of potential habitat for rare, threatened or endangered species;
- Observing for special-status species determined to have a moderate or higher potential for occurrence in the test sites and project vicinity based on the desktop review;
- Characterizing vegetation communities and land cover types;
- Searching for animal sign (e.g., detections of burrows, scat, tracks, vocalizations);
- Scanning with binoculars for potential avian nest sites;
- Photographing the test sites and project vicinity; and
- Recording weather data at the beginning and end of each survey day.

Plant nomenclature follows *The Jepson Manual: Higher Plants of California* (Baldwin et al. 2012). Plant species not recognized were collected and identified using botanical references (e.g., Baldwin et al. 2012). Vegetation types were classified according to CNPS nomenclature (Sawyer et al. 2009) or other systems as applicable (e.g., Holland 1986). The identified vegetation and land cover types were checked against the most recent CDFW *List of California Sensitive Natural Communities* (CDFW 2018). Wildlife nomenclature follows the *Checklist of North and Middle American Birds* from the American Ornithological Society (AOU 2018), *Checklist of Standard English and Scientific Names for Reptiles and Amphibians of North America North of Mexico* (SSAR 2017), and the *Revised Checklist of North American Mammals North of Mexico* (Baker et al. 2003).

Area Characteristics

The area surveyed includes all, or portions of, the Tahoe Keys development, lagoons and adjacent natural areas owned by the USFS and CTC, shown in Figures 3.3.6-1 and 3.3.6-2. It included all of the proposed test sites (Figure 2-4). The test sites and project vicinity have experienced heavy anthropogenic alteration, and the species that persist in the system are generally tolerant of human activity. The central and primary portion of the test sites and project vicinity is the Tahoe Keys development. The arms that extend into the lagoon are fully developed with homes and landscaped lawns. Undeveloped lots are largely ruderal with minimal native understory vegetation. The composition of the lagoon banks are largely vertical metal bulkheads, with some rock armored beaches or shallow angled sand and cobble. Most homes with lagoon access have boat docks that extend into the waterway. Ingress to Lake Tahoe is through the western and eastern channels. The west channel services the Tahoe Keys development, and the east channel services the marina. Boats need to launch from the marina to dock in the development. Fencing around or within developed homesites varies from none to metal railing or wooden fences. No homes appeared to be entirely fenced. Roads through the Tahoe Keys development area are paved and there are no gates between the community and the rest of South Lake Tahoe. Human activity in the form of homeowners, renters, and contractors is moderate to heavy and constant throughout the developed portions of the test sites and project vicinity. Areas of native vegetation can be found on USFS property to the west including Pope Marsh, to the south along the southern shore of Lake Tallac, and to the northeast within the CTC property. There is eight-foot tall metal fencing between Pope Marsh and the northwestern portion of the Tahoe Keys development area. The vegetation communities and land cover types within the test sites and project vicinity are described below and are displayed in Figure 3.3.6-3.

Vegetation Communities/Land Cover Types

Naturally-occurring native vegetation communities and disturbed or anthropogenically altered land cover are both present within the test sites and project vicinity. Additional information on the composition of wetland vegetation communities was obtained from the Upper Truckee River Marsh Restoration Project Draft EIR/EIS/EIS (AECOM & Cardno-ENTRIX 2013).

Six of the land cover types observed within the test sites and project vicinity represent native vegetation communities including: beach and dune, wet montane meadow, willow scrub wet meadow, sierra mixed conifer, Jeffrey pine (lodgepole pine), and restored upland shrub habitat. Three additional land cover types identified within the test sites and project vicinity during the survey included: open water (western, eastern, and Lake Tallac lagoons), open water (Lake Tahoe), and developed or disturbed/ruderal (upland) areas. Vegetation communities dominated by hydrophytic vegetation and associated with wetlands include the montane meadow, and willow scrub wet meadow. The areas of Jefferey pine mixed with lodgepole pine are transitional communities. Lower areas are dominated by facultative and wetter species and are associated with wetlands, while higher areas are dominated by facultative and upland species and do not meet the criteria for a hydrophytic plant community. The wetland plant communities were not described in the TBTR and are described in Sections 3.3.6.9 through 3.3.6.12.

Representative photographs of these communities and cover types are included in the Terrestrial Biology Technical Report. The vegetation communities and land cover types within the test sites and project vicinity are described below and are displayed in Figure 3.3.6-3.

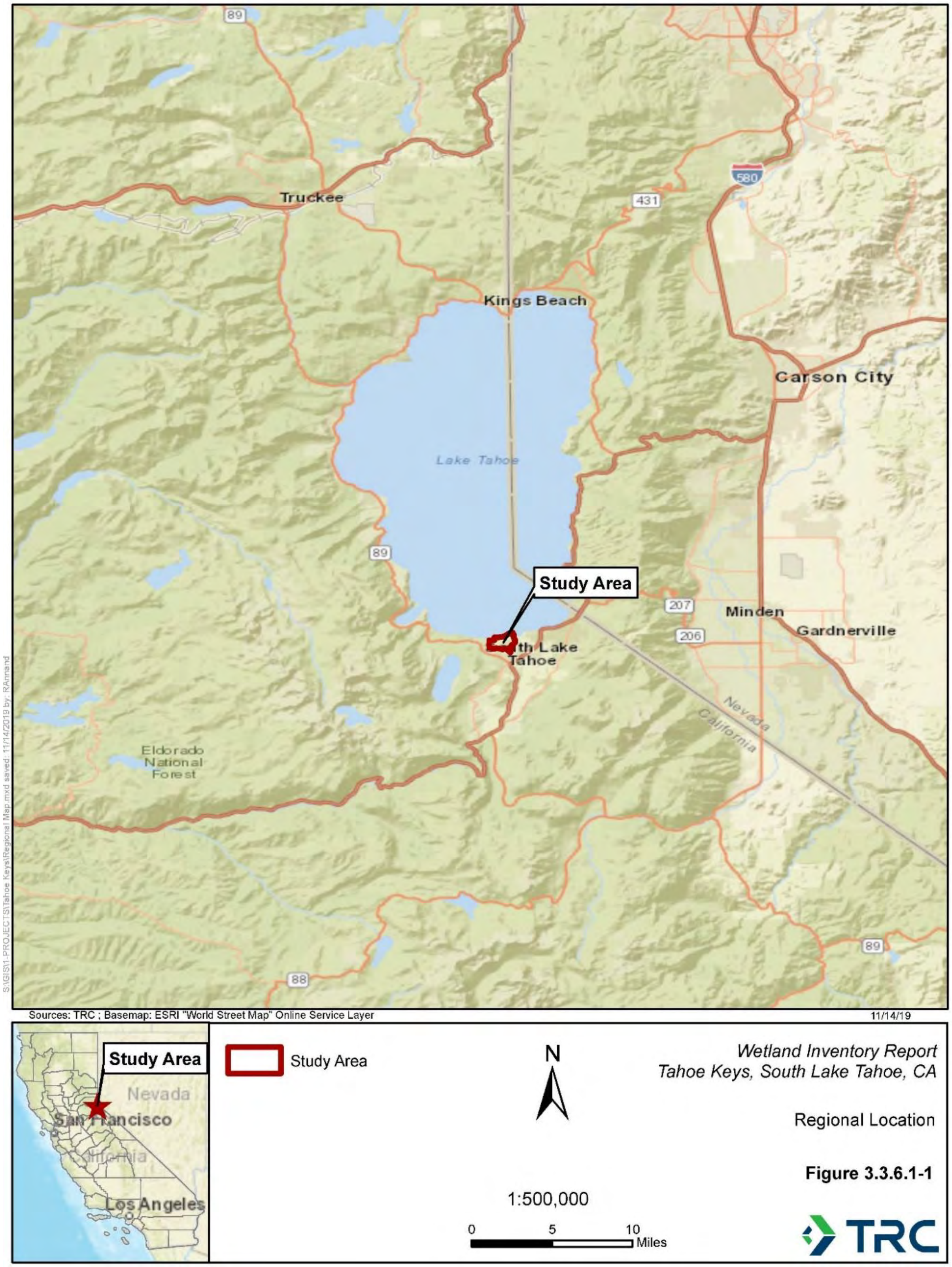


Figure 3.3.6-1 Regional Location.

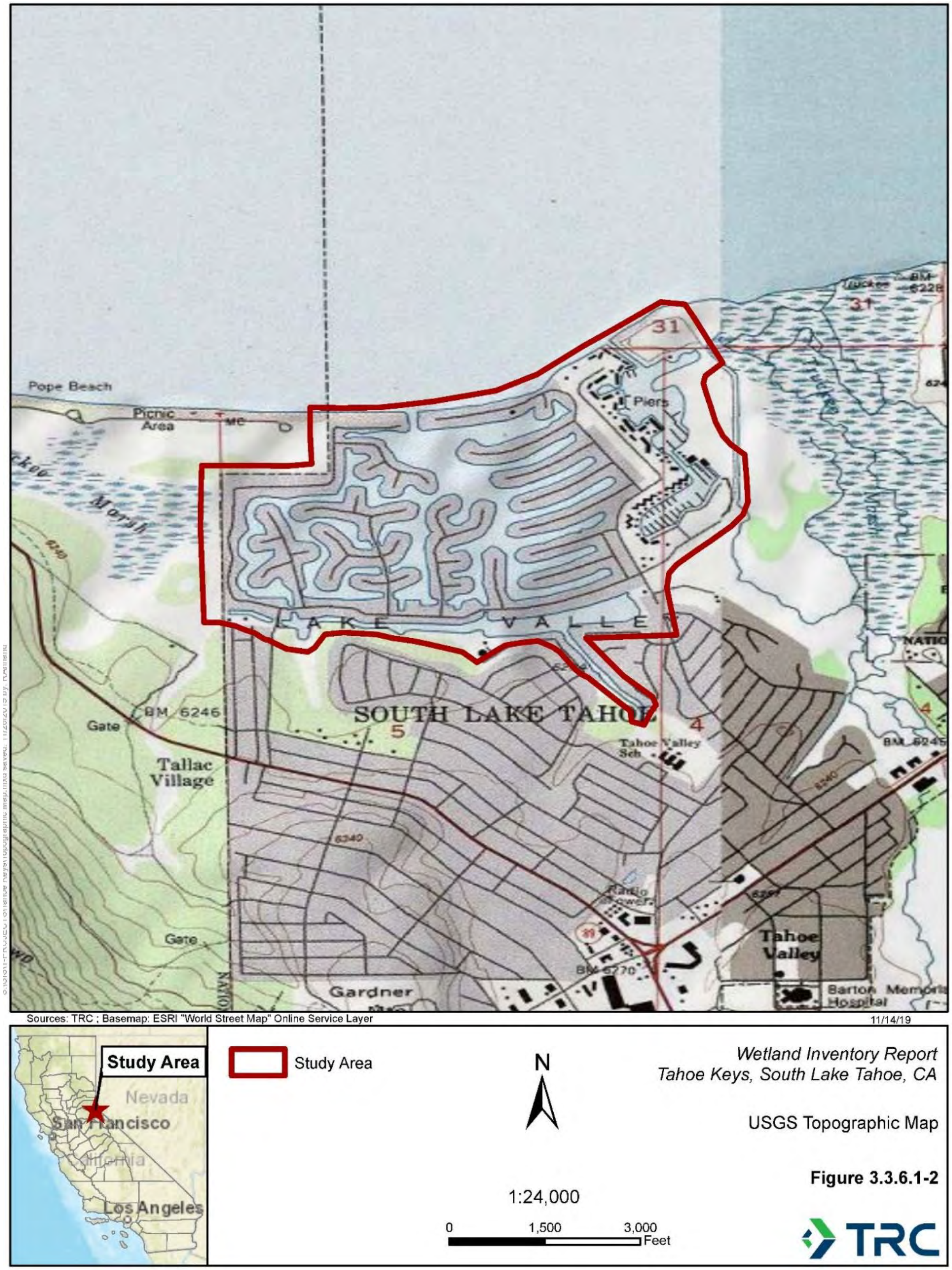


Figure 3.3.6-2 USGS Topographic Map.

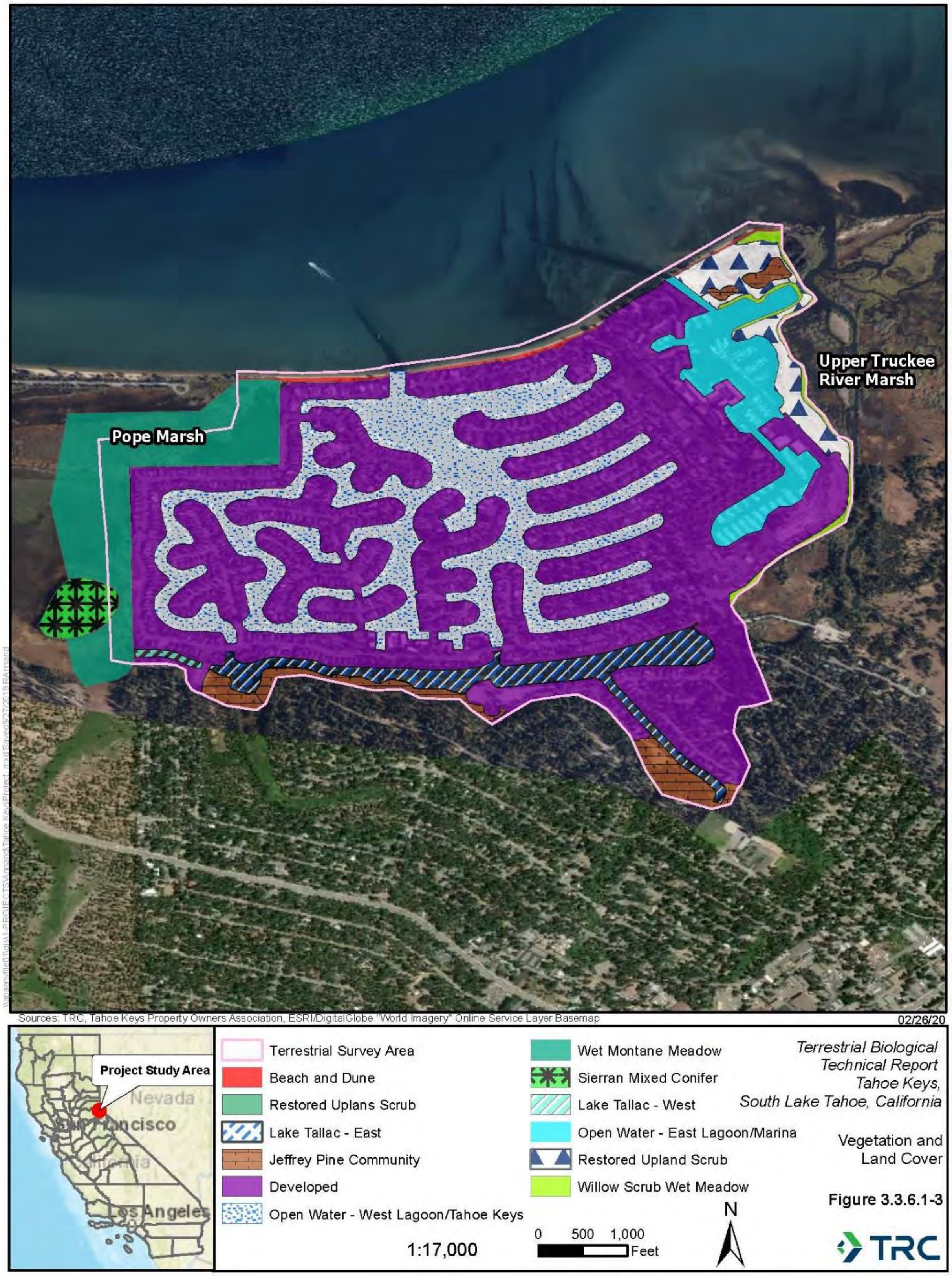


Figure 3.3.6-3 Vegetation Land Cover.

Land Cover Types and Vegetation Communities

Lot C; CTC Property Beach - Beach and Dune Community

The beach and dune community is the area of sandy substrate subject to wave action from Lake Tahoe. The size of the beach and dune system is dependent on the lake level. Above the current maximum lake level is often a ridge of sand stabilized by contiguous vegetation communities. The beach and dune communities of Lot C and CTC property are utilized for recreational activities by those who have access through the Tahoe Keys development or CTC pathways, and by those with aquatic vessels. At the time of the survey Lake Tahoe was near the maximum water levels and the beach width ranged from approximately three feet to twenty feet in the publicly accessible areas. A larger beach width of 40 feet occurs at the private access Lighthouse Shores development.

Plant species present within the ridge of stabilizing vegetation included; tidy lupine (*Lupinus lepidus*), Sierra beardstounge (*Penstemon heterodoxus*), Geyer's willow (*Salix geyeriana*), Lemmon's willow (*Salix lemmonii*), and Shining willow (*Salix lucida* ssp. *lasiandra*).

Pope Marsh – Wet Montane Meadow; Sierran Mixed Conifer Communities

Pope Marsh is a montane marsh bordering the northwest portion of the test sites. Managed by the USFS, the marsh is comprised of approximately 150 acres that were part of the Upper Truckee River wetland complex and became isolated by the Tahoe Keys development in the 1960s. Pope Marsh has hydrologic connectivity to Lake Tallac and Lake Tahoe but is dependent on rainfall, snowmelt, and groundwater as water sources (see Section 3.3.3). Lake Tahoe also has a groundwater connection to Pope Marsh along the marsh's northern boundary. During wet conditions (such as April 2019) high water levels in the marsh can cause overtopping of Pope Beach near Lighthouse Shore Drive, leading to a partial draining of the marsh and a connection between the marsh and Lake Tahoe. This connection happens intermittently and during wet conditions which are becoming less frequent, and is considered a baseline condition. Pope Marsh is bordered by Pope Beach, a public area heavily used by locals and tourists during the spring and summer months. Standing water was present at the time of the survey. An eight-foot tail rod iron metal fence borders the northeastern border of the marsh with the Tahoe Keys development. The wet montane meadow remains largely free from human use.

The wet montane meadow is characterized by a range of moisture and soil conditions that support plant species tolerant of saturated soil conditions. Species observed included: water sedge (*Carex aquatilis*), field sedge (*Carex praegracilis*), beaked sedge (*Carex utriculata*), tufted hair grass (*Deschampsia cespitosa*), Baltic rush/wire rush (*Juncus balticus*), Sierra rush (*Juncus nevadensis*), and Hooker's evening primrose (*Oenothera elata*). Further discussion of the wet montane meadow habitat type is provided in the separate Wetland Inventory Report (WIR) for the project.

Willow species (Geyer's, Lemmon's, and shining willow) are found within the ecotone areas between Pope Marsh and the Tahoe Keys development, and between the wet montane meadow and the Sierran mixed conifer community within Pope Marsh.

There is a small area of Sierran mixed conifer forest within the wet montane meadow complex. A black bear (*Ursis americanus*) was observed walking through the wet montane meadow to the Sierran mixed conifer forest of lodgepole pine (*Pinus contorta*), Jeffrey pine (*Pinus jeffreyi*) during the terrestrial biological resources assessment field survey performed in June 2019. The wet montane meadow was not traversed to evaluate the understory species composition.

Lake Tallac (15th St. Bridge; Water Treatment Facility; Lassen Drive; Dover Drive) – Jeffrey Pine Community

Jeffrey pine dominates in upland habitats with well drained soils. Often these areas experience heavy disturbance from recreational activities and the understory varies dependent on soil moisture and the level of disturbance. Lodgepole pine were also observed within more mesic areas of the Jeffrey pine community.

Plant species found within the Jeffrey pine community surrounding Lake Tallac included; Jeffrey pine, lodgepole pine, common yarrow (*Achillea millefolium*), smooth brome (*Bromus intermus*), cheatgrass (*Bromus tectorum*), tapertip hawksbeard (*Crepis acuminata*), Sierra juniper (*Juniperus grandis*), silvery lupine (*Lupinus agenteus*), tidy lupine, Rydberg penstemon (*Penstemon rydbergii*), antelope bitterbrush (*Purshia tridentata*), wax current (*Ribes cereum*), woods rose (*Rosa woodsii*), snow plant (*Sacrodes sanguinea*), and red clover (*Trifolium pretense*).

CTC Uplands – Restored Upland Shrub Habitat: Jeffrey Pine Communities

The upland portion of the CTC property is restored upland shrub habitat. Bare ground is patchy with 0 – 80 percent ground cover. There is a pathway of decomposed granite that separates the upland community from the willow scrub wet meadow community. The CTC property runs the north/south length of the east lagoon (marina) terminating at Lake Tahoe. Directly south of the beach/dune habitat associated with the CTC restoration property, there is an upland area that receives a large amount of additional human disturbance as individuals create additional trails adjacent to or leading toward the developed recreation facilities nearby. The open habitat is crisscrossed with human made trails outside of the designed trail system. This area has a large amount of observed recreational traffic including: hiking, walking, biking, strollers, and dog walking.

Plant species found within the Jeffrey pine community of the CTC uplands area include common yarrow, creeping bent grass (*Agrostis stolonifera*), green leaf manzanita (*Acrtostaphylos patula*), tobacco brush (*Ceanothus velutinus*), rubber rabbitsbrush (*Chrysothamnus nauseosus*), and Kentucky bluegrass (*Poa pratensis*).

Plant species found within the restored upland shrub habitat of the CTC property include common yarrow, creeping bent grass, green leaf manzanita, basin big sagebrush (*Artemisia tridentate* ssp. *tridentata*), giant red paintbrush (*Castilleja miniata*), prostrate ceanothus (*Ceanothus prostrates*), tobacco brush, rubber rabbitsbrush, slender willow herb (*Epilobium ciliatum*), primrose monkeyflower (*Erythranthe primuloides*), scarlet gilia (*Ipomopsis aggregata*), silvery lupine, tidy lupine, pineapple weed (*Matricaria discoidea*), slender phlox (*Microsteris gracilis*), dwarf purple monkey flower (*Mimulus nanus*), Hooker's evening primrose, firecracker penstemon (*Penstemon eatonii*), royal penstemon (*Penstemon speciosus*), Timothy-grass (*Phleum pratense*), ribwort plantain (*Plantago lanceolata*), Kentucky blue grass, quaking aspen (*Populus tremuloides*), western buttercup (*Ranunculus occidentalis*), golden currant (*Ribes aureum*), Oregon checker mallow (*Sidalcea oregana*), and grayswamp whiteheads (*Sphenosciadium capitellatum*).

CTC Ecotone – Willow Scrub Wet Meadow Community

This community is found between the open water of the Upper Truckee floodplain and the restored upland areas of the CTC property. Willow species are often associated with stream channels and are found in scattered patches within the floodplain of the streams.

Lodgepole pine were found in these more mesic ecotonal areas as opposed to Jeffrey pine. The primary willow species observed included Geyer's willow, Lemmon's willow and shining willow.

Open Water (Western, Eastern, and Lake Tallac Lagoons)

The open water lagoon land cover type consists of areas that were historically portions of the Upper Truckee River marsh and were anthropogenically altered into lagoon structures in service of the Tahoe Keys development. Open water occurs in the Main Lagoon (West Lagoon), the Marina Lagoon (East Lagoon) and the Lake Tallac lagoon. The west and east lagoons have direct access to Lake Tahoe and their water levels are directly affected by the lake's water levels. These lagoons are not historically known to dry out and their levels are dictated by the Bureau of Land Reclamation (BLM), the U.S. water master in Reno and the weir that connects Lake Tallac to the western lagoon. See Section 3.3.3, Hydrology, for a more detailed discussion of hydrology in the lagoons, Lake Tallac and Pope Marsh.

The composition of the lagoon banks of the west and east lagoons are largely vertical metal bulkheads, with some rock armored beaches or shallow angled sand and cobble. In developed areas of the Lake Tallac Lagoon, the banks were like those found in the west and east lagoons. Areas of unarmored banks were found along the northeastern portion of the east lagoon, and the south-central portion of the Lake Tallac lagoon. This area can experience water level fluctuations of six to nine feet, depending on the volume of water within Lake Tahoe.

Plant species commonly found at the water/upland ecotone included; spikerush (*Eleocharis macrostachya*), American waterweed (*Elodea canadensis*), western blue flag iris (*Iris missouriensis*), yellow flag iris (*Iris pseudacorus*), Mexican rush (*Juncus mexicanus*), Rocky Mountain pond-lily (*Nuphar polysepala*), and pondweed species (*Potamogeton spp.*). Further discussion of this land cover type is provided in the separate Tahoe Keys WIR for the project.

Open Water (Lake Tahoe)

Lake Tahoe is an alpine lake on the California – Nevada border known for the clarity and purity of its outstanding blue waters. Lake Tahoe was designated an Outstanding National Resource Water (ONRW) by the State of California and the USEPA in 1980. Section 3.3.3, Hydrology, describes the hydrologic connections within the test sites and project vicinity, and Section 3.4.6, Recreation, discusses boat use in the lagoons and surrounding waters. Lake Tahoe also has a groundwater connection to Pope Marsh along the marsh's northern boundary. During wet conditions (such as April 2019) high water levels in the marsh can cause overtopping of Pope Beach near Lighthouse Shore Drive, leading to a draining of the marsh and a connection between the marsh and Lake Tahoe. At the time of the survey the water level of Lake Tahoe was within less than an inch of the maximum allowed surface elevation of 6,229.1 feet (1,898 meters) above sea level. At the time of the survey Lake Tahoe was observed to be utilized for recreational activities including; beach access, kayaking, motor boating, sail boating, and parasailing. Further discussion of this land cover type is provided in the separate Tahoe Keys WIR for the project.

Developed or Disturbed/Ruderal Areas (Upland Areas)

The disturbed/developed classification includes areas where the native vegetation community has been heavily influenced by human actions such as grading, clearing and infill as well as areas that have been developed in some way. Disturbed and developed areas were combined into a single land cover type due to the patchwork nature of the two land cover types found throughout the project vicinity. Disturbed/developed areas were found throughout the entirety of the Tahoe Keys development, as well as in some of the northern portions of the CTC restoration area. The Tahoe Keys development consists of lots with a mix of landscaped lawns, native and horticultural trees, fencing of varied heights and materials, with a moderate to heavy human presence. Homes are interconnected through a series of paved roads and cement sidewalks. Motorized and human powered vehicles are present with speed limits of 25 to 35 miles per hour. Noise was low to moderate from the residents, contractors, vehicular traffic, and planes passing overhead.

The upland area proposed to be utilized for the Dredge and Replace Substrate Alternative is largely disturbed and open land once utilized by the Tahoe Keys Water Treatment Plant. This area is primarily barren with sandy soils from the former sand drying beds with minimal vegetation. Access to the area by residents and others for recreation is limited due to tall wooden or chain link fences surrounding the area. There is minimal nesting or foraging habitat for birds within the facility. No vegetation removal is anticipated to be required to utilize the site for siting treatment equipment, contractor access, stockpiling and storage.

Ground disturbance was observed outside of the developed areas, as this part of South Lake Tahoe is used heavily for recreational activities. Accessible areas outside of Pope Marsh and the personal properties of the Tahoe Keys development were observed to have human-created trails, presumably for recreational purposes such as fishing, biking, hiking, dog walking, birdwatching, and stroller rides.

Wildlife Observed

Vegetated areas within the project vicinity provide habitat for common terrestrial wildlife species. A total of 40 terrestrial wildlife species were observed or detected during the survey (Table 3.3.6-1), most of which were birds (23 species). Four terrestrial wildlife species are reported as commonly observed by residents within the test sites and project vicinity, although they were not sighted by the surveyor during the survey. These include mountain beaver (*Aplodontia rufa*), bobcat (*Lynx rufus*), red shouldered hawk (*Buteo lineatus*), and bald eagle (*Haliaeetus leucocephalus*).

Sensitive Natural Communities

The CDFW designates sensitive natural communities utilizing the NatureServe's Heritage Methodology, which is also used to assign rarity rankings for plant and animal species in CNDDB. Natural communities with a rating of S1 – S3 are considered Sensitive Natural Communities to be addressed in the CEQA process.

The Upper Truckee Marsh to the east of the CTC restoration project site, and Pope Marsh to the west of the Tahoe Keys development, together with their associated riparian and beach and dune communities are considered "uncommon plant communities" by TRPA as they are uncommon in the Basin or are of exceptional scientific, ecological or scenic value (TRPA 2012a).

There are limited barriers to entry to these sensitive natural communities, so most are affected by the disturbance of authorized and unauthorized recreational activities.

TRPA Critical Habitat

Per Section 62.3.3 "Critical Habitat" of the TRPA Code of Ordinances, TRPA defines critical habitat as any element of the overall habitat for any species of concern that, if diminished, could reduce the existing

Table 3.3.6-1 Terrestrial Wildlife Species Observed During Reconnaissance Survey June 17 – 19, 2019.

Scientific Name	Common Name
INSECTS	
California lady beetle	*Coccinella californica*
Eastern tiger swallowtail	*Papilio glaucus*
Eight spotted skimmer	*Libellula forensic*
Marine blue	*Leptotes marina*
Pacific forktail	*Ischnura cervula*
Sandhill skipper	*Polites sabuleti*
REPTILES AND AMPHIBIANS	
American bull frog	*Lithobates catebeianus*
Sierran tree frog	*Pseudacris sierra*
Valley garter snake	*Thamnophis sirtalis fitchi*
Western fence lizard	*Sceloporus occidentalis*
MAMMALS	
American black bear	*Ursus americanus*
Bobcat *	*Lynx rufus*
Cottontail rabbit	*genus syvilagus*
Coyote	*Canis latrans*
Douglas squirrel	*Tamiasciurus douglasii*
Golden mantled ground squirrel	*Callospermophilus lateralis*
Mountain beaver *	*Aplodontia rufa*
Mule deer (trails)	*Odocoileus hemionus*
Muskrat	*Ondatra zibethicus*
BIRDS	
American coot	*Fulica americana*
American kestrel	*Falco sparverius*
American robin	*Turdus migratorius*
Bald eagle *	*Haliaeetus leucocephalus*
Barn Swallow	*Hirundo rustica*
Black-billed magpie	*Pica hudsonia*
Brewers blackbird	*Euphagus cyanocephalus*
Bushtit	*Psaltriparus minimus*
BIRDS	
California gull	*Larus californicus*
Canada goose	*Branta canadensis*
Common merganser	*Mergus merganser*
Dark eyed junco	*Junco hyenalis*
Great egret	*Ardea alba*
Hairy woodpecker	*Leuconotopicus villosus*
Mallard	*Anas platyrihynchos*
Mountain chickadee	*Poecile gambeli*
Mourning dove	*Zenaida macroura*
Northern flicker	*Colaptes auratus*
Oak titmouse	*Baeolophus inornatus*
Osprey	*Pandion haliaetus*)
Red shouldered hawk *	*Buteo lineatus*
Red winged blackbird	*Agelaius phoeniceus*

Scientific Name	Common Name
Steller's jay	*Cyanocitta stelleri*
Tree swallow	*Tachycineta bicolor*
Western meadowlark	*Sturnella neglecta*
Yellow headed blackbird	*Xanthocephalus xanthocephalus*
* Noted by residents but not observed by surveyor during survey	

population or impair the stability or viability of the population (TRPA 2012b). TRPA extends this to habitat for special-interest species native to the Tahoe Basin whose breeding populations have been extirpated but could be return or be reintroduced. No critical habitat for terrestrial wildlife species observed within the test sites or project vicinity.

USFWS Critical Habitat

When a species is proposed for listing under the ESA, the USFWS must consider if there are areas of habitat believed to be essential to the conservation of the species. These areas are designated as "critical habitat" and impact activities where there is a federal nexus. Not all listed terrestrial wildlife species have areas designated as critical habitat.

The USFWS Critical Habitat for Threatened and Endangered Species online mapper was queried as part of the desktop review process. As of August 6, 2019, there remains no USFWS designated critical habitat for terrestrial wildlife species, or any species, within or adjacent to the test sites and project vicinity (USFWS 2019a).

Sensitive Wildlife Species Assessment

Twenty-six special-status fish and wildlife (invertebrate, amphibian, reptile, bird, and mammal) species were identified as having potential for occurrence in the test sites and project vicinity from the desktop review. The closest known occurrences to the CNDDB record are shown in Figure 3.3.6-4.

Based on an evaluation of habitat needs of the species in comparison with the habitats present within the test sites and project vicinity, five of the 26 special-status species were eliminated from further consideration, because no suitable habitat is present in the test sites or project vicinity, or the test sites are outside of the species' current range. Nine special-status species were considered to have a low potential occur. Twelve special-status wildlife species have a moderate or high potential to occur in the test sites and/or project vicinity or were observed to be present. Detailed information about each of the 26-wildlife species, including listing status and habitat requirements, can be found in Table 3.3.6-2.

Several species are listed as endangered under the CESA, and/or designated as a state Fully Protected Species meaning that the State may not issue a Take permit or otherwise authorize a development project to take any individual.

Of the wildlife species determined to have moderate or high potential to occur in the test site or project vicinity, or were present, none of the species were federally listed. The following species are considered USFWS Birds of Conservation Concern including the golden eagle (*Aquila chrysaetos*), willow flycatcher (*Empidonax trailii*), peregrine falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), and yellow-headed blackbird (*Xanthocephalux xanthocephalus*).

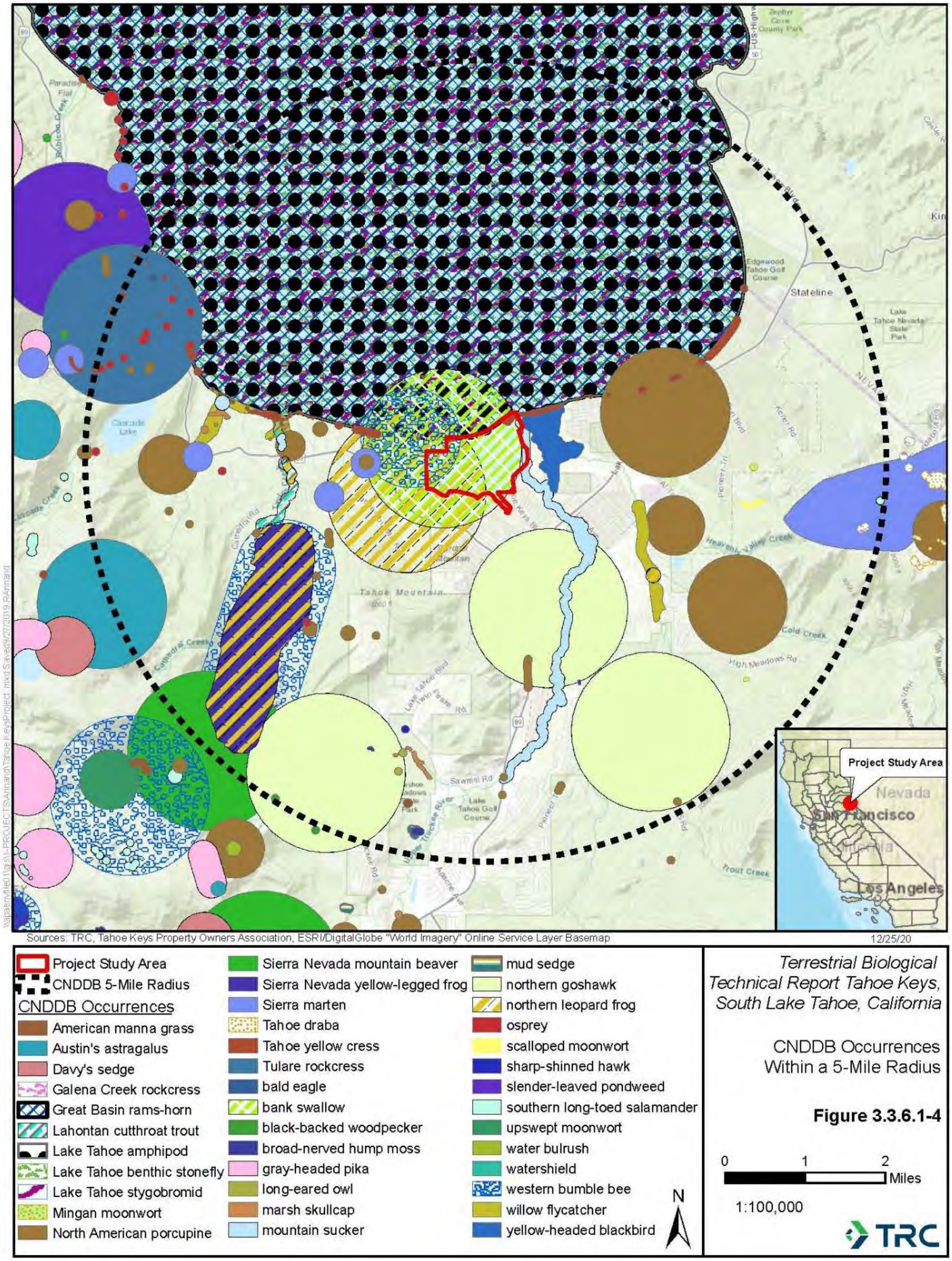


Figure 3.3.6-4 CNDDB Occurrences within 5-Mile Radius

Table 3.3.6-2 Special Status Wildlife Species with the Potential to Occur in the Project Vicinity.

Scientific Name **Common Name**	**Status**		**Habitat Requirements**	**Potential for Occurrence**
INVERTEBRATES				
Bombus occidentalis Western bumblebee	Fed: CA: TRPA:	**None None None**	Once found throughout the Western United States, this species can be found in a wide range of habitats including scrubland, grassland, and landscaped areas. Species is a pollinator of landscaped, cultivated, and naturally grown plants.	**Moderate potential:** The test sites or project vicinity may include habitat within the typical elevation range of this species.
Capnica lacustra Lake Tahoe benthic stonefly	Fed: CA: TRPA:	**None None None**	Endemic to Lake Tahoe. Found in deep water plant beds at a depth of 60 – 110 meters. Species has been found in the southeast part of the lake. Zooplankton is the primary food source for the species.	**No potential:** The test sites and project vicinity does not contain the appropriate habitat.
Helisoma newberryi Great Basin rams-horn	Fed: CA: TRPA:	**None None None**	Freshwater aquatic snail. Prefers muddy environments where macrophytes are present. Detritus feeder found primarily just below the sediment surface. Requires high water quality.	**No potential:** The test sites and project vicinity does not contain the appropriate habitat.
Stygobromus lacicolus Lake Tahoe amphipod	Fed: CA: TRPA:	**None None None**	Species is only known from freshwater samples taken near Lake Tahoe. Medium sized (0.6 cm) and found in deep lake areas, often with *Stygobromus tahoensis*.	**No potential:** The test sites and project vicinity does not contain the appropriate habitat.
Stygobromus tahoensis Lake Tahoe stygobromid	Fed: CA: TRPA:	**None None None**	Species is only known from freshwater samples taken near Lake Tahoe. Found in deep lake areas, often with *S. lacicolus.*	**No potential:** The test sites and project vicinity does not contain the appropriate habitat.
FISH				
Oncorhynchus clarkia henshawi Lahontan cutthroat trout	Fed: CA: TRPA:	**THR None None**	Found in freshwater lakes, streams, and rivers between northern Nevada, northeastern California, and southeastern Oregon. Feed on aquatic insects, crustaceans, small fishes, and floating plant matter. Currently occupy a very small fraction of their original range. Tolerates water too alkaline for other trout species.	**Low potential:** The test sites and project vicinity does not include conducive aquatic habitat for this species.
AMPHIBIANS				
Ambystoma macrodactylum sigillatum Southern long-toed salamander	Fed: CA: TRPA:	**None WL None**	Found up to 2,800 meters in temperate forests, coniferous forests, montane riparian zones, sagebrush plains, red fir forests, semiarid sagebrush, cheatgrass plains, and alpine meadows along the rocky shores of mountain lakes. During the breeding phase lives in slow moving streams, ponds and lakes. Species hibernates in the winter. Adults can be found in forest understory. Persists more readily in fishless waterbodies.	**Low potential:** The test sites and project vicinity does not include conducive upland or aquatic habitat for this species. Waterbodies have predatory fish present or were of sub-marginal quality.

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence
Lithobates pipiens Northern leopard frog	Fed: CA: TRPA:	**None** **SSC** **None**	Within westernmost range of the species. Habitat is still or slow-moving aquatic habitats including streams or rivers, wetlands, pools, beaver ponds, and stock tanks or burrow pits. Require damp upland habitat is for foraging during the active season. Heavily grazed areas and cultivated fields do not appear to be suitable.	**Low potential:** The test sites and project vicinity does not include conducive upland or aquatic habitat for this species.
Rana sierra Sierra Nevada yellow-legged frog	Fed: CA: TRPA:	**END** **WL** **None**	Found in high elevations primarily from 4,500 – 12,000 feet. Highly aquatic and rarely over 3 feet away from water. Can be found in lakes, ponds, marshes, meadows, and streams. Rarely, if ever, found in areas with predatory fish. Open streams and lake edges seem to be preferred.	**Low potential:** The test sites and project vicinity does not include the typical habitat for this species. Waterbodies have predatory fish present or were of sub-marginal quality.
BIRDS				
Accipiter gentilis Northern goshawk	Fed: CA: TRPA:	**None** **SSC** **SS**	Uses a variety of forest types and stand structures depending on what is available. In general, dense forests with large trees and high canopy closures is preferred. This species has large home ranges of 1,400 – 8,600 acres. Nest sites are typically near water. Generally restricted to wooded areas but may be found along edges.	**Low potential:** The test sites and project vicinity includes sub-marginal habitat for this species.
Accipiter striatus Sharp-shinned hawk	Fed: CA: TRPA:	**None** **WL** **None**	Occurs primarily in coniferous forests. Usually present in California woodlands outside of the breeding season. Nest within the canopy of dense tree stands. Prey on small birds, foraging in the open forest, on the forest floor, in meadows and bushy pastures.	**Moderate potential:** The test sites and project vicinity may include foraging habitat for this species.
Aquila chrysaetos Golden eagle	Fed: CA: TRPA:	**BCC** **WL; FP** **SS**	Utilizes a wide variety of habitats including tundra, alpine meadows, coniferous forests, shortgrass prairies and other grasslands, sage brush plateaus, shrubands, oak woodlands, and semidesert canyons. In California the species favors grasslands, shrublands with tree saplings and open-canopy blue oak woodlands. Nest on cliff ledges overlooking woodlands. Nest at 4,000 – 10,000 feet.	**Moderate potential:** The Study Area may include foraging habitat for this species.
Asio otus Long eared owl	Fed: CA: TRPA:	**None** **SSC** **None**	Found in woodlands and conifer groves. Nocturnal. Forages over rangeland, clearings, and fallow fields. Feeds on small mammals. Roost in heaviest forest cover available.	**Moderate potential:** The project vicinity may include foraging habitat for this species.
Empidonax trailii Willow flycatcher	Fed: CA: TRPA:	**BCC** **END** **None**	Habitat includes bushes, willow thickets, brushy fields, and upland copses. Breeds in thickets of deciduous trees and shrubs, especially willows, or along woodland edges. Most often found near streams or marshes. Diet is mostly insects. Forages from a perch. Nest 4 – 15 feet off the ground.	**Moderate potential:** The California Tahoe Conservancy (CTC) restoration portion of the project vicinity may include foraging habitat for this species.

Scientific Name **Common Name**	**Status**		**Habitat Requirements**	**Potential for Occurrence**
Falco peregrinus Peregrine falcon	Fed: CA: TRPA:	**BCC** **FP** **SS**	Prefer wide open spaces and coasts and can be found in a wide range of natural and human dominated environments. Travel widely outside of the nesting seasons. Prey on a wide range of other bird species. Nest on cliffs and ledges.	**Moderate potential:** The test sites and project vicinity may include foraging habitat for this species.
Haliaeetus leucocephalus Bald eagle	Fed: CA: TRPA:	**BCC** **END;** **FP** **SS**	Prefers to be near large areas of open water such as lakes, rivers and seacoast. Prefer "superdominant" trees for nesting which are often the oldest and largest. Avoid lakes with dense forest and cold-water fishes, preferring warm-water fish prey. Tend to utilize sites away from human disturbance.	**High potential:** The test sites and project vicinity may include foraging habitat for this species. Species has been observed foraging with the project vicinity by locals. A known bald eagle's nest is located to the west of the test sites, near Emerald Bay.
Pandion haliaetus Osprey	Fed: CA: TRPA:	**None** **WL** **SS**	Species has nearly worldwide distribution. Found in habitats associated with riparian plant communities such as; scrublands, grasslands, swamps, and coniferous or deciduous forests. In California osprey are associated with ponderosa pine and mixed-conifers. Found primarily near water with adequate fish supply. Nest near the top of a snag, tree, or manmade object such as a utility pole.	**Present:** Species was observed foraging over the Upper Truckee River marsh west of the CTC property portion of the project vicinity during the biological assessment and appeared undisturbed by the biologists on site.
Picoides arcticus Black-backed woodpecker	Fed: CA: TRPA:	**None** **None** **None**	Found within montane and boreal coniferous forests throughout North America. Species breeds across Central Canada. Cavity nesters utilizing both live and dead trees. Breeding density higher in burned than unburned forest. Primary diet is larvae of beetles including mountain pine, wood-boring and engraving.	**Moderate potential:** The project vicinity may include foraging habitat for this species.
Riparia riparia Bank swallow	Fed: CA: TRPA:	**None** **THR** **None**	Nest in colonies in soft banks or bluffs along rivers, streams, and coastal areas. Found from sea level to 2,100 meters. Forage in wetlands, grasslands, along open water and through open forests. Eat primarily insects.	**Low potential:** The test sites and project vicinity include sub-marginal foraging habitat for this species. The elevation of the test sites is near the top of the species range.
Xanthocephalux xanthocephalus Yellow-headed blackbird	Fed: CA: TRPA:	**BCC** **None** **None**	Found in cattail marshes. Nest in colonies and often share habitat with red-winged blackbirds. Migrate in winter to southwestern US and Mexico. Forage in the marsh.	**Present:** Species was observed foraging within Pope Marsh during the biological assessment and appeared undisturbed by the biologists on site.
MAMMALS				
Aplodontia rufa Sierra Nevada mountain beaver	Fed: CA: TRPA:	**None** **SSC** **None**	Forested areas often with second growth trees and scrubs. Prefer to be near water. More abundant in deciduous forest than coniferous. Construct a system of burrows and require deep soils. Species is herbivorous and not very social.	**Low potential:** The test sites and project vicinity include sub-marginal habitat for this species.

Scientific Name **Common Name**	**Status**		**Habitat Requirements**	**Potential for Occurrence**
Erethizon dorsatum North American porcupine	Fed: CA: TRPA:	**None** **None** **None**	Found throughout northern North America. Can be found in trees and the amount of time spent above ground is related to the amount of ground foraging available and the presence of predators. Utilize dens over winter. Species is herbivorous, social and will defend its territory.	**Moderate potential:** The test sites and project vicinity may include foraging habitat for this species.
Gulo gulo luscus North American Wolverine	Fed: CA: TRPA:	**CAN** **None** **None**	Found in boreal and tundra habitats. On the Tahoe National Forest an individual was found in habitats dominated by Jeffrey pine, California red fir, Sierra mixed conifer and Sierra lodgepole pine. Species lives solitary over large ranges. Typically found in higher elevations in summer and lower elevations in winter. Consume ungulates as carrion and prey on small- to medium-sized mammals. Primarily scavengers who are dependent on wolves and other predators.	**Low potential:** The test sites and project vicinity include sub-marginal habitat for this species.
Martes caurina sierra Sierra marten	Fed: CA: TRPA:	**None** **None** **None**	Mid-sized carnivore who is a dietary generalist as prey varies seasonally. Tend to prefer older forest stands that are a mix of old and large trees, canopy layers, dense understory and decaying elements. Prefer snags and downed logs as resting places. Heavily dependent on functional habitat for dispersal.	**Low potential:** The test sites and project vicinity include sub-marginal habitat for this species.
Ochotona princeps ssp. *schisticeps* Gray-headed pika	Fed: CA: TRPA:	**None** **None** **None**	Found on rocky talus slopes at the talus-meadow interface. Live from the tree line to the upper limit of vegetation. Can be found at lower elevations in rocky areas within forests or near lakes. Nests are concealed in talus. Pikas are herbivores.	**No potential:** The test sites and project vicinity does not contain the appropriate habitat.
Odocoileus hemionus Mule deer	Fed: CA: TRPA:	**None** **None** **SS**	Native to western North America. Found in habitats ranging from dense coniferous forests to open plains and alpine habitats. Absent from many desert communities. Size is region dependent. Plants and other foods eaten by mule deer vary widely.	**Present:** Trails created by the species were observed throughout the project vicinity during the biological assessment.

Federal Designations:
(Endangered Species Act [ESA], United State Fish and Wildlife Service [USFWS])
END: Federally listed, Endangered
THR: Federally listed, Threatened
CAN: Candidate for Federal Listing
BCC: USFWS Bird of Conservation Concern

State Designations:
(California Endangered Species Act [CESA], California Department of Fish and Wildlife [CDFW])
END: State-listed, Endangered
THR: State-listed, Threatened
SFP: State Fully Protected
SSC: Species of Special Concern
WL: Watch List species

Tahoe Regional Planning Association (TRPA):
SS: Sensitive Species

Raptors and Migratory Birds

Raptors and migratory birds are protected by the MBTA. In addition, all raptor species are protected from "take" pursuant to California Fish and Game Code Section 3503.5.

Suitable nesting, perching, and foraging habitat for a wide range of raptor and nesting bird species was observed in the test sites and project vicinity. The test sites and project vicinity experiences moderate and constant levels of human activity. Existing overstory could provide potential hunting perches and nesting habitat for larger raptors. Small trees and scrubs were located throughout the landscaped and natural portions of the test sites and project vicinity which provide potential locations for perching and nest development.

Many bird species are migratory and are protected under the MBTA and the joint CDFW and California DOJ 2018 memo addressing federal alterations to the MBTA (CDFW and DOJ 2018). Various species utilize intact lakes, rivers, grasslands, meadows, and marsh for foraging and nesting. Ground birds such as the Canada goose were observed utilizing the maintained lawns of the Tahoe Keys development. Mallards and other water birds were observed foraging the lagoons. Bald eagle adults have been observed by locals to forage in the Upper Truckee Marsh area, and forage Lake Tahoe while humans are present. No active nests were observed during the reconnaissance level survey. For a full list of the terrestrial wildlife observed, including raptor and migratory bird species, see Table 3.3.6-1.

Wildlife Movement Corridors, Linkages, and Significant Ecological Areas

Linkages and corridors facilitate regional animal movement and generally consist of waterways, riparian corridors, flood control channels, contiguous habitat, and upland habitat. Corridors also offer terrestrial wildlife unobstructed terrain to forage and they allow for the dispersal of young individuals. Wildlife movement corridors are an important ecological resource and are protected under the TRPA Code of Ordinances (TRPA 2012b).

The project vicinity provides a limited movement corridor or linkage for terrestrial wildlife, as habitat quality is generally low and adjacent habitat is fragmented. The test site and project vicinity itself is largely fragmented and highly developed with landscaped uplands of lower habitat quality. While numerous species were observed during the study and are observed by residents on a regular basis, the extent to which the area functions as a movement corridor could not be fully determined during the reconnaissance level survey. Fencing may deter the free movement of larger mammals within the project vicinity. Terrestrial wildlife within the project vicinity experience minimal to heavy human presence depending on the time of day and year. The test sites and project vicinity could allow species that are less sensitive to human development and roadways to move between the shorezone and areas upstream. Further discussion of aquatic corridors is provided in the separate WIR for the project.

Potential Impacts

Methods and Assumptions for Impact Analysis

The impact analysis for terrestrial resources is based on a reconnaissance level survey. Protocol level wildlife and plant surveys would be performed if it were determined that the project may have an impact on a listed species. Areas mapped as wetlands and riparian vegetation are assumed to potentially qualify as state and/or federally jurisdictional wetlands (the reconnaissance survey rigor did not allow a definitive determination to be made). A formal wetland delineation survey would be completed before the tests are implemented to obtain a USACE permit and RWQCB certification. The wetland delineation would be conducted after selection of a preferred alternative and once the footprint of temporary and permanent impacts are determined. The following communities mapped during the terrestrial biological survey are considered sensitive communities listed in Section 3.3.6.1 including; beach and dune, wet montane meadow, willow scrub wet meadow, sierra mixed conifer, Jeffrey pine, restored upland scrub, and open water.

Following the field survey, the potential for occurrence of special-status species was further refined based on field observations. The potential for occurrence of special status species based on desktop review and field survey is provided above in Table 3.3.6-2.

Determinations of potential "effect" on the special-status species were made accounting for the maximum anticipated project footprint and types of working activities that may occur.

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species. The potential for impact to special status species based on desktop review and field survey is provided below in Table 3.3.6-3. Measures would be implemented to comply with all the terms and conditions of required permits to lessen the potential impact level.

It is not likely that any special status terrestrial wildlife species would be affected by the project. The project area is not anticipated to extend beyond the Tahoe Keys development or involve terrestrial ground disturbance. Per Section 3.4.5, no significant unavoidable impacts to the noise environment are expected to be generated by the Proposed Project, Alternative 1 or Alternative 2. No habitat conservation plans, or natural community conservation plans have been identified for the project area. None of the species identified through the desktop review and site visit process were determined to have a potential effect rating of "may affect and is likely to adversely effect."

The test sites and project vicinity represents a system where species that are amenable to human activity and infrastructure can utilize the Proposed Project work area, and adjacent areas, for hunting, foraging, nesting, denning, and movement. Common and special-status terrestrial wildlife species are likely to be intermittently present in the Tahoe Keys lagoons. Under the Proposed Project the existing boat ramps within the Tahoe Keys Development would be utilized to launch various treatment boats and barges and select areas treatments would be implement within the open water of the western lagoons and Lake Tallac as shown in Figure 2-4.

Impacts due to waterborne traffic are expected to be less than significant. No alterations to upland habitats are anticipated, and the project would not involve upland ground disturbance. Existing terrestrial perches and nesting sites would remain unchanged. The project would not entail the use of machinery or other devices that would cause physical harm to a wildlife species.

Twelve special-status wildlife species have either been documented in the test sites and project vicinity or have a moderate to high likelihood of being present (see Table 3.3.6-2). Of the wildlife species determined to have moderate or high potential to occur in the test sites and project vicinity, or were present, none of the species were federally listed.

Table 3.3.6-3 Potential Effect of Project on Special Status Wildlife Species with the Potential to Occur in the Project Vicinity.

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence; Potential Effect of Project on Species
INVERTEBRATES				
Bombus occidentalis Western bumblebee	Fed: CA: TRPA:	**None** **None** **None**	Once found throughout the Western United States, this species can be found in a wide range of habitats including scrubland, grassland, and landscaped areas. Species is a pollinator of landscaped, cultivated, and naturally grown plants.	**Moderate potential to occur; May affect, but not likely to adversely affect** Upland foraging and nesting habitat would remain unaffected by the Proposed Project and the alternatives. The project is not anticipated to involve upland ground disturbance.
Capnica lacustra Lake Tahoe benthic stonefly	Fed: CA: TRPA:	**None** **None** **None**	Endemic to Lake Tahoe. Found in deep water plant beds at a depth of 60 – 110 meters. Species has been found in the southeast part of the lake. Zooplankton is the primary food source for the species.	**No potential to occur; No effect** No effect anticipated due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Helisoma newberryi Great Basin rams-horn	Fed: CA: TRPA:	**None** **None** **None**	Freshwater aquatic snail. Prefers muddy environments where macrophytes are present. Detritus feeder found primarily just below the sediment surface. Requires high water quality.	**No potential to occur; No effect** No effect anticipated due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Stygobromus lacicolus Lake Tahoe amphipod	Fed: CA: TRPA:	**None** **None** **None**	Species is only known from freshwater samples taken near Lake Tahoe. Medium sized (0.6 cm) and found in deep lake areas, often with *Stygobromus tahoensis*.	**No potential to occur; No effect** No effect anticipated due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Stygobromus tahoensis Lake Tahoe stygobromid	Fed: CA: TRPA:	**None** **None** **None**	Species is only known from freshwater samples taken near Lake Tahoe. Found in deep lake areas, often with *S. lacicolus.*	**No potential to occur; No effect** No effect anticipated due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
FISH				
Oncorhynchus clarkia henshawi Lahontan cutthroat trout	Fed: CA: TRPA:	**THR** **None** **None**	Found in freshwater lakes, streams, and rivers between northern Nevada, northeastern California, and southeastern Oregon. Feed on aquatic insects, crustaceans, small fishes, and floating plant matter. Currently occupy a very small fraction of their original range. Tolerates water too alkaline for other trout species.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites or project vicinity is low due to lack of conducive aquatic habitat for this species.
AMPHIBIANS				

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence; Potential Effect of Project on Species
Ambystoma macrodactylum sigillatum Southern long-toed salamander	Fed: CA: TRPA:	**None** **WL** **None**	Found up to 2,800 meters in temperate forests, coniferous forests, montane riparian zones, sagebrush plains, red fir forests, semiarid sagebrush, cheatgrass plains, and alpine meadows along the rocky shores of mountain lakes. During the breeding phase lives in slow moving streams, ponds and lakes. Species hibernates in the winter. Adults can be found in forest understory. Persists more readily in fishless waterbodies.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low due to lack of conducive upland or aquatic habitat for this species. Open water has predatory fish present or of sub-marginal quality.
Lithobates pipiens Northern leopard frog	Fed: CA: TRPA:	**None** **SSC** **None**	Within westernmost range of the species. Habitat is still or slow-moving aquatic habitats including streams or rivers, wetlands, pools, beaver ponds, and stock tanks or burrow pits. Require damp upland habitat is for foraging during the active season. Heavily grazed areas and cultivated fields do not appear to be suitable.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low due to lack of conducive upland or aquatic habitat for this species.
Rana sierra Sierra Nevada yellow-legged frog	Fed: CA: TRPA:	**END** **WL** **None**	Found in high elevations primarily from 4,500 – 12,000 feet. Highly aquatic and rarely over 3 feet away from water. Can be found in lakes, ponds, marshes, meadows, and streams. Rarely, if ever, found in areas with predatory fish. Open streams and lake edges seem to be preferred.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low due to lack of conducive upland or aquatic habitat for this species. Open water has predatory fish present or of sub-marginal quality.
BIRDS				
Accipiter gentilis Northern goshawk	Fed: CA: TRPA:	**None** **SSC** **SS**	Uses a variety of forest types and stand structures depending on what is available. In general, dense forests with large trees and high canopy closures is preferred. This species has large home ranges of 1,400 – 8,600 acres. Nest sites are typically near water. Generally restricted to wooded areas but may be found along edges.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low due to present habitat being of sub-marginal quality for the species.
Accipiter striatus Sharp-shinned hawk	Fed: CA: TRPA:	**None** **WL** **None**	Occurs primarily in coniferous forests. Usually present in California woodlands outside of the breeding season. Nest within the canopy of dense tree stands. Prey on small birds, foraging in the open forest, on the forest floor, in meadows and bushy pastures.	**Moderate potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Species primarily utilizes upland habitat for perching, nesting and foraging and the Proposed Project and alternatives are not anticipated to affect this species.

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence; Potential Effect of Project on Species
Aquila chrysaetos Golden eagle	Fed: CA: TRPA:	**BCC WL; FP SS**	Utilizes a wide variety of habitats including tundra, alpine meadows, coniferous forests, shortgrass prairies and other grasslands, sage brush plateaus, shrubands, oak woodlands, and semidesert canyons. In California the species favors grasslands, shrublands with tree saplings and open-canopy blue oak woodlands. Nest on cliff ledges overlooking woodlands. Nest at 4,000 – 10,000 feet.	**Moderate potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Species primarily utilizes upland habitat for perching, nesting and foraging and the Proposed Project and alternatives are not anticipated to affect this species.
Asio otus Long eared owl	Fed: CA: TRPA:	**None SSC None**	Found in woodlands and conifer groves. Nocturnal. Forages over rangeland, clearings, and fallow fields. Feeds on small mammals. Roost in heaviest forest cover available.	**Moderate potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Species primarily utilizes upland habitat for perching, nesting and foraging and the Proposed Project and alternatives are not anticipated to affect this species.
Empidonax trailii Willow flycatcher	Fed: CA: TRPA:	**BCC END None**	Habitat includes bushes, willow thickets, brushy fields, and upland copses. Breeds in thickets of deciduous trees and shrubs, especially willows, or along woodland edges. Most often found near streams or marshes. Diet is mostly insects. Forages from a perch. Nest 4 – 15 feet off the ground.	**Moderate potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Species forages over streams and marshes, however their preference for bushes and dense willow thickets, and their aversion to anthropogenic disturbance may preclude them from foraging the open water habitats. The Proposed Project and alternatives are not anticipated to affect this species.
Falco peregrinus Peregrine falcon	Fed: CA: TRPA:	**BCC FP SS**	Prefer wide open spaces and coasts and can be found in a wide range of natural and human dominated environments. Travel widely outside of the nesting seasons. Prey on a wide range of other bird species. Nest on cliffs and ledges.	**Moderate potential to occur; May affect, but not likely to adversely affect** Species may utilize open water for foraging. If these species do enter the western lagoon or Lake Tallac during the scope of work of the Proposed Project, individuals would encounter a habitat experiencing a level of human disturbance and infrastructure similar to the current conditions. The Proposed Project and alternatives are not anticipated to affect this species.
Haliaeetus leucocephalus Bald eagle	Fed: CA: TRPA:	**BCC END; FP SS**	Prefers to be near large areas of open water such as lakes, rivers and seacoast. Prefer "superdominant" trees for nesting which are often the oldest and largest. Avoid lakes with dense forest and cold-water	**High potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Bald eagles are unlikely

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence; Potential Effect of Project on Species
			fishes, preferring warm-water fish prey. Tend to utilize sites away from human disturbance.	to hunt in the Tahoe Keys area due to aversion to anthropogenic disturbance. The two herbicides proposed for use in the Methods Test reportedly do not bioaccumulate. If raptors feed on prey subjected to the proposed herbicides, as noted earlier the (USEPA) has determined that these two herbicides will have no significant acute or chronic impact on fish or freshwater invertebrates when recommended rates are used (USEPA 2004; WDNR 2012; WDOE Undated).
Pandion haliaetus Osprey	Fed: CA: TRPA:	**None** **WL** **SS**	Species has nearly worldwide distribution. Found in habitats associated with riparian plant communities such as; scrublands, grasslands, swamps, and coniferous or deciduous forests. In California osprey are associated with ponderosa pine and mixed-conifers. Found primarily near water with adequate fish supply. Nest near the top of a snag, tree, or manmade object such as a utility pole.	**High potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Osprey are known to forage the Tahoe Keys area and nest in areas with heavy anthropogenic movement such as Emerald Bay. The Proposed Project would affect 35.9 acres or 20.8% of the Keys; Action Alternative 1 would affect 17.8 acres (10.3%); and Action Alternative 2 would affect 5.6 acres (3.3%). The combination of the relatively restricted area affected and the fact that the herbicides proposed for use reportedly do not bioaccumulate indicates that effects are likely not to be significant, even if raptors feed on prey subjected to the proposed herbicides.
Picoides arcticus Black-backed woodpecker	Fed: CA: TRPA:	**None** **None** **None**	Found within montane and boreal coniferous forests throughout North America. Species breeds across Central Canada. Cavity nesters utilizing both live and dead trees. Breeding density higher in burned than unburned forest. Primary diet is larvae of beetles including mountain pine, wood-boring and engraving.	**Moderate potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Species primarily utilizes upland habitat for perching, nesting and foraging and the Proposed Project and alternatives are not anticipated to affect this species.
Riparia riparia Bank swallow	Fed: CA: TRPA:	**None** **THR** **None**	Nest in colonies in soft banks or bluffs along rivers, streams, and coastal areas. Found from sea level to 2,100 meters. Forage in wetlands, grasslands, along open water and through open forests. Eat primarily insects.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low due to present foraging habitat being of sub-marginal quality for the species. Additionally, the elevation of the test sites is near to top of the species range.

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence; Potential Effect of Project on Species
Xanthocephalux xanthocephalus Yellow-headed blackbird	Fed: CA: TRPA:	**BCC** **None** **None**	Found in cattail marshes. Nest in colonies and often share habitat with red-winged blackbirds. Migrate in winter to southwestern US and Mexico. Forage in the marsh.	**Species was present during the biological assessment; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. Work within Pope Marsh would require coordination with the USFS. Species may utilize open water for foraging. If these species do enter the western lagoon or Lake Tallac during the scope of work of the Proposed Project, individuals would encounter a habitat experiencing a level of human disturbance and infrastructure similar to the current conditions. The Proposed Project and alternatives are not anticipated to affect this species.
MAMMALS				
Aplodontia rufa Sierra Nevada mountain beaver	Fed: CA: TRPA:	**None** **SSC** **None**	Forested areas often with second growth trees and scrubs. Prefer to be near water. More abundant in deciduous forest than coniferous. Construct a system of burrows and require deep soils. Species is herbivorous and not very social.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low. The high levels of human presence would discourage the species from utilizing the test sites and project vicinity.
Erethizon dorsatum North American porcupine	Fed: CA: TRPA:	**None** **None** **None**	Found throughout northern North America. Can be found in trees and the amount of time spent above ground is related to the amount of ground foraging available and the presence of predators. Utilize dens over winter. Species is herbivorous, social and will defend its territory.	**Moderate potential to occur; May affect, but not likely to adversely affect:** The project area is not anticipated to extend beyond the Tahoe Keys development. Upland foraging, denning, and resting habitat would remain unaffected by the Proposed Project and alternatives; therefore, implementation of the project is not anticipated to affect this species.
Gulo gulo luscus North American Wolverine	Fed: CA: TRPA:	**CAN** **None** **None**	Found in boreal and tundra habitats. On the Tahoe National Forest an individual was found in habitats dominated by Jeffrey pine, California red fir, Sierra mixed conifer and Sierra lodgepole pine. Species lives solitary over large ranges. Typically found in higher elevations in summer and lower elevations in winter. Consume ungulates as carrion and prey on small- to medium-sized mammals. Primarily scavengers who are dependent on wolves and other predators.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low as sub-marginal habitat for this species is present. The high levels of human presence would discourage the species from utilizing the test sites and project vicinity.
Martes caurina sierra Sierra marten	Fed: CA:	**None** **None**	Mid-sized carnivore who is a dietary generalist as prey varies seasonally. Tend to prefer older forest stands	**Low potential to occur; May affect, but not likely to adversely affect**

Scientific Name **Common Name**	**Status**		**Habitat Requirements**	**Potential for Occurrence; Potential Effect of Project on Species**
	TRPA:	**None**	that are a mix of old and large trees, canopy layers, dense understory and decaying elements. Prefer snags and downed logs as resting places. Heavily dependent on functional habitat for dispersal.	The potential for this species to be within the test sites and project vicinity is low as sub-marginal habitat for this species is present. The high levels of habitat fragmentation would likely discourage the species from utilizing the test sites and project vicinity.
Ochotona princeps ssp. *schisticeps* Gray-headed pika	Fed: CA: TRPA:	**None** **None** **None**	Found on rocky talus slopes at the talus-meadow interface. Live from the tree line to the upper limit of vegetation. Can be found at lower elevations in rocky areas within forests or near lakes. Nests are concealed in talus. Pikas are herbivores.	**No potential to occur; No effect** No effect on this species is anticipated due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Odocoileus hemionus Mule deer	Fed: CA: TRPA:	**None** **None** **SS**	Native to western North America. Found in habitats ranging from dense coniferous forests to open plains and alpine habitats. Absent from many desert communities. Size is region dependent. Plants and other foods eaten by mule deer vary widely.	**Species was present during the biological assessment; May affect, but not likely to adversely affect** Species has a vast range of habitats where the species could utilize the western lagoon and Lake Tallac for drinking water and foraging along ecotonal habitats. While implementation of the Proposed Project may affect this species due being located within to potential foraging habitat, the impacts are expected to be less than significant and not impact the viability of the species.

Federal Designations:
(Endangered Species Act [ESA], United State Fish and Wildlife Service [USFWS])
END: Federally listed, Endangered
THR: Federally listed, Threatened
CAN: Candidate for Federal Listing
BCC: USFWS Bird of Conservation Concern

State Designations:
(California Endangered Species Act [CESA], California Department of Fish and Wildlife [CDFW])
END: State-listed, Endangered
THR: State-listed, Threatened
SFP: State Fully Protected
SSC: Species of Special Concern
WL: Watch List species

Tahoe Regional Planning Association (TRPA):
SS: Sensitive Species

Of the twelve species, one is a terrestrial insect, two are terrestrial mammals, and nine are avian. Western bumblebee (*Bombus occidentalis*) upland foraging and nesting habitat would remain unaffected by the Proposed Project; therefore, implementation of the project is not anticipated to affect this species. North American porcupine (*Erethizon dorsatum*) upland foraging, denning, and resting habitat would remain unaffected by the Proposed Project; therefore, implementation of the project is not anticipated to affect this species. Mule deer (*Odocoileus hemionus*) has a vast range of habitats where the species could utilize the western lagoon and Lake Tallac for drinking water and foraging along ecotonal habitats. While the Proposed Project is located within potential foraging habitat for this species, the impacts are expected to be less than significant and not impact the viability of the species.

The nine avian species and utilize upland areas for perching and nesting. Four utilize primarily upland habitat for foraging, including the sharp-shinned hawk (*Accipiter striatus*), golden eagle (*Aquila chrysaetos*), long eared owl (*Asio otus*), and black-backed woodpecker (*Picoides articus*). The Proposed Project is not anticipated to affect these species.

The remaining five avian species have the potential to utilize the open water of the western lagoon and Lake Tallac for foraging. Species such as osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*) may forage in the Tahoe Keys area but can show aversion to anthropogenic disturbance. Willow flycatcher (*Empidonax trailii*) forages over streams and marshes, however their preference for bushes and dense willow thickets, and their aversion to anthropogenic disturbance may preclude them from foraging the open water habitats. Yellow-headed blackbird (*Xanthocephalux xanthocephalus*) forages in marsh habitat in Pope Marsh, adjacent to the western lagoon. Peregrine falcon (*Falco peregrinus*) may utilize open water for foraging. If these species do enter the western lagoon or Lake Tallac during the scope of work of the Proposed Project, individuals would encounter a habitat experiencing a level of human disturbance and infrastructure similar to the current conditions. While implementation of the Proposed Project may affect these species due to minimal alterations to potential foraging habitats, there is no anticipation of injury to or mortality of special-status species. The potential impacts to the species are expected to be based on potential alterations in foraging behavior and be **less than significant** and not impact the viability of the species.

A significant impact in terms of disruptions to wildlife habitat (including extent of special-status habitat) would be one that: has a substantial effect, either directly or through habitat modification, on any special-status species; conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; causes a substantial change in the diversity or distribution of species, or the number of any species of animals; reduces the number of unique, rare, or endangered animal species; and/or deteriorates existing fish or wildlife habitat quantity or quality. Measures would be implemented to comply with all the terms and conditions of required permits to lessen the potential impact.

One terrestrial mammal and five avian species have the potential for their foraging behavior associated with open water to be altered by the Proposed Project scope of work introducing additional equipment into potential foraging habitat. Species that may utilize the western lagoon and Lake Tallac for foraging include mule deer, osprey, bald eagle, willow flycatcher, yellow-headed blackbird and peregrine falcon. These species exhibit a wide range of tolerance to human activity, with mule deer and peregrine falcon being the two species exhibiting the most tolerance. Osprey, bald eagle, and willow flycatcher ideal foraging habitat is not found within the Proposed Project area and these species are less tolerant of human activity. If these species do enter the western lagoon or Lake Tallac during the CMT, individuals would encounter a habitat experiencing a similar level of human disturbance and infrastructure as they do under current conditions.

While implementation of the Proposed Project may affect these species due to minimal alterations to potential foraging habitats, the impacts are expected to be **less than significant** and not impact the viability of the species.

Mitigation and Resource Protection Measures

The Proposed Project will comply with the best management practice delineated in the CEQA Initial Study, as described in Mitigation Measure MM-BIO-1 below.

MM-BIO-1: Field Reconnaissance and Monitoring. Prior to initiating the test program, TKPOA will conduct a pre-test field reconnaissance of potentially affected terrestrial, riparian, and aquatic (benthic and littoral zones), habitat and species. This will include the test sites and buffer zones indicated by the species in question (e.g., bald eagles have a larger range than Tahoe rock cress). The occurrence of any sensitive or listed species and/or habitat will be recorded. If sensitive receptors are observed, an evaluation will be made as to the potential impacts. If direct or indirect impacts are possible, coordination will be initiated with the appropriate federal (USFWS) or state (CDFW) agency to determine further mitigation to avoid impacts. The agencies contacted will be dependent on the special status of the species identified. Examples of mitigation measures could include environmental tailboards prior to the start of work, the establishment of exclusionary zones (i.e., around active nests), and/or assigning biological field monitors with stop work authority if impacts to receptors are possible. Should work stop based on discovery of sensitive or listed species, and TKPOA will consult with appropriate agencies to determine next steps prior to work restarting.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to terrestrial wildlife and the Proposed Project.

3.3.6.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting

The Regulatory Setting for Action Alternative 1 is the same as described for the Proposed Project.

Environmental Setting

The Environmental Setting for Action Alternative 1 is the same as described for the Proposed Project.

Potential Impacts

Issue TE-1: Short-Effects on Terrestrial Habitats and Species. Several common and special-status wildlife species could have their nesting or foraging behaviors altered. A significant impact would be one that: has a substantial effect, either directly or through habitat modification, on any special-status species; conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; and/or causes a substantial change in the diversity or distribution of species, or the number of any species of animals. Several common and special-status terrestrial wildlife species could have their foraging behaviors altered by the additional equipment being located within the test sites associated with Action Alternative 1. Measures would be implemented to comply with all the terms and conditions of applicable regulations or required permits to lessen the potential impact level.

Alternative 1 proposes a similar scope of work as the Proposed Project, without the herbicide component. The potential impacts to wildlife associated with Action Alternative 1 are expected to be largely the same as described above for the Proposed Project, with the exception that there would be no exposure to herbicides or degradation products, and zero potential for bioaccumulation of these chemicals. Impacts are expected to be **less than significant,** and not impact the viability of any species.

Mitigation and Resource Protection Measures

Action Alternative 1 will comply with best management practices delineated in the CEQA Initial Study, as described in Mitigation Measure MM-BIO-1 above.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to terrestrial wildlife and Action Alternative 1.

3.3.6.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

The Regulatory Setting for Action Alternative 2 is the same as described for the Proposed Project.

Environmental Setting

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species.

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species.

The general environmental setting for Action Alternative 2 is the same as for the Proposed Project. Under Action Alternative 2, three sites within the western lagoon would be dredged, and dewatering effluent could be discharged to the City of South Lake Tahoe sanitary sewer system or to Lake Tallac and ultimately Pope Marsh. The upland area proposed to be used for this alternative for dewatering and treatment is largely disturbed; it is comprised of open land once utilized by the Tahoe Keys Water Treatment Plant. This area is primarily barren with minimal vegetation and sandy soils from the former sand drying beds. Access to the area by residents and others for recreation is limited due to tall wooden or chain link fences. There is minimal nesting or foraging habitat for birds within the facility. No vegetation removal is anticipated to be required to utilize the site for siting treatment equipment, contractor access, stockpiling and storage.

Potential Impacts

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species.

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species.

Several common and special-status wildlife species could have their nesting or foraging behaviors altered due to activities undertaken in the implementation of Action Alternative 2. A significant impact would be one that: has a substantial effect, either directly or through habitat modification, on any special-status species; conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; and/or causes a substantial change in the diversity or distribution of species, or the number of any species of animals. Several common and special-status terrestrial wildlife species could have their nesting or foraging behaviors altered. Measures would be implemented to comply with all the terms and conditions of required permits to lessen the potential impact level.

Potential impacts under Action Alternative 2 would include be largely the same as previously described for the Proposed Project. The barren sandy soil of the Tahoe Keys Water Treatment Plant supports minimal vegetation and does not match the preferred upland foraging habitat of any species of concern. Large mammals such as mule deer are not expected to normally have access to the sediment treatment site due to the tall wooden or chain link fences surrounding the area. If species enter the Tahoe Keys Water Treatment Plant during the scope of work of the Alternative 2 project, the presence of equipment and materials would reduce their access to the limited resources on site.

While implementation of the Alternative 2 project may affect these species due to minimal alterations to potential foraging habitats, there is no anticipation of injury to or mortality of special-status species. The potential impacts to the species are expected to be based on potential alterations in foraging behavior over open water and in the disturbed and barren Tahoe Keys Water Treatment Plant upland area and are expected to be **less than significant,** and not impact the viability of the species.

Potential impacts under Action Alternative 2 would be largely the same as previously described for the Proposed Project in terms of disruptions to wildlife habitat (including extent of special-status habitat). A significant impact would be one that: has a substantial effect, either directly or through habitat modification, on any special-status species; conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; causes a substantial change in the diversity or distribution of species, or the number of any species of animals; reduces the number of unique, rare, or endangered animal species; and/or deteriorates existing fish or wildlife habitat quantity or quality. Measures would be implemented to comply with all the terms and conditions of required permits to lessen the potential impact level.

While implementation of the Alternative 2 project may affect several species due to minimal alterations to potential foraging habitats, the impacts are expected to be **less than significant** and not impact the viability of the species.

Mitigation and Resource Protection Measures

Action Alternative 2 will comply with best management practices delineated in the CEQA Initial Study, as described in Mitigation Measure MM-BIO-1 above.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to terrestrial wildlife and Action Alternative 2. No additional information on significant unavoidable impacts are presented in this section.

3.3.6.4 No Action Alternative

Regulatory Setting

The Regulatory Setting for the No Action Alternative would include the ongoing requirements to comply with all of the requirements listed in Section 1.4 and Chapter 6.

Environmental Setting

Under the No Action Alternative, existing conditions would be as described for the Proposed Project.

Potential Impacts

Under the No Action Alternative, no impacts to wildlife would occur. The extent and quality of terrestrial wildlife habitats would remain similar to existing conditions. Where existing conditions are degraded, existing adverse conditions would continue.

Mitigation and Resource Protection Measures

Because no potential impacts are anticipated, no mitigation measures are proposed.

Significant Unavoidable Impacts

Under the No Action Alternative, **no significant unavoidable impacts** are anticipated.

TERRESTRIAL VEGETATION

3.3.6.5 Proposed Project (Control Methods Test)

Regulatory Setting

Federal

The following federal laws related to terrestrial vegetation are relevant to the proposed alternatives. Permit requirements and compliance are described in Section 1.4 and Chapter 6.

- Federal Endangered Species Act (ESA)
- Section 404 of the Clean Water Act (CWA)

State

The following state laws related to terrestrial vegetation are relevant to the proposed alternatives. Permit requirements and compliance are described in Section 1.4 and Chapter 6.

- California Fish and Game Code Section 1602 – Streambed Alternations
- California Fish and Game Code Sections 1900 – 1913 – The Native Plant Protection Act (NPPA) of 1977
- California Fish and Game Code Section 2050 – 2116 – California Endangered Species Act (CESA) of 1984
- Section 401 Water Quality Certification/Porter-Cologne Water Quality Control Act
- California Environmental Quality Act

Lake Tahoe Region

Tahoe Regional Planning Agency

The following Tahoe Regional Planning Agency (TRPA) goals and policies related to terrestrial vegetation are relevant to the proposed alternatives.

The TRPA Threshold Standards (Amended 04/24/19) set management standards for common vegetation, and numerical standards for late seral and old growth forest ecosystems, uncommon plant communities, and sensitive plants (TRPA 2019).

The TRPA Regional Plan (Amended 04/24/19) Conservation Element (Chapter Four) establishes ten sub-elements aimed to address resources impacted by the preservation, development, utilization and management decisions made for the Region (TRPA 2019). Specific policies are listed for each of the sub-elements to aid in the decision-making process.

Vegetation (including wetlands) is listed in sub-element one where the following goals are established:

- Goal Veg-1: Provide for a wide mix and increased diversity of plant communities in the Tahoe Region.
- Goal Veg-2: Provide for the protection, maintenance, and restoration of such unique eco-systems as wetlands, meadows, and other riparian vegetation.
- Goal Veg-3: Conserve threatened, endangered, and sensitive plant species and uncommon plant communities of the Lake Tahoe Region.
- Goal Veg-4: Provide for and increase the amount of late seral/old growth stands within the Lake Tahoe Region.
- Goal Veg-5: The appropriate stocking level and distribution of snags and coarse woody debris shall be retained in the regions forests to provide habitat for organisms that depend on such features and to perpetuate natural ecological processes.
- Goal Veg-6: TRPA shall work with fire protection agencies in the Region to reduce the risk of catastrophic wildfire.

The TRPA Code of Ordinances (Amended 08/25/19) list provisions regarding vegetation (TRPA 2012b). Chapter 61 covers “Vegetation and Forest Health.” Section 61.3 “Vegetation Protection and Management” provides for the protection of Stream Environment Zone (SEZ) vegetation, other common vegetation, uncommon vegetation, and sensitive plants. TRPA requires the protection and maintenance of all native vegetation types. Section 61.3.6 “Sensitive and Uncommon Plant Protection and Fire Hazard Reduction” specifically lists standards for the preservation and management of vegetation of significant scenic, recreational, educational, scientific, or natural values of the region. Aspects of tree removal and protection are listed in Chapter 36; Section 33.6, 61.1, 61.3.6, and 61.4. Critical Habitat is addressed in Section 62.3.3 with the guidance that “*any element of the overall habitat for any species of concern that could reduce the existing population or impair the stability or viability of the population if the habitat is diminished shall be considered critical habitat.*” Critical habitat is extended to wetlands in that “*wetlands shall be preserved and managed for their ecological significance, including their value as nursery habitat to fishes, nesting and resting sites for waterfowl, and as a source of stream recharge, except as permitting pursuant to Chapter 30 of the Code of Ordinances*.”

City of South Lake Tahoe General Plan

The following City of SLT goals and policies listed in SLT's General Plan Policy Document (Final 05/17/11) are related to terrestrial vegetation and are relevant to the proposed alternatives include Goal NCR-3 which lists that polices have the mandate "*to protect, restore, and enhance biological habitats and wildlife species in South Lake Tahoe*" (City of SLT 2011).

Tahoe Valley Area Plan/Specific Plan

TRPA developed the Tahoe Valley Area goals and policies listed in the Area Plan/Specific Plan (final 07/22/15). The goals and policies were written to be a supplement to the Natural Resources and Cultural Resources Element of the City of South Lake Tahoe General Plan and the Conservation Element of the TRPA Regional Plan. The Natural and Cultural Resources section lists goals related to designing structures to complement the natural environment and protect the Stream Environment Zone (SEZ) (TRPA 2015).

Environmental Setting

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species.

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species.

To document the existing terrestrial vegetation communities, potential for special-status species and Tahoe Regional Planning Association (TRPA) critical habitat within the test sites or project vicinity, TRC biologists performed an assessment which is documented under Section 3.3.6.1, Wildlife: Environmental Setting. Sections relevant to terrestrial vegetation include: Background, Methodology, Area Characteristics, and Land Cover Types and Vegetation Communities. Figures relevant to terrestrial vegetation include Figures 3.3.6-1 through 3.3.6-4.

Plant Species Observed

A list of all plant species observed and identified during the survey is listed below in Table 3.3.6-4 "Terrestrial Plant Species Observed During Reconnaissance Survey June 17-19, 2019." This biological assessment was not a full protocol-level rare plant survey.

The non-native invasive species identified in other portions of the project vicinity are typical in developed or disturbed/ruderal areas. Overall invasive species presence was minimal, and the species observed included: ribwort plantain, cheatgrass, Kentucky blue grass, and creeping bent grass. The invasive species populations were found in upland areas that experience human disturbance on a regular basis. Invasive yellow flag iris was found in the ecotonal edges of Lake Tallac and the CTC property along the east lagoon (marina).

Sensitive Natural Communities

The CDFW designates sensitive natural communities utilizing the NatureServe's Heritage Methodology, which is also used to assign rarity rankings for plant and animal species in CNDDB. Natural communities with a rating of S1 – S3 are considered Sensitive Natural Communities to be addressed in the CEQA process.

Table 3.3.6-4 Terrestrial Plant Species Observed During Reconnaissance Survey June 17 – 19, 2019.

Common Name	Scientific Name	Invasive [1], Introduced [2], or Native	Arid West NWI [3]	Habitats					
				Beach & Dune	Wet Montane Meadow	Willow Scrub Wet Meadow	Sierra Mixed Conifer	Jeffrey Pine	Restored Upland Shrub Habitat
Common yarrow	*Achillea millefolium*	Native	FACU					X	X
Creeping bent grass	*Agrostis stolonifera*	***Invasive***	FACW					X	X
Green leaf manzanita	*Arctostaphylos patula*	Native	N/A - UPL					X	X
Basin big sagebrush	*Artemisia tridentata* ssp. *tridentata*	Native	N/A - UPL						X
Smooth brome	*Bromus inermis*	Introduced	FACU					X	
Cheatgrass	*Bromus tectorum*	***Invasive***	N/A - UPL					X	
Water sedge	*Carex aquatilis*	Native	OBL		X				
Field sedge	*Carex praegracilis*	Native	FACW		X				
Beaked sedge	*Carex utriculata*	Native	OBL		X				
Giant red paintbrush	*Castilleja miniata*	Native	FACW						X
Prostrate ceanothus	*Ceanothus prostrates*	Native	N/A - UPL						X
Tobacco brush; snowbrush	*Ceanothus velutinus*	Native	N/A - UPL					X	X
Rubber rabbitbrush	*Chrysothamnus nauseosus*	Native	N/A - UPL					X	X
Tapertip hawksbeard	*Crepis acuminata*	Native	N/A - UPL					X	
Tufted hair grass	*Deschampsia cespitosa*	Native	N/A - UPL		X				
Spikerush	*Eleocharis macrostachya*	Native	OBL					X	
American waterweed	*Elodea canadensis*	Native	OBL						
Slender willow herb	*Epilobium ciliatum*	Native	FACW						X

Common Name	Scientific Name	Invasive [1], Introduced [2], or Native	Arid West NWI [3]	Habitats					
				Beach & Dune	Wet Montane Meadow	Willow Scrub Wet Meadow	Sierra Mixed Conifer	Jeffrey Pine	Restored Upland Shrub Habitat
Primrose monkeyflower	*Erythranthe primuloides*	Native	N/A - UPL						X
Scarlet gilia	*Ipomopsis aggregata*	Native	N/A - UPL						X
Western blue flag iris	*Iris missouriensis*	Native	FACW					X	
Yellow flag iris	*Iris pseudacorus*	***Invasive***	OBL					X	
Baltic rush, wire rush	*Juncus balticus*	Native	FACW		X				
Mexican rush	*Juncus mexicanus*	Native	FACW					X	
Sierra rush	*Juncus nevadensis*	Native	FACW		X				
Sierra juniper	*Juniperus grandis*	Native	N/A - UPL					X	
Silvery lupine	*Lupinus argenteus*	Native	N/A - UPL					X	X
Tidy lupine	*Lupinus lepidus*	Native	N/A - UPL	X				X	X
Disc mayweed; pineapple weed	*Matricaria discoidea*	Native; introduced	FACU						X
Slender phlox	*Microsteris gracilis*	Native	FACU						X
Dwarf purple monkey flower	*Mimulus nanus*	Native	FACU						X
Rocky mountain pond-lily	*Nuphar polysepala*	Native	OBL						
Hooker's evening primrose	*Oenothera elata*	Native	FACW		X				X
Firecracker penstemon	*Penstemon eatonii*	Native	N/A - UPL						X
Sierra beardtounge	*Penstemon heterodoxus*	Native	FACU	X					

Common Name	Scientific Name	Invasive [1], Introduced [2], or Native	Arid West NWI [3]	Habitats					
				Beach & Dune	Wet Montane Meadow	Willow Scrub Wet Meadow	Sierra Mixed Conifer	Jeffrey Pine	Restored Upland Shrub Habitat
Rydberg penstemon	*Penstemon rydbergii*	Native	FACU					X	
Royal penstemon	*Penstemon speciosus*	Native	N/A - UPL						X
Timothy-grass	*Phleum pratense*	Introduced	FACU						X
Lodgepole pine	*Pinus contorta*	Native	FAC			X	X		X
Jeffrey pine	*Pinus jeffreyi*	Native	N/A - UPL				X	X	X
Ribwort plantain	*Plantago lanceolata*	***Invasive***	FAC						X
Kentucky blue grass	*Poa pratensis*	***Invasive***	FAC					X	X
Quaking aspen	*Populus tremuloides*	Native	FACU						X
Antelope bitterbrush	*Purshia tridentata*	Native	N/A - UPL					X	
Western buttercup	*Ranunculus occidentalis*	Native	FAC						X
Golden currant	*Ribes aureum*	Native	FAC						X
Wax currant	*Ribes cereum*	Native	N/A - UPL					X	
Woods rose	*Rosa woodsii*	Native	FACU					X	
Geyer's willow	*Salix geyeriana*	Native	OBL	X	X	X	X		
Lemmon's willow	*Salix lemmonii*	Native	FACW	X	X	X	X		
Shining willow	*Salix lucida* ssp. *lasiandra*	Native	FACW	X	X	X	X		
Snow plant	*Sarcodes sanguinea*	Native	N/A - UPL					X	
Oregon Checker mallow	*Sidalcea oregana*	Native	FACW						X
Grayswamp whiteheads	*Sphenosciadium capitellatum*	Native	FACW						X
Red clover	*Trifolium pratense*	Introduced	FACU					X	

[1] Per the Cal-IPC Inventory (Cal-IPC 2020)
[2] Per the National Resources Conservation Service (NRCS) Online Plants Database (NRCS 2019)

Common Name	Scientific Name	Invasive [1], Introduced [2], or Native	Arid West NWI [3]	Habitats					
				Beach & Dune	Wet Montane Meadow	Willow Scrub Wet Meadow	Sierra Mixed Conifer	Jeffrey Pine	Restored Upland Shrub Habitat

[3] Per *The National Wetlands Plant List: 2016* (Lichvar et al. 2012).
FAC = Equally likely to occur in wetlands or non-wetlands
FACW = Usually occur in wetlands, but occasionally found in non-wetlands
OBL = Almost always occurs in wetlands under natural conditions
FACU = Usually occurs in non-wetlands, but occasionally found in uplands
UPL = Almost always occurs in non-wetlands under natural conditions
N/A UPL= Not listed in the Arid West therefore listed as UPL by default

The Upper Truckee Marsh to the east of the CTC restoration project site, and Pope Marsh to the west of the Tahoe Keys development, together with their associated riparian and beach and dune communities are considered "uncommon plant communities" by TRPA as they are uncommon in the Basin or are of exceptional scientific, ecological or scenic value (TRPA 2012a).

There are limited barriers to entry to these sensitive natural communities, so most are affected by the disturbance of authorized and unauthorized recreational activities.

TRPA Critical Habitat

Per Section 62.3.3 "Critical Habitat" of the TRPA Code of Ordinances (TRPA 2012b), TRPA defines critical habitat as any element of the overall habitat for any species of concern that, if diminished, could reduce the existing population or impair the stability or viability of the population. TRPA extends this to habitat for special-interest species native to the Tahoe Basin whose breeding populations have been extirpated but could be return or be reintroduced.

Within the project vicinity there is TRPA designated critical habitat for the Tahoe yellow cress. Tahoe yellow cress occurs only on the sandy beaches of Lake Tahoe and has been designated a sensitive plant and threshold indicator by TRPA. Tahoe yellow cress is also state-listed as critically endangered by Nevada and endangered by California. Per subsection 61.3.6 of the TRPA Code "*all projects that are likely to harm, destroy, or otherwise jeopardize sensitive plants or their habitat, shall fully mitigate their significant adverse effects. Those projects or activities that cannot fully mitigate their significant adverse effects are prohibited.*"

The project is not expected to increase (substantially or otherwise) test-related or recreational disturbance levels in the shorezone above existing levels.

USFWS Critical Habitat

The USFWS Critical Habitat for Threatened and Endangered Species online mapper was queried as part of the desktop review process. As of August 6, 2019, there remains no USFWS designated critical habitat for terrestrial vegetation, or for any species, within or adjacent to the test sites and project vicinity (USFWS 2019a).

Sensitive Terrestrial Vegetation Species Assessment

Desktop review identified 19 special-status plant species known to occur within three miles of the test sites. The closest known occurrences to the CNDDB record are shown in Figure 3.3.6-4.

Following the field survey, the potential for occurrence of special-status species was further refined based on field observations. The potential for occurrence of special status species based on desktop review and field survey is provided below in Table 3.3.6-5.

Based on an evaluation of habitat needs of the species in comparison with the habitats present within the test sites and project vicinity, seven of these species were eliminated from further consideration, because no suitable habitat is present in the test sites or project vicinity, or the test sites are outside of the species' current range. Six species were considered to have a low potential to occur. Six plant species have moderate or high potential to occur in the test sites or project vicinity. Details for all 19-plant species, including listing status and habitat requirements, can be found in Table 3.3.6-5.

Potential Impacts

Methods and Assumptions for Impact Analysis

The analysis of the alternatives' potential effects on terrestrial vegetation resources considers short-term disturbance of increased traffic and contractor presence within the test sites and project vicinity, the short-term and long-term impacts of the dredging alternative, and the potential use of areas with the Tahoe Keys development as staging areas.

The analysis is based on reconnaissance level terrestrial biological survey. Protocol level wildlife and plant surveys would be performed if the analysis determines the project may have an impact on a listed species. Areas mapped as wetlands and riparian vegetation are assumed to potentially qualify as state and/or federally jurisdictional wetlands. A formal wetland delineation would be completed before the tests are implemented to obtain a USACE permit and RWQCB certification. The wetland delineation would be conducted after selection of a preferred alternative and once the footprint of temporary and permanent impacts are determined. The following communities mapped during the terrestrial biological survey are considered sensitive communities including beach and dune, wet montane meadow, willow scrub wet meadow, sierra mixed conifer, Jeffrey pine, restored upland scrub, and open water.

Determinations of potential "effect" on the special-status species were made accounting for this maximum anticipated project footprint and types of working activities that may occur.

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species. The potential for impact to special status species based on desktop review and field survey is provided below in Table 3.3.6-6.

Table 3.3.6-5 Special Status Plant Species with the Potential to Occur in the Project Vicinity.

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence
Boechera rigidissima Trinity mountain rockcress	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Upper montane coniferous forest (gravelly or rocky). Blooms June - August. Elevation 1,190 – 2,200 meters.	**Low potential:** Habitat typical of this species is not present. Elevation of the test sites is within typical range of this species.
Astragalus austiniae Austin's astragalus	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Habitat includes rocky areas such as alpine boulder and rock fields, and subalpine coniferous forest. Blooms (May) July – Sept. Elevation 2,440 – 2,970 meters.	**No potential:** Typical habitat not present within the test sites and project vicinity. Species known from higher elevations and different vegetation communities than present in the project area.
Boechera tularensis Tulare rockcress	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Habitat includes rocky slopes, sometimes roadsides, subalpine coniferous forest, and upper montane coniferous forest. Blooms (May) June – July (August). Elevation 1,825 – 3,350 meters.	**No potential:** Typical habitat not present within the test sites and project vicinity. Species known from higher elevations and different vegetation communities than present in the project area.
Botrychium ascendens Upswept moonwort	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Perennial rhizomatous herb. Habitat includes mesic lower montane coniferous forest, meadows and seeps. Blooms June (July) – August. Elevation 1,115 – 3,045 meters.	**Low potential:** The project vicinity may include sub-marginal fragments of mesic montane coniferous forest, and meadow habitat within the typical range of this species.
Botrychium crenulatum Scalloped moonwort	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat includes bogs and fens, lower montane coniferous forest, meadows and seeps, freshwater marshes and swamps, and upper montane coniferous forest. Blooms June – Sept. Elevation 1,283 – 3,280 meters.	**Low potential:** The project vicinity may include sub-marginal fragments of montane coniferous forest, and meadow habitat within the typical range of this species.
Botrychium minganense Mingan moonwort	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat includes mesic areas such as bogs and fens, lower montane coniferous forest, edges of meadows and seeps, and upper montane coniferous forest. Blooms July – Sept. Elevation 1,455 – 2,180 meters.	**Low potential:** The project vicinity may include sub-marginal fragments of montane coniferous forest, and meadow habitat within the typical range of this species.
Brasenia schreberi Watershield	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Aquatic perennial rhizomatous herb. Habitat freshwater marshes and swamps. Blooms June – Sept. Elevation at 30 – 2,200 meters.	**Present in Lake Tallac per TKPOA's 2019 Macrophyte Survey Report:** The abundance of watershield in the macrophyte samples from Lake Tallac has been 8% in 2015, 0% in 2016, 32% in 2017, 23% in 2018, and 6% in 2019. The endothall treatments in Lake Tallac under

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence
				the Proposed Project will be roughly 1,500 feet from the highest density of watershield (based on the 2019 survey).
Carex davyi Davy's sedge	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Habitat includes subalpine coniferous forest and upper montane coniferous forest. Blooms May – August. Elevation 1,500 – 3,200 meters.	**No potential:** Typical habitat not present within the test sites and project vicinity. Species known from higher elevations and/or different vegetation communities than present in the project area.
Carex limosa Mud sedge	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat includes bogs and fens, lower montane coniferous forest, meadows and seeps, marshes and swamps, and upper montane coniferous forest. Blooms June – August. Elevation 1,200 – 2,700 meters.	**Moderate potential:** The test sites and project vicinity may include marsh habitat, and sub-marginal fragments of montane coniferous forest and meadow habitat within the typical elevation range of this species.
Carex mariposana Mariposa sedge	Fed: CA: CNPS: TRPA:	**None** **None** **None** **SS**	Perennial grass. Habitat includes wetlands within meadows and on slopes. Blooms March – May. Elevation 1,980 to 3,300 meters.	**No potential:** Typical habitat not present within the test sites and project vicinity. Species known from higher elevations and different vegetation communities than present in the project area.
Draba asterophora var. *asterophara* Lake Tahoe draba	Fed: CA: CNPS: TRPA:	**None** **None** **1B.2** **SS**	Perennial herb. Habitat includes alpine boulder and rock field, and subalpine coniferous forest. Blooms July – August (Sept). Elevation 2,500 – 3,505 meters.	**No potential:** Typical habitat not present within the test sites. Species known from higher elevations and different vegetation communities than present in the project area.
Draba asterophora var. *macrocarpa* Cup Lake draba	Fed: CA: CNPS: TRPA:	**None** **None** **1B.1** **SS**	Perennial herb. Habitat includes rocky subalpine coniferous forest. Blooms July – August (Sept). Elevation 2,500 – 2,815 meters.	**No potential:** Typical habitat not present within the test sites. Species known from higher elevations and different vegetation communities than present in the project area.
Glyceria grandis American marina grass	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Perennial rhizomatous grass. Habitat includes bogs and fens, meadows and seeps, marshes and swamps, and streambanks and lake margins. Blooms June - August. Elevation 15 – 1,980 meters.	**Low potential:** The project vicinity may include marsh habitat, and sub-marginal fragments of meadow habitat within the typical elevation range of this species. The test sites is at the highest end of the species elevation range.
Lewisia pygmaea longipetala Long pedaled lewisia	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **SS**	Perennial herb. Habitat soil is granitic. Habitat includes alpine boulder and rock field, and mesic rocky subalpine coniferous forest. Blooms July – August (Sept). Elevation 2,500 – 2,925 meters.	**No potential:** Typical habitat not present within the test sites and project vicinity. Species known from higher elevations and different vegetation communities than present in the test sites.
Meesia uliginosa	Fed: CA:	**None** **None**	Moss. Habitat is damp soil and includes bogs and fens, meadows and seeps, subalpine coniferous	**Moderate potential:** The project vicinity may include marsh habitat, and sub-marginal fragments of

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence
Broad-nerved hump moss	CNPS: TRPA:	**2B.2** **None**	forest, and upper montane coniferous forest. Blooms July and October. Elevation 1,210 – 2,804 meters.	montane coniferous forest within the typical elevation range of this species.
Rorippa subumbellata Tahoe yellow cress	Fed: CA: CNPS: TRPA:	**None** **END** **1B.1** **SS**	Perennial rhizomatous herb. Habitat is decomposed granitic beaches, lower montane coniferous forest, and meadows and seeps. State-listed as Critically Endangered in Nevada and was previously a candidate for federal listing. Blooms May – Sept. Elevation 1,890 – 1,905 meters.	**High potential:** Pope Beach, the beach associated with Lighthouse Shores, and the beach of the CTC property are all decomposed granitic beaches associated with Lake Tahoe. Species is known to occur either on or within the vicinity of these beaches, and east of the CTC restoration property.
Schoenoplectus subterminalis Water bulrush	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Aquatic perennial rhizomatous herb. Habitat is bongs and fens, marshes and swamps, and montane lake margins. Blooms June – August (Sept). Elevation 750 – 2,250 meters.	**Moderate potential:** The tests sites and project vicinity may include marsh habitat within the typical elevation range of this species.
Scutellana galericulata Marsh skullcap	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat is lower montane coniferous forest, mesic meadows and seeps, and marshes and swamps. Blooms June – Sept. Elevation 0 – 2,100 meters.	**Low potential:** The test sites and project vicinity may include marsh habitat, and sub-marginal fragments of meadow habitat within the typical elevation range of this species. The test sites and project vicinity is at the highest end of the species elevation range.
Stuckenia filiformis ssp. *alpina* Slender-leaved pondweed	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Aquatic perennial rhizomatous herb. Habitat is marshes and swamps where it is associated with assorted shallow freshwater. Blooms May - July. Elevation 300 – 2,150 meters.	**Moderate potential:** The test sites and project vicinity may include marsh habitat within the typical elevation range of this species.

Federal Designations
(Endangered Species Act [ESA], United State Fish and Wildlife Service [USFWS])
END: Federally listed, Endangered
THR: Federally listed, Threatened
CAN Candidate for Federal Listing
BCC: USFWS Bird of Conservation Concern

State Designations:
(California Endangered Species Act [CESA], California Department of Fish and Wildlife [CDFW])
END: State-listed, Endangered
THR: State-listed, Threatened
RARE: State-listed, Rare
SFP: State Fully Protected
SSC: Species of Special Concern
WL: Watch List species

Scientific Name Common Name	Status	Habitat Requirements	Potential for Occurrence
<u>California Native Plant Society (CNPS) Threat Code</u> **.1:** Seriously threatened in CA **.2:** Moderately threatened in CA **.3:** Not very threatened in CA		**<u>California Rare Plant Ranks (CPRP)</u>** **1A:** Presumed extirpated in CA, and rare or extinct elsewhere **1B:** Rare, threatened, or endangered in CA, and elsewhere **2A:** Presumed extirpated in CA, but more common elsewhere **2B:** Rare, threatened, or endangered in CA, but more common elsewhere **3:** Review list of plants requiring more study **4:** Watch list of plants of limited distribution	

Table 3.3.6-6 Potential Effect of Project on Special Status Plant Species with the Potential to Occur in the Project Vicinity.

Scientific Name **Common Name**	**Status**		**Habitat Requirements**	**Potential for Occurrence; Potential Effect of Project on Species**
Boechera rigidissima Trinity mountain rockcress	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Upper montane coniferous forest (gravelly or rocky). Blooms June - August. Elevation 1,190 – 2,200 meters.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the test sites and project vicinity is low as habitat typical for this species is not present. Elevation of the test sites is within typical range of this species.
Astragalus austiniae Austin's astragalus	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Habitat includes rocky areas such as alpine boulder and rock fields, and subalpine coniferous forest. Blooms (May) July – Sept. Elevation 2,440 – 2,970 meters.	**No potential to occur; No effect** Due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Boechera tularensis Tulare rockcress	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Habitat includes rocky slopes, sometimes roadsides, subalpine coniferous forest, and upper montane coniferous forest. Blooms (May) June – July (August). Elevation 1,825 – 3,350 meters.	**No potential to occur; No effect** Due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Botrychium ascendens Upswept moonwort	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Perennial rhizomatous herb. Habitat includes mesic lower montane coniferous forest, meadows and seeps. Blooms June (July) – August. Elevation 1,115 – 3,045 meters.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the project vicinity is low as potential habitat includes sub-marginal fragments of mesic montane coniferous forest, and meadow habitat within the typical elevational range of this species.
Botrychium crenulatum Scalloped moonwort	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat includes bogs and fens, lower montane coniferous forest, meadows and seeps, freshwater marshes and swamps, and upper montane coniferous forest. Blooms June – Sept. Elevation 1,283 – 3,280 meters.	**Low potential to occur; May affect, but not likely to adversely affect** The potential for this species to be within the project vicinity is low as potential habitat includes sub-marginal fragments of mesic montane coniferous forest, and meadow habitat within the typical elevational range of this species.
Botrychium minganense Mingan moonwort	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat includes mesic areas such as bogs and fens, lower montane coniferous forest, edges of meadows and seeps, and upper montane coniferous forest. Blooms July – Sept. Elevation 1,455 – 2,180 meters.	**Low potential; May affect, but not likely to adversely affect** The potential for this species to be within the project vicinity is low as potential habitat may include sub-marginal fragments of montane coniferous forest, and meadow habitat within the typical range of this species.

Scientific Name **Common Name**	**Status**		**Habitat Requirements**	**Potential for Occurrence;** **Potential Effect of Project on Species**
Brasenia schreberi Watershield	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Aquatic perennial rhizomatous herb. Habitat freshwater marshes and swamps. Blooms June – Sept. Elevation at 30 – 2,200 meters.	**Present in Lake Tallac per TKPOA's 2019 Macrophyte Survey Report; May affect but not likely to adversely affect** The abundance of watershield in the macrophyte samples from Lake Tallac has been 8% in 2015, 0% in 2016, 32% in 2017, 23% in 2018, and 6% in 2019. The endothall treatments in Lake Tallac under the Proposed Project will be roughly 1,500 feet from the highest density of watershield (based on the 2019 survey). There can be no detectable active herbicide ingredients present outside of the treatment zone to comply with the requirements of the exemption to the Basin Plan prohibition. BIO-MM-2 would be implemented to ensure a monitoring program is in place that can effectively monitor the effects of the project.
Carex davyi Davy's sedge	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **None**	Perennial herb. Habitat includes subalpine coniferous forest and upper montane coniferous forest. Blooms May – August. Elevation 1,500 – 3,200 meters.	**No potential to occur; No effect** Due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity. Species known from higher elevations and/or different vegetation communities than present in the project area.
Carex limosa Mud sedge	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat includes bogs and fens, lower montane coniferous forest, meadows and seeps, marshes and swamps, and upper montane coniferous forest. Blooms June – August. Elevation 1,200 – 2,700 meters.	**Moderate potential to occur; May affect, but not likely to adversely affect** The test sites and project vicinity may include marsh habitat, and sub-marginal fragments of montane coniferous forest and meadow habitat within the typical elevation range of this species Work within Pope Marsh would require coordination with the USFS.
Carex mariposana Mariposa sedge	Fed: CA: CNPS: TRPA:	**None** **None** **None** **SS**	Perennial grass. Habitat includes wetlands within meadows and on slopes. Blooms March – May. Elevation 1,980 to 3,300 meters.	**No potential to occur; No effect** Due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Draba asterophora var. *asterophara* Lake Tahoe draba	Fed: CA: CNPS: TRPA:	**None** **None** **1B.2** **SS**	Perennial herb. Habitat includes alpine boulder and rock field, and subalpine coniferous forest. Blooms July – August (Sept). Elevation 2,500 – 3,505 meters.	**No potential to occur; No effect** Due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Draba asterophora var. *macrocarpa*	Fed: CA:	**None** **None**	Perennial herb. Habitat includes rocky subalpine coniferous forest. Blooms July –	**No potential to occur; No effect**

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence; Potential Effect of Project on Species
Cup Lake draba	CNPS: TRPA:	**1B.1** **SS**	August (Sept). Elevation 2,500 – 2,815 meters.	Due to lack of habitat and no potential for occurrence of the species within the test sites and project vicinity.
Glyceria grandis American marina grass	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Perennial rhizomatous grass. Habitat includes bogs and fens, meadows and seeps, marshes and swamps, and streambanks and lake margins. Blooms June - August. Elevation 15 – 1,980 meters.	**Low potential to occur; May affect, but not likely to adversely affect** The project vicinity may include marsh habitat, and sub-marginal fragments of meadow habitat within the typical elevation range of this species. The test sites is at the highest end of the species elevation range. Work within Pope Marsh would require coordination with the USFS.
Lewisia pygmaea longipetala Long pedaled lewisia	Fed: CA: CNPS: TRPA:	**None** **None** **1B.3** **SS**	Perennial herb. Habitat soil is granitic. Habitat includes alpine boulder and rock field, and mesic rocky subalpine coniferous forest. Blooms July – August (Sept). Elevation 2,500 – 2,925 meters.	**No potential to occur; No effect** Due to lack of habitat and no potential for occurrence of the species within the Study Area.
Meesia uliginosa Broad-nerved hump moss	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Moss. Habitat is damp soil and includes bogs and fens, meadows and seeps, subalpine coniferous forest, and upper montane coniferous forest. Blooms July and October. Elevation 1,210 – 2,804 meters.	**Moderate potential to occur; May affect, but not likely to adversely affect** The project vicinity may include marsh habitat, and sub-marginal fragments of montane coniferous forest within the typical elevation range of this species. Work within Pope Marsh would require coordination with the USFS.
Rorippa subumbellata Tahoe yellow cress	Fed: CA: CNPS: TRPA:	**None** **END** **1B.1** **SS**	Perennial rhizomatous herb. Habitat is decomposed granitic beaches, lower montane coniferous forest, and meadows and seeps. State-listed as Critically Endangered in Nevada and was previously a candidate for federal listing. Blooms May – Sept. Elevation 1,890 – 1,905 meters.	**High potential to occur within the project vicinity; May affect, but not likely to adversely affect** The test sites are not anticipated to extend beyond the Tahoe Keys development and the beaches are not anticipated to be exposed to the project actions or its environmental consequences. If the species is present within the final planned test sites, ground disturbance could impact individuals and/or the seedbank and additional coordination with the CDFW may be required.
Schoenoplectus subterminalis Water bulrush	Fed: CA: CNPS: TRPA:	**None** **None** **2B.3** **None**	Aquatic perennial rhizomatous herb. Habitat is bongs and fens, marshes and swamps, and montane lake margins. Blooms June – August (Sept). Elevation 750 – 2,250 meters.	**Moderate potential to occur; May affect, but not likely to adversely affect** The tests sites and project vicinity may include marsh habitat within the typical elevation range of this species. Work within Pope Marsh would require coordination with the USFS.

Scientific Name Common Name	Status		Habitat Requirements	Potential for Occurrence; Potential Effect of Project on Species
Scutellana galericulata Marsh skullcap	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Perennial rhizomatous herb. Habitat is lower montane coniferous forest, mesic meadows and seeps, and marshes and swamps. Blooms June – Sept. Elevation 0 – 2,100 meters.	**Low potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. The test sites and project vicinity may include marsh habitat, and sub-marginal fragments of meadow habitat within the typical elevation range of this species. Work within Pope Marsh would require coordination with the USFS.
Stuckenia filiformis ssp. *alpina* Slender-leaved pondweed	Fed: CA: CNPS: TRPA:	**None** **None** **2B.2** **None**	Aquatic perennial rhizomatous herb. Habitat is marshes and swamps where it is associated with assorted shallow freshwater. Blooms May - July. Elevation 300 – 2,150 meters.	**Moderate potential to occur; May affect, but not likely to adversely affect** The project area is not anticipated to extend beyond the Tahoe Keys development. The project vicinity may include marsh habitat within the typical elevation range of this species. Work within Pope Marsh would require coordination with the USFS.
<u>Federal Designations</u> (Endangered Species Act [ESA], United State Fish and Wildlife Service [USFWS]) **END:** Federally listed, Endangered **THR:** Federally listed, Threatened **CAN:** Candidate for Federal Listing			**<u>State Designations:</u>** (California Endangered Species Act [CESA], California Department of Fish and Wildlife [CDFW]) **END:** State-listed, Endangered **THR:** State-listed, Threatened **RARE:** State-listed, Rare **SFP:** State Fully Protected **SSC:** Species of Special Concern **WL:** Watch List species	
<u>California Native Plant Society (CNPS) Threat Code</u> **.1:** Seriously threatened in CA **.2:** Moderately threatened in CA **.3:** Not very threatened in CA			**<u>California Rare Plant Ranks (CPRP)</u>** **1A:** Presumed extirpated in CA, and rare or extinct elsewhere **1B:** Rare, threatened, or endangered in CA, and elsewhere **2A:** Presumed extirpated in CA, but more common elsewhere **2B:** Rare, threatened, or endangered in CA, but more common elsewhere **3:** Review list of plants requiring more study **4:** Watch list of plants of limited distribution	

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. Herbicide treatments utilized in the Proposed Project may directly impact the health and functioning of non-target species. A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; or has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA. The magnitude of short-term impacts to these species depends upon the herbicide applied, with endothall being the less-selective contract herbicide with potentially the greatest impacts to non-target species. Measures would be implemented to comply with all terms and conditions of the permits to lessen the impact level.

Of the plant species determined to have high to moderate potential to occur, Tahoe yellow cress (*Rorippa subumbellata*) is the only state-protected species and is listed as endangered by California and critically endangered by Nevada. The shoreline of Lake Tahoe, within the project vicinity, includes decomposed granitic beaches similar to locations of known occurrences in the vicinity. If the species is present within the footprint of any ground-disturbing project activities, impacts could occur to individuals and/or the seedbank. In that case, additional coordination with the USFWS and CDFW may be required.

The Proposed Project is the only alternative to utilize herbicides. Herbicide use would be limited to the test sites shown in Figure 2-4. The regulation of the selected herbicides under the CMT and their control within the proposed test sites is discussed in Chapter 2 and in Section 3.2, Environmental Health, and Section 3.3.4, Water Quality.

Ecotonal areas are prevalent along the shores of Lake Tallac and are largely absent along the shores of the western lagoon. Plant species commonly found at the water/upland ecotone included; spikerush (*Eleocharis macrostachya*), American waterweed (*Elodea canadensis*), western blue flag iris (*Iris missouriensis*), yellow flag iris (*Iris pseudacorus*), Mexican rush (*Juncus mexicanus*), Rocky Mountain pond-lily (*Nuphar polysepala*), and pondweed species (*Potamogeton spp.*). These species are not considered special-status species and are commonly found throughout the ecotonal habitat of the project vicinity.

Compliance with strict antidegradation regulations are expected to assure that herbicide levels outside of the treatment areas would have less than significant effects on any riparian habitat or other sensitive natural communities. The Compliance with CMT test protocols would ensure that the impact of herbicides on non-target species, particularly within Lake Tallac, remains at a less than significant level.

Watershield (*Brasenia* schreberi) is ranked 2B.3 by CNPS but is not state or federally listed. Species with California Rare Plant Rank of 2B meet the definitions of CESA and are eligible for state listing, though are not necessarily actively being considered. The abundance of watershield in the macrophyte samples from Lake Tallac has been eight percent in 2015, 0 percent in 2016, 32 percent in 2017, 23 percent in 2018, and six percent in 2019. The endothall treatments in Lake Tallac under the Proposed Project will be roughly 1,500 feet from the highest density of watershield (based on the 2019 survey). There can be no detectable active herbicide ingredients present outside of the treatment zone to comply with the requirements of the exemption to the Basin Plan prohibition. BIO-MM-2 listed below would be implemented to ensure a monitoring program is in place that can effectively monitor the effects of the project. With mitigation, impacts to TE-2 will be **less than significant**.

Mitigation and Resource Protection Measures

The Proposed Project will comply with the best management practice delineated and described in Mitigation Measure MM-BIO-2 below.

MM-BIO-2: Routine monitoring of the ecotonal areas within Lake Tallac outside and adjacent to the herbicide treatment areas will be performed during the duration of the Proposed Project. Monitoring will record cover and composition of native and non-native plant species within the ecotonal area. As the ecotonal areas are often portions of landowners' lakeshore, observations on plantings and removals outside of Proposed Project scope of work will be noted. For consistency, plots may be established with the cooperation of landowners to control the number of variables that may be influencing ecotonal plant growth.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to terrestrial vegetation and the Proposed Project. No additional information on significant unavoidable impacts are presented in this section.

3.3.6.6 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting

The Regulatory Setting for the Action Alternative 1 is the same as described for the Proposed Project.

Environmental Setting

The Environmental Setting for the Action Alternative 1 is the same as described for the Proposed Project.

Potential Impacts

All issues are anticipated to have **less than significant impacts** for terrestrial vegetation under Action Alternative 1.

Mitigation and Resource Protection Measures

Because no significant impacts occur, no mitigation measures are proposed under Action Alternative 1.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to terrestrial vegetation and Action Alternative 1.

3.3.6.7 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

The Regulatory Setting for the Action Alternative 2 is the same as described for the Proposed Project.

Environmental Setting

The Environmental Setting for the Action Alternative 2 is the same as described for the Proposed Project.

Potential Impacts

All issues are anticipated to have **less than significant impacts** for terrestrial vegetation under Action Alternative 2.

Mitigation and Resource Protection Measures

Because no significant impacts occur, no mitigation measures are proposed under Action Alternative 2.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to terrestrial vegetation and Action Alternative 2.

3.3.6.8 No Action Alternative

Regulatory Setting

The Regulatory Setting for the No Action Alternative would include the ongoing requirements to comply with all of the requirements listed in Section 1.4 and Chapter 6.

Environmental Setting

The Environmental Setting for the No Action Alternative is the same as described for the Proposed Project.

Potential Impacts

Under the No Action Alternative, no impacts to terrestrial vegetation would occur. The extent and quality of vegetative communities would remain similar to existing conditions. Where existing conditions are degraded, existing adverse conditions would continue. All issues are anticipated to have **less than significant impacts** for terrestrial vegetation under the No Action Alternative.

Mitigation and Resource Protection Measures

Because no significant impacts occur, no mitigation measures are proposed under the No Action Alternative.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to terrestrial vegetation under the No Action Alternative.

WETLANDS

3.3.6.9 Proposed Project (Control Methods Test)

Regulatory Setting

Federal

The following federal laws related to wetlands are relevant to the proposed alternatives. Permit requirements and compliance are described in Section 1.4 and Chapter 6.

- Federal Endangered Species Act (ESA)
- Section 404 of the Clean Water Act (CWA)

State

The following state laws related to terrestrial vegetation are relevant to the proposed alternatives. Permit requirements and compliance are described in Section 1.4 and Chapter 6.

- California Fish and Game Code Section 1602 – Streambed Alternations
- California Fish and Game Code Sections 1900 – 1913 – The Native Plant Protection Act (NPPA) of 1977
- California Fish and Game Code Section 2050 – 2116 – California Endangered Species Act (CESA) of 1984
- Section 401 Water Quality Certification/Porter-Cologne Water Quality Control Act

Lake Tahoe Region

Tahoe Regional Planning Agency

The following Tahoe Regional Planning Agency (TRPA) goals and policies listed in Section 3.3.6.5 for terrestrial vegetation are relevant to wetlands under the proposed alternatives.

The TRPA Code of Ordinances defines wetlands as "*Low-lying areas where the water table stands near or above the land surface for a portion of the year. These areas are characterized by poor drainage, standing water, and hydrophytes and include but are not limited to those areas identified in the land capability classification system as Class 1B lands*" (TRPA 2012b). Class 1B lands are Stream Environment Zones (SEZ) as defined in the Code of Ordinances.

The City of South Lake Tahoe goals and policies listed in their General Plan Policy Document (Final 05/17/11), and the Tahoe Valley Area goals and policies listed in their Area Plan/Specific Plan (Final 07/22/15) related to terrestrial vegetation and listed under Section 3.3.6.5 of this document are also relevant to wetlands and the proposed alternatives.

Environmental Setting

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. The potential for impact to special status species based on desktop review and field survey is provided below in Table 3.3.6-6.

A wetland inventory was conducted in the Tahoe Keys lagoons and adjacent lands that contain wetlands and waterways that are hydrologically connected to the lagoons, or that could otherwise be affected by the CMT. The reconnaissance level assessment addressed the following:

Desktop research and review of relevant information including;

- Aerial imagery via Google Earth (Google Earth 2019)
- Emerald Bay, California, USGS 7.5-minute quadrangle (USGS 2015)
- Lake Tahoe Basin Light Detection and Ranging (LiDAR) elevation data (TRPA 2010)
- Natural Resources Conservation Service (NRCS) Web Soil Survey – Last modified 04/09/2019 (NRCS 2019)
- South Lake Tahoe, California-Nevada, USGS 7.5-minute quadrangle (USGS 2012)
- Tahoe Keys West Lagoon Integrated Control Methods Test Joint TRPA Initial Environmental Checklist and CEQA Initial Study (TRPA and LRWQCB April 2018)

- Upper Truckee River and Marsh Restoration Project Draft Environmental Impact Report/Environmental Impact Statement (AECOM & Cardno-ENTRIX 2013)
- USFWS National Wetlands Inventory Mapper (USFWS 2019c)
- Reconnaissance level ground survey of the test sites and project vicinity to determine:
  - o Potential wetlands in or adjacent to the test sites;
  - o Extent of potential wetlands and waterway boundaries; and
  - o Characterization of vegetation communities and potential wetland types.
- Preparation of a WIR. The WIR in its entirety can be found at www.tahoekeysweeds.org.

Methodology

A wetland field inventory was conducted on June 17-19, 2019. The survey consisted of pedestrian surveys, as practicable, of all potential wetlands in the test sites and project vicinity. The Lake Tahoe shoreline, the East Lagoon, and representative portions of the West Lagoon were surveyed using a small powerboat. The survey included the following:

- Mapping wetland and waterway boundaries;
- Characterizing vegetation communities and wetland types; and
- Photographing the test sites and project vicinity.

The Clean Water Act wetlands definition was used for the WIR. The U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region (Version 2.0) (USACE 2010) were used as guidance to identify wetlands and wetland boundaries. Plant species' wetland indicator ratings (how often species occur in wetlands) were from the USACE National Wetlands Plant List (USACE 2016). Definitions for the wetland indicator ratings are in Table 3.3.6-7.

Accessible portions of wetland boundaries were mapped with a GPS unit with sub-meter accuracy. Waterway boundaries, and inaccessible portions of wetland boundaries were mapped from aerial photographs and LIDAR data.

Table 3.3.6-7 Wetland Indicator Rating System for Plant Species.

Rating	Definition
OBL (Obligate Wetland Plants)	Almost always occur in wetlands
FACW (Facultative Wetland Plants)	Usually occur in wetlands, but may occur in non-wetlands
FAC (Facultative Plants)	Occur in wetlands and non-wetlands
FACU (Facultative Upland Plants)	Usually occur in non-wetlands, but may occur in wetlands
UPL (Upland plants)	Almost never occur in wetlands

Source: National Wetland Plant List Indicator Rating Definitions (Lichvar et al. 2012)

Wetlands were classified by vegetative structural type using the National Wetlands Inventory's Classification of Wetlands and Deepwater Habitats of the United States (Federal Geographic Data Committee 2013) and by hydrogeomorphic type using the California Rapid Assessment Method (CRAM) typology (CWMW 2013).

Area Characteristics

The WIR addresses the test sites and a project vicinity encompassing all or portions of the Tahoe Keys development, lagoons, adjacent marina, and adjacent natural areas on U.S. Forest Service (USFS) and California Tahoe Conservancy (CTC) properties.

Historical Alteration to Wetlands

The Tahoe Keys development was constructed in the 1960s within the Truckee Marsh, a historic wetland complex. All historical images referenced can be viewed in the WIR. A 1939 aerial photograph shows a diverse and intermingled set of wetland types within Truckee Marsh with no visible indications of human development or alterations (Google Earth 2019). The 1955 USGS Quadrangle map shows some residential development on upland areas south of Truckee Marsh and a road to Pope Beach crossing the west end of Truckee Marsh. A 1968 aerial photograph shows the construction of Tahoe Keys in progress and the West Lagoon, East Lagoon, and Lake Tallac have been excavated. Fill material has been placed in the wetlands for the road system and residential and commercial development. The Upper Truckee River has been channelized along the east side of the Tahoe Keys development. A 1987 aerial photograph shows Tahoe Keys essentially built out. A 2004 aerial photograph shows the results of the CTC's Lower West Side project that restored wetlands along the east edge of Tahoe Keys by the removal of historic fill material (CTC 2019). A 2018 aerial photograph shows the recent conditions in the test sites and project vicinity.

Existing Wetland Mapping

The U.S. Fish and Wildlife Service (UWFWS) National Wetlands Inventory (NWI) mapped wetlands in the test sites and project vicinity in the 1980s (Figure 3.3.6-5). The NWI mapping was derived from 1:58,000 scale color infrared aerial photographs taken in 1984, with limited ground truthing to verify the aerial photographic interpretation.

Soils

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) mapping (NRCS 2019) shows six soil types within the test sites and project vicinity (Table 3.3.6-8 and see Figure 3.3.6-6). USDA NRCS defines hydric soils as *"a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part."* The environmental conditions that create hydric soils also favor the formation of many types of wetlands and the presence of hydric soils is a useful indicator of the presence of wetlands.

Most soils within the test sites are mapped as Oxyaquic Xerothent-Water association. This soil type was present primarily in the lagoons, and the backfilled and developed portion of the project vicinity. Tahoe complex, Watah peat, and Marla loamy coarse sand are hydric soils mapped in the remnant portions of Truckee Marsh east and west of Tahoe Keys and to the south of Lake Tallac. Soil samples were not taken as part of the wetland inventory.

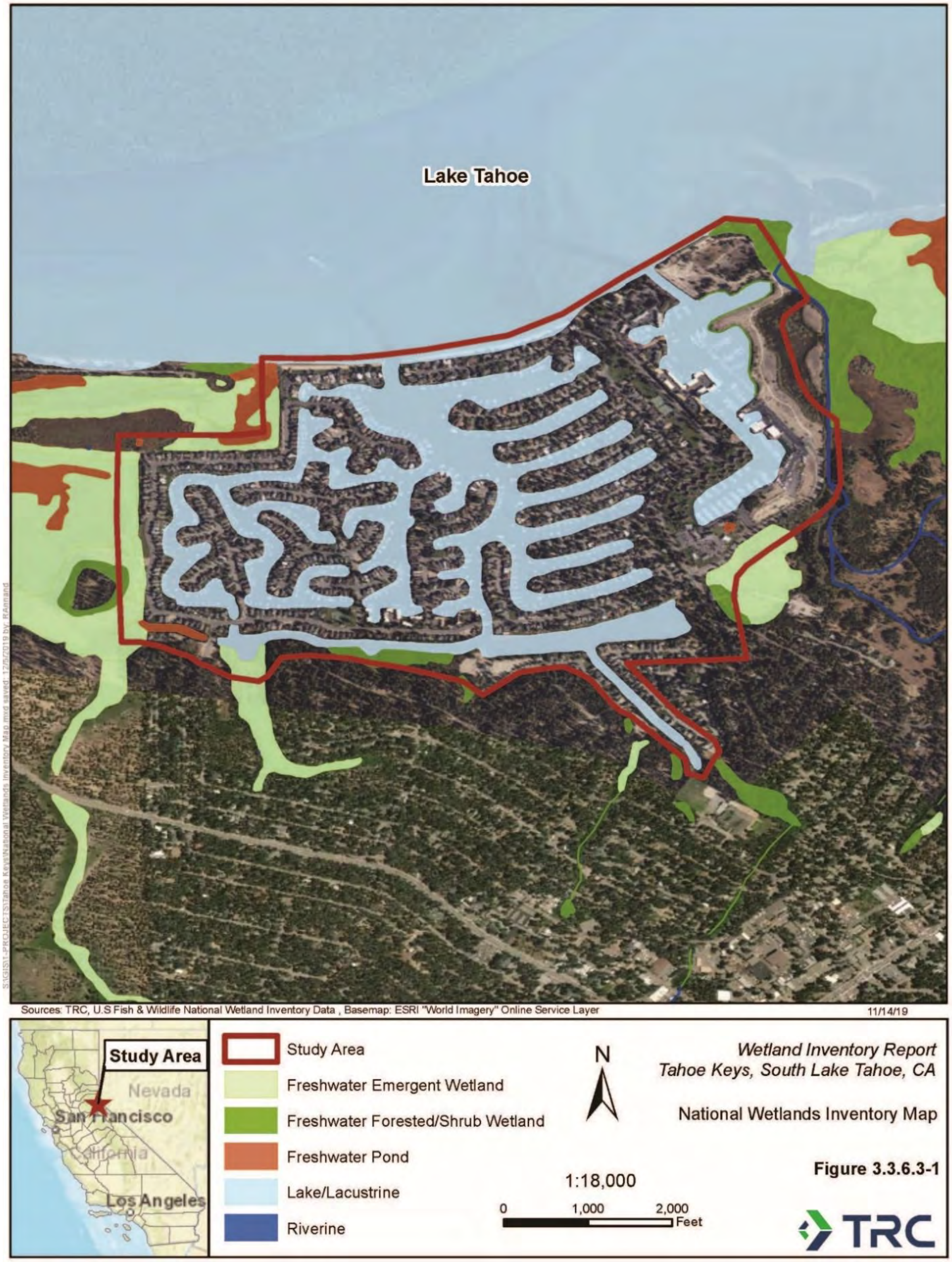


Figure 3.3.6-5 National Wetlands Inventory Map.

Table 3.3.6-8 NRCS Mapped Soil Types in the Test Sites and Project Vicinity.

Map Unit Symbol	Map Unit Name	Hydric
7011	Beaches (beach sand)	No
7041	Tahoe complex, 0 to 2 percent slopes	Yes
7051	Oxyaquic Xerorthents-Water association, 0 to 5 percent slopes	No
7071	Watah peat, 0 to 2 percent slopes	Yes
7444	Christopher-Gefo complex, 0 to 5 percent slopes	No
7471	Marla loamy coarse sand, 0 to 5 percent slopes	Yes

Hydrology

Section 3.3.3 describes the hydrology of the Tahoe Keys lagoons and associated waters in detail.

West Lagoon and East Lagoon (Western and Eastern Lagoons)

The West Lagoon and East Lagoon have direct connectivity to Lake Tahoe and their water levels are primarily related to the elevation of Lake Tahoe. Lake levels vary within each year and from year to year in relationship to several climatological factors in the Tahoe Basin including the timing and extent of snow pack, water content of snow pack, and melt rate of snow pack (TKPOA 2018). Lake levels are regulated by the Lake Tahoe Dam on the Truckee River at Tahoe City at the north end of Lake Tahoe. The dam regulates outflows through a gated spillway with 17 bays, capable to releasing water at a rate of 2,100 cubic feet/second. Lake levels have varied from a historic low of just over 6,220 feet to the maximum allowed legal high surface elevation of 6,229.1 feet. This legal high surface elevation is partially dictated by the maximum storage capacity of the reservoir and dam. At the time of the wetland inventory the water level of Lake Tahoe was within less than an inch of the maximum allowed legal high-water level. Hydrology of the test sites is discussed in further detail in Section 3.3.3.

The West Lagoon also has a groundwater connection to Pope Marsh along its western boundary and to Lake Tahoe along its northern boundary. The East Lagoon has a groundwater connection to Lake Tahoe along its northern boundary.

Open Water (Lake Tahoe)

Lake Tahoe is an alpine lake on the California – Nevada border known for the clarity and purity of its outstanding blue waters. Lake Tahoe was designated an Outstanding National Resource Water (ONRW) by the State of California and the USEPA in 1980. Section 3.3.3 further describes the hydrologic connections within the test sites and project vicinity. At the time of the survey the water level of Lake Tahoe was within less than an inch of the maximum allowed surface elevation of 6,229.1 feet (1,898 meters) above sea level. Further discussion of this land cover type is provided in the separate WIR for the project.

Lake Tallac and Pope Marsh

Water levels in Lake Tallac and Pope Marsh do not directly correlate to water levels in Lake Tahoe. In recent years there has been no direct surface water runoff connection between the western and eastern lagoons, and Lake Tallac. Lake Tallac intercepts freshwater runoff drainage from the neighboring communities and is separated from the western/eastern lagoons via a weir located immediately west of the intersection of Venice Drive and Lucerne Way. Lake Tallac and the western/eastern lagoons do exchange

Figure 3.3.6-6 USDA NRCS Soil Survey Map.

groundwater, and there is the potential of flooding into Lake Tallac. Lake Tallac has a groundwater connection to Pope Marsh along its western boundary.

The main portion of Lake Tallac, referred to in this report as Lake Tallac (East), is connected through a culvert under 15th Street to the small portion of the lake between 15th Street and Pope Marsh. This portion of Lake Tallac is referred to as Lake Tallac (West) in this report. The west end of Lake Tallac (West) is adjacent to Pope Marsh and depending on the snowpack and the season, flow can occur in either direction until water levels are equilibrated (Kopania 2019).

Pope Marsh is separated from Lake Tahoe by a low sand berm/levee at the northwest corner of the Tahoe Keys development at Lot C. In years with higher levels of snow melt and runoff water levels rise high enough in Pope Marsh to overtop and breach the berm, creating a notch that allows water to drain from Pope Marsh into Lake Tahoe. Wind-driven waves in Lake Tahoe act to push beach sediment back into the breach, eventually closing it back up (Kopania 2019). Lake Tahoe also has a groundwater connection to Pope Marsh along the marsh's northern boundary.

Upper Truckee River Marsh

Hydrology in Upper Truckee River Marsh is related to surface and groundwater inputs associated with the Upper Truckee River and surrounding uplands. There are no direct surface water connections between the Upper Truckee River Marsh and the other wetlands and waterways in the test sites.

Isolated Wetlands

There were four small wetland depressions mapped during the wetland inventory, identified as Isolated Wetlands 1 through 4. These depressions are in areas of historic fill and appear to receive hydrology through precipitation/snow melt runoff from surrounding higher areas. They do not have surface connections to other wetlands or waterways.

Vegetation Communities

Figure 3.3.6-7 maps wetlands and waterways using survey data, LIDAR data, and aerial imagery.

Descriptions of the vegetation communities and land cover types in and adjacent to the project vicinity are provided above in Section 3.3.6.1. Additional information on the composition of wetland vegetation communities was obtained from the Upper Truckee River Marsh Restoration Project Draft EIR/EIS/EIS (AECOM & Cardno-ENTRIX 2013).

Native vegetation communities found within the project vicinity include beach and dune, lake fringe wetlands, montane meadow, willow scrub wet meadow, lodgepole pine forest, sierra mixed conifer, Jeffrey pine, and restored upland shrub habitat. Vegetation communities dominated by hydrophytic vegetation and associated with wetlands include the lake fringe, montane meadow, and willow scrub wet meadow. The lodgepole pine forest is a transitional community. Lower areas are dominated by facultative and wetter species and are associated with wetlands, while higher areas are dominated by facultative and upland species and do not meet the criteria for a hydrophytic plant community. The wetland plant communities are described below.

Figure 3.3.6-7 Wetland Inventory Map.

Lake Fringe

Plant species observed in this community included spikerush (*Eleocharis macrostachya*), American waterweed (*Elodea canadensis*), western blue flag iris (*Iris missouriensis*), yellow flag iris (*Iris pseudacorus*), Mexican rush (*Juncus mexicanus*), Rocky Mountain pond-lily (*Nuphar polysepala*), and pondweed species (*Potamogeton spp.*). This vegetation community occurs around the edges of Lake Tallac (East) and is consistent with the National Wetlands Inventory's palustrine emergent wetland type.

Montane Meadow

The montane meadow community is dominated by sedges, rushes, and grasses. Species observed included: water sedge (*Carex aquatilis*), field sedge (*Carex praegracilis*), beaked sedge (*Carex utriculata*), tufted hair grass (*Deschampsia cespitosa*), Baltic rush/wire rush (*Juncus balticus*), Sierra rush (*Juncus nevadensis*), and Hooker's evening primrose (*Oenothera elata*). Additional species typically occurring in this community include straight-leaved rush (*Juncus orthophyllus*), common spikerush (*Eleocharis macrostachya*), domestic timothy (*Phleum pratense*), Kentucky bluegrass (*Poa pratensis*), aster (*Aster occidentalis*), arnica (*Arnica chamissonis* var. *foliosa*), cinquefoil (*Potentilla* spp.), and Douglas' knotweed (*Polygonum douglasii*). This vegetation community occurs in Pope Marsh and the Upper Truckee River Marsh and is also consistent with the National Wetlands Inventory's palustrine emergent wetland type.

Willow Scrub Wet Meadow

This community is dominated by Lemmon's willow (*Salix lemmonii*), Geyer's willow (*Salix geyeriana*), and shining willow (*Salix lucida* ssp. *lasiandra)*. Dense stands of willow scrub typically lack an understory. In more open stands, the understory is dominated by montane meadow herbaceous species such as sedges, creeping bent grass (*Agrostis stolonifera*), domestic timothy (*Phleum pratense*), and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*) and forbs such as cinquefoil (*Potentilla* spp.), aster (*Aster occidentalis*), arnica (*Arnica chamissonis* var. *foliosa*), and slender willow-herb (*Epilobium ciliatum* var. *ciliatum*). This vegetation community occurs in patches within Pope Marsh and the Upper Truckee River Marsh, and along the east shoreline of the Eat Lagoon and is consistent with the National Wetlands Inventory's palustrine scrub-shrub wetland type.

Lodgepole Pine Forest

Lodgepole pine occurs in areas that are transitional to montane meadow. This plant community is characterized by open canopies of lodgepole pine (*Pinus contorta* var. *murrayana*) with an understory that may include willow and herbaceous species. Willow species present include Lemmon's willow (*Salix lemmonii*), shining willow (*Salix lucida* ssp. *lasiandra*), and Geyer's willow (*Salix geyeriana*). Dominant herbs include Kentucky bluegrass (*Poa pratensis*), woolly sedge (*Carex lanuginosa*), Baltic rush (*Juncus balticus*), aster (*Aster occidentalis*), yarrow (*Achillea millefolium*), and checker mallow (*Sidalcea oregana*). This vegetation community occurs at the edges of the project vicinity along the south side of Lake Tallac (East) and in the Upper Truckee River Marsh and is consistent with the National Wetlands Inventory's palustrine forested wetland type.

Wetlands

Wetlands inventoried in the project vicinity are listed in Table 3.3.6-9 and shown on Figure 3.3.6-7. A protocol level survey and delineation of the waterways and wetlands per USACE standards was not performed as part of the survey. Areas mapped as wetlands and riparian vegetation are assumed to

Table 3.3.6-9 Wetlands Inventoried in the Project Vicinity.

Name	Vegetation Communities	NWI Type	CRAM Type
Pope Marsh	Montane Meadow Willow Scrub Wet Meadow	PEM PSS	Slope
Lake Tallac (East)	Lake Fringe Montane Meadow Willow Scrub Wet Meadow Lodgepole Pine Forest	PEM PEM PSS PFO	Lacustrine & Slope
East Lagoon *East Shoreline*	Willow Scrub Wet Meadow	PSS	Lacustrine
Upper Truckee River Marsh	Montane Meadow Willow Scrub Wet Meadow	PEM PSS	Riverine
Isolated Wetland *1, 2 and 4*	Montane Meadow	PEM	Depressional
Isolated Wetland 3	Willow Scrub Wet Meadow	PSS	Depressional

potentially qualify as state and/or federally jurisdictional wetlands. A formal wetland delineation survey would be completed before implementing the CMT, to obtain a USACE permit and RWQCB certification. The wetland delineation would be conducted after selection of a preferred alternative and once the footprints of temporary and permanent impacts are determined.

Pope Marsh

Managed by the USFS, the marsh is approximately 150 acres that were part of the Truckee Marsh wetland complex that became isolated by the Tahoe Keys development in the 1960s. Pope Marsh has hydrologic connectivity to Lake Tahoe but is dependent on rainfall, snowmelt, groundwater, and drainage from Lake Tallac as water sources. Vegetation is primarily the montane meadow community with large patches of willow scrub wet meadow. The wetland boundary in the project vicinity is the toe of the fill slopes along the west side of Venice Drive and the toe of the fill slopes of residential lots in areas where there is residential development west of Venice Drive.

Lake Tallac (East) Wetlands

There are several areas of wetlands bordering Lake Tallac (East). A naturally occurring wetland drains into the lake from the south, immediately east of 15th Street. This wetland is a mix of the montane meadow community with patches of willow scrub wet meadow. Wetland hydrological inputs include surface runoff from surrounding uplands and potential groundwater discharge at the base of the slopes that form the wetland's boundary.

There are several wetland areas along the southern and eastern shores of the lake. Wetland hydrology for these wetlands is provided by soil saturation and/or inundation by lake waters. Immediately west of the Water Circulation Facility is wetland area that includes areas of the lake fringe vegetation community, willow scrub wet meadow community, and lodgepole pine forest community. Narrow strips of lake fringe community wetlands are along the southern edge of the lake east of the Water Circulation Facility and at the east end of the lake.

The south end of the narrow lagoon that extends south from Lake Tallac contains wetlands with lake fringe vegetation. A naturally occurring wetland drains into the south end of this narrow lagoon from the southeast. This wetland contains montane meadow vegetation and receives hydrological inputs primarily from surface runoff from surrounding uplands.

East Lagoon East Shoreline Wetlands

The eastern shoreline of the East Lagoon contains a narrow strip of wetlands with the willow scrub wet meadow community. Wetland hydrology is provided by soil saturation and/or inundation by the waters of the lagoon.

Upper Truckee River Marsh

This area east of Tahoe Keys is the largest remnant portion of Truckee Marsh and includes the Upper Truckee River. The portions of the wetland in the project vicinity are a mix of the montane meadow community and the willow scrub wet meadow community. Hydrology sources are rainfall, snowmelt, groundwater, and overbank flooding from the river. There is no surface hydrological connection between the Marsh and any other wetlands or waterways test sites or project vicinity. The wetland boundary in the project vicinity is the toe of the historic fill slopes along the east side of Tahoe Keys Boulevard, Venice Drive, and along the eastern edge of the CTC's Lower West Side project.

Isolated Wetlands

Four small wetland depressions were mapped during the wetland inventory, identified as Isolated Wetlands 1 through 4. These depressions are in areas of historic fill and appear to receive hydrology through precipitation/snow melt runoff from surrounding higher areas. They do not have surface connections to other wetlands or waterways. Isolated Wetlands 1, 3, and 4 have components of the montane meadow vegetation community. Isolated Wetland 2 is vegetated with the willow scrub wet meadow community.

Other Waters

West Lagoon and East Lagoon (Western and Eastern Lagoons)

The West Lagoon and East Lagoon banks are composed of historic fill materials and include areas of vertical metal bulkheads, riprap slopes, and unarmored sand and cobble fill slopes. Lagoon depths vary with the level of Lake Tahoe and are approximately 20 to 30 feet at maximum depth with an average depth of 12 feet. There are no wetlands in the West Lagoon. The eastern shoreline of the East Lagoon contains a narrow strip of willow-dominated wetlands (described above).

Lake Tallac (West)

This waterway is the portion of Lake Tallac between 15th Street and Pope Marsh. Shorelines are composed of riprap or unarmored sand and cobble fill slopes. There are no wetlands present.

Upper Truckee River

The river runs through the Upper Truckee River Marsh east of Tahoe Keys.

Potential Impacts

Methods and Assumptions for the Wetlands Impact Analysis

The analysis of the alternatives' potential effects on wetland resources considers short-term disturbance of increased traffic and contractor presence within the test sites and project vicinity; the short-term and long-term impacts of the dredging alternative; and the potential use of the old water treatment area with the Tahoe Keys development as a staging area.

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. Even a short-term disturbance can create a disruption in the function of the ecosystem and the services provided by wetland and riparian habitats. A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA; involves the removal of vegetation in excess of the area utilized for the actual development permitted by TRPA's land capability program; results in the removal of riparian vegetation or other vegetation associated with critical wildlife habitat, through either direct removal or in direct lowering of the groundwater table; results in the cause a substantial change in the diversity or distribution of species, or the number of any species of plants; causes the reduction in the numbers of any unique, rare, or endangered species of plants; and/or removal of streambank and/or backshore vegetation, including woody vegetation such as willows.

Under the Proposed Project the existing boat ramps within the Tahoe Keys Development would be utilized to launch various treatment boats and barges, and select areas treatments would be implement within the open water of the western lagoons and Lake Tallac as shown in Figure 2-4. The project does not involve the removal of riparian vegetation or other vegetation associated with critical wildlife habitat; the reduction in numbers of any unique, rare, or endangered species of plants; and/or the removal of streambank and/or backshore vegetation including woody vegetation such as willows. No alteration of upland habitats is anticipated under the Proposed Project. The project does not involve upland ground disturbance.

Activities under the Proposed Project would be limited to the western lagoon and Lake Tallac. Wetlands were not mapped within the western lagoon during the WRI survey effort. Freshwater forested/shrub wetland was mapped south of the proposed LSA site within Lake Tallac. This LSA effort is not anticipated to result in direct impacts to shoreline wetland or riparian areas [see **Issue TE-2(A)**]. Wetlands were not mapped adjacent to the proposed herbicide sites in eastern Lake Tallac.

Due to the limited scope of the Proposed Project and the minimal potential for interaction with known wetland sites, effects to wetlands are anticipated to be **less than significant**.

Mitigation and Resource Protection Measures

Because no significant impacts are identified to wetlands, no mitigation measures are necessary.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to wetlands and the Proposed Project.

3.3.6.10 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting

The Regulatory Setting for Action Alternative 1 is the same as described for the Proposed Project.

Environmental Setting

The Environmental Setting for Action Alternative 1 is the same as described for the Proposed Project.

Potential Impacts

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. Even a short-term disturbance can create a disruption in the function of the ecosystem and the services provided by wetland and riparian habitats. A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA; involves the removal of vegetation in excess of the area utilized for the actual development permitted by TRPA's land capability program; results in the removal of riparian vegetation or other vegetation associated with critical wildlife habitat, through either direct removal or in direct lowering of the groundwater table; results in the cause a substantial change in the diversity or distribution of species, or the number of any species of plants; causes the reduction in the numbers of any unique, rare, or endangered species of plants; and/or removal of streambank and/or backshore vegetation, including woody vegetation such as willows.

Action Alternative 1 is the same as the Proposed Project except that none of the herbicide application sites would be used in the CMT. Impacts under Action Alternative 1 would be the same as the Proposed Project, except that no impacts associated with application of herbicides would occur.

Due to the minimal potential for interaction with known wetland sites, the effect of Action Alternative 1 on wetlands is anticipated to be **less than significant**.

Mitigation and Resource Protection Measures

No mitigation measures are required.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified to wetlands under Action Alternative 1.

3.3.6.11 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

The Regulatory Setting for Action Alternative 2 is the same as described for the Proposed Project.

Environmental Setting

The Environmental Setting for Action Alternative 2 is the same as described for the Proposed Project.

Potential Impacts

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. Even a short-term disturbance can create a disruption in the function of the ecosystem and the services provided by wetland and riparian habitats. A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA; involves the removal of vegetation in excess of the area utilized for the actual development permitted by TRPA's land capability program; results in the removal of riparian vegetation or other vegetation associated with critical wildlife habitat, through either direct removal or in direct lowering of the groundwater table; results in the cause a substantial change in the diversity or distribution of species, or the number of any species of plants; causes the reduction in the numbers of any unique, rare, or endangered species of plants; and/or removal of streambank and/or backshore vegetation, including woody vegetation such as willows.

The impacts of Action Alternative 2 would be limited to the three test sites for dredging and substrate replacement.

The upland lot proposed to be utilized for Action Alternative 2 for dewatering and treatment consists of disturbed and open land once utilized by the Tahoe Keys Water Treatment Plant. This area is primarily barren with sandy soils from the former sand drying beds with minimal vegetation. No vegetation removal is anticipated to be required to utilize the site for siting treatment equipment, contractor access, stockpiling and storage. No additional area is anticipated to be cleared or disturbed.

Activities associated with Action Alternative 2 that occur within open water are limited to the western lagoon and Lake Tallac. Wetlands were not mapped within the western lagoon during the WRI survey effort. Freshwater forested/shrub wetland was mapped northwest of the Tahoe Keys Water Treatment Plant alternative site, along the shore of Lake Tallac. However, a six-foot wooden fence separates the treatment plant from that portion of the shoreline.

Due to the limited scope of work of the Alternative 2 project and the minimal potential for interaction with known wetland sites, the effect is anticipated to be **less than significant**.

As described in Issue HY-1, treated effluent from the Tahoe Dredge and Replace Substrate Alternative, if not discharged to the sanitary sewer system, would be treated and discharged to Lake Tallac, where it would subsequently flow into Pope Marsh. A significant impact would be one that: has a substantially adverse effect on any riparian habitat or other sensitive natural community; or has a substantial adverse effect on any federally protected wetlands as defined by Section 404 of CWA. This discharge could raise water levels in Lake and Pope Marsh.

Action Alternative 2 includes the potential for treated effluent from sediment dewatering to be pumped into Lake Tallac. It is assumed that pumping would never exceed the current holding capacity of the lake and adjacent Pope Marsh. The open water of the western lagoon, eastern lagoon, and Lake Tallac are connected to Pope Marsh through varied means.

Hydrology of the test sites and project vicinity is discussed in detail in Section 3.3.3, where potential changes in water levels that could occur within Lake Tallac and Pope Marsh due to the introduction of treated water during a hypothetical dry year (i.e., 2016) and a hypothetical wet year (i.e., 2019) are modelled. The model assumes that water added to Lake Tallac would move to Pope Marsh, and then exist to Lake Tahoe via groundwater exchange. In total the water volume expected to be transported is 36 million gallons, or 110 acre-feet. The model assumes the transportation would occur from June to October at a rate of 22 acre-feet per month.

In the summer of 2016, per aerial photos, Pope Marsh was mostly dry with isolated pockets and standing water, and Lake Tallac water levels appear only slightly lower than in 2019 (a wet year). The model indicated that during a dry year (such as 2016), there would be an increase in water levels in Pope Marsh of 0.3 – 0.5 foot under Action Alternative 2, and 0.5 – 1.0 foot in Lake Tallac. This increased surface water also would lead to an estimated eight-percent increase in the amount of groundwater flow from Pope Marsh to the western lagoon, and a 20-percent increase in flow from Lake Tallac to the West Lagoon.

In the summer of 2019 Lake Tallac and Pope Marsh were closer to capacity. The model indicated that during a wet year there would be an increase in water levels in Pope Marsh of 0.1 – 0.2 foot and, and 0.1 – 0.5 foot in Lake Tallac. This led to an increase in seepage flows toward the western lagoon during all months from May to October. The net change in groundwater flow toward the western lagoon was an increase of about 35 percent from Lake Tallac and 66 percent from Pope Marsh.

Pope Marsh appears to be tolerant of drying during years with less precipitation and of inundation during heavy rainfall years, based on the historical data reviewed in Section 3.3.3. Thus, the fluctuation within the marsh that would occur under Action Alternative 2 may be within normal limits. Coordination with the U.S. Forestry Service (USFS) would be required if this human alternation to the hydrologic regime is not within their management plan for the marsh. An increase of 0.1 – 1.0 foot outside of the normal hydrologic regime (depending on dry versus closer to capacity) could alter the available shoreline for the emergent wetlands found along Lake Tallac. The discharge of treated effluent water to Lake Tallac represents a **potentially significant impact** on Lake Tallac and Pope Marsh due to the change in hydrologic regime and the subsequent alteration of water depth in the mapped wetlands, depending on timing and flow control (see Section 3.3.3). Changes of one to six inches in water level are not expected to violate TRPA non-degradations standards VP1 or SC10. The rates and timing of discharges can be adjusted to prevent impacts from being significant, and these hydrologic impacts could be completely avoided if the treated dewatering effluent were instead discharged to the sanitary sewer. Data is inconclusive on whether a single season of increased water levels would lead to habitat wide mortality or impacts. While the plant communities of these areas are adapted to dealing with seasonal water fluctuation, increased flooding has been shown to be increasingly stressful and lead to mortality of individuals or populations of species within wetlands (Cherry et al., 2015). Increased surface water can also impact wetland water chemistry and the biogeochemical cycling of materials within the wetland system (Mitch and Gosselink 1993).

Mitigation and Resource Protection Measures

Mitigation would be provided by the measures described in Section 3.3.3 Hydrology, including timing of releases of dewatering effluent and discharge to the South Lake Tahoe sanitary sewer system.

Measures would be implemented to comply with all the terms and conditions of required permits to lessen the impact level.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to wetlands and the Alternative 2 project. No additional information on significant unavoidable impacts are presented in this section.

3.3.6.12 No Action Alternative

Regulatory Setting

The Regulatory Setting for the No Action Alternative would include the ongoing requirements to comply with all of the requirements listed in Section 1.4 and Chapter 6.

Environmental Setting

The Environmental Setting for the No Action Alternative is the same as described for the Proposed Project.

Potential Impacts

Under the No Action Alternative, **no impacts** to wetlands would occur. The extent and quality of wetlands communities would remain similar to existing conditions. Where existing conditions are degraded, existing adverse conditions would continue.

All issues are anticipated to have **less than significant** impacts for wetlands under the No Action Alternative.

Mitigation and Resource Protection Measures

Because no significant impacts occur, no mitigation measures are proposed under the No Action Alternative.

Significant Unavoidable Impacts

No significant unavoidable impacts were identified in relation to wetlands under the No Action Alternative. Under the No Action Alternative, no test studies would occur. The extent and quality of wetland habitat would remain similar to existing conditions. Where existing conditions are degraded, the existing adverse conditions would continue.

3.4 BUILT/HUMAN ENVIRONMENT

3.4.1 Land and Shoreline Use

3.4.1.1 Proposed Project (Control Methods Test)

This section evaluates the Proposed Project and Action Alternatives in light of adopted land use policies of TRPA and the City of South Lake Tahoe. Although no potentially significant effects on land or shoreline use were identified for the Proposed Project in the Initial Environmental Checklist/Initial Study (IEC/IS), and no changes to Proposed Project or Action Alternatives have been made that would change that evaluation, this section expands upon the IEC/IS for the Proposed Project and the two Action Alternatives for the three land and shoreline use issues identified in Section 3.1.1.

Methods and Assumptions

The evaluation of potential land and shoreline use impacts of the Proposed Project and Action Alternatives is based on review of the applicable policies contained in the TRPA Regional Plan and the regulations of the TRPA Code of Ordinances. As the Tahoe Keys is located within the municipal boundary of South Lake Tahoe, the policies of the City of South Lake Tahoe General Plan, which align with TRPA's Regional Plan policies, are also considered in this analysis. The TRPA Regional Plan and PAS-102 were referenced for identification of permissible land uses in the Proposed Project area. Descriptions of existing land uses in Tahoe Keys and surrounding areas are based on aerial photographic observation and current development in Tahoe Keys as described in PAS-102.

Regulatory Setting

The following local and regional plans and codes govern land and shoreline use within the project area.

Federal

No federal regulations governing land and shoreline use within the project area are applicable to the Proposed Project.

State

No state regulations governing land and shoreline use within the project area are applicable to the Proposed Project.

Regional/Tahoe Regional Planning Agency (TRPA)

Threshold Standards and Regional Plan of the Tahoe Regional Planning Agency

The TRPA Regional Plan, adopted by the Agency's Governing Board in 2012, is one of the implementation tools for achieving the environmental threshold carrying capacities (Threshold Standards, see Section 1.4) for the Lake Tahoe Region. As a regional program, the Regional Plan can affect various actions of municipal agencies, county governments and utility providers. The Regional Plan establishes goals and policies intended to facilitate orderly development while achieving he resource values contained in the Threshold Standards, and it includes goals and policies specifically applicable to regional land use in its Land Use and Conservation sub elements (Chapters 2 and 4).

TRPA Code of Ordinances

The TRPA Code of Ordinances provides the regulations that facilitate implementation of the goals and policies in the TRPA Regional Plan. Regulations in the Code of Ordinances establish the framework for identifying allowable land uses, both generally and in individual plan area statements (Chapters 11, 21, and 22). Regulations also govern design and intensity of development, including standards for building heights, lot coverage, signage and parking, as well as other activities including grading, forest management and dredging occurring in the Lake Tahoe Region (Chapters 30-39). Sections in the Code of Ordinances also outline procedures for environmental analysis of any land use activities occurring in the Lake Tahoe Region (Chapter 3) and review, approval, and revocation of development entitlements (Chapter 5).

Lake Tahoe Environmental Improvement Program

The Lake Tahoe EIP supports the Regional Plan by implementing projects that help to achieve the TRPA Threshold Standards, and that protect and improve the natural and recreational resources of the Lake Tahoe Basin. The purpose and administration of the EIP is codified in Chapter 15 of the TRPA Code of Ordinances. Removal of aquatic invasive species from Lake Tahoe has been identified as an objective in the EIP, along with forest health, watershed restoration and restoration of the Lahontan Cutthroat Trout.

Table 3.4.1-1 summarizes applicable environmentally mitigating policies and land and shoreline use regulations listed in applicable TRPA governing documents, with a brief statement of how the project or alternative is consistent or inconsistent with each policy.

Local

City of South Lake Tahoe General Plan

The City of South Lake Tahoe General Plan was last comprehensively updated in May 2011 and provides a long-range vision for how the City will plan for and implement development, conservation, transportation systems and housing objectives through the year 2030. As prescribed in General Plan Land Use Policy LU-1.1, the City will not implement any policy in its General Plan that conflicts with the TRPA Regional Plan.

The City's General Plan assigns a land use designation of *Low Density Residential* to the Tahoe Keys residences and lagoons. The *Low Density Residential* land use designation allows residential development at a density of one to eight units per acre, consistent with the existing residential development pattern. In addition to assigning a land use designation to the Tahoe Keys development, the City's General Plan includes policies that reflect the policies of the TRPA Regional Plan and that are relevant to the Proposed Project, including Natural and Cultural Resources Policy NCR-2.13 (Minimize the Use of Fertilizers and Pesticides) and Policy NCR-3.1 (Natural Habitat Preservation).

City of South Lake Tahoe Zoning Ordinance and Tahoe Keys Plan Area Statement (PAS-102)

Chapter 11 of the TRPA Code of Ordinances describes plan area statements as "*written text and applicable plan area map [that] provides specific land use policies and regulations for a given geographic area*" (TRPA Code of Ordinances, Section 11.1). All activities occurring on property governed by a plan area statement (PAS) must be consistent with the corresponding PAS. A PAS may also include policies specific to the area that address issues not addressed in the Regional Plan (Section 11.6.7).

The plan area statement for the Tahoe Keys is PAS-102. Existing uses recognized in PAS-102 include single-family residences, townhouses, and multifamily residences; recreational amenities (clubhouse, pools, tennis courts, boat docks); public services (maintenance facilities, water company); a commercial marina; and a retail shopping center. PAS-102 supports maintaining the area's existing residential, recreational, public services, and commercial land uses, and related accessory uses as defined in Chapter 21 of the TRPA Code of Ordinances. Other uses identified as allowed or special uses under PAS-102 include churches and schools, health and safety facilities, riding and hiking trails, and reforestation. Nonstructural fish habitat management is identified in PAS-102 as an allowed use.

In accordance with Section 6.55.010 of the City of South Lake Tahoe Municipal Code, plan area statements provide the land use policies and regulations and thereby serve as the zoning regulations governing land use for a specific planning area.

Environmental Setting

Issue LN-1: Physical Division of an Established Community.

Issue LN-2: Conflicts with Land Use Plans, Policies, or Regulations.

Issue LN-3: Inclusion of Unpermitted Land Uses.

The Tahoe Keys development is a primarily residential development located inside the western boundary of the City of South Lake Tahoe, in the County of El Dorado. The development is situated in the Sierra Nevada mountains and is part of the 501-acre Lake Tahoe Region, which spans the border between the states of California and Nevada and includes 191 square miles of the waters of Lake Tahoe. The Tahoe Keys is located on the southern shore of Lake Tahoe. As part of the incorporated City of South Lake Tahoe, the development is subject to the land use and zoning regulations of the City. Additionally, due to its location within the Lake Tahoe Region, the development is subject to compliance with the land use policies and regulations of TRPA.

Tahoe Keys PAS-102 allows public services, limited commercial development in the marina and an existing retail center, and recreational and institutional facilities. The development includes lagoons and private recreational docks for private use of permanent residents and vacation renters in the development. Surrounding properties include predominantly undeveloped lands in the unincorporated community of Camp Richardson to the west; Lake Tallac and a neighborhood of single-family residences to the south; and the Tahoe Keys Marina, Keys Beach, and undeveloped lands of the Upper Truckee River marshes to the east.

Potential Impacts

Issue LN-1: Physical Division of an Established Community.

Issue LN-2: Conflicts with Land Use Plans, Policies, or Regulations.

Issue LN-3: Inclusion of Unpermitted Land Uses.

Consistent with the findings of the IEC/IS, there would be no significant effects related to land and shoreline use for the Proposed Project. The bases for these findings, as well as discussion of issues related to new alternatives that were not considered for the IEC/IS, are summarized below.

Table 3.4.1-1 TRPA Regional Plan Policy Consistency.

Regional Plan Goal or Policy	Consistency C=Consistent, PC=Partially Consistent, N=Inconsistent, N/A=Not Applicable				Discussion
	Project	Alt. 1	Alt. 2	No Action	
Restore, maintain, and improve the quality of the Lake Tahoe Region for the visitors and residents of the Region. (Goal LU-1)	C	C	C	PC	The Proposed Project and Action Alternatives 1 and 2 would improve the environmental quality of the region by establishing a program for removal of a quantified percentage of aquatic weeds from the Tahoe Keys Lagoons. The No Action Alternative would continue existing practices for weed control, which would not drastically reduce the existing invasive aquatic weed population nor improve water quality compared to current conditions.
The primary function of the Region shall be as a mountain recreation area with outstanding scenic and natural values. (Policy LU-1.1)	C	C	C	C	All scenarios would serve to manage the invasive aquatic weed population to equal or greater levels than current practices. The Proposed Project and Action Alternatives would facilitate continued recreational boating opportunities for Tahoe Keys residents.
The Plan shall seek to maintain a balance between economic/social health and the environment. (Policy LU-1.3)	C	C	C	C	The Proposed Project and Action Alternatives provide tools for management of invasive aquatic weeds with a goal to facilitate restoration of native species in the Tahoe Keys' lagoons and reduce the potential for spread of weeds to other parts of the region. All scenarios would maintain existing property tax-generating residential development in the Tahoe Keys, as well as corresponding private recreational boating opportunities for residents of the Tahoe Keys.
Uses of bodies of water within the Region shall be limited to outdoor water-dependent uses required to satisfy the goals and policies of this Plan. (Policy LU-2.6)	C	C	C	C	All scenarios would serve to manage the aquatic weed population to equal or greater levels than current practices. The Proposed Project and Action Alternatives would facilitate continued recreational boating opportunities for Tahoe Keys residents.
The Regional Plan adopted by the Agency shall specify the total additional development which may be permitted within the Region, not to exceed the limitations set forth below. (LU-2.1)	C	C	C	C	For residential development, the Regional Plan generally allows a development right of one residential unit per legal parcel existing as of August 17, 1986. Existing development in the project area is single-family residential and is a conforming land use under existing policy. No new development is necessary or proposed with the project or any alternative.
All persons shall have the opportunity to utilize and enjoy the Region's natural resources and amenities. (Policy LU-3.1)	C	C	C	C	All scenarios would serve to manage the aquatic weed population to equal or greater levels than current practices. The Proposed Project and Action Alternatives would facilitate continued recreational boating opportunities for Tahoe Keys residents.
Detailed plan area statements have been approved for all properties in the Region. These plan area statements were adopted in accordance with the 1987 Regional Plan and shall remain effect until superseded by area plans that are developed in accordance with and found in conformance with	C	C	C	C	Tahoe Keys' PAS-102 identifies the existing residential, recreation, public service and commercial uses within the Tahoe Keys development as permitted uses of land. No existing land uses would change with the Proposed Project, No Action, or either of the Action Alternatives, and therefore, no new land use would be created in

Regional Plan Goal or Policy	Consistency C=Consistent, PC=Partially Consistent, N=Inconsistent, N/A=Not Applicable				Discussion
	Project	Alt. 1	Alt. 2	No Action	
this Regional Plan. If any plan area statement contains provisions that contradict newer provisions of the Regional Plan or Development Code, the newer provisions of the Regional Plan or Development Code shall prevail, but only to the extent that specific provisions conflict. (Policy LU-4.2)					conflict with the applicable PAS. Nonstructural fish habitat management is identified in PAS-102 as an allowed use.
The Regional Plan shall attempt to mitigate adverse impacts generated by the Plan within the Region, and not export the impacts to surrounding areas. (Policy LU-5.1)	C	C	C	C	The intents of the Proposed Project, the Action Alternatives and the No Action scenarios are control of aquatic weed species within the Tahoe Keys lagoons and to control their spread outside of the lagoons, consistent with Regional Plan policy VEG-1.10 (referenced below). Herbicide applications would include a water barrier and turbidity curtains or other containment to isolate herbicides to the lagoons.
Ensure the preservation and enhancement of the natural features and qualities of the Region, provide public access to scenic views, and enhance the quality of the built environment. (Goal CD-1)	C	C	C	PC	The Proposed Project and Action Alternatives 1 and 2 would enhance the environmental quality of the region by establishing a program for removal of a quantified percentage of aquatic weeds from the human-built Tahoe Keys Lagoons. The No Action Alternative would continue existing practices for weed control, which would not drastically reduce the existing aquatic weed population nor serve to enhance water quality compared to current conditions.
Support federal, state, local and private water quality improvement programs that improve water quality in the Region. (Policy WQ-1.6)	C	C	C	PC	The Proposed Project and Action Alternatives 1 and 2 would enhance the environmental quality of the region by establishing a program for removal of a quantified percentage of aquatic weeds from the human-built Tahoe Keys Lagoons. The Project and Action Alternative 2 would include applications of only herbicides registered with applicable state and federal agencies. The No Action Alternative would continue existing practices for weed control, which would not drastically reduce the existing aquatic weed population nor serve to enhance water quality compared to current conditions.
Coordinate with public and private entities to maximize the efficiency and effectiveness of water quality programs (Policy WQ-1.7)	C	C	C	PC	The Project and each of the alternatives involve the cooperative effort between the property owners, TRPA and the Lahontan RWQCB to manage aquatic weeds and restore water quality within the Tahoe Keys development and connected waterways. The No Action Alternative would continue existing practices for weed control, which would not drastically reduce the existing aquatic weed population nor serve to enhance water quality compared to current conditions.
Discharge of municipal or industrial wastewater to Lake Tahoe, its tributaries, or the groundwaters of the Tahoe Region is prohibited, except for existing development operating under approved alternative	N/A	N/A	C	N/A	Discharge of domestic, municipal or industrial wastewater to Lake Tahoe is prohibited under TRPA Code of Ordinances Section 60.1.3. Only Action Alternative 2 (Dredge and Substrate Replacement) would generate effluent, and in this alternative, effluent would be discharged

Regional Plan Goal or Policy	Consistency C=Consistent, PC=Partially Consistent, N=Inconsistent, N/A=Not Applicable				Discussion
	Project	Alt. 1	Alt. 2	No Action	
plans for wastewater disposal, and for fire suppression efforts in accordance with applicable state laws. (Policy WQ-2.1)					to the South Lake Tahoe sanitary sewer or treated at the dredge processing and dewatering site (south side of Lake Tallac) and Pope Beach Marsh before discharge to Lake Tahoe.
No person shall discharge solid wastes in the Lake Tahoe Region by depositing them on or in the land, except as provided by TRPA Ordinance. (Policy WQ-2.4)	N/A	N/A	C	N/A	Only Action Alternative 2 (Dredge and Replace Substrate) would generate solid material requiring disposal to a landfill. Dredging and filling is typically prohibited under TRPA Code of Ordinances Section 84.15.3, unless TRPA finds it to be beneficial to existing shorezone conditions. The intent of Action Alternative 2 is to remove aquatic weed species from the Tahoe Keys lagoons and would be beneficial to water quality, habitat restoration, and recreational opportunities in the lagoons. Consistent with TRPA Code of Ordinances Section 84.15.5 and the Regional Plan policy, undesirable dredge material would be transported to compost or landfill sites outside of the shorezone, in Carson City or Reno.
Require all persons who own land and all public agencies which manage public lands in the Lake Tahoe Region to install and maintain Best Management Practices (BMPs) improvements in accordance with a BMP Manual that shall be maintained and regularly updated by TRPA. BMP requirements shall protect vegetation from unnecessary damage; restore the disturbed soils and be consistent with fire defensible space requirements. As an alternative, area-wide water quality treatment facilities and funding mechanisms may be implemented in lieu of certain site specific BMPs where area-wide treatments can be shown to achieve equal to or greater water quality benefits. (Policy WQ-3.11)	PC	C	PC	PC	TRPA's guidance for implementation of BMPs is found in its BMP Handbook (May 2014). Section 5.3.2.3 of the BMP Handbook discourages the use of pesticides in favor of integrated pest management, mechanical methods of weed removal, and changes in human behavior. TRPA Code of Ordinances Section 60.1.7 reflects the guidance in the BMP Handbook but includes limited allowances for pesticide application if the chemical is registered by applicable state and federal agencies and detectable concentration of the chemical is not allowed to enter surface water or groundwater. Action Alternative 1 would exclude herbicides and would be consistent with the BMP Handbook guidance. Herbicides selected for use in the Proposed Project would be used only if registered with the USEPA and have short half-lives up to 10 days; double turbidity curtains would be used to contain the majority of dissolved herbicides to the specific areas of application. Thus, the Proposed Project would be partially consistent with the Regional Plan policy. Action Alternative 2 (Dredge and Substrate Replacement) would meet the intent of the BMP Handbook by precluding use of chemical applications but could result in unintentional removal of native plants during substrate removal, and so would be partially consistent. Similarly, the No Action Alternative would not involve chemical applications but would not result in greater aquatic weed removal as compared to current conditions. It is noted that a similar policy of the City of South Lake Tahoe General Plan, Natural and Cultural Resources Policy NCR-2.13 (Minimize the Use of Fertilizers and Pesticides), also discourages use of chemical

Regional Plan Goal or Policy	Consistency C=Consistent, PC=Partially Consistent, N=Inconsistent, N/A=Not Applicable				Discussion
	Project	Alt. 1	Alt. 2	No Action	
					pesticides, and the Proposed Project would be partially consistent with this local policy.
Projects shall be required to meet TRPA BMP requirements as a condition of approval for all projects. (WQ-3.12)	C	C	C	C	The Project would include applications of only herbicides registered with applicable state and federal agencies (see discussion of Policy WQ-3.11, above). Compliance with TRPA Code of Ordinances Chapter 60 would be required of part of consideration of approval for the Proposed Project or either Action Alternative.
The management of vegetation in urban areas shall be in accordance with the policies of this Plan and shall include provisions that allow for the perpetuation of the natural-appearing landscape. (Policy VEG-1.6)	C	C	C	PC	The Proposed Project, both Action Alternatives and the No Action Alternative are intended to reduce populations of aquatic weed species and facilitate restoration of native species in the Tahoe Keys lagoons. The No Action Alternative would maintain existing operations for weed control without the quantified reduction objective of the Proposed Project or either Action Alternative.
Work to eradicate and prevent the spread of invasive species. (Policy VEG-1.10)	C	C	C	C	The Proposed Project and all of the Alternatives are intended to reduce the population of aquatic weed species in the Tahoe Keys lagoons. The No Action Alternative would maintain existing efforts at species management while the Proposed Project and two Action Alternatives would augment those efforts with herbicide, mechanical, and/or ultraviolet light applications. It is noted that the removal of aquatic weed species from the Tahoe Keys lagoons under the Proposed Project and each Action Alternative is also consistent with Policy NCR-3.1 (Natural Habitat Preservation) of the City of South Lake Tahoe General Plan, which directs the City to "*protect, maintain, and restore key riparian areas, natural open space meadows, and Stream Environment Zones for the preservation of natural habitats.*"
All solid wastes shall be exported from the Region. Consolidation and transfer methods shall be developed to achieve a reduction in the volume of wastes being transported to landfills. (Policy PS-3.2)	N/A	N/A	C	N/A	Neither the Proposed Project, Action Alternative 1, nor the No Action Alternative would involve generation of notable quantities of solid waste. Action Alternative 2 would involve removal of dredged material from the Tahoe Keys lagoons. Consistent with TRPA Code of Ordinances Section 33.3.4, dredged material would be temporarily stockpiled and dried off-site of the lagoons, with sand returned to the lagoons and other solid waste fill transported to a landfill.

The Proposed Project does not include any component that involves demolition of any existing structures nor construction of any new buildings or facilities. Therefore, the Proposed Project would not divide an established community and would have **no impact** pertaining to Issue LU-1.

The Proposed Project does not conflict with a local or regional policy intended to avoid a significant effect, and it is consistent with the overall goals and objectives of the TRPA Regional Plan and City of South Lake Tahoe General Plan. As outlined in Table 3.4.1-1, the project is partially consistent with TRPA Regional Plan Policy WQ3.1-11, and more specifically, best management practices referenced in the policy that discourage use of chemical pesticides for weed management. A similar policy of the City of South Lake Tahoe General Plan, Natural and Cultural Resources Policy NCR-2.13 (Minimize the Use of Fertilizers and Pesticides), also discourages use of chemical pesticides.

In general, the Proposed Project is consistent with several more goals and policies of the Regional Plan, including Goal LU-1 intended to foster improvement of the quality of the Lake Tahoe Region; Goal LU-1.3 and Policies WA-1.6 and WA1.7 supporting enhancement of water quality and the quality of the built environment; and Policy VEG-1.10 supporting the eradication of invasive species. Removal of aquatic invasive plant species from the Tahoe Keys lagoons under the Proposed Project is also consistent with Policy NCR-3.1 (Natural Habitat Preservation) of the City of South Lake Tahoe General Plan, which directs the City to "*protect, maintain, and restore key riparian areas, natural open space meadows, and Stream Environment Zones for the preservation of natural habitats*."

The CMT is a scientific study project. Chapter 81.2, Applicability, of the TRPA Code of Ordinances outlines permissible and special uses within the shorezone and lakezone of Lake Tahoe. Scientific study projects are listed as a permissible special use. To allow a special use, TRPA is required to conduct a public hearing in accordance with the procedures found in the Rules of Procedure (TRPA 2012.c), and the project is subject to TRPA review to ensure that it meets the requirements of Code of Ordinances Chapter 81.2.2, Special Uses. The EIP does note that one of the top science priorities for managing invasive species includes "*using carefully designed pilot projects, complete science-based evaluations of the effectiveness of alternative strategies to control and manage invasive and noxious species that are now established in the Tahoe Basin.*"

Because the Proposed Project is consistent with the overall goals and objectives of the TRPA Regional Plan and the City of South Lake Tahoe General Plan, and it would be subject to compliance with TRPA Code of Ordinances Chapter 81.2.2, Special Uses, the potential impact of the Proposed Project with respect to Issue LN-2 is **less than significant**.

Tahoe Keys' PAS-102 recognizes and supports maintenance of the existing residential, recreation, public service and commercial uses within the Tahoe Keys development as permitted uses of land. No existing land uses would change with the Proposed Project, and therefore, no new land use would be created, and no nonconforming land use would be expanded that would conflict with the land uses permitted under PAS-102. Nonstructural fish habitat management is identified in PAS-102 as an allowed use. Because the Proposed Project would manage an invasive aquatic plant species present in the lagoons and would not create a new, unpermitted, or nonconforming land use that conflicts with the applicable PAS-102 for Tahoe Keys, there would be **no impact** pertaining to this Issue LN-3 for the Proposed Project.

Mitigation and Resource Protection Measures

Because no potential impacts have been identified, no mitigation is necessary for land and shoreline use.

Significant Unavoidable Impacts

No significant unavoidable impacts would occur for land and shoreline use.

3.4.1.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

The Regulatory Setting and Environmental Setting for Action Alternative 1 are the same as those described for the Proposed Project above.

Potential Impacts

Issue LN-1: Physical Division of an Established Community.

Issue LN-2: Conflicts with Land Use Plans, Policies, or Regulations.

Issue LN-3: Inclusion of Unpermitted Land Uses.

Effects of Action Alternative 1 on Land and Shoreline Use would be similar to the Proposed Project. As with the Proposed Project, Action Alternative 1 does not include demolition or construction of any new structures, nor introduction of any new land uses to the Tahoe Keys development. Action Alternative 1 would be consistent with Regional Plan Policy WQ3.1-11, in that it excludes use of chemical pesticides for control of aquatic weed species and would be subject to the same procedural review as required for the Proposed Project. Action Alternative 1 would have **no impact** with respect to Issue LN-1 and LN-3. The impact on land and shoreline use from Action Alternative 1 with respect to Issue LN-2 would be **less than significant**.

Mitigation and Resource Protection Measures

Because no potential impacts have been identified, no mitigation is necessary for land and shoreline use.

Significant Unavoidable Impacts

No significant unavoidable impacts would occur for land and shoreline use.

3.4.1.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

The Regulatory Setting and Environmental Setting for Action Alternative 2 are the same as those described for the Proposed Project above.

Potential Impacts

Issue LN-1: Physical Division of an Established Community.

Issue LN-2: Conflicts with Land Use Plans, Policies, or Regulations.

Issue LN-3: Inclusion of Unpermitted Land Uses.

Effects of Action Alternative 2 on Land and Shoreline Use would be similar to the Proposed Project. As with the Proposed Project, Action Alternative 2 does not include demolition or construction of any new structures, nor introduction of any new land uses to the Tahoe Keys development. Action Alternative 2 would be consistent with Regional Plan Policy WQ3.1-11, in that it excludes use of chemical pesticides for control of the target aquatic weed species. Although Action Alternative 2 would meet the intent of the BMP Handbook by precluding use of chemical applications, it could also result in unintentional removal of native plants during substrate removal, and so would be partially consistent with the policy. Still, Action Alternative 2 would be consistent with the overall goals and objectives of the Regional Plan to reduce the population of aquatic weed species, improve quality of water and the built environment, and restore native species in the Tahoe Keys lagoons. Action Alternative 2 would have **no impact** with respect to Issue LN-1 and LN-3. The impact on land and shoreline use from Action Alternative 2 with respect to Issue LN-2 would be **less than significant**.

Mitigation and Resource Protection Measures

No mitigation would be required.

Significant Unavoidable Impacts

No significant unavoidable impacts would occur for land and shoreline use.

3.4.1.4 No Action Alternative

The Regulatory Setting and Environmental Setting for the No Action Alternative are the same as those described for the Proposed Project above.

Potential Impacts

Issue LN-1: Physical Division of an Established Community.

Issue LN-2: Conflicts with Land Use Plans, Policies, or Regulations.

Issue LN-3: Inclusion of Unpermitted Land Uses.

Effects of the No Action Alternative on Land and Shoreline Use would be similar to the Proposed Project with respect to Issues LN-1 and LN-3, in that the No Action Alternative does not include demolition or construction of any new structures, nor introduction of any new land uses to the Tahoe Keys development. The No Action Alternative would be consistent with Regional Plan Policy WQ3.1-11 because it excludes use of chemical pesticides for control of the target aquatic weed species, but because it would sustain current weed abatement efforts without a quantified reduction goal, it is only partially consistent with Regional Plan policies that support improvement and enhancement of the natural environment (Regional Plan Goals LU-1 and CD-1 and Policy WQ-1.6). Still, the No Action Alternative would be consistent with the overall goals and objectives of the Regional Plan to prevent the spread of aquatic weed species in the region. The No Action Alternative would therefore have **no impact** with respect to Issues LN-1 and LN-3, and the impact on land and shoreline use from No Action Alternative with respect to Issue LN-2 would be **less than significant**.

Mitigation and Resource Protection Measures

Because no potential impacts have been identified, no mitigation is necessary for land and shoreline use.

Significant Unavoidable Impacts

No significant unavoidable impacts would occur for land and shoreline use.

3.4.2 Utilities

This section considers how the proposed Tahoe Keys lagoon aquatic weeds control methods test and alternatives could potentially affect utilities. The analysis focuses on the potential of herbicide testing to affect drinking water supplies. Analysis is based on the isolation of test sites and the potential for herbicides and degradates to affect supplies at intakes, considering the distance from the lagoons to the intakes.

Methods and Assumptions: No quantitative approaches to impact analysis were undertaken for this section. Input on water purveyor concerns was received through the project Stakeholder Committee and interviews with purveyors. The location of water purveyors directly sourcing Lake Tahoe water was determined by interviews with purveyors; the distance of purveyors from the Tahoe Keys was estimated using GIS and Google Maps. Water systems operating under filtration exemption and filtration exemption requirements were reported by Tahoe Water Suppliers Association. The dilution of any contaminants resulting from the project was estimated by comparing the volumes of Lake Tahoe versus the Tahoe Keys lagoons. Sections 3.2 and 3.3.4 of the Draft EIR/EIS are referenced with regard to the degree of dilution needed to reduce the concentrations of herbicides (at maximum application rates) to levels that have no restrictions for drinking. Current water quality characteristics of the nearest reporting water purveyors drawing from the lake were compared to filtration exemption requirements.

3.4.2.1 Proposed Project (Control Methods Test)

Regulatory Setting

Federal

The USEPA administers drinking water requirements for States and public water systems under the Safe Drinking Water Act (SDWA, P.L. 93-523 ad amended; 42 USC §300f). The USEPA has established protective drinking water standards for more than 90 contaminants, including drinking water regulations issued since the 1996 amendments to the Safe Drinking Water Act. These standards determine the maximum concentration allowable for a specific contaminant in drinking water at the tap. States must comply with these standards, but also have the option to adopt more stringent standards or develop standards for contaminants that the federal government has not acted on. A state may not set a drinking water standard that is less protective than the USEPA.

State

In California, as of 2014 the administration of the Drinking Water Program (DWP) has transferred from the Department of Public Health (DPH) to the California State Water Board (SWB), but DPH establishes drinking water standards for contaminants. Division of Drinking Water (DDW) District 9 includes El Dorado County and water systems on the California side of Lake Tahoe.

SWB’s Safe Drinking Water Plan for California includes the assessment of the overall quality of the state's drinking water, the identification of specific water quality problems, an analysis of the known and potential health risks that may be associated with drinking water contamination in California, and specific recommendations to improve drinking water quality.

Regulatory oversight for the Public Water System Supervision Program (PWSSP) is provided by the staff of the Nevada Division of Environmental Protection (NDEP), Bureau of Safe Drinking Water.

It is not the purpose of this DEIR/DEIS to provide a detailed review of public drinking water law and regulation. The key regulatory requirement of concern for water systems drawing from Lake Tahoe is the "filtration exemption" that can be granted under the SDWA upon application for exemption to the SWB in California or NDEP in Nevada.

Filtration Exemption

The purity of Lake Tahoe water, a Tier III Outstanding National Resource Water (see Section 3.3.4), affords water systems drawing from the lake a unique regulatory status and opportunity in qualifying for filtration exemption under the Surface Water Treatment Rule (40 CFR Part 141, Subpart H). Filtration exemption status is rare nationwide (only 60 of roughly 160,000 public water systems nationwide hold this exemption, and six of them are in the Lake Tahoe basin). Making the situation even more unusual, most filtration-exempt system do not draw from multi-use source waters such as Lake Tahoe (which, e.g., supports such other uses as recreational boating). TWSA water systems operating under filtration exemption are:

- Incline Village General Improvement District (IVGID)
- Kingsbury General Improvement District (KGID)
- Edgewood Water Company (Edgewood)
- Zephyr Water Utility District (ZWUD)
- Glenbrook Water Cooperative (Glenbrook)
- North Tahoe Public Utility District (NTPUD)

The nearest known Lake Tahoe drinking water intake to the Tahoe Keys is at Lakeside Park Association, approximately four miles distant. The nearest intake for a water system operating under filtration exemption is a little further (Edgewood Water Company or Glenbrook General Improvement District, about 4.1 to 4.2 miles). A comment received during scoping stated "Jameson Beach residents [have] for many years obtained potable and drinking water untreated and directly from Lake Tahoe, immediately next to Tahoe Keys." Multiple attempts were made to reach out to the Jameson Beach community, but were unanswered, and the location or existence of intakes could not be confirmed. If intakes exist along Jameson Road, they would be at least one mile to the west of the Tahoe Keys West Channel entrance. A map showing the locations of intakes from Lake Tahoe is not published, in order to assure infrastructure security and protection.

When a project affects interstate waters, such as Lake Tahoe, the Lahontan Water Board consults with the Nevada Division of Environmental Protection (NDEP), and with the California Department of Public Health (CDPH) in reviewing exemption requests that may affect surface drinking water intakes.

Filtration exemption is granted only when source water is sufficiently pure that systems may meet all drinking water standards with no other water treatment than disinfection. Implications of losing filtration exemption drive concerns. Filtration exemption treatment requirements as reported by the TWSA are provided in Table 3.4.2-1.

Table 3.4.2-1 Treatment Requirements for Filtration Avoidance.

Water Quality Parameter	SWTR[1]	SWTR + LT2ESWTR[2]
Giardia	3 log removal/inactivation[3]	3 log removal/inactivation
Virus	4 log removal/inactivation	4 log removal/inactivation
Cryptosporidium		2 log removal/inactivation
Turbidity	< 5 NTU	< 5 NTU
Total Coliform	<100/100 ml	<100/100 ml
Fecal Coliform	<20/100 ml	<20/100 ml

1 SWTR = Surface Water Treatment Rule 40 CFR Part 141, Subpart H

2 LT2ESWTR = Long Term 2 Enhanced Surface Water Treatment Rule (LT2 rule/ LT2ESWTR) can be found in TWSA 2019 on p. 168 of 518, or defined at this link: *http://water.epa.gov/lawsregs/rulesregs/sdwa/lt2/index.cfm*

3 A log removal value (LRV) is a measure of the ability of a treatment processes to remove pathogenic microorganisms. LRVs are determined by taking the logarithm of the ratio of pathogen concentration in the influent and effluent water of a treatment process.

For a drinking water system to qualify for filtration avoidance under the Surface Water Treatment Rule (SWTR) the system cannot be the source of a waterborne disease outbreak, must meet source water quality limits for coliform and turbidity and meet coliform and total trihalomethane maximum contaminant levels (MCLs). Disinfectant residual levels and redundant disinfection capability must also be maintained. Filtration avoidance also requires that a watershed control program be implemented to minimize microbial contamination of the source water. This program must characterize the watershed's hydrology, physical features, land use, source water quality and operational capabilities. It must also identify, monitor and control manmade and naturally occurring activities that are detrimental to water quality. The watershed control program must also be able to control activities through land ownership or written agreements. (Filtration avoidance criteria are detailed in 40 CFR §141.71; TWSA 2019.)

Regional/Tahoe Regional Planning Agency (TRPA)

TRPA Code of Ordinances

The TRPA Code of Ordinances provides the regulations that facilitate implementation of the goals and policies in the TRPA Regional Plan. Regulations in the Code of Ordinances Chapter 32 establish the framework for basic services, sets forth requirements for projects to be served by paved roads and water, electrical, and wastewater treatment services, and establishes standards to implement those requirements. Section 32.4.2 addresses water supply systems.

Local

No local regulatory standards govern water systems. Drinking water standards are set and regulated at the Federal and State levels, however the Washoe County Land Development Program and Environmental Health Services Division assure compliance with the SDWA and administer water system reporting on the Nevada side of Lake Tahoe.

In the Tahoe Keys, the TKPOA Water Department operates and maintains all wells, water delivery systems, and monitoring equipment to consistently provide safe drinking water throughout the Tahoe Keys. The Water Department services all Tahoe Keys owners and renters as well as the Tahoe Keys Marina and Tahoe Keys Office Center.

Environmental Setting

Issue UT-1: Effects on Water Supply. Because the potential loss of filtration exemption is the issue of greatest concern to water systems drawing from Lake Tahoe, the most recent annual reports of the water systems operating under filtration exemption nearest to Tahoe Keys (Edgewood Water Company and Glenbrook General Improvement District) are taken as the most pertinent data characterizing the environmental setting for potential impacts of the Proposed Project and its alternatives (as reported in TWSA 2019). Tables 3.4.2-2 and 3.4.2-3 show the most recent reported turbidity and total coliform levels for the two water systems (TWSA 2019).

Potential Impacts

Issue UT-1: Effects on Water Supply. A primary concern raised by water purveyors sourcing Lake Tahoe has been the potential to affect the quality of water taken at their drinking water intakes, such that they would no longer qualify for the filtration exemption. Of the six treatment requirements listed in Table 3.4.2-1, the only one that could be affected by the Proposed Project would be turbidity. The Proposed Project has no potential to influence microbial contamination or trihalomethanes in Lake Tahoe. This analysis of potential impacts also considers the potential for herbicides or degradates to reach water intakes in detectible concentrations, such that drinking water sourced at these intakes would be rendered contaminated or unsuitable for human use.

Table 3.4.2-2 Edgewood Water Company Water Quality, 2019.

2018-2019	Turbidity (NTU)	Total Coliform (#/100mL)
Mean	0.24	0.09
Maximum	0.66	36.40
Date Maximum	26-Oct	7-Nov
Highest Monthly Mean	0-31	n/a
Date Mean	Sep-18 Nov-18	n/a

Table 3.4.2-3 Glenbrook General Improvement District Water Quality, 2019.

2018-2019	Turbidity (NTU)	Total Coliform (#/100mL)
Mean	0.19	2.82
Maximum	0.81	28.80
Date Maximum	19-Feb	31-Jul
Highest Monthly Mean	0.24	n/a
Date Mean	July-18 Apr-18	n/a

The IEC/IS found that surface water intakes are not located in sufficient proximity to the Tahoe Keys lagoons to be affected. As noted above, the proposed aquatic herbicide test sites are located approximately four miles from the nearest drinking water intake on Lake Tahoe (TKPOA 2018e.). In traveling such a distance, any contaminant diffusing from the lagoons would experience a very large dilution in the water of Lake Tahoe. As noted in Sections 3.2 and 3.3.4, because the volume of Lake Tahoe is approximately 58,000 times greater than the combined volume of the Tahoe Keys lagoons, potential changes in lagoon water quality are not expected to be measurable in the greater Lake Tahoe.

These sections note that it would require at most a 25-fold dilution to reduce the concentrations of herbicides (at maximum application rates) to levels that have no restrictions for drinking. Moreover, the project does not count on dilution to protect drinking water supplies because monitoring of receiving waters within the lagoons will detect the herbicides at concentrations two orders of magnitude below those specified for drinking water, and double turbidity curtain barriers will remain in place within the West Lagoon until the herbicides are no longer detected.

Thus, the distance from the proposed test sites to existing drinking water intakes, together with the isolation of herbicide tests behind barriers within the Tahoe Keys (coupled with monitoring to assure that residuals are well below levels that would be required to meet drinking water standards even if purveyors intakes were within the lagoons themselves), would be well more than sufficient to assure that the potential for any herbicides or degradates of concern to affect drinking water is negligible. There would be **no impact** to Issue UT-1.

Potential effects to groundwater purveyors were also considered. However, nearby wells draw water from a deeper aquifer and rhodamine dye studies resulted in no detection in samples taken at the three TKWC groundwater wells, indicating herbicides would not reach these water supplies. Other wells are located upgradient from the Tahoe Keys lagoons. See also the discussion in Issue EH-3.

Mitigation and Resource Protection Measures

No mitigation would be required beyond that proposed for water quality (Section 3.3.4) and designed as part of the Proposed Project, as no impacts to utilities would occur. TKPOA has proposed contingency plans, including monitoring and alert systems (TKPOA 2018e.; see also the IEC/IS), that would be implemented if necessary, to remove herbicides and other chemicals to treat the potable water before distribution. The negligible potential for impact forestalls the need for other mitigation.

Significant Unavoidable Impacts

No significant unavoidable impacts to utilities would occur.

3.4.2.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Issue UT-1 does not occur under Action Alternative 1 because no applications of herbicides would be made and aquatic weed control by other methods would avoid the potential for turbidity-related effects to water supplies.

3.4.2.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue UT-1 does not occur under Action Alternative 2 because no applications of herbicides would be made and aquatic weed control by other methods would avoid the potential for turbidity-related effects to water supplies.

3.4.2.4 No Action Alternative

While there would be no potential for herbicide-related impacts to occur under Issue UT-1 in the No Action Alternative, a potential turbidity-related impact could occur if intakes are located in shallow waters where habitat could support uncontrolled growth of aquatic weeds. Depending on the success of ongoing the TMDL to reduce sediment and nutrient loading in the Basin, an increase in turbidity could occur as a result of the gradual buildup of nearshore sediments from decaying aquatic weeds. The degree of potential significance is speculative; however, effects could be **potentially significant**.

3.4.3 Traffic and Transportation

This section evaluates the potential impacts of the Proposed Project and each Action Alternative on transportation and the roadway network in the vicinity of the Tahoe Keys test sites.

The IEC/IS analysis concluded that the Proposed Project would have potential transportation impacts related to interference with boating traffic between Lake Tahoe and the Tahoe Keys West Lagoon. Due to the temporary nature of this interference, the potential impact was concluded to be less than significant. This impact was associated with the placement of an impermeable barrier at the West channel entrance which is no longer proposed. The IEC/IS also concluded that the Proposed Project would have no impacts on rail or air traffic. No rail facilities are located near the Tahoe Keys development, and the Proposed Project and all of the Alternatives exclude any element of rail transport. Likewise, although the Lake Tahoe Airport is located three miles from the test sites in the Tahoe Keys development, the Proposed Project and all of the Alternatives exclude any air traffic component. Thus, rail and air traffic are not discussed further in this DEIR/DEIS. No element of the Proposed Project nor any of the Alternatives would require permanent closure or obstruction of any existing right-of-way, such that emergency access would become be impaired; thus, inadequacy of emergency access is also not further discussed in this DEIS/DEIR.

Transit service for the City of South Lake Tahoe is provided by the Tahoe Transportation District. Although there is an existing bus route provided by the District that runs along U.S. Highway 50, with a stop near the intersection of the highway at Tahoe Keys Boulevard approximately one mile southeast of the development, there is no scheduled bus service on Tahoe Keys Boulevard or within the Tahoe Keys development. Water transportation services across Lake Tahoe are provided by private companies operating out of Camp Richardson, Timber Cove, and other marinas located east and west of Tahoe Keys. There are recreational, sightseeing and charter boat services operating out of the Tahoe Keys Marina; however, there is no scheduled commercial water transportation serving Tahoe Keys. With no regular transit or water transportation services to the Tahoe Keys, there would be no impacts from the Proposed Project or any Alternative, and this topic is not further discussed in this DEIS/DEIR.

Methods and Assumptions: For the Proposed Project, herbicide application and post-application monitoring would be performed using a single boat during the spring season, as described in Chapter 2. It is assumed that one Qualified Applicator Certificate Holder (QAL) plus three additional contracted support QAL staff would conduct application and post-application monitoring, and that any additional support would be provided by existing maintenance staff of the Tahoe Keys Property Owners' Association (TKPOA), as needed. Up to three agency personnel are assumed to participate in observation for compliance during application and monitoring.

Application of ultraviolet light occurring as a standalone test or over an approximately seven-week period in the summer following the herbicide application and monitoring would use an equal number of contracted personnel (four) and an equal number of agency staff on-site for monitoring (three). ultraviolet light application would require two boats, as described in Chapter 2.

For laminar flow aeration (LFA), it is assumed that one boat would be deployed for each of the three test sites in the Tahoe Keys lagoons, and that placement of the disks and hoses associated with this method would be done by existing TKPOA maintenance staff. Because prior tests of LFA in the Lake Tahoe region have occurred in spring, it is assumed that installation of LFA equipment would occur at the same time as herbicide application.

Group B methods to be implemented in years following the LFA and herbicide and ultraviolet light applications would employ equipment and personnel comparable to that used for the ultraviolet light application, consisting of two boats, four personnel (combination of divers, boat operators, ultraviolet equipment operators, and/or suction equipment operators) and three agency monitors.

It is further assumed that each individual involved in herbicide application and monitoring, ultraviolet light application, and laminar flow aeration would make one inbound and one outbound trip per day to the Tahoe Keys using a car or light truck, plus up to two additional inbound and two additional outbound trips per day for employees driving alone or as a carpool for lunch breaks off-site.

Speed limits and travel restrictions would be placed on roads used for dredge spoil transportation and disposal to reduce the potential for releases due to collisions and other accidents. These restrictions would need to be in place for at least six months based on current understanding.

For Action Alternative 2 (Dredge and Replace Substrate), one barge and a team of six employees would be utilized for the dredge operation. An additional three people would be needed for the substrate replacement. As with the Proposed Project, it is assumed that each employee would make one inbound trip to the Tahoe Keys development and one outbound trip using a car or light truck, plus four midday trips (two outbound, two inbound) for lunch.

As described in Section 2.5, truckloads of sand would be delivered from the dewatering site to the TKPOA boat ramps closest to the test sites where they would be re-deposited. Truckloads of material that is not re-deposited as substrate would be transported off-site to landfills via U.S. Highway 50, moving through South Lake Tahoe either along U.S. Highway 50 via Spooner Summit, or along State Route 89 via Woodford to U.S. Highway 395/Interstate 580. If sand is not separated and returned to the lagoons, all dredged material would be transported to one of the landfills listed in Section 2.5. The total number of inbound arrival truck trips and outbound delivery truck trips is summarized in Table 3.4.3-1, for both 20-cubic yard (cy) and 10-cy trucks.

As described in Section 2.5.3, for the estimated six months of work, three trucks per day are estimated for delivery of sand from the mothballed Tahoe Keys Water Treatment Plant (WTP) back to the lagoons. An additional five truck trips per day are estimated for transport of material to landfills. It is important to note that, as with total truck trips, the number of daily truck trips would be doubled should smaller, 10 cubic yard trucks be used for materials transport.

3.4.3.1 Proposed Project (Control Methods Test)

Regulatory Setting

Federal

Table 3.4.3-1 Total Truck Trips (20-cy and 10-cy trucks).

	Dredge and Discard		Dredge & Replace Substrate			
	Dredge to Landfill		Sand to Lagoons		Dredge to Landfill	
	20-cy trucks	10-cy trucks	20-cy trucks	10-cy trucks	20-cy trucks	10-cy trucks
Inbound	715	1430	285	570	430	860
Outbound	715	1430	285	570	430	860
Total Trips	**1430**	**2860**	**570**	**1140**	**860**	**1720**

Title 23 U.S. Code – Highways

Section 103 of Title 23 U.S. Code establishes the federal and interstate highway system consisting of highway routes that serve to support commerce and connect major population centers, ports, points of entry and travel destinations. Section 116 of the Title 23 U.S. Code assigns to state departments of transportation the duty to maintain federal highways and routes.

In accordance with Section 134 of Title 23 U.S. Code, a metropolitan planning organization (MPO) must be designated for each urbanized area with a population exceeding 50,000 people. MPOs are charged with developing long-range transportation plans and improvement programs for various modes of transportation, in coordination with state transportation agencies and public transportation operators, on four- or five-year cycles. Compliance with the federal statute makes MPO's eligible for receipt of federal transportation funds.

State

Senate Bill 375 (Steinberg)

California Government Code section 65080, as amended in 2008 by Senate Bill 375 (Steinberg) requires regional transportation planning agencies in the state to "*prepare and adopted a regional transportation plan directed at achieving a coordinated and balanced regional transportation system*." The statute further directs that the Regional Transportation Plan (RTP) address multiple modes of transportation, including transportation of goods and people by automobile, railroad, water, bicycle, pedestrian, mass transit, water and air. The RTP must also address equity in transportation and include a sustainable communities strategy (SCS) that outlines land uses, identifies areas for housing future regional population, and specifies transportation network improvements that align with regional needs. The RTP describes a forecasted development pattern that would have the effect of achieving state-legislated goals for reductions in greenhouse gas emissions from light trucks and automobiles, including but not limited to the Governor's Executive Order S-3-05, which sets a greenhouse gas emission reduction target of 80 percent below 1990 levels by 2050.

Senate Bill 743 (Steinberg)

Approved by the Governor in 2013, Senate Bill 743 (Steinberg) directs a change in transportation impact analysis conducted under CEQA, wherein transportation impacts of a project are evaluated using the metric of vehicle miles traveled rather than level of service. Level of service (LOS) is a method of describing how much relative delay an automobile driver experiences on a street segment or at an intersection. LOS is described using a letter grade of LOS A through LOS F, where LOS A indicates free flowing traffic with minimal delays, and LOS F indicates severe congestion. By contrast, vehicle miles traveled accounts for the number of trips generated by a project, multiplied by the length in miles of each trip. The intent of the legislation is to greenhouse gas emissions from automobile use by reducing the length or number of automobile trips.

California Department of Transportation

Pursuant to Article 3 of California Streets and Highways Code (SHC), the Department of Transportation (Caltrans) controls and is responsible for State highway right-of-way acquisition, construction and maintenance, including repair of highway facilities (e.g., pavement, bridges, signage), litter abatement, deicing, and installation and upkeep of lighting, landscaping and transit amenities within State highway rights-of-way. Caltrans oversees the State Scenic Highway Program, which was established in 1963 to preserve and protect the aesthetic value of scenic highway corridors and adjacent lands. Caltrans also issues federal grant funds for transportation projects to regional and local agency projects and conducts long-range planning efforts aimed at reducing single-occupant vehicle trips and increasing use of alternative transportation modes.

In anticipation of the July 1, 2020, date for implementation of the VMT impact analysis requirements of Senate Bill 743, Caltrans is developing guidance for analysis of projects' impacts on State facilities using VMT as the metric. Until it has adopted a guidance document, Caltrans supports the technical guidance offered by the State Office of Planning and Research in its "Technical Advisory on Evaluating Transportation Impacts in CEQA," which suggests that a development project would have a potentially significant VMT impact if it did not reduce VMT by 15 or more percent below the per capita average for the region in which the project is located. OPR's technical advisory provides no direct guidance for short-term projects or construction impacts; OPR's technical guidance also includes a screening criterion of 110 new vehicle trips, below which a project would not be anticipated to have a significant impact.

Regional/Tahoe Regional Planning Agency (TRPA)

TRPA Regional Transportation Plan/Sustainable Communities Strategy

Pursuant to California Government Code section 29532.1(b), TRPA is the Tahoe Metropolitan Planning Agency (TMPO), the regional transportation planning agency tasked with developing the RTP and SCS for the Lake Tahoe region, as required by Government Code 65080. TRPA/TMPO released its first RTP/SCS in 2012 and adopted a first update in 2017 with a horizon year of 2040. Enhancing transit, closing gaps in trails and paths, and improving transportation technology to reduce traffic congestion and vehicle emissions are ranked as the highest priorities for the RTP/SCS. The goals and policies of the Transportation Element of the TRPA Regional Plan are the same as those adopted in the RTP/SCS.

TRPA Regional Plan

Chapter 3, Transportation Element, of the TRPA Regional Plan lists transportation-related goals and policies for the Lake Tahoe Region. As the goals and policies of the RTP/SCS and the Regional Plan are consistent with each other, the Regional Plan also includes policies targeted toward enhancing transit and other non-automobile travel modes, reducing vehicle emissions through trip reduction and vehicle technology, and improving safety and access for all users of the transportation system. Policy 4.6 in the Regional Plan also establish desired LOS for the region's highway system as: LOS C on rural recreational/scenic roads; and LOS D on rural developed area roads, urban developed area roads and at signalized intersections. LOS E is acceptable in urban areas, but only during peak periods, for not more than four hours per day.

TRPA Code of Ordinances

Chapter 65, section 65.2 of the TRPA Code of Ordinances establishes regulations applicable to transportation that are intended to implement Regional Plan policies supporting reduction of air pollution in the Lake Tahoe Basin. Under these regulations, proposals for development subject to review by TRPA are defined as having an insignificant increase in traffic if the development would generate 100 or fewer daily vehicle trips. For a project that would generate more than 100 daily vehicle trips, or for any project that would occur within 300 feet of the centerline of the U.S. Highway 50 right-of-way, the proposal must include a traffic impact analysis. Other provisions of Chapter 65 address bicycle facilities and employer trip reduction programs as mechanisms to reduce single-occupant vehicle travel and resulting air emissions.

Local

City of South Lake Tahoe General Plan, Circulation Element

California Government Code section 65302 requires that the general plan of each local jurisdiction in the state include a circulation element that outlines goals and policies pertaining to transportation systems and the multimodal network within the jurisdiction's boundaries. The Circulation and Transportation Element of the City of South Lake Tahoe General Plan was amended with the last comprehensive amendment of the General Plan on 2011. Consistent with state law, the Circulation and Transportation Element describes and categorizes the City's roadway system into classifications of arterial, collector, or local street, and it establishes goals and policies for achieving an efficient transportation system for all users and modes of movement, including automobile, bicycle, pedestrian, water, air and rail.

The Circulation and Transportation Element includes Policy TC-1.2, which defines the City's desired standard of standard of LOS D, with the exception that LOS E is considered acceptable for up to four hours in a day, on City roadways and intersections. Policy TC-1.5 also directs the City to implement a street repair program intended to ensure adequate funding for maintenance of the City's streets.

Environmental Setting

The Proposed Project would occur in the lagoons of the Tahoe Keys development. Properties within Tahoe Keys are predominantly residential, with private docks extending into the lagoons to accommodate private recreational boating in the lagoons and into Lake Tahoe.

Road Network – Local Streets

Automobile circulation within the Tahoe Keys development is provided by an internal network of public streets. Streets within the development accommodate two-way traffic with parking on both sides of the street. No sidewalks or formal bike lanes are provided on the development's internal streets. Two streets within the development—Venice Drive and Tahoe Keys Boulevard—are identified as collector streets in the City of South Lake Tahoe General Plan, Circulation and Transportation Element. These two streets carry much of the traffic entering and exiting the development and are each improved with two-way travel lanes. Venice Drive also has striped shoulders that can accommodate on-street automobile parking and bicycles. Tahoe Keys Boulevard has no shoulders, and the travel lanes are separated by a landscaped median to the development boundary. Beyond the Tahoe Keys, Tahoe Keys Boulevard extends as a two-lane roadway, with one travel lane in each direction and four-foot wide shoulders on both sides of the street, but without median to U.S. Highway 50 south and east of the Tahoe Keys development. Posted speed limits on streets within the Tahoe Keys development are 25 miles per hour; outside of the development, Tahoe Keys Boulevard has a posted speed limit of 30 miles per hour.

Automobile parking lots are located near the Tahoe Keys Marina and adjacent to the Tahoe Keys Village commercial complex at the intersection of Tahoe Keys Boulevard and Venice Drive, with approximately 560 vehicle stalls striped between the various parking areas.

Road Network – State and Federal Highways

State Route 89 is a State facility that generally extends in a north/south direction and is located approximately one mile south and west of the Tahoe Keys development. The roadway is identified in SHC section 253.1 as a State highway maintained by Caltrans. Within El Dorado County, the highway has official designation as a scenic highway, though it is not adjacent to or visible from the project site. In the vicinity of the Tahoe Keys development, State Route 89 has two travel lanes in each direction, a center two-way left-turn lane, striped bicycle lanes in each direction, and paved sidewalks on both sides of the street. The roadway has a posted speed limit of 35 miles per hour.

U.S. Highway 50 is a federal highway that generally extends in a north/south direction and is located approximately one mile south and east of the Tahoe Keys development. U.S. Highway 50 intersects State Route 89 at a signalized "Y" intersection south of the Tahoe Keys, and near the project site, the highway is eligible for designation as a scenic highway, although it is not adjacent to or visible from the project site. In the vicinity of the Tahoe Keys development, U.S. Highway 50 has two travel lanes in each direction, a center two-way left-turn lane, and sidewalks on both sides of the street. The posted speed limit is 40 miles per hour.

Potential Impacts

Issue TR-1: Generation of New Daily Vehicle Trips. For the CMT, the number of new daily vehicle trips are anticipated not to rise to significance. Given the assumptions stated above, the Proposed Project is estimated to generate 18 new vehicle trips on each day of herbicide application and follow-up monitoring over an approximately 30-day period in spring, and an equal number of daily trips for an additional seven-week period in summer following the herbicide application. However, these trips are temporary, would last only for the duration of the CMT, and would not constitute a persistent and long-term increase in vehicle trips on the local road system. Existing TKPOA maintenance staff are currently generating vehicle trips to the Tahoe Keys; these trips are considered part of current background traffic and would not be considered new trips resulting from the Proposed Project. No new trips would be required for installing LFA equipment in the three standalone LFA test sites, or to provide support for the herbicide and ultraviolet light applications.

The Proposed Project would not generate any new, permanent and ongoing vehicle trips beyond the duration of the CMT. With fewer than 100 net new daily trips, the short-term impact of the Project would be insignificant pursuant to the definitions contained in Chapter 65, section 65.2 of the TRPA Code of Ordinances and Caltrans' and OPR's recommended screening criteria for projects with potentially significant impacts requiring further study. The Proposed Project would have a **less than significant impact**.

Issue TR-2: Changes in Demand for Parking. For the both the Group A and Group B methods, no significant impacts related to parking are anticipated. No changes to existing parking facilities are proposed with the CMT.

For approximately 11 weeks, an estimated seven additional cars or light trucks would be driven each day to the Tahoe Keys development by QAL and agency staff during each day of herbicide and/or ultraviolet light application. Existing TKPOA maintenance staff would provide support during the herbicide and ultraviolet light applications and would place the equipment necessary for the LFA tests. These maintenance staff members would already be parking in the Tahoe Keys development and would not generate new demand for parking.

The rights-of-way within the Tahoe Keys development are wide enough to allow on-street vehicle parking. In addition to available on-street parking, approximately 560 parking off-street spaces are available in parking lots proximate to the Tahoe Keys marina and the TKPOA office in the commercial area of the development. These off-street spaces could be used as assembly points for QAL, TKPOA and agency staff to park individual vehicles and carpool or travel by boat to the individual test sites. With sufficient on-street and off-street parking within the Tahoe Keys development to accommodate an estimated seven additional vehicles, the Proposed Project would have a **less than significant impact.**

Issue TR-3: Effects on Roads and Level of Service. Policy 4.6 of the Regional Plan and Policy TC-1.2 of the City of South Lake Tahoe define a desired standard of LOS D, with the exception that LOS E is considered acceptable for up to four hours in a day, on roadways and intersections in urbanized areas.

Existing LOS analysis conducted for TRPA's "Linking Tahoe: Regional Transportation Plan and Sustainable Communities Strategy" update of its RTP/SCS in 2017 indicated that the segment of U.S. Highway 50 near Tahoe Keys Boulevard currently operates at LOS D, and the segment of State Route 89 near U.S. Highway 50 currently operates at LOS C. Table 18 of the IEC/IS prepared for that effort indicated that, with implementation of the RTP, projected LOS in the year 2040 would decrease to LOS E during the peak hour on U.S. Highway 50 and to LOS D on State Route 89 at U.S. Highway 50 near the Proposed Project site. Neither road segment would exceed the allowable LOS objective for urban developed roadways as established in the TRPA Regional Plan and the City of South Lake Tahoe General Plan. The intersection of U.S. Highway 50 and State Route 89 currently operates at an acceptable LOS C and would continue to operate at LOS C in the long-term horizon (2040).

Although long-term horizon projections of traffic volumes under the RTP indicate that studied facilities would operate acceptably in 2040, the Proposed Project would terminate after two years and would not contribute to the long-term traffic volumes in the horizon year of the RTP. Thus, while the Proposed Project would cause a short-term, insignificant increase in daily trips associated with contractors for the CMT, the Proposed Project would not generate permanent or long-term increases in roadway volumes nor contribute to decreasing levels of service in the area. No existing roadways would be modified or closed for the Proposed Project, such that the Proposed Project would not change or redirect existing travel routes. Cars and light trucks that would be driven by QAL, TKPOA and agency staff would be characteristic of vehicles currently driven by residents and employees in the Tahoe Keys development, and thus, would not accelerate deterioration of roads in the Proposed Project area nor create new conflicts with or hazards to pedestrians, bicyclists or other vehicles. The Proposed Project would have a **less than significant impact.**

Issue TR-4: Effects on Water Traffic. The Proposed Project would deploy a single small barge for herbicide application and post-application monitoring for a short duration of time (approximately 30 days) in spring. Installation of equipment for LFA would deploy an additional three boats, one for each of the test standalone LFA test sites in the lagoons and would also occur in spring. During the summer months, two boats no longer than 24 feet would be used for the ultraviolet light application. Thus, during the spring months, as many as four additional boats associated with the Proposed Project would be in the lagoons. For the Group B methods proposed to be employed in future years, the number of boats utilized is anticipated to be similar to that needed for the ultraviolet light application.

The Tahoe Keys development currently affords docking slips for more than 900 boats and potentially 2700 moorings for recreational use of the tenants of the development. The combined four watercraft that would be used in spring for herbicide application and LFA represents less than one percent of available boating capacity (as a proportion of boat slips), and one-third of that proportion of moorings in the lagoons. This level of use is not expected to significantly interfere with recreational use of the lagoons by other boaters. Given the capacity of the lagoons to accommodate this many watercraft, the travel path of the barge and three boats is not expected to significantly alter existing waterborne traffic within the lagoons. There are no Lake Tahoe commercial water transportation services that serve the Tahoe Keys and that would therefore be affected by the Proposed Project. The Proposed Project would have a **less than significant impact.**

Mitigation and Resource Protection Measures

No mitigation is required for any of the issues.

Significant Unavoidable Impacts

With less than significant impacts of the Proposed Project on each of the identified traffic and transportation issues, the Proposed Project would have **no significant unavoidable impacts** on traffic and transportation.

3.4.3.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory and Environmental Setting

The Regulatory Setting and Environmental Setting for this issue under Action Alternative 1 are the same as those described for the Proposed Project, above.

Potential Impacts

The impacts of Action Alternative 1 for the non-herbicide tests would be the same as described above for the Proposed Project. The impacts of travel associated with the application of herbicides would be avoided, however, and these were considered to be **less than significant** for the Proposed Project.

Mitigation and Resource Protection Measures

No mitigation is required for Action Alternative 1, as no significant impacts would occur.

Significant Unavoidable Impacts

Action Alternative 1 would have **no significant unavoidable impacts** on traffic and transportation.

3.4.3.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

This alternative would involve conveyance of dredged materials via pipeline from the dredge sites in the Tahoe Keys lagoons to the non-operational WTP adjacent to Lake Tallac, south of the Tahoe Keys. At the WTP, dredged material would be processed and dewatered. The proposed route for trucks transporting dewatered dredge material from the lagoons would extend beyond the Tahoe Keys development to public rights-of-way in the City of South Lake Tahoe (see Figure 2-11).

Regulatory Setting

The Regulatory Setting for this issue under Action Alternative 2 is the same as described for the Proposed Project, above, with the addition of State regulations applicable to large truck use of State highways, as well as local regulations applicable to large vehicles on public streets. Local regulations are invoked due to the inclusion of trucks in the transport of dredged material on City streets.

State

California Vehicle Code (CVC) section 35551(a) establishes gross vehicle weight limitations for large vehicles using State highways, from 34,000 pounds up to 80,000 pounds (17 to 40 tons), depending on the length of the vehicle and number of axles. CVC section 35780 gives authority to Caltrans to issue permits for vehicles that exceed these codified weight limitations to travel on State facilities, upon showing of good cause by the permittee.

Local

CVC section 35700(a) allows local jurisdictions to establish vehicle weight maximums that exceed the weight limits in State law, for streets that fall under the authority of the local jurisdiction. Though statute allows cities to establish unique weight criteria for certain streets, the City of South Lake Tahoe does not have any weight limits or roadway use restrictions for its local streets that differ from those codified in State law. The City would require a transportation permit for use of its local streets by any vehicle that exceeds maximum weight limits. (Carlton, pers. communication)

Environmental Setting

Road Network

The internal Tahoe Keys road network as described for Action Alternative 2 is the same as that described for the Proposed Project. Cars and light trucks driven by contractors would use the same local streets described for the Proposed Project. Action Alternative 2, however, would also include transport of reclaimed sand from the WTP back to the lagoons in Tahoe Keys or to landfills outside of the City, with remnant dredge material transported to landfills. Transport of landfill material would be occur using 10- or 20-cubic yard trucks, depending on roadway and intersection capacity and the potential for noise impacts.

Action Alternative 2 includes use of a barge to remove accumulated sediment in the lagoons and replace it with a clean bottom substrate that is less favorable for growth of aquatic weed species. Dredged material would be transported out of the lagoons by a temporary pipeline installed in the lagoons and inside of culverts under existing roads. Dredged material would outfall from the pipeline at the WTP site on the south side of Lake Tallac for processing and dewatering. From the WTP site, sand material separated from the dredged spoils would either be transported by truck back to the dredge sites within the Tahoe Keys lagoons or would be transported by truck to landfills outside the City, via routes on U.S. Highway 50 or State Route 89. Remaining materials not appropriate for deposit back into the Tahoe Keys lagoons would also be transported to landfills, via routes on U.S. Highway 50 or State Route 89.

The proposed route between the WTP and the Tahoe Keys lagoons would include Texas Avenue, Whitney Drive, Royal Avenue, Tahoe Island Drive, 12th Street, State Route 89 and 15th Street, in addition to Tahoe Keys Boulevard and Venice Drive as described for the Proposed Project (see Figure 2-11). These streets serve single-family residential neighborhoods south of the Tahoe Keys development. One elementary school, Tahoe Valley Elementary, also has its main access from Tahoe Island Drive, though the school is located southeast of and not directly on the proposed truck route.

The proposed route between the WTP and offsite landfills would include Texas Avenue, Whitney Drive, Royal Avenue, Tahoe Island Drive and 12th Street before turning onto State Route 89 and U.S. Highway 50. This route also spans the single-family residential neighborhoods south of the Tahoe Keys development.

Similar to the streets in the Tahoe Keys development, local streets proposed to be used for truck transport of sand or remnant dredge material accommodate two-way traffic, with one travel lane in each direction. There are no paved shoulders or sidewalks, though Washington Avenue does have striped on-street bicycle lanes. Speed limits on these streets is 25 miles per hour with the following two exceptions: (1) Washington Avenue, where the posted speed limit is 30 miles per hour; and (2) Tahoe Island Drive in the vicinity of Tahoe Valley Elementary, where the posted speed limit is reduced to 15 miles per hour when school children are present.

Potential Impacts

Issue TR-1: Generation of New Daily Vehicle Trips. Up to nine employees would be needed for the dredge and substrate replacement under this Action Alternative 2, excluding materials transport truck drivers. Consistent with the assumptions applied for the Proposed Project, these nine employees are estimated to generate 22 new daily trips for up to six months. Once dredged material has been processed and dewatered, an additional 16 or 32 truck trips per day are estimated for transport of dredged material, depending upon the size of truck used (see Tables 3.4.4-3 and 3.4.4-4). Total trip ends made by cars and large materials transport trucks could be as many as 54 per day.

However, as with the Proposed Project, these contractor and truck trips would be temporary, would last only for the duration of the dredge and substrate replacement work, and would not constitute a persistent and long-term increase in vehicle trips on the local road system. With fewer than 100 net new daily trips, the short-term impact of Action Alternative 2 would be insignificant pursuant to the definitions contained in Chapter 65, section 65.2 of the TRPA Code of Ordinances and State-recommended screening criteria for potential traffic impacts. In the long term, Action Alternative 2 would not generate any new, permanent and ongoing vehicle trips. Thus, Action Alternative 2 would have a **less than significant impact**.

Issue TR-2: Changes in Demand for Parking. As with the Proposed Project, no changes to existing parking facilities are proposed under Action Alternative 2. Up to nine employees are estimated to be needed to conduct the dredge operation. The rights-of-way within the Tahoe Keys development are wide enough to allow on-street vehicle parking for cars and light trucks. In addition to available on-street parking, approximately 560 parking off-street spaces are available in parking lots. Excepting some holiday weekends, parking in these areas is typically available for employees, residents and visitors (Lind, pers. comm.) Trucks unloading sand for substrate replacement would stage within the existing public right-of-way near existing TKPOA work vessel launch ramps. These trucks would remain parked only for as long as necessary to unload material and would not eliminate access to on-street parking stalls for extended periods of time.

With sufficient on-street and off-street parking within the Tahoe Keys development to accommodate an estimated nine additional vehicles, Action Alternative 2 would have a **less than significant impact.**

Issue TR-3: Effects on Roads and Level of Service. No existing roadways would be modified or closed for the Action Alternative 2. In the short term, Action Alternative 2 is estimated to generate 18 new daily trips by dredge workers. Action Alternative 2 would generate no new daily trips in the long-term. Consistent with the definitions contained in Chapter 65, section 65.2 of the TRPA Code of Ordinances, and with fewer than 100 new daily vehicle trips during dredge and substrate replacement activities, Action Alternative 2 would have an insignificant temporary increase in traffic volumes. With no permanent increase in daily trips, Action Alternative 2 would have no impact on level of service.

Cars and light trucks driven by employees of the dredge operation are characteristic of vehicles currently driven by residents and employees in the Tahoe Keys development, and thus, would not accelerate deterioration of roads in the Proposed Project area nor create new conflicts with or hazards to pedestrians, bicyclists or other vehicles as compared to current conditions. However, Action Alternative 2 would include as many as 32 daily inbound and outbound trips by large trucks transporting sand from the WTP back to the lagoons or other dredge material from the WTP to off-site landfills. According to manufacturers' specifications for 10 to 20 cubic yard trucks, gross vehicle (loaded) weight of large trucks can range from 25 tons for smaller trucks, up to 40 tons for larger trucks. The effect on pavement condition of a truck weighing 20 tons can be as much as 30 times that of a typical passenger automobile on an urban highway (FHWA, 2000).

Roads proposed to be used for circulation of trucks from the WTP to the lagoons and off-site landfills include several residential streets that could experience damage, such as pavement cracking or wheel ruts in the asphalt surface from repeated travel by heavy loads. Damage to a road's paved surface can cause increased noise from tires and reduce vehicle fuel efficiency, resulting increased air and greenhouse gas emissions from automobiles (FHWA, 2015). Additionally, potential conflicts between these large vehicles and pedestrians and bicyclists may occur on segments of streets that lack formal sidewalks, striped bicycle lanes or other multi-use paths for pedestrians and bicyclists.

Unmitigated, the potential for damage (cracks or ruts) to occur on the road surface of the residential streets in and outside of the Tahoe Keys development, and the potential for increased hazards to vehicles, bicyclists or pedestrians due to large materials truck transport on residential streets would be a potentially significant impact. However, with implementation of Mitigation Measure TR-3a, the impact of Action Alternative 2 on Road and Level of Service would be **less than significant.**

Issue TR-4: Effects on Water Traffic. Action Alternative 2 would deploy a single barge for dredge operations. Impacts on waterborne traffic would be similar to, but less than, those described above for the Proposed Project. However, those effects of the Proposed Project were determined to be less than significant.

Mitigation and Resource Protection Measures

TR-3a: Prior to commencement of work under Action Alternative 2, the permittee shall coordinate with the City of South Lake Tahoe Public Works, Roads Division, for the operation of heavy vehicles on City streets. As required by the City, the permittee may be required to submit an application for a transportation permit and/or a traffic control plan and a program for minimizing damage to the road surface as a result of the project. The plan and program shall be prepared by a professional traffic engineer and, at a minimum, shall include:

- Inspection of the condition of the roads along the proposed materials transport truck route, in conjunction with City of South Lake Tahoe Public Works staff:
    - no more than 10 days prior to commencement of dredging operations, to evaluate the existing condition of the roads to be utilized for the transport of sand or dredged material; and
    - no more than 10 days after completion of dredging, disposal and substrate replacement operations, to evaluate the condition of roads along the transport route and identify any new deficiencies or necessary repairs not previously identified in the initial inspection.
- Requirement for the permittee to conduct repairs to the road surfaces as necessary to restore the road surface to its condition prior to commencement of work. This requirement may include payment of a deposit to the City, as may be required by the Public Works Department, which shall be submitted to the City prior to commencement of work and which shall be returned to the permittee if no new deficiencies or necessary repairs are identified after completion of dredging, disposal and substrate replacement work.
- Notification to occupants and owners of property along the proposed truck route at least 15 days prior to commencement of truck operations.
- Limitation of truck operations to those hours outside of morning and evening peak hours of travel, and no less than one hour before and after the start and end of each school day.

Significant Unavoidable Impacts

With mitigation, Action Alternative 2 would have **no significant unavoidable impacts** on traffic and transportation.

3.4.3.4 No Action Alternative

Regulatory and Environmental Setting

The Regulatory Setting and Environmental Setting for this issue under the No Action Alternative are the same as those described for the Proposed Project, above.

Potential Impacts

Issue TR-1: Generation of New Daily Vehicle Trips. As the No Action Alternative maintains existing operations for aquatic weed abatement, this alternative would generate no new trips beyond those presently occurring into and within the Tahoe Keys development. As existing trip generation would not change, the No Action Alternative would have **no impact.**

Issue TR-2: Changes in Demand for Parking. As with new trip generation, this alternative would generate no new demand for parking beyond the present demands associated with current weed abatement efforts of TKPOA maintenance staff. The No Action Alternative would therefore have **no impact.**

Issue TR-3: Effects on Roads and Level of Service. No existing roadways would be modified or closed for the No Action Alternative. Cars and light trucks currently operated by TKPOA staff would continue to be used, and the number of daily vehicle trips would not increase; therefore, level of service would not change compared to existing conditions. The No Action Alternative would therefore have **no impact.**

Issue TR-4: Effects on Water Traffic. Current boating operations would be maintained with the No Action Alternative, with no increases in the number or frequency of weed abatement boat trips in the Tahoe Keys lagoons compared to current conditions. The No Action Alternative would therefore have **no impact.**

Mitigation and Resource Protection Measures

No mitigation is required for the No Action Alternative.

Significant Unavoidable Impacts

The No Action Alternative would have **no significant unavoidable impacts** on traffic and transportation.

3.4.4 Noise

This section considers how the proposed Tahoe Keys lagoon aquatic weeds control methods test and alternatives could potentially create noise impacts. The analysis focuses on the similarity of noise associated with project activities to ambient daytime noise typical of the project area; the short-term duration of construction noise and the standard mitigations specified under existing regulations; the intermittent, non-stationary nature of noise effects; and attenuation by distance to receptors.

Methods and Assumptions

Noise evaluations are focused on residential receptors near the lagoons. Project noise was compared to noise ordinances of El Dorado County and the TRPA. However, no numerical noise thresholds were determined to apply to the Project.

The general approach to evaluating noise was to (1) determine if numerical noise thresholds from any local agencies apply to the Project, and (2) if no numerical thresholds were found to apply, determine if any general noise restrictions from any local agencies apply to the Project. Considerations included the timing, duration and spatial extent of activities. Mitigation and Resource Protection Measures were part of the evaluation, including requirements for proper equipment maintenance and limitations on work hours.

The following methods and assumptions were applied in evaluating specific water quality issues:

NO-1: Generally, the noise generated by the Project activities will be similar to, or less than ambient daytime noise in an active marina environment, typical of the Project area.

NO-2: Road and water traffic associated with the Project, and the noise that result from it, will occur for a limited duration and are not expected to result in a significant change in the overall noise generated by transportation activities in the Project area.

NO-3: Project noise will be similar to temporary construction noise. Noise producing activities in the Project area are regulated by El Dorado County and the Tahoe Regional Planning Agency (TRPA), which have jurisdiction over the local discretionary noise requirements for the Project. Each of these agencies has developed rules, regulations and policies regarding environmental noise. While the Project does not include "construction", the temporary nature and the types of equipment to be used for one or more alternatives were considered to be similar to that of construction activity for the purpose of the noise analysis.

NO-4: Project noise will be intermittent, non-stationary, and attenuated by distance to receptors.

3.4.4.1 Proposed Project (Control Methods Test)

Regulatory Setting

Federal and State

There are no federal or state noise regulations applicable to the project.

Local

The Project is located in the eastern portion of El Dorado County, California, within the Lake Tahoe Basin. Noise producing activities in the project area are regulated by El Dorado County and the Tahoe Regional Planning Agency (TRPA), which have jurisdiction over the local discretionary noise requirements for the project. Each of these agencies has developed rules, regulations and policies regarding environmental noise. While the project does not include construction, the temporary nature and the types of equipment to be used for one or more alternatives are similar to typical construction activity.

Section 130.37.020.I of the El Dorado County Code of Ordinances states that "*Construction (e.g., construction, alteration or repair activities) during daylight hours provided that all construction equipment shall be fitted with factory installed muffling devices and maintained in good working order*" is exempt from the County Noise Ordinance and consistent with the El Dorado County General Plan Goal 6.5 (Acceptable Noise Levels) for new land uses.

TRPA's Noise Ordinance is focused primarily on transportation sources, but Section 68.9 states that "*The Standards of this Chapter shall not apply to noise from TRPA-approved construction or maintenance projects or demolition of structures provided such activities are limited to the hours between 8 a.m. and 6:30 p.m.*"

Environmental Setting

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. The Project is located in the southern portion of the Lake Tahoe Basin within the Tahoe Keys community. The Project is located in close proximity to various land uses, primarily residential. Contributors to the ambient noise environment primarily consist of continuous sounds of vehicles (automobiles and boats) throughout the Tahoe Keys community and marina, airplane noises, sounds emanating from nearby residents, and naturally occurring sounds (e.g. wind).

Potential Impacts

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. Activities associated with the Proposed Project that could generate noise include boats used to conduct the CMT and to access study areas for herbicide application, and on-road vehicles from workers involved with performing the CMT. Generally, the noise generated by these activities is similar to or less than ambient daytime noise in an active marina, typical of the project area. Any potential increase in noise due to these activities is expected to be more than offset by the reduction in noise from recreational watercraft as each test area will be blocked by the use of turbidity curtains during the CMT for a period of up to 130 days (see Section 3.4.6, Recreation). The implementation of the CMT will result in vehicle travel for workers (10 workers or less per day) performing the test. As described in Section 3.4.4, road and water traffic associated with the project, and the noise that result from it, will occur for a limited duration and are not expected to result in a significant change in the overall noise generated by transportation activities in the project area. Therefore, impacts from temporary noise levels at the nearest sensitive receptors (residences) due to the Proposed Project would be **less than significant.**

Mitigation and Resource Protection Measures

Analysis of the noise generated by the Proposed Project indicates that no significant Project-related impacts to the noise environment are expected. Therefore, no Mitigation and Resource Protection Measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts to the noise environment are expected from the Proposed Project.

3.4.4.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting

The Regulatory Setting and Environmental Setting for Action Alternative 1 are the same as those described for the Proposed Project above.

Potential Impacts

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. Activities associated with Action Alternative 1 that could generate noise include boats used to access study areas for treatment, and on-road vehicles from workers (see Section 3.4.4, Traffic and Transportation). Impacts for non-herbicide tests will be the same as the Proposed Project. Any impacts associated with the herbicide tests will be avoided, although these were considered to be less than significant. As described in Section 3.4.4, road and water traffic associated with the project, and the noise that result from it, will occur for a limited duration and are not expected to result in a significant change in the overall noise generated by transportation activities in the project area. Therefore, impacts from temporary noise levels at the nearest sensitive receptors (residences) due to Action Alternative 1 would be **less than significant.**

Mitigation and Resource Protection Measures

Analysis of the noise generated by Action Alternative 1 indicates that no significant Project-related impacts to the noise environment are expected. Therefore, no Mitigation and Resource Protection Measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts to the noise environment are expected from Action Alternative 1.

3.4.4.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

The Regulatory Setting and Environmental Setting for Action Alternative 2 are the same as those described for the Proposed Project above. The nearest noise-sensitive receptors to the project area are residences, some of which are located within approximately 50 feet of CMT activities. For Action Alternative 2, those activities would consist of proposed dredging and dewatering operations, as shown on Figures 2-9 and 2-10.

Potential Impacts

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. Activities associated with the project that could produce noise include a barge, pumps and equipment used for dredging, processing (dewatering) and water return, haul trucks for off-site disposal of dredged material, and vehicle travel from construction workers. A description of the activities associated with Action Alternative 2 are provided in Section 2.5.

Most equipment used in dredging and dewatering could be considered typical of similar construction equipment, creating a maximum sound intensity of approximately 85 dB (FHWA, 2006). Actual equipment noise will likely be less, and the sources will be non-stationary and intermittent.

Generally, the noise generated by dredging and dewatering equipment for the project would be similar to ambient daytime noise in an active marina, typical of the project area. There are no applicable quantitative regulatory requirements limiting temporary increases in noise levels due to this type of temporary activity. As described in Section 3.4.4, road and water traffic associated with the project, and the noise that result from it after implementation of Mitigation and Resource Protection Measures, will occur for a limited duration and are not expected to result in a significant change in the overall noise generated by transportation activities in the project area. Also, considering that noise levels would be intermittent, non-stationary, attenuated by distance to receptors, and the project would comply with County code and TRPA ordinance per NO-1 and NO-2, any temporary increase in noise levels at the nearest sensitive receptors (residences) would be **less than significant with mitigation incorporated**.

Mitigation and Resource Protection Measures

NO-1: Work During Daylight Hours. Action Alternative 2 activities will occur only during daylight hours between 8:00 a.m. and 6:30 p.m.

NO-2: Maintenance and Muffling of Equipment. All equipment used during performance of Action Alternative 2 will be maintained in good working order and fitted with factory-installed muffling devices throughout the duration of the project.

Implementation of NO-1 and NO-2 are expected to maintain project-related noise impacts at a **less-than-significant level.**

Significant Unavoidable Impacts

No **significant unavoidable impacts** to the noise environment are expected from Action Alternative 2.

3.4.4.4 No Action Alternative

Regulatory Setting

The Regulatory Setting and Environmental Setting for the No Action Alternative are the same as those described for the Proposed Project above.

Potential Impacts

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. Under the No Action Alternative, noise will not be generated in excess of current noise generated by activities within the project area. Therefore, the No Action Alternative is not expected to generate short-term noise, and impacts are considered **less than significant.**

Mitigation and Resource Protection Measures

Under the No Action Alternative, noise will not be generated in excess of current noise generated by activities within the project area. Therefore, no Mitigation and Resource Protection Measures are proposed.

Significant Unavoidable Impacts

No significant unavoidable impacts to the noise environment are expected from the No Action Alternative.

3.4.5 Cultural Resources

This section considers how the proposed Tahoe Keys lagoon aquatic weeds control methods test and alternatives could potentially affect cultural resources. The analysis focuses on the results of AB 52 consultation conducted by the Lahontan Water Board, and the United Auburn Indian Community's written request for consultation and recommendations for Mitigation and Resource Protection Measures.

Methods and Assumptions

The potential for significant impacts to cultural resources were evaluated under CEQA, TRPA, and AB 52 criteria and guidelines. Background research and anticipated project activities identified no cultural resources that would be significantly impacted under CEQA, TRPA, or AB 52. Under AB 52, lead agencies are required to initiate consultation with California Native American groups that are traditionally and culturally affiliated with the Project area.

In response to AB 52 requirements, the United Auburn Indian Community was identified as traditionally and cultural affiliated with the Project area. Through consultation, the United Auburn Indian Community were informed of the Project and were requested to provide input or concerns. The United Auburn Indian Community identified the Project as potentially impacting an area of interest to the Tribe. Under CEQA, one criterion for determining if an impact is significant to cultural resources is whether it causes a substantial adverse change in the significance of a Tribal Cultural Resource. AB 52 states that parties may propose Mitigation and Resource Protection Measures "capable of avoiding or substantially lessening potential significant impacts to a tribal cultural resource or alternatives that would avoid significant impacts to a tribal cultural resource."

Culturally appropriate treatment that preserves or restores the cultural character and integrity of a Tribal Cultural Resource may include Tribal Monitoring, culturally appropriate recovery of cultural objects, and reburial of cultural objects or cultural soil. If adverse impacts to tribal cultural resources, unique archeology, or other cultural resources occurs, then consultation with traditionally and culturally affiliated Native American Tribes regarding mitigation should occur. The following methods and assumptions were applied in evaluating cultural resources issues.

CR-1: Sensitivity to traditional Native American resources and values. Recommendations for addressing tribal concerns include developing an Unanticipated Discovery Plan, Awareness Training for workers, and an associated Tribal Cultural Resources Awareness brochure will be included in a Proposed Project Mitigation Monitoring Plan. The Unanticipated Discovery Plan will include guidelines that a qualified cultural resources specialist, in conjunction with Native American Representatives and Monitors from traditionally and culturally affiliated Native American Tribes, will assess the significance of any unanticipated finds and make recommendations for further evaluation and treatment as necessary. Awareness Training for workers will be conducted in coordination with traditionally and culturally affiliated Native American Tribes. The Proposed Project proponent will develop and administer a worker training program for all personnel involved in the CMT or its alternatives. The training will include relevant information regarding sensitive tribal cultural resources, including applicable regulations, protocols for avoidance, and consequences of violating State laws and regulations. The training will outline what to do and whom to contact if any potential resources or artifacts are encountered. The training will also underscore the requirement for confidentiality and culturally-appropriate treatment of any find of significance to Native Americans. The Associated Tribal Cultural Resources Awareness brochure will provide guidelines for protection measures and protocols for unanticipated finds or the discovery of human remains, shows examples of potential cultural resources, and encourages respect for Native American Culture. The brochure will be provided in conjunction with Awareness Training.

3.4.5.1 Proposed Project (Control Methods Test)

Regulatory Setting

Federal

National Historic Preservation Act of 1966

Enacted in 1966 and amended most recently in 2014, the National Historic Preservation Act (NHPA) (54 United States Code [USC 300101 et seq.) instituted a multifaceted program, administered by the Secretary of the Interior, to encourage sound preservation policies of the nation’s cultural resources at the federal, state, and local levels. The NHPA authorized the expansion and maintenance of the National Register of Historic Places (NRHP), established the position of State Historic Preservation Officer, and provided for the designation of State Review Boards. The NHPA also set up a mechanism to certify local governments to carry out the goals of the NHPA, assisted Native American tribes in preserving their cultural heritage, and created the Advisory Council on Historic Preservation (ACHP).

Section 106

Section 106 of the NHPA (54 USC 306108) states that federal agencies with direct or indirect jurisdiction over federally funded, assisted, or licensed undertakings must take into account the effect of the undertaking on any historic property that is included in or eligible for inclusion in the NRHP, and that the ACHP must be afforded an opportunity to comment, through a process outlined in the ACHP regulations in Title 36 of the Code of Federal Regulations (CFR) part 800, on such undertakings. The Section 106 process involves identification of significant historic resources within an "*area of potential effect [APE]; determination if the undertaking will cause an adverse effect on historic resources; and resolution of those adverse effects through execution of a Memorandum of Agreement.*" In addition to the ACHP, interested members of the public, including individuals, organizations, and agencies (such as the California Office of Historic Preservation), are provided with opportunities to participate in the process.

National Register of Historic Places

The NRHP was established by the NHPA of 1966 as "*an authoritative guide to be used by Federal, State, and local governments, private groups and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment*" (36 CFR part 60.2). The NRHP recognizes properties that are significant at the national, state, and local levels. To be eligible for listing in the NRHP, a resource must be significant in American history, architecture, archaeology, engineering, or culture. Districts, sites, buildings, structures, and objects of potential significance must also possess integrity of location, design, setting, materials, workmanship, feeling, and association.

Significance

A property is eligible for the NRHP if it is significant under one or more of the following criteria:

- **Criterion A:** It is associated with events that have made a significant contribution to the broad patterns of our history.
- **Criterion B:** It is associated with the lives of persons who are significant in our past.
- **Criterion C:** It embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.
- **Criterion D:** It has yielded, or may be likely to yield, information important in prehistory or history. Ordinarily cemeteries, birthplaces, or graves of historic figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations; reconstructed historic buildings; and properties that are primarily commemorative in nature are not considered eligible for the NRHP unless they satisfy certain conditions. In general, a resource must be 50 years of age to be considered for the NRHP unless it satisfies a standard of exceptional importance.

Integrity

In addition to meeting the significance criteria, a property must retain historic *integrity*, which is defined in National Register Bulletin 15 as the "ability of a property to convey its significance" (National Park Service 1990). In order to assess integrity, the National Park Service recognizes seven aspects or qualities that, considered together, define historic integrity. To retain integrity, a property must possess several, if not all, of these seven qualities, which are defined in the following manner in National Register Bulletin 15:

- **Location:** The place where the historic property was constructed or the place where the historic event occurred.
- **Design:** The combination of elements that create the form, plan, space, structure, and style of a property.

- **Setting:** The physical environment of a historic property.
- **Materials:** The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- **Workmanship:** The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- **Feeling:** A property's expression of the aesthetic or historic sense of a particular period of time; and/or;
- **Association:** The direct link between an important historic event or person and a historic property.

State

California Environmental Quality Act (CEQA)
CEQA requires a State or local lead agency to analyze whether historic and/or archaeological resources may be adversely impacted by a proposed project. Under CEQA, a "*project that may cause a substantial adverse change in the significance of a historic resource is a project that may have a significant effect on the environment*" (PRC Section 21084.1). Answering this question is a two-part process: first, the determination must be made as to whether the proposed project involves cultural resources. Second, if cultural resources are present, the proposed project must be analyzed for a potential "substantial adverse change in the significance" of the resource.

Historical Resources
According to State CEQA guidelines section 15064.5, for the purposes of CEQA, historical resources are as follows:

A resource listed in, or formally determined eligible … for listing in the CRHR (PRC 5024.1, Title 14 California Code of Regulations [CCR], Section 4850 et seq.).

A resource included in a local register of historical resources, as defined in Section PRC 5020.1(k), of the Public Resources Code or identified as significant in a historic resources survey meeting the requirements of Section PRC 5024.1(g).

Any object, building, structure, site, area, place, record, or manuscript that the lead agency determines to be eligible for national, state, or local landmark listing; generally, a resource shall be considered by the lead agency to be historically significant (and therefore a historic resource under CEQA) if the resource meets the criteria for listing on the CRHR (as defined in PRC Section 5024.1, Title 14 CCR Section 4852).

Resources nominated to the CRHR must retain enough of their historic character or appearance to convey the reasons for their significance. Resources whose historic integrity (as defined above) does not meet the NRHP criteria may still be eligible for listing in the CRHR.

According to CEQA, the fact that a resource is not listed in or determined eligible for listing in the CRHR or is not included in a local register or survey shall not preclude the lead agency from determining that the resource may be an historical resource (PRC Section 5024.1). Pursuant to CEQA, a project with an effect that may cause a substantial adverse change in the significance of a historical resource may have a significant effect on the environment (state CEQA guidelines Section 15064.5[b]).

Substantial Adverse Change and Indirect Impacts to Historical Resources

State CEQA guidelines specify that a "*substantial adverse change in the significance of an historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired*" (state CEQA guidelines Section 15064.5). Material impairment occurs when a project alters in an adverse manner or demolishes "*those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion*" or eligibility for inclusion in the NRHP, CRHR, or local register. In addition, pursuant to state CEQA guidelines section 15126.2, the "*direct and indirect significant effects of the project on the environment shall be clearly identified and described, giving due consideration to both the short-term and long-term effects.*"

The following guides and requirements are of particular relevance to this study's analysis of indirect impacts to historic resources. Pursuant to state CEQA guidelines (Section 15378), study of a project under CEQA requires consideration of "*the whole of an action, which has the potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment*." State CEQA guidelines (section 15064(d)) further defines direct and indirect impacts as follows:

(1) A direct physical change in the environment is a physical change in the environment which is caused by and immediately related to the project.

(2) An indirect physical change in the environment is a physical change in the environment, which is not immediately related to the project, but which is caused indirectly by the project. If a direct physical change in the environment in turn causes another change in the environment, then the other change is an indirect physical change in the environment.

(3) An indirect physical change is to be considered only if that change is a reasonably foreseeable impact which may be caused by the project.

Archaeological Resources

In terms of archaeological resources, PRC Section 21083.2(g) defines a *unique archaeological resource* as an archaeological artifact, object, or site about which it can be clearly demonstrated that without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

(1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
(2) Has a special and particular quality such as being the oldest of its type or the best available example of its type.
(3) Is directly associated with a scientifically recognized important prehistoric or historic event or person.

If it can be demonstrated that a proposed project will cause damage to a unique archaeological resource, the lead agency may require reasonable efforts be made to permit any or all of these resources to be preserved in place or left in an undisturbed state. To the extent that they cannot be left undisturbed, Mitigation and Resource Protection Measures are required (PRC Sections 21083.2[a], [b], and [c]). CEQA notes that, if an archaeological resource is neither a unique archaeological resource nor an historical resource, the effects of the project on those resources shall not be considered to be a significant effect on the environment (State CEQA guidelines section 15064.5[c][4]).

California State Assembly Bill 52

Assembly Bill 52 of 2014 (AB 52) amended PRC Section 5097.94 and added PRC Sections 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2, and 21084.3.

Consultation with Native Americans

AB 52 formalizes the lead agency – tribal consultation process, requiring the lead agency to initiate consultation with California Native American groups that are traditionally and culturally affiliated with the project, including tribes that may not be federally recognized. Lead agencies are required to begin consultation prior to the release of a negative declaration, mitigated negative declaration, or environmental impact report.

Tribal Cultural Resources

Section 4 of AB 52 adds Sections 21074(a) and 21074(b) to the PRC, which address tribal cultural resources and cultural landscapes. Section 21074(a) defines *tribal cultural resources* as one of the following:

1) Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:
   (A) Included or determined to be eligible for inclusion in the CRHR.
   (B) Included in a local register of historical resources as defined in subdivision (k) of Section 5020.1.
2) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1. In applying the criteria set forth in subdivision (c) of Section 5024.1 for the purposes of this paragraph, the lead agency shall consider the significance of the resource to a California Native American tribe.

Section 1 (a)(9) of AB 52 establishes that "*a substantial adverse change to a tribal cultural resource has a significant effect on the environment.*" Effects on tribal cultural resources should be considered under CEQA. Section 6 of AB 52 adds Section 21080.3.2 to the PRC, which states that parties may propose Mitigation and Resource Protection Measures "*capable of avoiding or substantially lessening potential significant impacts to a tribal cultural resource or alternatives that would avoid significant impacts to a tribal cultural resource*." Further, if a California Native American tribe requests consultation regarding project alternatives, Mitigation and Resource Protection Measures, or significant effects to tribal cultural resources, the consultation shall include those topics (PRC Section 21080.3.2[a]). The environmental document and the mitigation monitoring and reporting program (where applicable) shall include any Mitigation and Resource Protection Measures that are adopted (PRC Section 21082.3[a]).

California Register of Historical Resources

Created in 1992 and implemented in 1998, the CRHR is "*an authoritative guide in California to be used by state and local agencies, private groups, and citizens to identify the state's historical resources and to* *indicate what properties are to be protected, to the extent prudent and feasible, from substantial adverse change*" (PRC Sections 21083.2 and 21084.1). Certain properties, including those listed in or formally determined eligible for listing in the NRHP and California Historical Landmarks numbered 770 and higher, are automatically included in the CRHR. Other properties recognized under the California Points of Historical Interest program, identified as significant in historical resources surveys, or designated by local landmarks programs, may be nominated for inclusion in the CRHR. According to PRC Section 5024.1(c), a resource, either an individual property or a contributor to a historic district, may be listed in the CRHR if the State Historical Resources Commission determines that it meets one or more of the following criteria, which are modeled on NRHP criteria:

- **Criterion 1:** It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
- **Criterion 2:** It is associated with the lives of persons important in our past.
- **Criterion 3:** It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
- **Criterion 4:** It has yielded, or may be likely to yield, information important in history or prehistory.

Resources nominated to the CRHR must retain enough of their historic character or appearance to convey the reasons for their significance. Resources whose historic integrity does not meet NRHP criteria may still be eligible for listing in the CRHR.

Local

Tahoe Regional Planning Agency (TRPA)

The Tahoe Regional Planning Agency (TRPA) adopted the Tahoe Valley Area Plan in 2015 to provide regulations, standards, and strategies for development in the Tahoe Valley area. A strategy in the Natural and Cultural Resources section of the Plan is proved to protect Historic and Archeological Resources. The policies to attain this goal are proved below:

Goal NCR-6: Historic and Archeological Resources

To preserve cultural and historic resources in the Tahoe Valley area.

- Policy NCR-6.1: Resource Protection

  Preserve identified historic and cultural resources where feasible. Where it is found that a resource has no economically viable future use, require mitigation for the loss of the resource that would preserve public access to its historic or cultural significance.

- Policy NCR-6.2: Archeological Investigations

  The City shall require archeological investigations for all applicable discretionary projects, in accordance with CEQA regulations, for areas not previously surveyed and/or that are determined sensitive for cultural resources (e.g., undeveloped parcels near water features). The City shall require the preservation of discovered archeologically-significant resources (as determined based on

TRPA, State, and Federal standards by a qualified professional) in place if feasible, or provide mitigation (avoidance, excavation, documentation, curation, data recovery, or other appropriate measures) prior to further disturbance.

- Policy NCR-6.3: Human Remain Discovery

The City shall require/condition projects and other ground disturbance activities to notify the City if human remains are discovered and halt work. The County Coroner will be notified according to Section 5097.98 of the State Public Resources Code and Section 7050.5 of California's Health and Safety Code. If the remains are determined to be Native American, the coroner will notify the Native American Heritage Commission and Washoe Tribe, and the procedures outlined in CEQA Section 15064.5(d) and (e) shall be followed.

Environmental Setting

Issue CR-1: Traditional Native American Resources and Values. The Proposed Project and Action Alternatives are primarily focused on actions occurring around or in the waters of the Tahoe Keys lagoons. One land site (at the mothballed Tahoe Keys Water Treatment Plant) would be utilized for staging and sediment and clean substrate handling under the Tahoe Keys Dredge and Replace Substrate Alternative; however, that site is highly disturbed. There are currently no historic structures, sites, or artifacts identified in this area that would be affected.

Potential Impacts

Issue CR-1: Traditional Native American Resources and Values. The Lake Tahoe Valley is a rich cultural area of traditional importance to Native American tribes. Through tribal consultation conducted by the Lahontan Water Board with California Native American groups that are traditionally and culturally affiliated with the project, required by AB 52, the United Auburn Indian Community identified the project as potentially impacting an area of interest to the Tribe. An attempt was also made to consult with the Washoe Tribe of California and Nevada, but no response was received. Effects on tribal cultural resources should be considered under CEQA, and AB 52 states that parties may propose Mitigation and Resource Protection Measures "*capable of avoiding or substantially lessening potential significant impacts to a tribal cultural resource or alternatives that would avoid significant impacts to a tribal cultural resource.*"

No other potentially affected cultural resources of significance were identified for the Proposed Project or its alternatives. With mitigation, there would be **no impact** on cultural resources.

Mitigation and Resource Protection Measures

On November 15, 2018, the United Auburn Indian Community provided a written request for consultation and recommendations for Mitigation and Resource Protection Measures. These measures included an Unanticipated Discovery Plan, Awareness Training for workers, and an associated Tribal Cultural Resources Awareness brochure to be included in the Proposed Project Mitigation Monitoring Plan.

The Unanticipated Discovery Plan would include guidelines that a qualified cultural resources specialist, in conjunction with Native American Representatives and Monitors from traditionally and culturally affiliated Native American Tribes, will assess the significance of any unanticipated finds and make recommendations for further evaluation and treatment as necessary. Culturally appropriate treatment that preserves or restores the cultural character and integrity of a Tribal Cultural Resource may include Tribal Monitoring, culturally appropriate recovery of cultural objects, and reburial of cultural objects or cultural soil. If adverse impacts to tribal cultural resources, unique archeology, or other cultural resources occurs, then consultation with traditionally and culturally affiliated Native American Tribes regarding mitigation should occur.

Awareness Training for workers will be conducted in coordination with traditionally and culturally affiliated Native American Tribes. The Proposed Project proponent will develop and administer a worker training program for all personnel involved in the CMT or its alternatives. The training will include relevant information regarding sensitive tribal cultural resources, including applicable regulations, protocols for avoidance, and consequences of violating State laws and regulations. The training will outline what to do and whom to contact if any potential resources or artifacts are encountered. The training will also underscore the requirement for confidentiality and culturally appropriate treatment of any find of significance to Native Americans.

The Associated Tribal Cultural Resources Awareness brochure was developed by the United Auburn Indian Community and provides guidelines for protection measures and protocols for unanticipated finds or the discovery of human remains, shows examples of potential cultural resources, and encourages respect for Native American Culture. The brochure will be provided in conjunction with Awareness Training.

Incorporation of the Unanticipated Discovery Plan, Awareness Training, and Associated Awareness brochure into the final Mitigation Monitoring Plan for the Proposed Project will satisfy AB 52 compliance for the United Auburn Indian Community, and implementation of these measures would make this impact less than significant.

Significant Unavoidable Impacts

There are **no significant unavoidable impacts** for cultural resources.

3.4.5.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

Regulatory Setting

The regulatory setting for Action Alternative 1 is the same as for the Proposed Project.

Environmental Setting

Issue CR-1: Traditional Native American Resources and Values. The environmental setting for Action Alternative 1 is the same as for the Proposed Project.

Potential Impacts

Issue CR-1: Traditional Native American Resources and Values. Potential impacts for Issue CR-1 are the same as for the Proposed Project.

Mitigation and Resource Protection Measures

Mitigation and Resource Protection Measures for Issue CR-1 are the same as for the Proposed Project.

Significant Unavoidable Impacts

There are **no significant unavoidable impacts** for cultural resources.

3.4.5.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Regulatory Setting

The regulatory setting for Action Alternative 1 is the same as for the Proposed Project.

Environmental Setting

Issue CR-1: Traditional Native American Resources and Values. The environmental setting for Action Alternative 1 is the same as for the Proposed Project.

Potential Impacts

Issue CR-1: Traditional Native American Resources and Values. Potential impacts for Issue CR-1 are the same as for the Proposed Project.

Mitigation and Resource Protection Measures

Mitigation and Resource Protection Measures for Issue CR-1 are the same as for the Proposed Project.

Significant Unavoidable Impacts

There are **no significant unavoidable impacts** for cultural resources.

3.4.5.4 No Action Alternative

Regulatory Setting

The regulatory setting for Action Alternative 1 is the same as for the Proposed Project.

Environmental Setting

Issue CR-1: Traditional Native American Resources and Values. The environmental setting for Action Alternative 1 is the same as for the Proposed Project.

Potential Impacts

Issue CR-1: Traditional Native American Resources and Values. Potential impacts for Issue CR-1 are the same as for the Proposed Project.

Mitigation and Resource Protection Measures

Mitigation and Resource Protection Measures for Issue CR-1 are the same as for the Proposed Project.

Significant Unavoidable Impacts

There are **no significant unavoidable impacts** for cultural resources.

3.4.6 Recreation

This section considers how physical changes in the environment due to the Proposed Project and alternatives could affect recreation resources. Effects of concern include obstruction of private recreational boating access directly to Lake Tahoe from those moorings that could be blocked when turbidity curtains and other barriers are installed in the lagoons during the CMT, and the potential increased use of the Tahoe Keys Marina and other facilities due to displaced boat launches. As a result of increased use of the Tahoe Keys Marina and/or other facilities could result in overcrowding contributing to physical deterioration of the facilities. It also considers consistency with TRPA Thresholds.

Methods and Assumptions

The evaluation of potential recreation impacts is based on the calculation of blocked slips and moorings and the estimated boat use for the duration of the Proposed Project and Action Alternatives. Aerial photography interpretation was used to count the number of slips and moorings blocked, and the loss of direct Lake Tahoe boating access-days is calculated based on the duration of control for water quality (that is, the installation of turbidity curtains). There are 924 boat-slips (to which one boat each may be tied) in the Tahoe Keys.

The period during which the turbidity curtains would be in place was defined for the Proposed Project by the maximum length of time during which herbicides or degradants could be detected in the waters of the lagoons (up to 130 days, based on their half-lives, detection limits, and application rate). The period for which turbidity curtains would be in place for Action Alternative 2 (up to 4.5 months or 137 days for each dredge site) was defined by the engineer designing the alternative, as reported in Chapter 2.

The 2021 recreational boating season extends from Memorial Day weekend (beginning Friday May 31, 2021) through Labor Day weekend (ending Monday, September 6, 2021), a total of 102 days. Of those 102 days, 35 (34%) are holidays and weekends, and the remaining 68 are weekdays. Based on a 2018 study done by TRPA (Ascent 2018, Table 2, p. 3), it is assumed that 40 percent of boat moorings are actively used to launch on weekends and 29 percent are used on weekdays. Based on this data, an aggregate weighted average use rate of approximately one-third of the total potential boat-use days was assumed to be used on any given day or over the season.

The loss of boating direct access days was calculated by multiplying the maximum number of days during which direct access would be blocked times the number of boat slips and moorings blocked by each turbidity curtain, assuming one boat per slip and using the a weighted average weekend/holiday/ weekday use rate cited above.

As shown in Figure 3.4.2-1, for the CMT, aerial photo interpretation indicated that the barriers at Sites 14 and 15 would block a total of 540 slips comprising 1,620 potential moorings on each day during the test period. This would affect 58 percent of Tahoe Keys boat slips and block up to 55,080 boat-use days over the 102-day peak recreational boating period in the worst case. (If monitoring indicates that levels of herbicides and degradation products fall within acceptable limits for short-term detection in receiving waters, barriers could be removed much earlier.) Assuming that one-third of slips are in active use on any given day, the probable impact would be 18,360 boat-use days.

SOURCE: DigitalGlobe, 2016
Edits to Original Graphic By: TRC Companies 1/14/2020

Tahoe Keys Lagoons Restoration Program EIR/EIS, D180990

ESA

Figure 3.4.6-1 Areas of the Tahoe Keys Lagoons Blocked for Recreational Boat Use by Barriers Placed for the Testing of Herbicides.

On a regional scale, for Lake Tahoe as a whole, comprehensive data are not available to characterize the total public and private boat use on the Lake. Therefore, estimates by TRPA were used to establish potential use (Dennis Zabaglo, pers. comm. May 19, 2020). Approximately 30,000 launches are estimated to occur annually. However, it cannot be assumed that the estimated number of launches equates to the annual potential number of boat user-days on Lake Tahoe from these facilities, since it is not known whether, after launching, a boat is used for multiple user-days or is taken out of the water for relaunch later. An additional 4,500 Lake Tahoe buoys are estimated to provide the potential to launch, to which may be added 2,443 moorings that occur in the Tahoe Keys and approximately 2,000 additional private moorings that are estimated to exist in the remainder of the Lake. Thus, the estimated aggregate total number of moorings is 8,943. This number of moorings, if about one-third of boat user-days are used (as calculated above), would result in about 304,000 boat user-days for the Lake Tahoe season. The proportion blocked for the CMT in the Tahoe Keys would amount to about 6 percent of total Lake use.

Potential displacement of use to the Tahoe Keys Marina and other facilities was taken as the potential number of boat slips blocked by barriers in the Keys (540 per day).

3.4.6.1 Proposed Project (Control Methods Test)

Regulatory Setting

No Federal or local regulations pertinent to Issue RE-1 for the Proposed Project and alternatives as they affect recreation were identified.

State

The Findings of the Lahontan Water Board in the Tahoe Keys WDRs (Lahontan Water Board Order No. R6T-2014-0059) state that excessive growth of aquatic plants within the [Tahoe Keys] impairs beneficial uses of water, such as Water Contact Recreation and Non-contact Recreation.

Regional

The recreation subprogram of the EIP facilitates implementation of projects that 1) improve lake access, 2) develop a comprehensive trail system, 3) improve recreational facilities, and 4) improve educational programs and interpretive facilities (TRPA 2010). Application of the Code of Ordinances and implementation of projects under the EIP recreation program support maintaining a fair share of available resource capacity for public recreation. Although "improving lake access" would include recreational boating, little mention is made of watercraft or recreational boating in TRPA's evaluation of recreation facilities created or improved, outcomes, or recommendations. This threshold is in attainment and is represented on the TRPA EIP webpage as "considerably better than target" and "implemented".

The TRPA EIP includes Recreation and Scenic Resources; its goals include improving Lake Tahoe access and recreational facilities. The TRPA Recreation Threshold is stated in TRPA Resolution 82-11 and Goals and Policies. The TRPA Bi-State Compact recognizes that maintaining recreational values is critical to the social and economic health of the Region. For this reason, the Bi-State Compact requires that the Regional Plan include "a recreation plan for the development, utilization, and management of the recreational resources of the region…" (Public Law 96-551). The adopted threshold standards for recreation are statements of policy rather than numerical standards. The threshold standard includes two separate policy statements that are evaluated separately. One policy statement directs TRPA to preserve and enhance high quality recreational experiences and provide additional access to the shorezone and other areas for dispersed recreational uses. The second policy statement directs TRPA to "…establish and ensure a fair share of the total basin capacity for outdoor recreation is available to the general public" (TRPA 1982). The goal of the recreation element of the Regional Plan is to manage recreation consistent with the guidance provided in the recreation threshold policy statements to "ensure equilibrium between the region's natural endowment and its manmade environment" (Public Law 96-551).

The R-1, High Quality Recreational Experiences, threshold is intended to assure recreational user satisfaction with a high-quality recreation experience in the Lake Tahoe Basin. The human and environmental drivers of the quality of recreation experiences include the variety of recreational activities available, the condition of the natural environment and developed recreation facilities, the density of visitors using recreation sites, and the ease of accessing recreation sites.

Threshold R-1 was established with two parts: (1) preservation and enhancement of a high-quality recreation experience and (2) the provision of additional high-quality, undeveloped lands for recreation, including lake access. The R-1 threshold is in attainment, as reported on the TRPA webpage tracking the recreation carrying capacity threshold (TRPA 2015 Threshold Evaluation).

The R-2, Fair Share of Resource Capacity, threshold is intended to ensure that a fair share of the region's outdoor recreation capacity is available to the general public. The human and environmental drivers affecting the fair share distribution of recreation capacity are land use and the location and amount of private development relative to recreation capacity.

Local

TKPOA manages a majority of the waterways within the Tahoe Keys, primarily for recreation.

Environmental Setting

Issue RE-1: Obstruction of Direct Access to Lake Tahoe for Recreational Boating. Lake Tahoe offers an exceptional recreational experience as a unique alpine lake known worldwide for the clarity and purity of its outstanding blue waters. The Lake was designated an Outstanding National Resource Water (ONRW) by the State of California and the USEPA in 1980. The recreational quality of Lake Tahoe was a primary attraction in developing the Tahoe Keys, and in the ongoing use of the Lake. The Keys is a boat-oriented development, and much of the recreation use enjoyed by Tahoe Keys property owners and their guests is mediated by direct access to Lake Tahoe for boat use. The primary potential impact of the Proposed Project and Action Alternatives on recreation occurs through its effects on boat access and displacement of use to nearby marinas and other facilities.

As noted above, the Tahoe Keys development incorporates 924 boat-slips (to which one boat each may be tied), together with a marina and dock facilities to serve property owners boating recreation. Homeowners in the Tahoe Keys generally launch at the marina in the east lagoon to bring their boats south into the boat slips of the west lagoons. Because the Tahoe Keys is primarily a boating community and has a high density of vacation rentals, the number of boat trips in and out of the Keys is much greater than most other locations around Lake Tahoe. Many property owners rent their homes to vacationers, who use their facilities to engage in recreational boating.

The TKPOA lagoons provide private boating access to Lake Tahoe and are used by residents and visitors for recreational boating and fishing. These waterways are a key attraction for residents and authorized visitors. TKPOA is responsible for maintaining the common areas of the development and is tasked with maintaining navigation in the waterways of the Tahoe Keys lagoons.

Issue RE-2: Increased use of the Tahoe Keys Marina and Other Facilities. The Tahoe Keys Marina provides an alternative means to access the lake for recreational boating during the period that barriers are placed within the Keys to implement the CMT. It is a privately-owned, full-service marina and boat-launching facility adjacent to the study area. The Marina is the largest marina on the lake and is open year-round, offering indoor and outdoor, wet and dry dock storage with over 280 slips, including a double inland concrete launch ramp. The launch ramp is open to the public for a launch fee. TKPOA has signed a stipulated agreement with the Marina that allows members to launch from the Marina with no fees (Upper Truckee River and Marsh Restoration Project DEIR/DEIS/DEIS AECOM and Cardno ENTRIX California Tahoe Conservancy/DGS, Reclamation, and TRPA, December 2015).

El Dorado Beach includes a boat-launching facility located on Highway 50 at Lakeview Avenue. The beach and boat ramp are managed by the City of South Lake Tahoe Parks Department. The boat ramp is open seasonally depending on accessibility and the lake's water level. The launch ramp is open to the public for a launch fee.

In addition, there are other boat launching facilities within the South Lake Tahoe area at Lakeside Marina and Cave Rock Lake Tahoe Nevada State Park. These boat ramps are also open seasonally depending on accessibility and the lake's water level and are open to the public for a launch fee.

Potential Impacts

Issue RE-1: Obstruction of Direct Private Access to Lake Tahoe for Recreational Boating. Long-term impacts of aquatic weed management are expected to be beneficial because weed infestations originating in the Tahoe Keys lagoons diminish the recreational experience of Keys boaters and threaten the extraordinary natural and recreational resources of Lake Tahoe, particularly in the nearshore zone. The Proposed Project, however, is a test of methods to control aquatic weeds, and as such does not directly offer the long-term benefits of weeds management.

As described in Chapter 2, during the CMT turbidity barriers would be placed to isolate herbicide test sites. As stated in Section 2.3.2.

> *All applications of herbicides in individual Group A treatment areas will occur in a single day and monitoring for herbicide residues will continue both within treatment areas and in adjacent receiving waters for a minimum of 30 days after application. Monitoring will continue after 30 days, if necessary, until the herbicide active ingredient and metabolite concentrations (i.e., chemical compounds resulting from herbicide degradation) are non-detectable.*
>
> *One round of aquatic herbicides will be applied at each herbicide or combination test site in a single day in either May or the first half of June, although completion of applications to all sites may take several days as a result of the amount of time required to physically apply herbicides at a site, or due to other factors described below. Timing will be determined by assessing Lake Tahoe Basin snowmelt runoff conditions and the associated hydraulic flow patterns between Lake Tahoe and the lagoons.*

As shown in Figure 2-4, barriers are placed immediately to the west of Site 14, blocking all lagoons to the west, and at Site 15, blocking all lagoons to the south. Figure 3.4.6-1 shows the total areas of Tahoe Keys lagoons blocked by these two barriers, comprising a total of 540 boat slips. As described in Chapter 2, these turbidity curtains would be maintained for a minimum of 30 days and would not be removed until specific criteria are met. Including time for mobilization and demobilization, it is expected that these barriers may preclude launchings from docks within the blocked lagoons and thus direct access to Lake Tahoe from those moorings for a period of about five to seven weeks. However, barriers will be maintained until monitoring shows no detection of herbicides or their degradation products, which could be as long as 130 days. For the purposes of impact analysis, the assumption was made that barriers would block direct boat access throughout the peak recreation boating season (102 days) and as long as the potential non-detect limit (130 days).

Changes to how a boater may access Lake Tahoe, in and of itself, is a social impact rather than a change to the physical environment. However, an otherwise insignificant physical change to the environment may be considered significant based on impacts to social conditions (CEQA Guidelines Section 15064(e)). Here, some TKPOA (the project applicant) homeowners and guests will temporarily lose the convenience of accessing Lake Tahoe directly from their docks via the lagoons. This social impact does not raise the physical change to the environmental represented by the placement of the turbidity curtain to a level of significance in this instance because (1) alternative access exists for boaters, (2) any change in access location is temporary rather than a permanent loss of recreational opportunity, (3) the homeowners via their own homeowners association are requesting the placement of the turbidity screens, (4) any temporary loss of direct access to Lake Tahoe does not represent a significant impact to total boating on Lake Tahoe. Therefore, effects from the Proposed Project in the Tahoe Keys would be **less than significant.**

Swimming is not expected to be substantially affected, especially as none of the herbicides proposed for testing require restriction on the use of treated water for recreational purposes, including swimming (USEPA 2017; SePRO 2007; WDNR 2012). Dilute concentrations of the herbicides have not been shown to cause skin irritation or other health effects on swimmers or other recreational water users (USEPA 2017b; WDNR 2012a; 2012b). However, swimming and other direct water contact restrictions will be implemented to avoid and mitigate the potential impact from HABs.

HABs can have negative impacts on the environment and raise serious concerns for drinking water sources, recreational use, pets, wildlife, and livestock (Anderson-Abbs et al. 2016; USEPA 2015a). The potential for acute effects to occur due to contact recreational exposure to cyanotoxins from such activities as swimming and jet skiing is addressed in Section 3.2. Swimming and other direct water contact restrictions will be implemented to avoid and mitigate the potential impact from HABs.

Recreation in Lake Tallac Lagoon or the Marina Lagoon is not expected to be affected by the Proposed Project. No boat slips were tabulated, and no barriers would be placed associated with the CMT test sites in the Lake Tallac Lagoon. Therefore, there would be **no significant impact** at this location. The Marina Lagoon is located on the eastern side of the Tahoe Keys and is directly connected to Lake Tahoe through the East Channel. It is relatively open, with heavy boat traffic from commercial, governmental, and private boat usage, and would be **unaffected** for recreational boating by the CMT.

Issue RE-2: Increased use of the Tahoe Keys Marina and Other Facilities. It is estimated that up to 540 boat users per day would not have direct access to Lake Tahoe, and that active use on a given day would be about one-third that number, or 180 launches on an average day. Since Tahoe Keys residents may launch their boats free of charge at the Tahoe Keys Marina boat ramp located less than a mile away, it is projected that this demand may be displaced there. (Other moorings may be available for rent on a seasonal and shorter time spans.) Users of those properties whose docks are blocked would lose the convenience of accessing associated moorings within the affected area of the TKPOA. This could increase the current number of launches from Tahoe Keys Marina by approximately one-third on a given day. This level of demand could lead to overcrowding and over-use of the existing facilities that cause physical deterioration, ultimately leading to repair or replacement.

Since Tahoe Keys Marina is a privately-owned marina, the owner could choose to limit the number of launches per day and boat users could be forced to travel to a different boat ramp/launch facility. Boat users that travel to a different boat ramp/launch facility could increase the use of existing recreational facilities. This increased use is not expected to require the construction or expansion of recreational facilities, because the increase is expected to be temporary. Any construction or expansion of recreational facilities would require the approval of TRPA and the Lahontan Water Board (California only). Because the possible increase would be limited to one recreation season, it is not expected that any private or public facility would consider constructing or expanding their facilities due to a one season increase. In addition, many owners would likely choose to launch from the Tahoe Keys Marina before considering other facilities due to its proximity. As a result, the number of owners that travel to a different boat ramp/launch facility will be less than the current number of launches from Tahoe Keys Marina. Use of those facilities will likely be distributed throughout the boating season, among different facilities. Therefore, the temporary nature of the increase is not expected to result in substantial physical deterioration of recreational facilities in the South Lake Tahoe area.

Because this impact is temporary, lasting only one recreation season and because the owner could choose to manage the number of boats launched, it is considered **less than significant**.

Issue RE-3: Inconsistency with TRPA Recreation Thresholds. This analysis considers two thresholds:

R-1. High Quality Recreational Experience. Although the Proposed Project would temporarily result in the loss of the opportunity to directly access Lake Tahoe for boating from parts of the Tahoe Keys for extended periods where testing would occur, the evaluation of this threshold is geared toward public recreational experiences in the Lake Tahoe Basin, and would not adversely affect the attainment status of the R-1 threshold. **No impact would result**.

R-2. Public's Fair Share of Resource Capacity. The Proposed Project would not significantly affect the public's fair share of the region's outdoor recreation capacity**. No impact would result.**

Resource Protection Measures

Issue RE-1: Obstruction of Direct Private Access to Lake Tahoe for Recreational Boating. Several RPM's could reduce project-related impacts for Issue RE-1. These measures were proposed in the IEC/IS and have been carried forward to the Proposed Project, with modifications:

REC-1: Public Noticing. TKPOA will design and carry out an information campaign targeting homeowners, renters, and rental agencies, to provide advance notice on any public access or recreational restrictions during the test period. The campaign will employ e-mails, flyers, letters, TKPOA's periodical (The Breeze), and social media. Announcements and project summaries will be prepared and distributed three to six months in advance of the proposed treatment, as well as two weeks prior to the start of the CMT. In addition, adequate signage shall be displayed by TKPOA 30 days prior to project implementation, throughout project implementation and 14 days after project completion. Notices will be posted in publicly visible locations immediately adjacent to all nine test sites and at the intersection of Tahoe Keys Blvd. and Venice Drive. The notices will inform property owners and visitors about the project and current status of waterways.

REC-2: Timing for Placement and Removal of Barriers. Monitoring will be conducted to determine levels of herbicides and degradation products and barriers need to remain in place until monitoring shows these falling within acceptable limits for short-term detection in receiving waters. As soon as acceptable limits are reached, barriers would be removed, however they could remain in place through much if not all of the recreational boating season. For Action Alternative 2, barriers would remain in place for up to 4.5 months at each dredge site, and no mitigation is proposed for their early removal.

REC-3: Swimming and Other Direct Water Contact Restriction. TKPOA will design and carry out a homeowner, renter, and rental agency information campaign notifying them of the CMT and warning against direct water contact throughout the CMT until monitoring determines warning can be lifted. The campaign will employ e-mails, flyers, letters, TKPOA's periodical (The Breeze), and social media. In addition, adequate signage shall be displayed by TKPOA 30 days prior to project implementation, during project implementation, and 14 days after project completion in a publicly visible location immediately adjacent to all CMT test locations and at the intersection of Tahoe Keys Blvd. and Venice Drive to inform property owners and visitors about the need to avoid direct water contact.

The project would implement TR-1, which includes a homeowner, renter, and rental agency information campaign to give advance notice of the restrictions during the test period, including the display of adequate signage in the area. REC-1 would also be implemented, which requires the CMT to be conducted before the beginning of the peak recreational boating season, generally considered to begin with Memorial Day weekend. Implementation of TR-1 and REC-1 are expected to maintain project-related impacts on loss of public access for recreational boating to a less-than-significant level.

3.4.2.2 Action Alternative 1 (Testing Non-Herbicide Methods Only)

The Regulatory Setting and Environmental Setting for this issue under Action Alternative 1 are the same as those described for the Proposed Project above.

Potential Impacts

Issue RE-1: Obstruction of Direct Private Access to Lake Tahoe for Recreational Boating. Effects of Action Alternative 1 on recreational boating would be entirely avoided because no barriers would be required to be placed in Tahoe Keys for non-herbicide testing of ultraviolet light and LFA. Therefore, under the Non-Herbicide Alternative, no property owners' sites would be obstructed from dock usage to access Lake Tahoe. **No impact would result.**

Issue RE-2: Increased use of the Tahoe Keys Marina and Other Facilities. No property owners' sites would be obstructed from dock usage to access Lake Tahoe resulting in an increased use of Tahoe Keys Marina. **No impact would result.**

Issue RE-3: Inconsistency with TRPA Recreation Thresholds

R-1. High Quality Recreational Experience. Implementation of Action Alternative 1 would not adversely affect the attainment status of the R-1 threshold. **No impact would result.**

R-2. Public's Fair Share of Resource Capacity. Action Alternative 1 would not affect the public's fair share of the region's outdoor recreation capacity. **No impact would result.**

Mitigation Measures

No mitigation would be required, as no impacts to recreational boating would occur.

Significant Unavoidable Impacts

No significant unavoidable impacts would occur for recreation.

3.4.2.3 Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

The Regulatory Setting and Environmental Setting for this issue under Action Alternative 1 are the same as those described for the Proposed Project above.

Potential Impacts

Issue RE-1: Obstruction of Direct Private Access to Lake Tahoe for Recreational Boating. The effects of Action Alternative 2 for Issue RE-1 on recreational boating would differ from the Proposed Project because turbidity curtains would not be placed in the same locations as would be used to control the effects of herbicides (since herbicides would not be tested under this alternative). Rather, turbidity curtains would be placed in the three lagoons selected for testing dredging and substrate replacement (see Figure 2-9). For those property owners with docks located within these test sites (numbered 28-30), their docks and moorings would be removed during the period of dredging and substrate replacement. Including mobilization and demobilization, Section 2.5 states that approximately six months may be required to complete operations for Action Alternative 2, including up to 4.5 months in each lagoon.

> *The actual dredging operation might sequentially require three weeks at Site 29; six weeks at Site 28; and seven weeks at Site 30, for a total of 16 weeks. Considering staging of work, the overall project might require 2.5 to 4.5 months in each area, including preparation and cleanup, and a total period of six months for all three sites.*

For the Dredge and Replace Substrate Alternative, the barriers at Sites 28-30 would block a total of 57 slips or 171 moorings on each day during the test period, comprising six percent of Tahoe Keys boat slips, and causing an aggregate loss of up to 5,814 direct access days at three sites (for up to 4.5 months at each site over the test period), or the probable loss of about 1,938 active boat-user days. Because effects would occur for only one recreation season, effects in the Tahoe Keys would be temporary and therefore **less than significant** for the Action Alternative 2. For Lake Tahoe as a whole, effects also would be **less than significant**.

Issue RE-2: Increased use of the Tahoe Keys Marina and Other Facilities. The displacement of launches from a total of 57 slips could increase the current number of launches from Tahoe Keys Marina. The result could be overcrowding and over-use of the existing facilities that could lead to physical deterioration ultimately leading to repair or replacement.

Since Tahoe Keys Marina is a privately-owned marina, the owner could choose to limit the number of launches per day and boat users could be forced to travel to a different boat ramp/launch facility. Boat users that travel to a different boat ramp/launch facility could increase the use of existing recreational facilities. This increased use is not expected to require the construction or expansion of recreational facilities, because the increase is expected to be temporary. Any construction or expansion of recreational facilities would require the approval of TRPA and the Lahontan Water Board (California only). Because the possible increase would be limited to one recreation season, is not expected that any private or public facility would consider constructing or expanding their facilities due to a one season increase. In addition, many owners would likely choose to launch from the Tahoe Keys Marina before considering other facilities due to its proximity. As a result, the number of owners that travel to a different boat ramp/launch facility will be less than the current number of launches from Tahoe Keys Marina. Use of those facilities will likely be distributed throughout the boating season, among different facilities. Therefore, the temporary nature of the increase is not expected to result in substantial physical deterioration of recreational facilities in the South Lake Tahoe area.

Because this impact is temporary, lasting only one recreation season and because the owner could choose to manage the number of boats launched, it is considered **less than significant**.

Issue RE-3: Inconsistency with TRPA Recreation Thresholds. For Threshold R-1. High Quality Recreational Experience, although Action Alternative 2 could temporarily result in the loss of the opportunity to directly access Lake Tahoe for boating from parts of the Tahoe Keys for extended periods where testing would occur, the evaluation of this threshold is geared toward public recreational experience in the Lake Tahoe Basin, and would not adversely affect the attainment status of the R-1 threshold. **No impact would result**. For Threshold R-2. Public's Fair Share of Resource Capacity, the public's fair share of the region's outdoor recreation capacity would not be affected, and **no impact would result.**

Resource Protective Measures

Measures-REC-1 and REC-4 described above for the Proposed Project would be applied to the Dredge and Replace Substrate Alternative. REC-2 would not be possible to apply, due to the extended (six-month) duration of this alternative, andREC-3 is applicable only to herbicide use.

Significant Unavoidable Impacts

No significant unavoidable impacts would occur for recreation**.**

3.4.2.4 No Action Alternative

The Regulatory Setting and Environmental Setting for Issue RE-1 under the No Action Alternative are the same as those described for the Proposed Project above.

Potential Impacts

Issue RE-1: Obstruction of Direct Private Access to Lake Tahoe for Recreational Boating. No impacts to recreational boating access were identified for Issue RE-1 under the No Action Alternative. Assuming that existing measures to control weeds in the lagoons by harvesting and other methods continue to be implemented, boating use would continue as it is. However, if as a result of No Action aquatic weeds are not effectively controlled in the long term, the unremediated invasion of weeds in the Tahoe Keys lagoons could continue to affect Lake Tahoe and could diminish the quality of recreational boat use in the lake. Quantifying this impact would be speculative, but this could become a **potentially significant** impact.

Issue RE-2: Increased use of the Tahoe Keys Marina and Other Facilities. No property owners' sites would be obstructed from dock usage to access Lake Tahoe resulting in an increased use of Tahoe Keys Marina. The No Action Alternative 1 would have no impact on Tahoe Keys Marina.

Issue RE-3: Inconsistency with TRPA Recreation Thresholds. R-1. High Quality Recreational Experience. As discussed previously, under the No Action Alternative, if aquatic weeds are not effectively controlled in the long term, the unremediated invasion of weeds in the Tahoe Keys lagoons could continue to affect Lake Tahoe and could diminish the quality of recreational use in the lake. This would **adversely affect** the attainment of threshold R-1 established for the preservation and enhancement of a high-quality recreation experience in the Lake Tahoe Basin.

R-2. Public's Fair Share of Resource Capacity. The No Action Alternative would not affect the public's fair share of the region's outdoor recreation capacity. **No impact would result.**

Mitigation Measures

No mitigation is proposed for this issue under the No Action Alternative, beyond the continued harvesting of aquatic weeds as currently practiced by the TKPOA.

Significant Unavoidable Impacts

Long-term **significant unavoidable impacts** to recreational boating could accumulate for this issue under the No Action Alternative, if the continued harvesting of aquatic weeds as currently practiced by the TKPOA is ineffective in preventing the spread of the weeds to Lake Tahoe.

4.1 DEFINITIONS AND APPROACH

4.1.1 Definitions of Cumulative impacts

TRPA Definition of Cumulative Impacts

TRPA has not established a definition of cumulative impacts. Rather, TRPA looks to NEPA and CEQA definitions of cumulative impacts for impact assessments.

CEQA Definition of Cumulative Impacts

CEQA Guidelines (CCR Section 15355) defines cumulative impacts as follows:

> *"Cumulative impacts" refers to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.*
>
> *(a) The individual effects may be changes resulting from a single project or a number of separate projects.*
>
> *(b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.*

4.1.2 Approach to the Cumulative Impact Analysis

CEQA (CCR Section 15130) provides that cumulative impacts analysis may be undertaken in one of two ways:

> *Either: (A) A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency, or (B) A summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or areawide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the lead agency.*

This EIR/EIS adopts the first approach, that is, utilizing a list of past, present, and probable future projects as the basis for the cumulative impact analysis.

The cumulative effects analysis is required to discuss not only approved projects under construction and approved related projects not yet under construction, but also unapproved projects currently under environmental review with related impacts or which result in significant cumulative impacts. This analysis should include a discussion of projects under review by the Lead Agency and projects under review by other relevant public agencies.

Geographic Scope of Effects of the Project

Table 4.1-1 defines the geographic scope of the effects of the proposed action and alternatives for each of the resources addressed in this EIR/EIS.

Table 4.1-1 Geographic Scope of Cumulative Impacts for Resources with Potential Impacts Considered in the EIR/EIS.

Resource Area	Geographic Scope
Air Quality/Greenhouse Gas	Air Quality: Lake Tahoe Air Basin GHG: NA (global)
Aquatic Resources	Proposed project/action alternatives: Tahoe Keys West Lagoon and Lake Tallac No action alternative: Lake Tahoe
Earth Resources	Test program implementation area (Tahoe Keys)
Environmental Health and Risk	Test program implementation area (Tahoe Keys West Lagoon and Lake Tallac) and other receiving waters (Lake Tahoe)
Hydrology	Test program implementation area (Tahoe Keys) and connected waters including Lake Tallac and Pope Marsh
Land and Shoreline Use	Tahoe Keys and environs
Noise	Tahoe Keys and environs
Recreation	Tahoe Keys Lagoons, Tahoe Keys Marina, Lake Tallac and Lake Tahoe
Terrestrial Resources, including Wetlands	Test program implementation area (Tahoe Keys lagoons and environs, including the CMT and dredge test sites and the WTP site), and surrounding habitat
Traffic and Transportation	Tahoe Keys and Boat/Truck Transport Routes for Action Alternative 2
Utilities	Test program implementation area (Tahoe Keys) and source waters for purveyors
Water Quality	Test program implementation area (Tahoe Keys West Lagoon and Lake Tallac) and receiving waters in Lake Tahoe, and Pope Marsh

Content of the Cumulative Effects Discussion

The cumulative impacts discussion will include or address these things:

- The nature of each environmental resource being examined (refer to Chapter 3).
- The location of the project and its type (refer to Chapter 2).
- The geographic scope of the area affected by the cumulative effect (Table 4-1).
- A summary of the expected environmental effects to be produced by related projects, with specific reference to additional information stating where that information is available.
- Reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

Considerations in Cumulative Effects Analysis

An EIR may determine that a project’s contribution to a significant cumulative impact will be mitigated to a less-than-significant level and thus is not significant.

A project’s contribution is less than cumulatively considerable and therefore less than significant if the project is required to implement or fund its fair share of mitigation measures designed to alleviate the cumulative impact.

An EIR may determine that a project's contribution to a significant cumulative impact is de minimis and thus not significant. A de minimis contribution means that the environmental conditions would essentially be the same whether or not the proposed project is implemented.

Significance Criteria

When considering cumulative impacts of the Project, the environmental consequences of project-related actions were evaluated, using the criteria in Appendix G of the CEQA checklist, to determine whether implementing such actions would make a cumulatively considerable contribution to a significant cumulative impact.

The effects of project actions were evaluated in combination with the effects of other past, present, and reasonably foreseeable future actions to determine whether (1) the overall cumulative impact would be significant and (2) the actions would considerably contribute to that overall cumulative impact. Both circumstances must exist to conclude that an environmental consequence would be cumulatively significant.

Cumulatively significant effects would do any of the following:

- Cause a significant adverse impact on a resource (using the thresholds of significance described in Section 3.1.1 above).
- Make a considerable contribution to the trend of an already degraded or declining resource that has experienced substantial adverse effects from other past, present, or reasonably foreseeable future projects.
- Cause an effect that was initially not significant by itself, but that would be part of a cumulatively degrading or declining future trend resulting from other reasonably foreseeable future actions.

The potential cumulative impacts that would be significant based on the criteria above may be reduced to a less-than-significant level if the project would comply with the requirements of an approved plan or mitigation program designed to reduce the project's potential incremental contribution to a cumulative effect to a level that is not cumulatively considerable. The approved plan or mitigation program must contain specific requirements that, if implemented, would avoid or substantially lessen the cumulative problem within the geographic area where the effect would occur.

4.1.3 Related Projects Considered in the Cumulative Impact Analysis

Probable future projects may include:

- Private projects requiring agency approval for an application which has been received at the time the NOP is released, unless a project has been abandoned by the applicant.
- Public projects for which money has been budgeted or included in an adopted capital improvement program, general plan, regional transportation plan, or other similar plan.
- Projects included in a summary of projects in a general plan or similar plan.
- Projects anticipated as later phases of a previously approved project.

Past, present and probable future projects considered for this EIR/EIS are listed below. Anticipated timelines for implementation of the listed projects are included in the description of each project, though it is noted that project implementation schedules could be affected by the current COVID-19 pandemic.

TRPA Permit Actions

Lakewide Aquatic Invasive Plant Control Project. Proposed by the Tahoe Resource Conservation District (Tahoe RCD) on behalf of the Tahoe Aquatic Invasive Species Coordination Committee (AISCC), this long-term program is aimed at prevention, early detection and ongoing monitoring of aquatic invasive plant species, particularly Eurasian watermilfoil and curly-leaf pondweed, in Lake Tahoe. Methods initially consisted of light-blocking bottom barriers and hand removal of invasive plants; later methods introduced ultraviolet light as a tool for aquatic weed management. The program targets identified areas of aquatic invasive plant infestation and potentially suitable habitat within the lakeshore, nearshore and backshore of Lake Tahoe and a three-mile length of the Truckee River. Efforts under the program have focused on Lake Tahoe and the lake's tributaries; however, the initial project scope identified 2.9 acres within Tahoe Keys lagoons as an area of known weed infestation. The program was anticipated to result in increased boat traffic in target areas; mitigation measures, including public noticing and scheduling of work outside of periods of busy recreational boat use (such as summer holidays) were identified to reduce the impact. Boats used to implement the various methods were also anticipated to generate noise and burn fuels resulting in air and greenhouse gas emissions at levels that would not exceed established noise or emissions thresholds of regional agencies. Additionally, disturbance to the lakebed (turbidity) and desirable native plants was expected to occur, though these impacts of the program were found to be less than significant with mitigation. Project implementation began in the summer of 2014 and remains ongoing as new methods and the effectiveness of existing methods are continually evaluated.

Target Invasive Fish Control Program at Lake Tahoe. This joint effort by the Tahoe RCD and TRPA consists of a selection of non-chemical, mechanical methods to reduce non-native invasive fish species, thereby improving water quality and fostering greater abundance of native and desirable non-native recreational fish populations in Lake Tahoe. These methods include but are not limited to electrofishing (to stun fish), nets, traps and sport fishing, and they would be implemented lakewide in all tributaries and shallow areas of the lake where invasive species could occur. High priority target areas where invasive fish species have been identified include the Tahoe Keys and proximate nearshore areas in Lake Tahoe. The program could result in increased boat traffic in target areas, though recreational anglers' and sport fishers' boats would be restricted in the navigation lanes of Tahoe Keys to preserve safety. Minor, temporary turbidity from streambed disturbance could occur from some methods, such as those that involve wading or nets being dragged along the lake bottom. Boats used to implement the various methods would generate noise and burn fuels resulting in air and greenhouse gas emissions, though not at levels that would exceed established noise or emissions thresholds of regional agencies. Funding for the program is currently limited to planning, environmental review and permitting, with program implementation to occur once additional funding is secured.

TRPA Shoreline Plan Update. TRPA last updated its Shoreline Plan in October 2018 to amend existing regulations governing permitting of public and private piers, motorized watercraft moorings (buoys, slips and boat houses), boat ramps, marinas and other similar structures such as breakwaters and jetties that are associated with habitat restoration projects. The Shoreline Plan Update also establishes motorized watercraft speed limits to minimize wake near the shore and non-motorized recreational watercraft, and it creates a funding source and boater education program to augment its existing boat inspection program for management of aquatic invasive species. The physical elements addressed in the Plan (piers, moorings, ramps and marinas) potentially affect the aesthetics and scenic quality of the lake's shoreline, as well as the quality of fish habitat and spawning areas, which are addressed by the modified regulations of the Shoreline Plan. The Shoreline Plan specifies limits on the rate of new pier development, though boating activity is still projected to have some increase, with consequential increases in air and greenhouse gas emissions from engines. Engine noise generated by the increased boat use would be managed by regulations of the Plan. The policies of the Shoreline Plan were codified as amendments to applicable chapters of the TRPA Code of Ordinances in late 2018. The regulations would apply to the entirety of the Lake Tahoe shorezone, generally defined as that area between where the lake depth reaches 30 feet and that part of the shore that is 10 feet inland from the wave run-up area. Development standards of the Shoreline Plan apply to the Tahoe Keys Marina but do not apply to the private docks and slips in the Tahoe Keys lagoons.

Tahoe Keys Aquatic Invasive Weed Management Program. This long-term aquatic invasive weed management program would be developed following completion of the Proposed Project or selected Action Alternative in late 2023. As described in Chapter 2 of this DEIR, prior to implementation of this Program, additional environmental review will be conducted to inform selection of the long-term strategy for management of the target aquatic weed populations in the Tahoe Keys lagoons. TKPOA would implement the program under permit from TRPA and the Lahontan Water Board. Potential impacts of the Program would be similar to those identified for the CMT or a selected Action Alternative, but probably more extensive. Timing for implementation of the Program will depend on the length of time needed to develop the preferred weed control method program and complete the requisite environmental review.

Upper Truckee River Marsh and Restoration Project. Implemented by the California Tahoe Conservancy, this project will restore river and floodplains on approximately 500 acres of recreational area in the Upper Truckee River Marsh located just north of the Tahoe Keys development and the Tahoe Keys Marina. The project will help to facilitate the clarity of Lake Tahoe and will enhance native species' habitat and climate change resiliency of the marsh and its environs. Construction of the project will occur over several years starting in 2020. The initial stage of the project consists of restoration of historic river channels, conversion of a "Sailing Lagoon" to functioning wetland, removal of previously placed fill, and trail improvements. Project implementation will ultimately have beneficial impacts to lake water quality and biological resources but will temporarily affect recreational access to the marsh and generate short-term construction-related vehicle trips and equipment noise and air emissions. Construction of this initial stage of the project began in April 2020, with construction expected to be complete before 2021 and monitoring expected to continue between 2021 and 2023.

Meeks Bay Ecosystem Restoration Project (EIP Project No. 01.02.02.0039). This project is a joint effort by the TRPA, Lake Tahoe Basin Management Unit and Lahontan Water Board, with the U.S. Forest Service as the primary agency on the project. The project would remove a 120-slip marina from Meeks Creek and lagoon and restore the creek and lagoon to more closely match the area's natural condition, with improved habitat for native aquatic and terrestrial species. The project includes installation of a new, 300-foot long pier for temporary mooring of 10 to 20 day-use boats; an aquatic invasive species inspection station; pedestrian connectivity routes; and a reconstructed campground. The project is related to the Meeks Bay Aquatic Invasive Species Control Project (EIP No. 01.04.02.0057), a three-year long effort starting in 2019 to utilize mechanical methods to remove Eurasian watermilfoil from the Meeks Bay marina and creek; the restoration project would remove any invasive plants remaining after completion of that effort. Environmental review of the project is currently underway; construction is estimated to occur between 2023 and 2027. During and after construction of the project, recreational boating opportunities to and from Meeks Bay would be reduced. The Meeks Bay and Marina is located off State Route 89, approximately 9 miles northwest of the Tahoe Keys lagoons.

Forest Fuels Reduction

Lake Tahoe West Restoration Project. An effort of the Lake Tahoe Conservancy, the Lake Tahoe West Restoration Project is a multi-jurisdictional approach toward restoring resiliency and habitat value of lands surrounding the west shore of Lake Tahoe. The project is among several related regional projects aimed at reducing catastrophic fire danger threat in the Lake Tahoe basin. Related projects that will be included in the environmental analysis of this project include the West Shore Wildland Urban Interface Hazardous Fuels Reduction Program (EIP Project No. 02.01.01.0131), the Program Timberland Project (EIP Project No. 02.01.01.0146), and the Liberty Resilience Corridor Project. The Lake Tahoe West Restoration Project consists of forest thinning of overly dense forest stands to reduce fire fuel accumulation and improve overall forest health. Forest thinning would be conducted using a variety of approaches that include mechanical pruning and prescribed burns. Forest thinning occurring on steep slopes would require cuttings to be burned in piles or removed by helicopter. The project also includes reforestation using native species; aquatic, meadow and aspen forest restoration; and management of aquatic invasive species using non-chemical control methods. The project could increase traffic volumes as a result of transport of pruned materials, and regional emissions of greenhouse gases and particulate matter would be expected to occur as a result of prescribed burns, vehicle and/or helicopter engine operations, and release of sequestered carbon from tree removal. The project area encompasses 19,500 acres between Dollar Point and Emerald Bay, the latter of which is approximately 4 miles northeast of the Tahoe Keys lagoons. The project is currently in the environmental review phase and notice of preparation of an EIR was released in April 2020. Project operations are anticipated to commence in 2022.

Pesticide Applications

County of El Dorado Vector Control Pesticide Application Plan (PAP). Implemented by the County of El Dorado Environmental Management Department, the PAP is a regional program for management of mosquito populations in standing water bodies (such as abandoned swimming pools, snow melt ponds and roadside ditches), utilizing a combination of physical, cultural, biological and chemical techniques. The PAP is recurrent each year, with application areas throughout the County. In the Proposed Project area, applications of larvacides and insecticides targeting mosquito populations have been made at locations south of the Tahoe Keys development, along Texas Avenue and in the meadow south of Venice Drive. Some terrestrial insecticide applications for yellowjackets have been made on properties in the Tahoe Keys. No chemical pesticide applications have been performed in the Tahoe Keys lagoons in recent years, and none are anticipated to occur in the future (Bender, pers. comm.)

Traffic/Transportation

U.S. 50 South Shore Community Revitalization Project. This Project is a combined effort of the Tahoe Transportation District (TTD), Federal Highway Administration, (FHWA) California Department of Transportation (Caltrans) and Nevada Department of Transportation (NDOT) to support revitalization of the planning area, which is defined as the right-of-way and adjacent properties along U.S. Highway 50 from 0.25 mile west of Pioneer Trail in South Lake Tahoe to Nevada State Route 207 in Douglas County. The project consists of a program of transportation system improvements to reduce automobile congestion, enhance bicycle and pedestrian safety, and improve transit services, in turn benefiting the economic vitality and redevelopment opportunities in the project area. TTD, TRPA, the City of South Lake Tahoe and Douglas County are currently developing a Main Street Management Plan that will include street design details and parking and transit strategies. Specific improvements identified in the U.S. 50 South Shore Community Revitalization Project are currently unfunded with no specific timeline for completion. The planning area is approximately 3 miles northeast of the Tahoe Keys development.

U.S. Highway 50 Corridor Collision Reduction (EIP Project No. 03.01.01.0021). Implemented by Caltrans, this project consists of installation of roadway lighting, and pedestrian and bicycle safety improvements from the “Y” intersection of U.S. Highway 50 and State Route 89, northeast to U.S. Highway 50 and Park Avenue. A segment of the improvements is within 1 mile of the Tahoe Keys development. Design of the improvements is currently underway, with construction scheduled to occur between 2023 and 2027. Depending on more precise scheduling, project construction could overlap with implementation of the CMT or selected Action Alternative and could result in delays or re-routing of trucks if the dredge and substrate replacement alternative is implemented.

Pavement Resurfacing on U.S. Highway 50 from “Y” Junction to California/Nevada Stateline (EIP Project No. 06.01.03.0005). This roadway maintenance project will replace the surface pavement of a stretch of U.S. Highway 50, between the highway’s intersection with State Route 89 and the California/Nevada state border. A portion of the project area is within one mile of the Tahoe Keys development. The project is being implemented by Caltrans, and design of the improvements is scheduled to begin in 2022. Construction of the improvements is currently scheduled to occur between 2025 and 2027 and would follow completion of the selected CMT or Action Alternative.

Waste Discharge Regulations and Section 401 Permits

Aquatic Weed Control in the Tahoe Keys Lagoons (WDR Order R6T-2014-0059). Waste Discharge Requirement (WDR) Order No. R6T-2014-0059 issued to TKPOA by the Lahontan Water Board, prohibits chemical discharges and illicit discharges such as paint, detergents and chlorinated pool water to the Tahoe Keys lagoons and Lake Tahoe. Conditions of the WDR require TKPOA to prepare and implement an integrated management plan (IMP) for aquatic invasive weeds in the Tahoe Keys lagoons. The IMP must specify non-chemical means for control of aquatic weeds and weed fragments to prevent further dispersion. Order No. R6T-2014-0059 authorizes current aquatic invasive weed management methods by the TKPOA, which could continue to include harvesting and bottom barriers beyond the CMT application areas. Watercraft currently used in weed harvesting operations under the permit would continue with existing effects on recreational boat usage in the lagoons. The authorizations granted under Order No. R6T-2014-0059 do not expire, though the Lahontan Water Board generally reviews orders every 10 years to determine if they should be re-issued, amended or revoked.

Lake Tallac Yellow Pond Lily Weed Abatement Project. This project will be implemented by TKPOA under the existing Lahontan Water Board WDR Order No. R6T-2014-0059. The Yellow Pond Lily is a native aquatic plant; however, in recent years, TKPOA has observed an exponential growth of the plant in Lake Tallac and the canal connecting Lake Tallac to the Tahoe Keys lagoons. The effort includes installation of curtains to contain turbidity and aquatic plant fragments, followed by mechanical removal of Yellow Pond Lily specimens from the Lake Tallac Canal. Plant removal will be conducted by divers. Management of the Yellow Pond Lily is intended to prevent spread of the plant into Lake Tahoe, improve aquatic habitat and water quality, reduce algal blooms, and protect recreational boating opportunities in the Tahoe Keys lagoons. The project would require short-term use of boats in the vicinity of Tahoe Keys but is ultimately intended to support recreational boat use in the Tahoe Keys lagoons. Work is scheduled to occur in July 2020 with monitoring ongoing through 2021.

Dock, Pier and Bulkhead Replacement. In accordance with Section 401 of the federal Clean Water Act, the Lahontan Water Board issues Section 401 permits for any activity that might result in discharge to waters of the state. In recent years, in the Tahoe Keys lagoons, Section 401 permits have been issued for bulkhead repair, revetment installation, and a laminar flow test project for removal of aquatic invasive weeds. These types of activities, along with dock and pier replacement and repairs, have the potential to increase turbidity and release aluminum from soil disturbance in the lagoons. Section 401 permits for projects located in the Tahoe Keys lagoons are generally issued at a rate of one to two permits per year.

4.2 ENVIRONMENTAL HEALTH

Geographic Scope of Effects

The geographic scope of effects for environmental health/risk is the East Lagoon and Lake Tallac where activities are proposed under the CMT and action alternatives, and greater Lake Tahoe.

Related Projects

- Dock, pier, and bulkhead replacement: Boat docks and bulkheads on private residences and TKOA properties at Tahoe Keys shorelines require repairs and replacement from time to time, and a larger program of bulkhead replacement may be necessary in the future where existing structures are becoming more vulnerable to instability. Pier replacement and other sediment-disturbing projects are also approved from time to time at other areas around Lake Tahoe. These projects all require permits with conditions to minimize sediment disturbance and turbidity caused during construction.

- Upper Truckee River and Marsh Restoration Project: Sediment disturbance and short-term turbidity increases could occur during filling of the Sailing Lagoon area on the east side of the East Lagoon near its mouth.

- Tahoe Keys Aquatic Invasive Weed Management Program: This long-term aquatic invasive weed management program would be developed and implemented following completion of the Proposed Project or selected Action Alternative in late 2023, with similar environmental issues as the Project or alternative but possibly with greater intensity.
- County of El Dorado Vector Control Pesticide Application Plan (PAP): The County of El Dorado Environmental Management Department's regional program for management of mosquito

populations in standing water bodies utilizes a combination of physical, cultural, biological and chemical techniques.

- Aquatic Weed Control in the Tahoe Keys Lagoons (WDR Order R6T-2014-0059): TKPOA's current aquatic invasive weed management program, authorized by the Lahontan Water Board, includes non-chemical weed removal methods such as harvesting and bottom barriers that could cause sediment disturbance.
- Lake Tallac Yellow Pond Lily Weed Abatement Project: Diver hand removal of Yellow Pond Lily from Lake Tallac and the Lake Tallac canal could cause sediment disturbance in the areas of work. Curtains would be installed to contain turbidity and aquatic plant fragments. Work is scheduled to occur in July 2020 with monitoring ongoing through 2021.
- Lakewide Aquatic Invasive Plant Control Project. Under this program, methods currently evaluated for use in removal of aquatic invasive plant species from Lake Tahoe and the Truckee River include light-blocking bottom barriers, hand removal, and ultraviolet light. Environmental analysis of the program anticipated turbidity impacts due to disturbance to the lakebed from barriers and hand removal, though these impacts of the program were found to be less than significant with mitigation.
- Target Invasive Fish Control Program at Lake Tahoe: The non-chemical, mechanical methods to reduce non-native invasive fish species from Lake Tahoe and its tributaries could include wading or nets dragged along the lake bottom for fish capture, causing disturbance to the lakebed. The partially funded program is currently in planning phases.

No other related projects have been identified that could cumulatively affect environmental health when combined with the Proposed Project or its Action Alternatives. There is no past, present, or reasonably foreseeable future projects that would use aquatic herbicides within the geographic scope of effects of the Proposed Project. Because several years would pass between the Proposed Project and approval of any long-term aquatic weed management program for the Tahoe Keys lagoons, there would be no potential carry-over effects if the approved long-term program were to include herbicide treatment. The El Dorado County Vector Control District provides mosquito control services in South Lake Tahoe and El Dorado County, including the application of insecticides that target mosquito larvae (EDCVCD 2020). However, they do not use any insecticides that would interact with the aquatic herbicides proposed for use in the Tahoe Keys lagoons, and the lagoons are not among the areas they have treated with insecticides. Removal of the Yellow Pond Lily from Lake Tallac would precede implementation of the Proposed Project by several months and would not compound effects of the Proposed Project. Similarly, no specific efforts under the Lakewide Aquatic Invasive Plant Control Project or Target Invasive Fish Control Program are underway or scheduled to occur during implementation of the Proposed Project. There are no projects known to increase the risk of HABs and cyanotoxins in the Tahoe Keys or other areas of Lake Tahoe.

However, any projects or activities that disturb bottom sediments (e.g., pier or piling removal or replacement, replacement or repair of bulkheads, maintenance dredging, bottom barrier removal, filling the Sailing Lagoon, etc.) in the West Lagoon, East Lagoon, or other areas of Lake Tahoe found to have elevated aluminum concentrations have the potential to exceed aquatic toxicity water quality criteria for aluminum.

Proposed Project (Control Methods Test)

Issue EH-5: Short-term Increases in Aluminum Concentrations. Short-term exceedances of aluminum criteria have not been documented within the geographic scope but may have occurred during past sediment-disturbing activities in the Tahoe Keys Lagoons, including the West Channel dredging and beach replenishment project, other maintenance dredging projects, and the removal of bottom barriers. The potential for exceedances under such circumstances would be limited to during and a few hours after the activity, when waters are highly turbid. This kind of effect would be anticipated with bottom barrier removal and other activities proposed in the CMT, but because other sediment-disturbing projects or activities would not be occurring in the lagoons at the same time as CMT activities and because the duration of effects would be very short, the potential for cumulative impacts is not considered significant.

Lahontan Water Board sampling and analysis of sand from 8 beaches around Lake Tahoe found widespread elevated concentrations of aluminum, including concentrations at Tahoe City Beach and El Dorado Beach that were similar to TKPOA samples analyzed for the West Channel dredging and beach replenishment project (LRWQCB 2016). Where sediment aluminum concentrations are high, such as in the Tahoe Keys, in-water construction and maintenance activities (e.g., pier replacement, maintenance dredging, etc.) have the potential to cause exceedances of aquatic toxicity water quality criteria. Short-term exceedances of criteria for aluminum could also occur during sediment disturbance associated with filling the Sailing Lagoon area of the East Lagoon. However, fish and other aquatic life are generally able to swim away and avoid exposure. Therefore, the overall cumulative impacts on aquatic life in Lake Tahoe is considered **less than significant**.

Action Alternative 1 (Testing Non-Chemical Methods Only)

Issue EH-5: Short-term Increases in Aluminum Concentrations. Sediment-disturbing activities associated with the non-herbicide tests conducted under the CMT would be the same under Alternative 1 as the Proposed Project, and therefore the potential cumulative effects of short-term increases in aluminum concentrations would be the same. These short-term increases in aluminum were considered less than significant for the Proposed Project and would be **less than significant** for Action Alternative 1.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue EH-5: Short-term Increases in Aluminum Concentrations. There is a potential that localized sediment disturbance from the small-scale use of bottom barriers and their removal could coincide with suction dredging and/or substrate replacement in the West Lagoon. However, because localized bottom barrier removal would not be occurring in the same locations as suction dredging, and because potential short-term exceedances of aluminum criteria from the dredging and substrate replacement activities would be contained behind turbidity curtains, potential cumulative impacts to aquatic life in the West Lagoon would be **less than significant** for Action Alternative 2. Potential cumulative impacts on aquatic life in Lake Tahoe would also not be significant because fish and other aquatic life are generally able to swim away and avoid exposure.

No Action Alternative

Issue EH-5: Short-term Increases in Aluminum Concentrations. Short-term exceedances of aluminum criteria from small-scale disturbance of bottom sediments during currently approved programs for bottom barriers, LFA, and other aquatic weed control activities under the No Action Alternative are expected to be minimal and would not contribute significantly to overall aquatic life exposure to aluminum in Lake Tahoe. No new sediment disturbance beyond the continued placement of bottom barriers would occur under the No Action Alternative. No Action would not affect these ongoing maintenance actions, and therefore there would be no cumulative effects.

4.3 NATURAL ENVIRONMENT

4.3.1 Earth Resources

Geographic Scope of Effects

The geographic scope of effects for Earth Resources is the Tahoe Keys lagoons, including dredge test sites and the WTP site.

Related Projects

No related past, present or reasonably foreseeable projects have been identified that would cumulatively affect the earth resources of the Tahoe Keys project area in concert with the Proposed Project or its alternatives.

Proposed Project (control Methods Test), Action Alternatives and No Action Alternative

No potential cumulative impacts to earth resources arising from the implementation of the Proposed Project (CMT), the Action Alternatives or the No Action Alternative have been identified.

4.3.2 Air Quality and Greenhouse Gas

Geographic Scope of Effects

The geographic scope of effects for air quality is the Lake Tahoe Air Basin.

Related Projects

- Lake Tahoe West Restoration Project: Forest thinning under the project could include mechanical pruning and prescribed burns, including pile burning of materials pruned on steep slopes. The Project is currently in the environmental review phase and notice of preparation of an EIR was released in April 2020. Project operations are anticipated to commence in 2022.

Regional emissions of particulate matter would be expected as a result of prescribed burns; however, as noted in the notice of preparation for the project, prescribed burns would only be conducted when conditions comply with relevant air quality regulations and the project would commence after implementation of the CMT or selected Alternative. No other related past, present or reasonably foreseeable projects have been identified that would individually exceed an established air quality plan or emission threshold and thereby cumulatively affect the air quality of the Lake Tahoe Air Basin or the Tahoe Keys project area in concert with the Proposed Project or its alternatives.

Proposed Project (Control Methods Test)

Issue AQ-3: Cumulative Net Increases of Criteria Pollutants. The Proposed Project would result in emissions of criteria pollutants from on-road vehicle and watercraft engine exhaust. These emissions are short-term in nature but can have the potential to contribute to air quality impacts. However, emissions generated by the CMT are expected to be more than offset by the reduction in emissions from recreational watercraft as turbidity curtains will be installed that will obstruct boat passage in large portions of the Keys (see Section 3.4.2 Recreation) during mobilization and testing and during the period when detection of herbicides and degradation products would exceed acceptable limits in receiving waters (up to 130 days). Project-related vehicle travel and subsequent emissions will occur for a limited duration and are expected to result in an insignificant change in the overall pollutant emissions resulting from transportation activities in the region. These less than significant effects could accumulate with impacts from other projects or contribute to a declining trend or affect an already degraded resource. However, projects that are consistent with established air quality plans and numerical emission thresholds are not considered to have aggregative effects that are cumulatively considerable (EDCAQMD, 2002). The Proposed Project is not expected to conflict with established air quality plans or exceed emission thresholds. Therefore, no cumulative effects are anticipated to occur under the Proposed Project.

Action Alternative 1 (Testing Non-Chemical Methods Only)

Issue AQ-3: Cumulative Net Increases of Criteria Pollutants. Action Alternative 1 would result in emissions of criteria pollutants from on-road vehicle and watercraft engine exhaust. Similarly, to the Proposed Project, these emissions are expected to be more than offset by the reduction in emissions from recreational watercraft during implementation due to restrictions on boat passage. These less than significant effects could accumulate with impacts from other projects or contribute to a declining trend or affect an already degraded resource. However, projects that are consistent with established air quality plans and numerical emission thresholds are not considered to have aggregative effects that are cumulatively considerable. Action Alternative 1 is not expected to conflict with established air quality plans or exceed emission thresholds. Therefore, no cumulative effects are anticipated to occur from Action Alternative 1.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue AQ-3: Cumulative Net Increases of Criteria Pollutants. Action Alternative 2 would result in emissions of criteria pollutants from equipment used for dredging, pumping, material handling, haul trucks importing and exporting materials, and vehicle travel from workers. As described in Section 3.2.2, these emissions were estimated using CalEEMod and watercraft emission factors provided by CARB. Based on the modeling, Action Alternative 2 is expected to result in 22.1 lbs/day of NO_x, 3.0 lbs/day of ROG, and 1.6 lbs/day of PM_{10}. These values are all below applicable significance thresholds. These less than significant effects could accumulate with impacts from other projects or contribute to a declining trend or affect an already degraded resource. However, projects that are consistent with established air quality plans and numerical emission thresholds are not considered to have aggregative effects that are cumulatively considerable (EDCAQMD, 2002). Action Alternative 2 will not conflict with established air quality plans or exceed emission thresholds. Therefore, no cumulative effects are anticipated to occur under the Proposed Project.

No Action Alternative

Issue AQ-3: Cumulative Net Increases of Criteria Pollutants. Because air emissions in the project area would continue unchanged under this alternative and No Action would not cause new effects, no cumulative effects are anticipated to occur under the No Action Alternative.

4.3.2.1 Green House Gas Emissions

Geographic Scope of Effects

The geographic scope of effects for GHG emissions is global.

Related Projects

Any past, present or reasonably foreseeable project in the Lake Tahoe area which burns fossil fuels would cumulatively affect GHG emissions in concert with the Proposed Project or its alternatives. The number and list of such projects are extensive and are typically recognized in State policy and at all scales more through comprehensive measures of greenhouse gas emissions and trends than by enumerating lists of specific projects.

Proposed Project (Control Methods Test)

Issue GHG-1: Cumulative Net Increase of Greenhouse Gas Emissions. The Proposed Project would result in GHG emissions from on-road vehicle and watercraft engine exhaust. Emissions generated by the CMT are expected to be more than offset by a reduction in emissions from recreational watercraft that will experience obstructed boat passage for up to 130 days. Project-related vehicle travel and consequent emissions will occur for a limited duration and are expected to result in a negligible contribution to overall GHG emissions resulting from transportation activities in the region. These emissions would represent a very small addition to global GHG concentrations and a correspondingly small contribution to global climate change. Given that these emissions would be offset as noted, the project's GHG emissions would not be a considerable contribution to the cumulative condition. Therefore, no cumulative effects are anticipated to occur under the Proposed Project.

Action Alternative 1 (Testing Non-Chemical Methods Only)

Issue GHG-1: Cumulative Net Increase of Greenhouse Gas Emissions. GHG emissions from Action Alternative 1 would be similar to those described above for the Proposed Project, however no offset would occur because no turbidity curtains would obstruct recreational boat use. Although quantitative modeling was not done for Action Alternative 1, anticipated emissions would fall well below CARB and SMAQMD significance thresholds, and by that measure, no cumulative effects would occur from Action Alternative 2. The CARB and SMAQMD significance thresholds were established to provide context for evaluating whether a project's contribution to the global impact of climate change is considered substantial. Projects with GHG emissions that are less than the significance threshold would not be expected to result in a cumulatively considerable contribution to global climate change (SMAQMD, 2019). Since GHG emissions under Action Alternative 1 will be short term, finite in nature rather than ongoing, and are below the CARB and SMAQMD significance thresholds, the project's GHG emissions would not be a considerable contribution to the cumulative condition. Therefore, no cumulative effects are anticipated to occur under Action Alternative 1.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue GHG-1: Cumulative Net Increase of Greenhouse Gas Emissions. Action Alternative 2 would result in GHG emissions from equipment used for dredging, pumping, material handling, haul trucks importing and exporting materials, and vehicle travel from workers. As described in Section 3.2.2, these emissions were estimated using CalEEMod and watercraft emission factors provided by CARB. Based on the modeling, Action Alternative 2 is expected to result in an estimated 200.8 $MTCO_2e$/yr. This value is well below CARB and SMAQMD significance thresholds and by that measure, no cumulative effects would occur from Action Alternative 2. As described for Action Alternative 1, the CARB and SMAQMD significance thresholds were established to provide context for evaluating whether a project's contribution to the global impact of climate change is considered substantial. Since GHG emissions under Action Alternative 2 will be short term, are finite rather than ongoing, and are below the CARB and SMAQMD significance thresholds, the project's GHG emissions would not be a considerable contribution to the cumulative condition. Therefore, no cumulative effects are anticipated to occur under Action Alternative 2.

No Action Alternative

Issue GHG-1: Cumulative Net Increase of Greenhouse Gas Emissions. Because GHG emissions in the project area would not be changed by No Action, no new effects would result, and no cumulative effects are anticipated to occur under the No Action Alternative.

4.3.3 Hydrology

Geographic Scope of Effects

The geographic scope of effects for Hydrology is the Tahoe Keys lagoons, Lake Tallac and Pope Marsh.

Related Projects

No related past, present or reasonably foreseeable projects have been identified that would cumulatively affect the hydrology of the Tahoe Keys project area in concert with the Proposed Project or its alternatives.

Proposed Project (Control Methods Test), Action Alternatives and No Action Alternative

No potential cumulative impacts to hydrology arising from the implementation of the Proposed Project (CMT), the Action Alternatives or the No Action Alternative have been identified.

4.3.4 Water Quality

Geographic Scope of Effects

The geographic scope of effects for water quality is the Tahoe Keys west Lagoon, Lake Tallac, Pope Marsh, and greater Lake Tahoe.

Related Projects

- Dock, pier, and bulkhead replacement: Boat docks and bulkheads on private residences and TKOA properties at Tahoe Keys shorelines require repairs and replacement from time to time, and a larger program of bulkhead replacement may be necessary in the future where existing structures are becoming more vulnerable to instability. Pier replacement and other sediment-disturbing projects are also approved from time to time at other areas around Lake Tahoe. These projects all require permits with conditions to minimize sediment disturbance and turbidity caused during construction.
- Upper Truckee River and Marsh Restoration Project: Sediment disturbance and short-term turbidity increases could occur during filling of the Sailing Lagoon area on the east side of the East Lagoon near its mouth.
- Aquatic Weed Control in the Tahoe Keys Lagoons (WDR Order R6T-2014-0059): TKPOA's current aquatic invasive weed management program, authorized by the Lahontan Water Board, includes non-chemical weed removal methods such as harvesting and bottom barriers that could cause sediment disturbance and turbidity.
- Lake Tallac Yellow Pond Lily Weed Abatement Project: Diver hand removal of Yellow Pond Lily from Lake Tallac and the Lake Tallac canal could cause sediment disturbance and turbidity in the areas of work. Curtains would be installed to contain turbidity and aquatic plant fragments. Work is scheduled to occur in July 2020 with monitoring ongoing through 2021.
- Lakewide Aquatic Invasive Plant Control Project. Under this program, methods currently evaluated for use in removal of aquatic invasive plant species from Lake Tahoe and the Truckee River include light-blocking bottom barriers, hand removal, and ultraviolet light. Environmental analysis of the program anticipated turbidity impacts due to disturbance to the lakebed from barriers and hand removal, though these impacts of the program were found to be less than significant with mitigation.
- Target Invasive Fish Control Program at Lake Tahoe: The non-chemical, mechanical methods to reduce non-native invasive fish species from Lake Tahoe and its tributaries could include wading or nets dragged along the lake bottom for fish capture. The partially funded program is currently in planning phases.
- Meeks Bay Ecosystem Restoration Project (EIP Project No. 01.02.02.0039): Along with the Meeks Bay Aquatic Invasive Species Control Project (EIP Project No. 01.04.02.0057), removal of the existing marina from Meeks Creek, installation of a new pier, and removal of invasive vegetation from Meeks Bay could increase turbidity in the Lake as a result of disturbance to the lakebed.

Within the Tahoe Keys, there are no other past, present, or reasonably foreseeable future projects that are expected to combine with Proposed Project activities to cause potentially significant cumulative impacts to water quality.

Removal of the Yellow Pond Lily from Lake Tallac would precede implementation of the Proposed Project by several months and would not compound effects of the Proposed Project. Similarly, no specific efforts under the Lakewide Aquatic Invasive Plant Control Project or Target Invasive Fish Control Program are underway or scheduled to occur during implementation of the Proposed Project. In Lake Tahoe, water quality improvement efforts are focused under the Total Maximum Daily Load (TMDL) implementation program, TRPA Environmental Improvement Program, and the Lake Tahoe Nearshore Water Quality Protection Plan (USEPA 2020). These three programs are involved in planning and funding projects to reduce the inputs of fine sediments, phosphorus and nitrogen that have directly or indirectly reduced the clarity of Lake Tahoe.

Proposed Project (Control Methods Test)

Issue WQ-2: Sediment Disturbance and Turbidity. Projects or activities that disturb bottom sediments (e.g., pier or piling removal or replacement, maintenance dredging, bottom barrier removal, etc.) in the West Lagoon would not coincide with localized short-term increases in turbidity from LFA testing or implementing Group B methods, and would not cause cumulative turbidity impacts within the lagoons. These CMT activities that may cause short-term turbidity increases are confined within the lagoons and are not expected to contribute to the declining trend in Lake Tahoe water clarity that has been attributed to stormwater, tributary inflows, and phytoplankton productivity. Therefore, no adverse cumulative effects from the Proposed Project and alternatives on turbidity or water clarity are expected.

Issue WQ-6: Increases in Total Phosphorus Concentrations. The Lake Tahoe TMDL Report (LRWQCB and NDEP 2010) estimated basin-wide total phosphorus loading to be 38 metric tonnes/year, and targeted TP reductions of 17 percent over 15 years and 35 percent over 65 years. The most recent TRPA trend analysis indicated that there were insufficient data to determine a trend in phosphorus loading from stormwater, but a moderate improvement in phosphorus loading from tributary streams was noted (TRPA 2016). The potential for the CMT to generate short-term increases in TP loading to Lake Tahoe would occur primarily during dieback of aquatic weeds, when phosphorus is released to the water column as plants decompose. The modeling of nutrient loading and nutrient cycling in Tahoe Keys estimated that as much as 808 kg of TP is contained in target aquatic weeds species in the entire West Lagoon (Appendix WQ-2). With a little over 23 percent of the West Lagoon proposed for herbicide and/or ultraviolet light testing in the CMT, this could amount to a release of up to 190 kg of TP. Most of the phosphorus would remain in the lagoon where it would support algae growth or settle to the bottom. If 10 percent of this TP was circulated through the West Channel into Lake Tahoe, it would represent approximately 0.05 percent of the basin-wide TP loading. However, because herbicide and ultraviolet light treatments would prevent the plants from reaching full biomass, there would be a reduction in the transfer of TP from plant tissues to the lagoon water that would otherwise occur when the plants naturally die back in the fall, so overall TP loading from decomposing plants would not increase, accumulate with impacts from other projects, or contribute to a declining trend or affect an already degraded resource. Therefore, phosphorus release from treatment of aquatic plants proposed in the CMT is not expected to increase TP loading or contribute to cumulative impacts of phosphorus loading to Lake Tahoe.

Issue WQ-7: Increases in Total Nitrogen Concentrations. The Lake Tahoe TMDL Report (LRWQCB and NDEP 2010) estimated basin-wide total nitrogen loading to be 345 metric tonnes/year, and targeted TN reductions of 4 percent over 15 years and 10 percent over 65 years. The most recent TRPA trend analysis indicated that there were insufficient data to determine a trend in nitrogen loading from stormwater, and little or no change in nitrogen loading from tributary streams was noted (TRPA 2016). Similar to TP, nutrient modeling has shown that the potential for the CMT to generate short-term increases in TN loading to Lake Tahoe would occur primarily during dieback of aquatic weeds when nitrogen is released to the water column as plants decompose. Up to 4,677 kg of TN was estimated to be contained in target aquatic weed species in the entire West Lagoon (Appendix WQ-2). With a little over 23 percent of the lagoon proposed for herbicide and/or ultraviolet light testing, up to 1,076 kg of TN could be released to the water during plant decomposition. If 10 percent of this TN was circulated into Lake Tahoe, it would represent approximately 0.03 percent of basin-wide TN loading. However, because herbicide and ultraviolet light treatments would prevent the plants from reaching maturity, there would be a reduction in TN release from plant tissues compared to when full-grown plants naturally die back in the fall, so overall TN loading from decomposing plants would not increase, accumulate with impacts from other projects, or contribute to a declining trend or affect an already degraded resource. Therefore, nitrogen release from treatment of aquatic plants proposed in the CMT is not expected to increase TN loading or contribute to cumulative impacts of nitrogen loading to Lake Tahoe.

Action Alternative 1 (Testing Non-Chemical Methods Only)

Issue WQ-2: Sediment Disturbance and Turbidity. Projects or activities that disturb bottom sediments (e.g., pier or piling removal or replacement, maintenance dredging, bottom barrier removal, etc.) in the West Lagoon would not coincide with localized short-term increases in turbidity from LFA testing or implementing Group B methods and would not accumulate with impacts from other projects or contribute to a declining trend or affect an already degraded resource. Therefore, any adverse cumulative effects from Action Alternative 1 and other related projects are expected to be less than significant.

Issue WQ-6: Increases in Total Phosphorus Concentrations. Under Alternative 1 the release of TP to lagoon water from dieback of aquatic plants would only be expected at the 4.94 acres of sites where ultraviolet light would be tested. Thus, the potential for phosphorus release from treatment of aquatic plants would be less than for the CMT. A less than significant effect would result from the Proposed Project, and Action Alternative 1 would not accumulate with impacts from other projects or contribute to a declining trend or affect an already degraded resource. Therefore, Action Alternative 1, which has a reduced scope of potential effects, also would not be expected to contribute to cumulative impacts of phosphorus loading to Lake Tahoe.

Issue WQ-7: Increases in Total Nitrogen Concentrations. Under Alternative 1 the release of TN to lagoon water from dieback of aquatic plants would only be expected at the 4.94 acres of sites where ultraviolet light would be tested. Thus, the potential for nitrogen release from treatment of aquatic plants would be less than for the CMT. A less than significant effect would result from the Proposed Project, and Action Alternative 1 would not accumulate with impacts from other projects or contribute to a declining trend or affect an already degraded resource. Therefore, Action Alternative 1, which has a reduced scope of potential effects, and also would not be expected to contribute to cumulative impacts of phosphorus loading to Lake Tahoe.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue WQ-2: Sediment Disturbance and Turbidity. Projects or activities that disturb bottom sediments (e.g., pier or piling removal or replacement, maintenance dredging, bottom barrier removal, etc.) in the West Lagoon would not coincide with localized and isolated short-term increases in turbidity from suction dredging and substrate replacement testing, or implementing Group B methods and would not accumulate with impacts from other projects or contribute to a declining trend or affect an already degraded resource. Therefore, any adverse cumulative effects from Action alternative 2 and other related projects are expected to be less than significant.

The removal of organic sediments and aquatic plants through suction dredging would reduce phosphorus and nitrogen loading in the West Lagoon and therefore would not contribute to the potential cumulative effects with other nutrient loading sources to Lake Tahoe. No potential cumulative impacts from Alternative 2 have been identified for Water Quality.

No Action Alternative

Because water quality parameters would continue unchanged under the No Action Alternative and No Action would not cause new effects, no cumulative impacts are anticipated to occur under the No Action Alternative.

4.3.5 Aquatic Biology and Ecology

Geographic Scope of Effects

The geographic scope of effects for aquatic biology and ecology for the Proposed Project and action alternatives includes the Tahoe Keys West Lagoon and Lake Tallac. Under the No Action Alternative, the geographic scope also includes Lake Tahoe.

Related Projects

- Tahoe Keys Aquatic Invasive Weed Management Program: Long-term future Tahoe Keys aquatic weeds management program to be developed following this testing program.
- Upper Truckee River and Marsh Restoration Project: Restoration work in the marsh north of Tahoe Keys has potential for introduction and spread of aquatic invasive plants by construction activities.
- Aquatic Weed Control in the Tahoe Keys Lagoons (WDR Order R6T-2014-0059): TKPOA's current aquatic invasive weed management program, authorized by the Lahontan Water Board, includes non-chemical weed removal methods such as harvesting and bottom barriers.
- Lake Tallac Yellow Pond Lily Weed Abatement Project: Project uses divers to remove by hand specimens of Yellow Pond Lily, a native but aggressive aquatic plant, from Lake Tallac and the Lake Tallac canal. Work is scheduled to occur in July 2020 with monitoring ongoing through 2021.
- Lakewide Aquatic Invasive Plant Control Project. The project would remove aquatic invasive plant species from Lake Tahoe and the Truckee River using light-blocking bottom barriers, hand removal, ultraviolet light and potentially other methods to be evaluated in the future.
- Meeks Bay Ecosystem Restoration Project (EIP Project No. 01.02.02.0039): Along with the Meeks Bay Aquatic Invasive Species Control Project (EIP Project No. 01.04.02.0057), the project would remove invasive vegetation from Meeks Bay as part of other improvements.

Within the Tahoe Keys, there are no other past, present, or reasonably foreseeable future projects that are expected to combine with Proposed Project activities to cause potentially significant cumulative impacts to aquatic biology and ecology. The IMP for Aquatic Weed Control in the Tahoe Keys Lagoons (TKPOA 2020) addresses ongoing approved aquatic plant management activities in the lagoons. Ongoing approved aquatic plant management activities for Lake Tahoe proper are addressed in the Lake-Wide Aquatic Invasive Plant Control Project (TRCD 2014).

Proposed Project (Control Methods Test)

Issue AQU-3: Effects on Sensitive Macrophyte Species. The primary sensitive macrophyte species of concern in the project area is watershield, a CNPS 2B.3 ranked sensitive plant species known to occur in Lake Tallac. The CMT has the potential to affect this species, and current and long-term future Tahoe Keys aquatic weeds management would also continue in Lake Tallac with existing approved methods, largely the use of harvesters to remove the upper several feet of target vegetation. Based on surveys conducted since 2015, there is no evidence that the population of watershield is declining in Lake Tallac despite the use of harvesters since that time, and the CMT is not expected to alter that trend. Therefore, no adverse cumulative effects from the Proposed Project and related projects that address weed management are expected.

Action Alternative 1 (Testing Non-Chemical Methods Only)

Issue AQU-3: Effects on Sensitive Macrophyte Species. Under Alternative 1, only limited LFA testing would be conducted in Lake Tallac where watershield is known to occur. There are no documented adverse effects on watershield due to LFA. Further, there is no evidence that the population of watershield is declining in Lake Tallac despite the continued use of macrophyte harvesters in recent years. Therefore, no adverse cumulative effects from Alternative 1 and related projects are expected.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue AQU-4: Changes in Macrophyte Community Composition. Under Alternative 2, there is uncertainty about the potential for re-establishment of macrophytes in areas where suction dredging and substrate replacement could be tested. It is known that curlyleaf pondweed is expanding in the lagoons, including into deeper water habitats. Current and long-term future Tahoe Keys aquatic weeds management in the West Lagoon would continue using existing approved methods. Given the relatively small areas where dredging and substrate replacement would occur, no cumulative adverse effects on macrophyte community composition from Action Alternative 2 and other aquatic weed management activities in Tahoe Keys are expected.

Construction activities associated with the UTRM Project have the potential to introduce other aquatic invasive plants. These introductions have the potential to impact macrophyte community composition. However, it is unlikely that effects on macrophyte communities under the UTRM Project would interact with those in the West Lagoon or Lake Tallac and therefore no adverse cumulative effects on macrophyte community composition from Action Alternative 2 are expected.

No Action Alternative

Issue AQU-4: Changes in Community Composition. Under the No Action Alternative existing methods currently approved for the West Lagoon, Lake Tallac, and Lake Tahoe proper would be applied to control target aquatic macrophytes. Long-term future Tahoe Keys aquatic weeds management would also continue with existing approved methods. Under the No Action Alternative, fragments would continue to enter Lake Tahoe proper from the lagoons, intra-lake spread of fragments in Lake Tahoe proper would still occur, as would the expansion of curlyleaf pondweed to deeper areas of the lagoons. Therefore, adverse cumulative effects to macrophyte community composition from the No Action

Alternative and other activities within Lake Tahoe that create aquatic weed fragments would likely be significant.

4.3.6 Terrestrial Biology and Ecology

Geographic Scope of Effects

The geographic scope of effects for Terrestrial Resources is the Tahoe Keys lagoons and environs, including the CMT and dredge test sites and the WTP site and surrounding habitat.

Related Projects

No related past, present, or reasonably foreseeable projects have been identified that would cumulatively affect the terrestrial resources of the Tahoe Keys project area in concert with the Proposed Project or its alternatives.

Proposed Project (Control Methods Test), Action Alternatives and No Action Alternative

No potential cumulative impacts to terrestrial resources arising from the implementation of the Proposed Project (CMT), the Action Alternatives or the No Action Alternative have been identified.

4.4 BUILT/HUMAN ENVIRONMENT

4.4.1 Land and Shoreline Use

Geographic Scope of Effects

The geographic scope of effects for Land and Shoreline Use is the Tahoe Keys lagoons and environs.

Related Projects

No related past, present or reasonably foreseeable projects have been identified that would cumulatively affect the land and shoreline use of the Tahoe Keys project area in concert with the Proposed Project or its alternatives.

Proposed Project (Control Methods Test), Action Alternatives and No Action Alternative

No potential cumulative impacts to land and shoreline use arising from the implementation of the Proposed Project (CMT), the Action Alternatives or the No Action Alternative have been identified.

4.4.2 Recreation

Geographic Scope of Effects

The geographic scope of effects considered for recreation is the Tahoe Keys Lagoons, Marina, Lake Tallac, the Marina (Table 4-1), and Lake Tahoe.

Related Projects

- Meeks Bay Ecosystem Restoration Project, would remove a 120-slip marina from Meeks Creek and lagoon and install a new pier for temporary mooring of day-use recreational watercraft, along with removal of invasive vegetation and restoration of the area's natural condition.

This restoration project is located approximately 9 miles northwest of the Tahoe Keys lagoons. No other related past, present or reasonably foreseeable projects with nexus to the CMT or its alternatives and which could potentially affect recreational boating within the geographic scope have been identified.

Proposed Project (Control Methods Test)

Issue RE-1: Obstruction of Recreational Boat Passage. Although the potentially related pier repair and replacement projects could potentially affect public recreational boating, recreational boating is not experiencing a declining trend on Lake Tahoe nor is the recreation resource on the lake degrading. Although the Proposed Project and Action Alternative 2 could cause temporary effects, they will be local to the Tahoe Keys and are not expected to make a considerable contribution to recreational boating effects as far distant as the north shore. Therefore, no cumulative effects are anticipated to occur under the Proposed Project.

Action Alternative 1 (Testing Non-Chemical Methods Only)

Issue RE-1: Obstruction of Recreational Boat Passage. Because no effects on recreational boating occur under this alternative, no cumulative effects are anticipated to occur under Action Alternative 1.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue RE-1: Obstruction of Recreational Boat Passage. Although the potentially related pier repair and replacement projects could potentially affect public recreational boating, recreational boating is not experiencing a declining trend on Lake Tahoe nor is the recreation resource on the lake degrading. Although the Proposed Project and Action Alternative 2 could cause temporary effects, they will be local to the Tahoe Keys and are not expected to make a considerable contribution to recreational boating effects as far distant as the north shore. Therefore, no cumulative effects are anticipated to occur under Action Alternative 2.

No Action Alternative

Issue RE-1: Obstruction of Recreational Boat Passage. If as a result of No Action aquatic weeds are not effectively controlled in the long term, the unremediated invasion of weeds in the Tahoe Keys lagoons could continue to affect Lake Tahoe and could cumulatively diminish the quality of recreational boat use in the lake in association with other projects that affect boating.

Issue RE-3: Inconsistent with TRPA Thresholds. For the R-1 High Quality Recreational Experience Threshold, if aquatic weeds are not effectively controlled in the long term, the unremediated invasion of weeds in the Tahoe Keys lagoons could continue to affect Lake Tahoe and could diminish the quality of recreational use in the lake. Cumulative impacts would occur with any other project that reduces the attainment of threshold R-1 established for the preservation and enhancement of a high-quality recreation experience in the Lake Tahoe Basin.

4.4.3 Utilities

Geographic Scope of Effects

The geographic scope of effects for Utilities is the Tahoe Keys lagoons and source waters for water purveyors.

Related Projects

No related past, present or reasonably foreseeable projects have been identified that would cumulatively affect the water and other utilities in the Tahoe Keys or Lake Tahoe in concert with the Proposed Project or its alternatives.

Proposed Project (Control Methods Test), Action Alternatives and No Action Alternative

No potential cumulative impacts to water and other utilities arising from the implementation of the Proposed Project (CMT), the Action Alternatives or the No Action Alternative have been identified.

4.4.4 Traffic and Transportation

Geographic Scope of Effects

The geographic scope for traffic and transportation is the Tahoe Keys development and the Boat/Truck Transport Routes for Action Alternative 2.

Related Projects

The following restoration, maintenance or multi-modal transportation improvement projects are funded, within the geographic scope of the Project, and are in planning, design or implementation phases:

- Upper Truckee River and Marsh Restoration Project: Phase 1 project construction (conversion of a "Sailing Lagoon" to functioning wetland) began in April 2020 and will generate short-term construction-related vehicle trips and truck trips for removal of fill. Phase 1 project construction is expected to be complete in 2020, with monitoring continuing through 2023.
- U.S. 50 South Shore Community Revitalization Project: The project consists of a program of transportation system improvements to reduce automobile congestion, enhance bicycle and pedestrian safety, and improve transit services. Specific improvements listed in the planning document are currently unfunded
- U.S. Highway 50 Corridor Collision Reduction (EIP Project No. 03.01.01.0021): Project consists of installation of roadway lighting, and pedestrian and bicycle safety improvements from the "Y" intersection of U.S. Highway 50 and State Route 89, northeast to U.S. Highway 50 and Park Avenue. Construction is scheduled to occur between 2023 and 2027 and would follow completion of the Proposed Project or selected Action Alternative.

- Pavement Resurfacing on U.S. Highway 50 from "Y" Junction to California/Nevada Stateline (EIP Project No. 06.01.03.0005): This roadway maintenance project will replace the surface pavement of a stretch of U.S. Highway 50 in the vicinity of the Tahoe Keys. Construction of the improvements is currently scheduled to occur between 2025 and 2027.

These four projects could affect potential truck routes for disposal of dredged materials from the Tahoe Keys lagoons under Action Alternative 2. However, construction of the first phase of the Upper Truckee River and Marsh Restoration Project would occur during the year prior to implementation of the CMT or selected Alternative, and the other projects are unfunded or in planning and design phases. No other related past, present or reasonably foreseeable projects have been identified that have nexus to the CMT, Action Alternatives or the No Action Alternative.

Proposed Project (Control Methods Test), Action Alternative 1 (Testing Non-Chemical Methods Only), and No Action Alternative

Issue TR-1: Generation of New Daily Vehicle Trips.

Issue TR-2: Changes in Demand for Parking.

Issue TR-3: Effects on Roads and Level of Service.

Issue TR-4: Effects on Water Traffic.

The Proposed Project, Action Alternative 1 and the No Action Alternative are not anticipated to have significant traffic impacts, and therefore, no significant cumulative traffic impacts are anticipated under these scenarios.

The Proposed Project and Action Alternative 1 are estimated to generate up to 18 new daily vehicle trips and to utilize up to four additional watercraft for the duration of the CMT. These trips would be temporary and would not continue beyond implementation of the Proposed Project or Action Alternative 1. Watercraft necessary for implementation of the Proposed Project and Action Alternative 1 would also be temporary. As these watercraft would be launched from and travel only within the lagoons, they would not affect recreational boating activity on the lake proper. The low volumes of new vehicles and boats are considered to have a less than significant impact on road conditions, parking demands, and water traffic in the lagoons for the Proposed Project and Action Alternative 1.

The related roadway improvement projects listed above would not be constructed until after completion of the Proposed Project or Action Alternative 1, though each would ultimately have a beneficial impact, improving traffic flows and consequential air emissions from vehicles by supporting non-automobile transportation and maintaining the road surface. The initial phase of construction of the Upper Truckee River and Marsh (UTRM) Restoration Project could add as many as 77 worker and truck trips to the roadway network in the vicinity of the Tahoe Keys during the evening peak hour, though these trips will occur in the current year and will not coincide with implementation of the CMT or Action Alternative 1.

The No Action Alternative would not result in any changes to the existing condition for vehicle trips and boat volumes in the lagoons and, therefore, would have no impact on traffic.

No cumulative traffic effects are anticipated to occur under the Proposed Project, Action Alternative 1 or the No Action Alternative.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue TR-1: Generation of New Daily Vehicle Trips.

Issue TR-2: Changes in Demand for Parking.

Issue TR-3: Effects on Roads and Level of Service.

Issue TR-4: Effects on Water Traffic.

With mitigation implemented, Action Alternative 2 is not anticipated to have significant traffic impacts, and therefore, no significant cumulative traffic impacts are anticipated for this alternative.

Action Alternative 2 would require one barge and is estimated to temporarily generate as many as 54 daily vehicle trips from materials transport trucks and contractor/employee passenger vehicles. These trips would be temporary and would not continue beyond implementation of Action Alternative 2. Watercraft necessary for implementation of the Action Alternative 2 would also be temporary. As this watercraft would be launched from and travel only within the lagoons, it would not affect recreational boating activity on the lake proper. Action Alternative 2 would have less than significant impacts on daily vehicle trips, parking and water traffic in the lagoons, due to the low volume of watercraft and the volume of daily vehicle trips falling below 100.

Trips by heavy trucks have the potential to intensify wear and damage to the road surface of streets used for materials transport, and mitigation is recommended to reduce the potentially significant impact to less than significant. As for the Proposed Project, Action Alternative 1 and the No Action Alternative, the roadway improvement projects listed above follow completion of Action Alternative 2 but would ultimately have a beneficial impact, improving traffic flows and consequential air emissions from vehicles by supporting non-automobile transportation and maintaining the road surface for all vehicle use. The EIR for the UTRM Restoration Project estimated that the project would generate as many as 20 inbound or outbound truck trips per day for removal of fill material. However, the conversion of the "Sailing Lagoon" in the first phase of the UTRM Restoration Project is already under construction, and truck trips associated with fill removal would not occur concurrently with implementation of Action Alternative 2, should that alternative be selected.

No cumulative traffic effects are anticipated to occur for Action Alternative 2, as mitigated.

4.4.5 Noise

Geographic Scope of Effects

The geographic scope of effects for Noise is the Tahoe Keys lagoons and environs, including the CMT and dredge test sites and the WTP site and surrounding habitat.

Related Projects

No related past, present, or reasonably foreseeable projects have been identified that would cumulatively affect the noise environment of the Tahoe Keys Project area in concert with the Proposed Project or its alternatives.

Proposed Project (Control Methods Test)

Issue NO-1: Short-Term Noise Associated with Project Activities. Since the proposed project has no significant effects on noise and no other projects have been identified that could affect the noise environment in the Project area, no cumulative effects are anticipated to occur for the CMT.

Action Alternative 1 (Testing Non-Chemical Methods Only)

Issue NO-1: Short-Term Noise Associated with Project Activities. Since the proposed project has no significant effects on noise and no other projects have been identified that could affect the noise environment in the Project area, no cumulative effects are anticipated to occur under Action Alternative 1.

Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)

Issue NO-1: Short-Term Noise Associated with Project Activities. Since no other projects have been identified that could affect the noise environment in the Project area that will occur at the same time as Action Alternative 2 or which would be sufficiently proximate in space to accumulate noise effects, no cumulative effects are anticipated to occur under Action Alternative 2.

No Action Alternative

Issue NO-1: Short-Term Noise Associated with Project Activities. Under the No Action Alternative, the noise environment in the Project area would be unchanged, and there are no consequences to No Action that would cause noise impacts. Therefore, no cumulative effects are anticipated to occur under the No Action Alternative.

4.4.6 Cultural Resources

Geographic Scope of Effects

The geographic scope of effects for Utilities is the Tahoe Keys lagoons and environs.

Related Projects

No related past, present, or reasonably foreseeable projects have been identified that would cumulatively affect cultural resources in the Tahoe Keys or Lake Tahoe in concert with the Proposed Project or its alternatives.

Proposed Project (Control Methods Test), Action Alternatives and No Action Alternative

No potential cumulative impacts to cultural resources arising from the implementation of the Proposed Project (CMT), the Action Alternatives or the No Action Alternative have been identified.

5.0 SUMMARIES OF ENVIRONMENTAL IMPACTS, FINDINGS, AND THRESHOLDS

This section provides summaries of the potential impacts of the Proposed Project, Action Alternatives, and No Action Alternative. Table 5-1 summarizes the effects of each environmental issue identified in Section 3.1 and evaluated in Chapter 3, including which alternatives are affected, impact duration, and the level of significance both pre- and post-mitigation. Mitigation measures and offsets are summarized in the table.

Section 5.1, together with Table 5-1, summarizes significant effects and measures or alternatives to reduce or avoid effects.

Section 5.2 summarizes significant environmental effects that cannot be avoided.

Section 5.3 identifies significant irreversible/irretrievable effects.

Section 5.4 describes the relationship between short-term uses and long-term effects and enhancement of long-term productivity.

Section 5.5 addresses growth-inducing effects.

Section 5.6 present CEQA Mandatory Findings of Significance.

Section 5.7 identifies the environmentally superior alternative.

5.1 SUMMARY OF SIGNIFICANT EFFECTS AND MEASURES OR ALTERNATIVES TO REDUCE OR AVOID EFFECTS

5.1.1 Environmental Health

Issue EH-1: Herbicide Applicator Exposure and Heath. This issue would have less than significant effects for the Proposed Project, assuming aquatic herbicide applications will be made only by a Qualified Applicator Certificate Holder in accordance with label restrictions.

Issue EH-2: Detectable Concentrations of Herbicides and Degradates in Receiving Waters. The potential impact of detectable concentrations of herbicides and degradates in receiving waters will be less than significant for the Proposed Project, given the timing and limited extent of application. A spill response plan would also be employed, and double turbidity curtains would be used to prevent movement of herbicides toward the West Lagoon connecting channel. LFA or other aeration technology will be used at test sites to accelerate the degradation of herbicide active ingredients and degradates.

Issue EH-3: Protection of Drinking Water Supplies. This issue would have less than significant effects for the Proposed Project, given measures to contain the herbicide applications with double turbidity curtains to prevent movement of active ingredients toward the West Lagoon connecting channel and Lake Tahoe. Dye tracing and well monitoring will document herbicide movement, and existing or mobile carbon filtration systems would be activated to remove herbicide residues if they reach wells.

Issue EH-4: Introduction of Toxic Substances into the Environment. This issue would have less than significant chronic or acute effects on aquatic life for the Proposed Project, given the characteristics of the herbicides proposed for use. Application concentrations would be no more than label rates.

Issue EH-5: Short-term Increases in Aluminum Concentrations. This issue would have less than significant effects for the Proposed Project and Action Alternatives, with BMPs and other measures to control bottom disturbance and turbidity, including turbidity curtains and effluent discharge testing/treatment under Action Alternative 2.

Issue EH-6: Harmful Algal Blooms (HABs). Although uncertainty exists this potentially significant issue would have a less than significant risk for increased HABs under the Proposed Project and Action Alternative 1 with preventative measures such as the use of barley straw and aeration. Under Action Alternative 2 and the No Action Alterative, HABs would continue unchanged, although unaffected by the project.

5.1.2 Earth Resources

Issue ER-1: Suction Dredging and Dredge Materials Disposal. This issue applies only to Action Alternative 2. Potentially significant effects could result if spills occur in dredge material handling and transport for Action Alternative 2. Potentially significant effects caused by removing docks and bulkheads in dredge areas would be mitigated by fully replacing them. These would be mitigated through spill containment and spill response. No significant environmental effects would occur for the Proposed Project and all other alternatives.

5.1.3 Air Quality and Greenhouse Gas

Issue AQ-1: Compliance with the Basin Air Quality Plan. This issue would have less than significant effects with respect to normal, background levels of emissions from vehicle and boat use in the Tahoe Keys under the Proposed Project and all alternatives. Effects of Alternative 2 on diesel fuel use would be minor. No mitigation would be required.

Issue AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants. This issue would have less than significant effects with respect to normal, background levels of emissions from vehicle and boat use in the Tahoe Keys under the Proposed Project and all alternatives. Activities associated with Action Alternative 2 that generate PM_{10} emissions would be well below applicable significance thresholds for criteria pollutants. No mitigation would be required.

Issue AQ-3: Exposure of Sensitive Receptors. This issue would not expose sensitive receptors to substantial pollutant concentrations under the Proposed Project and all alternatives. Effects such as odors from internal combustion engine exhaust would be localized and would occur in an area with relatively low population density for a short duration. This issue would have less than significant effects with respect to the normal background in the Tahoe Keys. No mitigation would be required.

Issue GHG-1: Greenhouse Gas Emissions. While minor amounts of greenhouse gases would be generated by activities related to the Proposed Project and Action Alternative 1, these emissions would be less than significant with respect to the normal, background levels of emissions from vehicle and boat use in the Tahoe Keys.

5.1.4 Hydrology

Issue HY-1: Disposal of Dewatering Effluent. This issue affects only Action Alternative 2. Discharge of treated dewatering effluent to Lake Tallac could affect the hydrology of Lake Tallac and Pope Marsh, ultimately leading to slightly higher water levels, and a greater resulting groundwater flux to the West Lagoon. Both Pope Marsh and Lake Tallac are considered Stream Environment Zones (SEZ) which have a strict non-degradation standard (VP1 and SC10) applied to native deciduous trees, wetlands, and meadows, the preservation of plant communities, and the preservation of naturel functions and hydrologic conditions. Native plant communities and significant wildlife habitat are to be preserved while providing opportunities to increase the acreage of riparian associations. As shown in Section 3.3.3 Hydrology, the modeled discharge of treated dewatering effluent led to an increase in water levels of about 0.1 to 0.5 foot in Lake Tallac and about 0.1 to 0.2 foot in Pope Marsh. Changes of one to six inches in water level are not expected to violate TRPA non-degradations standards VP1 or SC10. The rates and timing of discharges can be adjusted to prevent impacts from being significant, and these hydrologic impacts could be completely avoided if the treated dewatering effluent were instead discharged to the sanitary sewer.

5.1.5 Water Quality

Issue WQ-1: Water Temperature Effects. The Proposed Project and Action Alternatives would have less than significant effects on water temperature after mitigation. Real-time temperature monitoring would be used to adjust rates of ultraviolet light treatment or injection of hot water under bottom barriers if temperature exceedances were measured. Under the No Action Alternative, continued spread of aquatic weeds could result in potentially significant long-term impacts of increased water temperature in affected nearshore areas of Lake Tahoe.

Issue WQ-2: Sediment Disturbance and Turbidity. The Proposed Project and Action Alternatives would have less than significant effects on turbidity after mitigation. Real-time monitoring would be used to adjust the methods and rate of activities if turbidity exceeded limits during LFA installation and startup or removal of bottom barriers. For Action Alternative 2, adjustments to dredge cutter head speed and movement, and a moveable cutter head shield would be used to minimize turbidity, and turbidity curtains would be used to confine short-term turbidity impacts to test areas. Spill control and containment plans would be used for dredge spoil transport and handling. Any discharge of dredged sediment dewatering effluent to Lake Tallac would require treatment and testing to ensure that it would not exceed permit limits. Under the No Action Alternative, continued spread of aquatic weeds could result in potentially significant long-term impacts of increased turbidity in affected nearshore areas of Lake Tahoe.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. Action Alternative 2 would have less than significant effects on dispersal of aquatic weed fragments after mitigation. Turbidity curtains would contain floating fragments within test sites where they would be skimmed from the surface before barriers are removed. Spill control and containment plans would manage accidental spills of dredge spoils, if any. Under the No Action Alternative, continued spread of aquatic weeds could result in potentially significant long-term impacts of increased dispersal of aquatic weed fragments in affected nearshore areas of Lake Tahoe.

Issue WQ-4: Changes in pH. The Proposed Project and Action Alternatives would have less than significant effects on pH as test sites are a small portion of the lagoons, alkalinity concentrations in lagoon water provide buffering capacity to minimize potential changes in pH from proposed activities, and LFA sites and herbicide test sites with aeration will improve circulation and moderate the pH extremes that have been documented pre-project. Under the No Action Alternative, continued spread of aquatic weeds could result in potentially significant long-term impacts of increased pH extremes in affected nearshore areas of Lake Tahoe that develop dense weed beds.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. The Proposed Project and Action Alternatives would have less than significant effects on turbidity after mitigation. Timing treatments to cause weed dieback early in the growing season when the plants are small, and the small portion of the lagoons to be treated will minimize biomass decomposition and short-term DO impacts. DO conditions will be improved at LFA test sites and at herbicide test sites where aeration systems are deployed. Under the No Action Alternative, continued spread of aquatic weeds could result in potentially significant long-term impacts of near-bottom DO depletion in affected nearshore areas of Lake Tahoe that develop dense weed beds.

Issue WQ-6: Increases in Total Phosphorus Concentrations. The Proposed Project and Action Alternatives would have less than significant effects on TP as test sites are a small portion of the lagoons, and treatments would be timed to cause weed dieback and nutrient release early in the growing season when the plants are small, Under the No Action Alternative, continued spread of aquatic weeds could result in potentially significant long-term impacts of increased TP release in affected nearshore areas of Lake Tahoe that develop dense weed beds.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. The Proposed Project and Action Alternatives would have less than significant effects on TN as test sites are a small portion of the lagoons, and treatments would be timed to cause weed dieback and nutrient release early in the growing season when the plants are small. Under the No Action Alternative, continued spread of aquatic weeds could result in potentially significant long-term impacts of increased TN release in affected nearshore areas of Lake Tahoe that develop dense weed beds.

5.1.6 Aquatic Biology and Ecology

Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species. Given the small areas proposed for testing aquatic weed control methods under the Proposed Project or Action Alternatives, and the ability to adjust test site locations to avoid areas dominated by native plant communities, effects on non-target aquatic macrophyte species would be less than significant.

Issue AQU-2: Competitive Exclusion of Aquatic Macrophytes Due to Increased Growth of Curlyleaf Pondweed. Given the small areas proposed for testing aquatic herbicides under the Proposed Project, and the ability to adjust test site locations to avoid areas dominated by native plant communities, changes or reduction in the diversity or distribution of the non-target macrophyte community or increased growth of curlyleaf pondweed would be less than significant.

Issue AQU-3: Effects on Sensitive Aquatic Macrophyte Species. Measures taken to avoid watershield in Lake Tallac, the only know occurrence of a sensitive aquatic macrophyte species in the project area, are expected to result in no substantial changes in the watershield population under the Proposed Project or Action Alternatives. This impact would be less than significant.

Issue AQU-4: Changes in Aquatic Macrophyte Community Composition. Given the small areas proposed for testing aquatic weed control methods under the Proposed Project or Action Alternatives, and the ability to adjust test site locations to avoid areas dominated by native plant communities, effects on overall macrophyte community composition would be less than significant. Endemic macrophytes (i.e., native macrophyte species found only in a particular area) are known to be found in the deeper waters accessible to curlyleaf pondweed in Lake Tahoe, outside the project area potentially affected by the CMT. Continuing the status quo aquatic weed control efforts in the Tahoe Keys under the No Action Alternative is expected to lead to expansion of aquatic weed growth in the lagoons and in other nearshore areas of Lake Tahoe, particularly with continued spread of curlyleaf pondweed infestations, and these changes in macrophyte community composition would be significant.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Implementation of the Proposed Project or Action Alternatives would not be expected to result in a substantial change or reduction in the diversity or distribution of the aquatic BMI community and this impact would be less than significant. Continued spread of aquatic invasive weeds under the No Action Alternative has the potential to further change the plant community composition in deeper water areas of the lagoons, and also further spread in nearshore areas of Lake Tahoe proper. This would be expected to further degrade conditions for aquatic BMIs, similar to that for the Tahoe Keys lagoons. If the continued spread of aquatic invasive weeds goes unchecked under the No Action Alternative, the resulting changes to the BMI community composition could be significant.

Issue AQU-6: Effects on Special-Status Fish Species. Lahontan Cutthroat Trout are not expected to occur in the Tahoe Keys lagoons, Tui Chub may only be present in small numbers, and other special-status fish do not occur in the lagoons. All treatments under the Proposed Project or Action Alternatives would be temporary and localized. Implementation of the methods testing would be less significant for the Proposed Project and Action Alternatives. If the continued spread of aquatic invasive weeds goes unchecked under the No Action Alternative, the resulting effects on special-status fish species could be significant.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. Potential direct adverse effects on fish movement that would block access to spawning habitat as a result of the Proposed Project or Action Alternatives would not occur because Tahoe Keys lagoons are highly modified habitats that do not provide specialized spawning or rearing habitat for native, including special-status fish species, and this impact would be less than significant. If the continued spread of aquatic weeds goes unchecked and substantially expands into the mouths of the Upper Truckee River, Trout Creek, or other tributaries, access to spawning habitat could become limited due to physical blockage from dense stands of weeds, and/or due to increases in predatory fish and predation risk. However, high spring flows associated with runoff would seasonally scour and clear any aquatic weed growth that may accumulate over the summer months. Further, most native fish that would access these tributaries are spring spawners (Table 3.3.5-2); therefore, their movement timing would coincide with the same period when access would be temporarily restored. While conditions could become seasonally degraded, they would not be expected to degrade to a point that would result in substantial effects on fish movement that would block access to spawning habitat. As a result, this impact would be less than significant.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. Implementation of the Proposed Project or Action Alternatives would not be expected to result in substantial reduction in the suitability of habitat for native or recreationally important game fish species, and recreationally important nonnative fish species are generally not present in the lagoons. This impact would be less than significant. Continued spread of aquatic invasive weeds under the No Action Alternative has the potential to further change the plant community composition in deeper water areas of the lagoons, and also further spread in nearshore areas of Lake Tahoe proper. This would be expected to further degrade habitat conditions for native or recreationally important game fish species. If the continued spread of aquatic invasive weeds goes unchecked under the No Action Alternative, the resulting changes to habitat for native or recreationally important game fish species would be significant.

Issue AQU-9: Effects Associated with the Introduction or Spread of Invasive Aquatic Species. Given the rigorous inspection program at Lake Tahoe, it is unlikely that AIS would be introduced via watercraft. Protocols for inspecting and cleaning all in-water work equipment would be included in the permit conditions for the Proposed Project. This impact would be less than significant for the Proposed Project or Action Alternatives. The potential impacts for AQU-9 under the No Action Alternative are less than those presented for the Proposed Project because there would be no additional boats and equipment entering the lagoons to conduct methods testing and monitoring. However, without the testing and development of methods that are effective in controlling aquatic weeds in the lagoons, the Tahoe Keys would continue to be a significant source of aquatic weed fragments spreading to other areas of the lake. If prevention measures are not successful, the introduction, establishment, and continued spread of AIS would be significant.

5.1.7 Terrestrial Biology and Ecology

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species. Although the Proposed Project and alternatives may cause minimal alterations to potential foraging habitats, the areas affected would be relatively small. A total of 41.4 acres of the surface area of the Tahoe Keys would be utilized by the CMT, including 5.5 acres of control sites, which would be undisturbed. The Proposed Project would affect 35.9 acres, or 20.8% of the Keys. Action Alternative 1 would affect 17.8 acres (10.3%), and Action Alternative 2 would affect 5.6 acres (3.3%). These changes would not affect the viability of sensitive species and would be less than significant. Mitigation includes pre-project field reconnaissance for the presence of species, and ongoing monitoring.

Further, as discussed in Section 3.2 Environmental Health, the USEPA has determined that the herbicides proposed for use in the CMT will have no significant acute or chronic impact on fish or freshwater invertebrates when recommended rates are used (USEPA 2004; W DNR 2012; WDOE Undated). The combination of the relatively restricted area affected and the fact that the herbicides proposed for use reportedly do not bioaccumulate indicates that effects are likely not to be significant, even if raptors feed on prey subjected to the proposed herbicides. Mitigation includes pre-project field reconnaissance for the presence of species, and potentially monitoring if sensitive species are found within species appropriate buffer areas (see Section 3.3.6 for a description of proposed monitoring measures).

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. Although implementation of the Proposed Project and alternatives may have small effects on the potential foraging habitats of sensitive species, these impacts are expected to be less than significant. These impacts include potential alterations in foraging behavior over open water and in the disturbed and barren upland area of the Tahoe Keys Water Treatment Plant and are expected to not impact the viability of the species.

Under the Proposed Project, compliance with strict antidegradation regulations are expected to assure that herbicide levels outside of the treatment areas would have less than significant effects on any riparian habitat or other sensitive natural communities. Compliance with CMT test protocols would ensure that the impact of herbicides on non-target species, particularly within Lake Tallac, remains at a less than significant level. There exists minimal potential for interaction with known wetland sites, and effects to wetlands are anticipated to be less than significant.

Under Action Alternative 2, three sites within the western lagoon would be dredged, and dewatering effluent could be discharged to the City of South Lake Tahoe sanitary sewer system or to Lake Tallac and ultimately Pope Marsh. If treated effluent is discharged water to the City of South Lake Tahoe system, there would be no significant impact. If discharged to Lake Tallac a potentially significant impact on Lake Tallac and Pope Marsh could occur to the change in hydrologic regime and the subsequent alteration of water depth in the mapped wetlands, depending on timing and flow control (see Section 3.3.3).

Pope Marsh appears to be tolerant of drying during years with less precipitation and of inundation during heavy rainfall years, based on the historical data reviewed in Section 3.3.3. Thus, the fluctuation within the marsh that would occur under Action Alternative 2 may be within normal limits. Changes of one to six inches in water level are not expected to violate TRPA non-degradations standards VP1 or SC10. The rates and timing of discharges can be adjusted to prevent impacts from being significant, and these hydrologic impacts could be completely avoided if the treated dewatering effluent were instead discharged to the sanitary sewer. Data is inconclusive on whether a single season of increased water levels would lead to habitat wide mortality or impacts. While the plant communities of these areas are adapted to dealing with seasonal water fluctuation, increased flooding has been shown to be increasingly stressful and lead to mortality of individuals or populations of species within wetlands (Cherry et al., 2015). Increased surface water can also impact wetland water chemistry and the biogeochemical cycling of materials within the wetland system (Mitch and Gosselink 1993).

5.1.8 Land and Shoreline Use

Issue LN-1: Physical Division of an Established Community. No impact to this issue would occur under the Proposed Project or any of the alternatives.

Issue LN-2: Conflicts with Land Use Plans, Policies or Regulations. A less than significant impact to this issue would occur under the Proposed Project and all of the alternatives.

Issue LN-3: Inclusion of Unpermitted Land Uses. No impact to this issue would occur under the Proposed Project or any of the alternatives.

5.1.9 Recreation

Issue RE-1: Obstruction of Recreational Boat Passage. This issue would have a less than significant impacts for the Proposed Project and Action Alternative 2. For the Proposed Project, boats would be temporarily blocked from launching at 66 percent of Tahoe Keys docks/moorings for up to 130 days in the first year of the CMT. The obstruction could include the entire recreational boating season, depending on how long turbidity curtains remain in place (turbidity curtains could be removed in as few as 30 days if herbicides or their degradation products cannot be detected). Action Alternative 2 would block launching from 6 percent of Tahoe Keys docks/mooring for up to 4.5 months during the dredge and replace substrate operation. Effects on the recreational boating season under Action Alternative 2 would depend on the timing of the operation. No obstruction would occur under Action Alternative 1, and therefore no impact. A potentially significant impact would occur for the No Action Alternative if the continued growth of aquatic weeds in Tahoe Keys increasingly affects recreational boating in the Keys. Mitigation includes Public noticing, timing for placement and removal of barriers, swimming and other direct water contact restriction; use of Tahoe Keys Marina for recreational boat launch.

Issue RE-2: Increased use of the Tahoe Keys Marina and Other Facilities. A temporary and less than significant effect would occur under the Proposed Project and Action Alternative 2 as a result of Tahoe Keys boaters whose docks or moorings are blocked choosing to launch instead from the Tahoe Keys Marina. The potential extent of displacement under the Proposed Project is roughly 10 times greater than that under Action Alternative 2. No displacement would occur under Action Alternative 1 and therefore no impact.

Issue RE-3: Inconsistent with TRPA Thresholds. A temporary and less than significant inconsistency with TRPA Thresholds would occur for Recreation Threshold R-1 High Quality Recreational Experience. Although the Proposed Project would temporarily result in the loss of the opportunity to directly access Lake Tahoe for boating from parts of the Tahoe Keys for extended periods where testing would occur, the evaluation of this threshold is geared toward public recreational experiences in the Lake Tahoe Basin, and would not adversely affect the attainment status of the R-1 threshold.

5.1.10 Utilities

Issue UT-1: Effects on Water Supply. No impact to this issue would occur under the Proposed Project or any of the alternatives. No significant unavoidable environmental effects would occur for this issue under the Proposed Project and Action Alternatives. Though the degree of potential significance is speculative, the No Action Alternative could result in a potentially significant turbidity-related impact if intakes are located in shallow waters where habitat could support uncontrolled growth of aquatic weeds.

5.1.11 Traffic and Transportation

Issue TR-1: Generation of New Daily Vehicle Trips. This issue would have less than significant effects for the Proposed Project and all alternatives. No mitigation would be required.

Issue TR-2: Changes in Demand for Parking. This issue would have less than significant effects for the Proposed Project and all alternatives. No mitigation would be required.

Issue TR-3: Effects on Road Level of Service. This issue would have less than significant effects for the Proposed Project and all alternatives. No mitigation would be required for the Proposed Project, Action Alternative 1 and the No Action Alternative. Action Alternative 2 would implement a traffic control plan to mitigate impacts; no other mitigation would be required so long as the Venice Drive Bridge is avoided in truck transport under Action Alternative 2.

Issue TR-4: Effects on Water, Rail or Air Traffic. This issue would have less than significant effects for the Proposed Project and all alternatives. No mitigation would be required.

5.1.12 Noise

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. This issue would have less than significant effects for the Proposed Project and all alternatives. Mitigation includes limiting work during daylight hours, between 8:00 a.m. and 6:30 p.m.; maintenance and muffling of equipment.

5.1.13 Cultural Resources

Issue CR-1: Traditional Native American Resources and Values. This issue would have less than significant effects for the Proposed Project and all alternatives. Mitigation includes preparation of an Unanticipated Discovery Plan; Awareness Training for workers; preparation of a Tribal Cultural Resources Awareness brochure to be included in the Project Mitigation Monitoring Plan; culturally appropriate treatment that preserves or restores the cultural character and integrity of Tribal Cultural Resources, including Tribal Monitoring, culturally appropriate recovery of cultural objects, and reburial of cultural objects or cultural soil; and consultation with traditionally and culturally affiliated Native American Tribes regarding mitigation if adverse impacts to tribal cultural resources, unique archeology, or other cultural resources occurs.

5.2 SIGNIFICANT ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

5.2.1 Environmental Health

No significant unavoidable environmental effects would occur for any of the identified environmental health issues under the Proposed Project and Action Alternatives. Potentially significant effects may occur under the No Action Alternative.

5.2.2 Earth Resources

Issue ER-1: Suction Dredging and Dredge Materials Disposal. This issue applies only to Action Alternative 2. Potentially significant effects could occur if spills occur in dredge material handling and transport for Action Alternative 2.

5.2.3 Air Quality and Greenhouse Gas

No significant unavoidable environmental effects would occur for any of the identified air quality and greenhouse gas issues under the Proposed Project and all alternatives.

5.2.4 Hydrology

Issue HY-1: Disposal of Dewatering Effluent. This issue affects only Action Alternative 2. The hydrologic effects of increased flooding risk would be avoided by discharging treated dewatering effluent to the sanitary sewer system or discharging to Lake Tallac after the snowmelt runoff season when the water level in Lake Tallac is not high. Therefore, there would be no significant unavoidable impacts under Action Alternative 2.

5.2.5 Water Quality

Issue WQ-1: Water Temperature Effects. While long-term temperature increases in nearshore areas of Lake Tahoe is a potentially significant effect under the No Action Alternative with increased aquatic weed proliferation, no significant unavoidable water temperature effects would occur from the Proposed Project or Action Alternatives.

Issue WQ-2: Sediment Disturbance and Turbidity. While long-term turbidity increases in nearshore areas of Lake Tahoe is a potentially significant effect under the No Action Alternative with increased aquatic weed proliferation, no significant unavoidable turbidity effects would occur from the Proposed Project or Action Alternatives.

Issue WQ-3: Dispersal of Aquatic Weed Fragments. While long-term increases in aquatic weed fragment dispersal in nearshore areas of Lake Tahoe is a potentially significant effect under the No Action Alternative with increased aquatic weed proliferation, no significant unavoidable effects on aquatic weed fragment dispersal would occur from the Proposed Project or Action Alternatives.

Issue WQ-4: Changes in pH. While long-term increased occurrence of high and low pH in nearshore areas of Lake Tahoe is a potentially significant effect under the No Action Alternative with increased aquatic weed proliferation, no significant unavoidable pH effects would occur from the Proposed Project or Action Alternatives.

Issue WQ-5: Changes in Dissolved Oxygen Concentrations. While long-term increased occurrence of deep-water oxygen depletion in nearshore areas of Lake Tahoe is a potentially significant effect under the No Action Alternative with increased aquatic weed proliferation, no significant unavoidable DO effects would occur from the Proposed Project or Action Alternatives.

Issue WQ-6: Increases in Total Phosphorus Concentrations. While long-term TP increases in nearshore areas of Lake Tahoe is a potentially significant effect under the No Action Alternative with increased aquatic weed proliferation, no significant unavoidable TP effects would occur from the Proposed Project or Action Alternatives.

Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations. While long-term TN increases in nearshore areas of Lake Tahoe is a potentially significant effect under the No Action Alternative with increased aquatic weed proliferation, no significant unavoidable TN effects would occur from the Proposed Project or Action Alternatives.

5.2.6 Aquatic Biology and Ecology

Issue AQU-1: Effects on Non-Target Macrophyte Species. While mortality of non-target macrophyte specimens is expected under the Proposed Project and Action Alternatives, populations of these species would not be substantially affected and would recolonize test sites; therefore, effects on non-target species would not be significant and unavoidable. However, potentially significant unavoidable effects could occur under the No Action Alternative.

Issue AQU-2: Competitive Exclusion of Aquatic Macrophytes Due to Increased Growth of Curlyleaf Pondweed. This is only a potential issue for the Proposed Project which would not result in substantial competitive exclusion from increased growth of curlyleaf pondweed, thus this is not a significant and unavoidable effect.

Issue AQU-3: Effects on Sensitive Aquatic Macrophyte Species. This is only a potential issue for the Proposed Project. Measures to identify and avoid stands of watershield, the only sensitive aquatic macrophyte species known to occur in the lagoons, will keep this from being a significant and unavoidable impact.

Issue AQU-4: Changes in Aquatic Macrophyte Community Composition. While mortality of non-target macrophyte specimens is expected under the Proposed Project and Action Alternatives, only small areas will be treated and test sites will rapidly recolonize; therefore, effects on the overall macrophyte community composition would not be significant and unavoidable. With continued expansion of aquatic weed growth in the Tahoe Keys lagoons and other nearshore areas of Lake Tahoe, including the continued spread of curlyleaf pondweed, impacts to macrophyte community composition could be significant and unavoidable under the No Action Alternative.

Issue AQU-5: Effects on the Aquatic Benthic Macroinvertebrate Community. Implementation of the Proposed Project or Action Alternatives would not be expected to result in a substantial change or reduction in the diversity or distribution of the aquatic BMI community and this impact would not be significant and unavoidable. If the continued spread of aquatic invasive weeds goes unchecked under the No Action Alternative, the resulting changes to the BMI community composition could be significant and unavoidable.

Issue AQU-6: Effects on Special-Status Fish Species. All treatments would be temporary and localized. Implementation of the Proposed Project or Action Alternatives would not be expected to result in a substantial reduction in numbers or reduced viability of special-status fish species and this impact would not be significant and unavoidable. If the continued spread of aquatic invasive weeds goes unchecked under the No Action Alternative, the resulting effects on LCT and Tui Chub could be significant and unavoidable.

Issue AQU-7: Effects on Fish Movement that would Block Access to Spawning Habitat. Potential direct adverse effects on fish movement that would block access to spawning habitat would not occur under the Proposed Project or Action Alternatives because Tahoe Keys lagoons are highly modified habitats that do not provide specialized spawning or rearing habitat for native, including special-status fish species. This impact would be not be significant and unavoidable**.** However, if the continued spread of aquatic invasive weeds goes unchecked under the No Action Alternative and substantially expands into the mouth of the Upper Truckee River or Trout Creek, the resulting effects on fish movement, including blocking access to spawning habitat would be less than significant.

Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species. All treatments would be temporary and localized, and implementation of the Proposed Project or Action Alternatives would not be expected to result in a substantial reduction in the suitability of habitat for native or recreationally important game fish species. Recreationally important nonnative fish species are generally not present in the lagoons, and this impact would not be significant and unavoidable. However, if the continued spread of aquatic invasive weeds goes unchecked under the No Action Alternative, the resulting changes to habitat for native or recreationally important game fish species in nearshore areas of Lake Tahoe could be significant and unavoidable.

Issue AQU-9: Effects Associated with the Introduction or Spread of Invasive Aquatic Species. Given the rigorous watercraft inspection program at Lake Tahoe and the expectation that requirements for inspecting and cleaning all in-water work equipment would be included in the permit conditions for the Proposed Project or Action Alternatives, this impact would not be significant and unavoidable. No additional boats or equipment would enter the water to conduct methods testing or monitoring under the No Action Alternative, so this impact would also not be significant and unavoidable under this alternative.

5.2.7 Terrestrial Biology and Ecology

Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species. No significant unavoidable environmental effects would occur for this issue under the Proposed Project and all alternatives.

Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species. A significant unavoidable environmental effect could occur to a sensitive community (Pope Marsh) under the Proposed Project and all alternatives if dewatering effluent is discharged at times or in amounts that cause water level fluctuations to have a substantially adverse effect. However, it is expected that mitigation will be applied to avoid such an outcome.

5.2.8 Land and Shoreline Use

No significant unavoidable environmental effects would occur for any of the identified land and shoreline under the Proposed Project and all alternatives.

5.2.9 Recreation

No significant unavoidable environmental effects would occur for any of the identified recreation issues under the Proposed Project and all alternatives.

5.2.10 Utilities

Issue UT-1: Effects on Water Supply. No significant unavoidable environmental effects would occur for this issue under the Proposed Project and all alternatives. No significant unavoidable environmental effects would occur for this issue under the Proposed Project and Action Alternatives. In the No Action Alternative, a potentially significant turbidity-related impact could occur if intakes are located in shallow waters where habitat could support uncontrolled growth of aquatic weeds.

5.2.11 Traffic and Transportation

No significant unavoidable environmental effects would occur for any of the identified traffic and transportation issues under the Proposed Project and all alternatives.

5.2.12 Noise

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. No significant unavoidable environmental effects would occur for this issue under the Proposed Project and all alternatives.

5.2.13 Cultural Resources

Issue CR-1: Traditional Native American Resources and Values. No significant unavoidable environmental effects would occur for this issue under the Proposed Project and all alternatives.

5.3 SIGNIFICANT IRREVERSIBLE/IRRETRIEVABLE EFFECTS

CEQA Section 21100(b)(2)(B) states that an EIR shall analyze in a separate section significant and irreversible environmental changes. State CEQA Guidelines Section 15126.2(c) provides the following guidance for an analysis of the significant and irreversible changes of a project:

Uses of nonrenewable resources during the initial and continued phases of the project may be irreversible since a large commitment of such resources makes removal or nonuse thereafter unlikely. Primary impacts and, particularly, secondary impacts (such as highway improvement which provides access to a previously inaccessible area) generally commit future generations to similar uses. Also irreversible damage can result from environmental accidents associated with the project. Irretrievable commitments of resources should be evaluated to assure that such current consumption is justified.

40 CFR 1502.16 also states that an EIS shall analyze irreversible and irretrievable commitments of resources such as soils, wetlands, and waterfowl habitat. The irreversible and irretrievable commitment of resources is the permanent loss of resources for future or alternative purposes. These resources cannot be recovered or recycled or are consumed or reduced to unrecoverable forms.

5.3.1 Environmental Health

No significant irreversible or irretrievable environmental health effects would occur for any of the identified environmental health issues under the Proposed Project or any alternative.

5.3.2 Earth Resources

Issue ER-1: Suction Dredging and Dredge Materials Disposal. The potentially significant unavoidable effects that could result if spills occur in dredge material handling and transport for Action Alternative 2 would not cause significant irreversible or irretrievable environmental effects.

5.3.3 Air Quality and Greenhouse Gas

No significant irreversible or irretrievable environmental effects would occur for any of the identified air quality and greenhouse gas issues under the Proposed Project and all alternatives.

5.3.4 Hydrology

Issue HY-1: Disposal of Dewatering Effluent. This issue affects only Action Alternative 2. No significant irreversible or irretrievable environmental effects would occur for this issue under Action Alternative 2.

5.3.5 Water Quality

No significant irreversible or irretrievable water quality effects would occur for any of the identified water quality issues under the Proposed Project or any Action Alternative. However, if the spread of aquatic invasive plants continues under the No Action alternative then some water quality impacts could eventually become irreversible and irretrievable (e.g., increased nearshore turbidity and decreased lake clarity when fine organic sediments from plant decomposition are disturbed). The permanence of these adverse water quality impacts is uncertain because there is the potential that new aquatic weed control technologies could be developed to control and reduce aquatic invasive plant infestations.

5.3.6 Aquatic Biology and Ecology

Significant and unavoidable impacts to aquatic biological communities and habitat were identified for the No Action Alternative only. If the spread of aquatic invasive plants continues under the No Action Alternative, then impacts to macrophyte and BMI communities and fish habitat could eventually become irreversible and irretrievable. However, the permanence of these significant impacts is uncertain because there is the potential that new aquatic weed control technologies could be developed to control and reduce aquatic invasive plant infestations in the future.

5.3.7 Terrestrial Biology and Ecology

No significant irreversible or irretrievable environmental effects would occur for any of the identified terrestrial issues under the Proposed Project and all alternatives.

5.3.8 Land and Shoreline Use

No significant irreversible or irretrievable environmental effects would occur for any of the identified land and shoreline issues under the Proposed Project and all alternatives.

5.3.9 Recreation

No significant irreversible or irretrievable environmental effects would occur for any of the identified recreation issues under the Proposed Project and all alternatives.

5.3.10 Utilities

Issue UT-1: Effects on Water Supply. No significant irreversible or irretrievable environmental effects would occur for this issue under the Proposed Project and all alternatives.

5.3.11 Traffic and Transportation

No significant irreversible or irretrievable environmental effects would occur for any of the identified traffic and transportation issues under the Proposed Project and all alternatives.

5.3.12 Noise

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. No significant irreversible or irretrievable environmental effects would occur for this issue under the Proposed Project and all alternatives.

5.3.13 Cultural Resources

Issue CR-1: Traditional Native American Resources and Values. No significant irreversible or irretrievable environmental effects would occur for this issue under the Proposed Project and all alternatives.

5.4 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM EFFECTS AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Section 3.7.2 of the TRPA Code of Ordinances and 40 CFR 1502.16 require a discussion of the relationship between a project's local short-term uses of the environment and the maintenance and enhancement of long-term productivity. The following discussion addresses how implementing the project would affect the short-term use and the long-term productivity of the environment.

5.4.1 Environmental Health

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified environmental health issues under the Proposed Project or any alternative.

5.4.2 Earth Resources

Issue ER-1: Suction Dredging and Dredge Materials Disposal. The potentially significant avoidable effects that could result if spills occur in dredge material handling and transport for Action Alternative 2 would not create a trade-off between short-term uses and long-term effects and enhancement of long-term productivity.

5.4.3 Air Quality and Greenhouse Gas

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified air quality and greenhouse gas issues under the Proposed Project and all alternatives.

5.4.4 Hydrology

Issue HY-1: Disposal of Dewatering Effluent. This issue affects only Action Alternative 2. No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for this issue.

5.4.5 Water Quality

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified water quality issues under the Proposed Project or any alternative.

5.4.6 Aquatic Biology and Ecology

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified aquatic biology and ecology issues under the Proposed Project or any alternative.

5.4.7 Terrestrial Biology and Ecology

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified terrestrial issues under the Proposed Project and all alternatives.

5.4.8 Land and Shoreline Use

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified land and shoreline issues under the Proposed Project and all alternatives.

5.4.9 Recreation

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified recreation issues under the Proposed Project and all alternatives.

5.4.10 Utilities

Issue UT-1: Effects on Water Supply. No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for this issue under the Proposed Project and all alternatives.

5.4.11 Traffic and Transportation

No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for any of the identified traffic and transportation issues under the Proposed Project and all alternatives.

5.4.12 Noise

Issue NO-1: Short-Term Noise Associated with Dredging and Substrate Replacement. No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for this issue under the Proposed Project and all alternatives.

5.4.13 Cultural Resources

Issue CR-1: Traditional Native American Resources and Values. No significant tradeoffs in the relationship between short-term uses and long-term effects and enhancement of long-term productivity would occur for this issue under the Proposed Project and all alternatives.

5.5 GROWTH-INDUCING IMPACTS

CEQA Section 21100(b)(5) specifies that the growth-inducing impacts of a project must be addressed in an EIR. Section 15126.2(d) of the State CEQA Guidelines provides that a project alternative would be growth inducing if it could "foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment." Direct growth inducement would result if a project involved, for example, the construction of new housing. Indirect growth inducement would result if a project established substantial new permanent employment opportunities (e.g., new commercial, industrial, or governmental enterprises), involved a construction effort with substantial short-term employment opportunities that would indirectly stimulate the need for additional housing and services, or removed an obstacle to housing development.

Examples of growth-inducing actions include developing water, wastewater, fire, or other types of service areas in areas not previously served; extending transportation routes into previously undeveloped areas; and establishing major new employment opportunities.

Growth would not be directly induced under the Proposed Project or Action alternatives because none of them propose additional housing. In addition, growth would not be indirectly induced because substantial new permanent employment opportunities would not result under the Proposed Project or Action Alternatives. The Proposed Project and Action Alternatives would generate short-term employment opportunities; however, the work would be temporary and would occur intermittently over several years, with certain activities starting and stopping for shorter durations within that period. The No Action Alternative would not result in changes to activities already occurring. Because of the limited number and type of jobs that would be generated and the temporary nature of those jobs, it is anticipated that the jobs would be filled using the existing local employment pool. Existing available housing in the region would easily accommodate any workers who relocate from outside the area, if needed. The number of permanent employees would not increase under any of the alternatives. Therefore, the Proposed Project and Action Alternatives would have no effect on the local workforce and would not significantly affect employment.

In addition, the project would not involve the provision of any new services or construction of new utilities to the study area that would have more capacity than needed for uses currently being proposed, and no road improvements are proposed as part of the project. For these reasons, indirect growth-inducing impacts resulting from implementing the Proposed Project or Action Alternatives would be less than significant.

5.6 CEQA MANDATORY FINDINGS OF SIGNIFICANCE

Mandatory findings are addressed in CEQA 15065 (attached). Mandatory findings of Significant Effects are determined by the California Legislature and the California Secretary of Resources and are listed in CEQA Guidelines Appendix G. California courts have determined that some impacts are considered significant "by definition". Mandatory findings of significance with respect to the TRPA EIP Environmental Threshold Carrying Capacities are addressed in Section 5.7.

In general, no mandatory findings of significance as defined under CEQA 15065 and Appendix G would apply to the Proposed Project and Action Alternatives 1 and 2 for any of the identified environmental issues evaluated in this DEIR/DEIS, with the following exceptions:

Appendix G Significant Effect: Have a substantially adverse effect on any riparian habitat or other sensitive community identified in local plans or policies or violate CDFW or USFWS regulations.

- Sensitive communities (wetlands) could be affected by discharge of dewatering effluent to Pope Marsh and/or Lake Tallac under Action Alternative 2 (alternative discharges and mitigations in terms of timing and amounts of discharge are available).

The No Action Alternative requires a mandatory finding of significance with regard to water quality:

Appendix G Significant Effect: Substantially degrade water quality.

- Water temperature, sediment disturbance and turbidity, dispersal of aquatic fragments, changes in pH, changes in dissolved oxygen, and increases in total phosphorus and total nitrogen could all be affected in Tahoe Keys and Lake Tahoe (particularly in shallow nearshore areas) if the Proposed Project does not proceed and the No Action Alternative governs future activities.

5.7 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

CEQA Guidelines 15126.6 address Alternatives to the Proposed Project, stating that "*an EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives,*" and further, "*The range of potential alternatives to the proposed project shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects*."

Sections 15126.6(a) and 15126.6e(2)) require that an EIR's analysis of alternatives identify the "environmentally superior" alternative among all of those considered. In addition, if the No-Project Alternative is identified as the environmentally superior alternative, then the EIR must also identify the environmentally superior alternative among the other alternatives. Under CEQA, the goal of identifying the environmentally superior alternative is to assist decision makers in considering project approval. CEQA does not require an agency to select the environmentally superior alternative (State CEQA Guidelines Section 15042–15043).

The TRPA Compact and Code of Ordinances do not specifically call for identifying an environmentally superior alternative.

In this case, the No Action Alternative is not the environmental superior alternative; in fact, as shown in Table 5-1, it would have the greatest potentially significant unavoidable impacts of the four alternatives considered.

Action Alternative 1 (Testing of Non-Herbicide Methods Only) was selected as an alternative that might reduce the potentially significant effects of the Proposed Project by avoiding the application of herbicides.

Action Alternative 2 (Tahoe Key Dredge and Replace Substrate) was selected after scoping as an alternative suggested by stakeholders that also might reduce impacts by avoiding the application of herbicides.

As shown in Table 5-1, both the Proposed Project and Action Alternative 2 would have potentially significant unavoidable impacts on recreational boating. In addition, although the Proposed Project and both Action Alternatives mitigate all other identified environmental issues to less than significant, both the Proposed Project and Action Alternative 2 entail activities (application of herbicides and the dredging, dewatering and disposal of sediment) that would not occur under Action Alternative 1. Although mitigated, these additional activities entail some measure of potential risk and reduced impact. For all these reasons, Action Alternative 1 is the environmentally superior alternative.

Table 5-1 Alternatives Comparison.

Notes: LOS = Level of Significance, PS = Potentially Significant, LTS = Less Than Significant, PP = Proposed Project, AA1 = Action Alternative 1, AA2 = Action Alternative 2, NOA = No Action Alternative

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
Environmental Health and Risk				
Issue EH-1: Herbicide Applicator Exposure and Heath.	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable (herbicides would not be applied under this Alternative)	Not applicable (herbicides would not be applied under this Alternative)	Not applicable (herbicides would not be applied under this Alternative)
Issue EH-2: Detectable Concentrations of Herbicides and Degradates in Receiving Waters.	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable (herbicides would not be applied under this Alternative)	Not applicable (herbicides would not be applied under this Alternative)	Not applicable (herbicides would not be applied under this Alternative)
Issue EH-3: Protection of Drinking Water Supplies.	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and	Not applicable (herbicides would not be applied under this Alternative)	Not applicable (no nexus to affect drinking water exists under this Alternative)	Not applicable (herbicides would not be applied under this Alternative)

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect			
Issue EH-4: Introduction of Toxic Substances into the Environment.	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable (herbicides would not be applied under this Alternative)	Not applicable (herbicides would not be applied under this Alternative)	Not applicable (herbicides would not be applied under this Alternative)
Issue EH-5: Short-term Increases in Aluminum Concentrations.	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant unavoidable effects No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue EH-6: Harmful Algal Blooms (HABs).	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and	Not applicable (organic matter will be removed by suction dredge)	Potentially significant unavoidable effects continue for long-term. No effect on the relationship between short-term uses and

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect		long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Earth Resources				
Issue ER-1: Suction Dredging and Dredge Materials Disposal.	Not applicable (dredge alternative only)	Not applicable (dredge alternative only)	No significant unavoidable effects after mitigation No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable (dredge alternative only)
Air Quality and Greenhouse Gas				
Issue AQ-1: Compliance with the Basin Air Quality Plan.	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
Issue AQ-2: Cumulatively Considerable Net Increases of Criteria Pollutants.	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue AQ-3: Exposure of Sensitive Receptors.	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue GHG-1: Greenhouse Gas Emissions.	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	No irreversible or irretrievable effect	No irreversible or irretrievable effect	No irreversible or irretrievable effect	No irreversible or irretrievable effect
Hydrology				
Issue HY-1: Disposal of Dewatering Effluent.	Not applicable (dredge alternative only)	Not applicable (dredge alternative only)	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable (dredge alternative only)
Water Quality				
Issue WQ-1: Water Temperature Effects.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable to dredge alternative	Potentially significant effects in shallow nearshore areas if weeds continue to proliferate No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effects
Issue WQ-2: Sediment Disturbance and Turbidity.	No significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and	Potentially significant effects in shallow nearshore areas if weeds continue to proliferate. No effect on the relationship between short-term uses and long-term effects, and

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue WQ-3: Dispersal of Aquatic Weed Fragments.	Not applicable (Proposed Project does not affect dispersal of weed fragments)	Not applicable (Action Alternative 1 does not affect dispersal of weed fragments)	No significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant unavoidable effects continue for long-term. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue WQ-4: Changes in pH.	No significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant unavoidable effects continue for long-term. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
Issue WQ-5: Changes in Dissolved Oxygen Concentrations.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant unavoidable effects continue for long-term. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue WQ-6: Increases in Total Phosphorus Concentrations.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant unavoidable effects continue for long-term. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue WQ-7: Increases in Lagoon Water Total Nitrogen Concentrations.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	Potentially significant unavoidable effects continue for long-term. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	No irreversible or irretrievable effect	No irreversible or irretrievable effect	No irreversible or irretrievable effect	No irreversible or irretrievable effect
Aquatic Biology and Ecology				
Issue AQU-1: Effects on Non-Target Aquatic Macrophyte Species.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant adverse effect. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue AQU-2: Competitive Exclusion of Aquatic Macrophytes Due to Increased growth of Curlyleaf Pondweed.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable (proposed project only)	Not applicable (proposed project only)	Not applicable (proposed project only)
Issue AQU-3: Effects on Sensitive Aquatic Macrophyte Species.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity	Not applicable (proposed project only, applies to watershield in Lake Tallac)	Not applicable (proposed project only, applies to watershield in Lake Tallac)	Not applicable (proposed project only, applies to watershield in Lake Tallac)

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	No growth-inducing effects No irreversible or irretrievable effect			
Issue AQU-4: Changes in Aquatic Macrophyte Community Composition.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant adverse effect. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue AQU-5: Effects on Aquatic Benthic Macroinvertebrate Community.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant adverse effect. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue AQU-6: Effects on Special-Status Fish Species.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity	Potentially significant adverse effect. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	No growth-inducing effects No irreversible or irretrievable effect	No growth-inducing effects No irreversible or irretrievable effect	No growth-inducing effects No irreversible or irretrievable effect	No growth-inducing effects No irreversible or irretrievable effect
Issue AQU-7: Effects on Fish Movement That Would Block Access to Spawning Habitat.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant adverse effect. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue AQU-8: Effects on the Suitability of Habitat for Native or Recreationally Important Game Fish Species.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Potentially significant adverse effect. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue AQU-9: Effects Associated with the Introduction or Spread of Invasive Aquatic Species.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity	No significant unavoidable effects; no mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity	Potentially significant adverse effect. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	No growth-inducing effects No irreversible or irretrievable effect	No growth-inducing effects No irreversible or irretrievable effect	No growth-inducing effects No irreversible or irretrievable effect	No growth-inducing effects No irreversible or irretrievable effect
Terrestrial Biology and Ecology				
Issue TE-1: Short-Term Effects on Terrestrial Habitats and Species.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue TE-2: Effects on Non-Target Riparian and Wetland Habitats and Species.	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Land and Shoreline Use				
Issue LN-1: Physical Division of an Established Community.	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue LN-2: Conflicts with Land Use Plans, Policies or Regulations.	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue LN-3: Inclusion of Unpermitted Land Uses.	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Recreation				
Issue RE-1: Obstruction of Recreational Boat Passage	No significant unavoidable effects; no mitigation required	Not applicable	No significant unavoidable effects; no mitigation required	Potentially significant unavoidable effects.

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	Relatively short-term (6 months) use of test sites in the Tahoe Keys for application of herbicide tests under the CMT would obstruct recreational boating but enhance long-term productivity through improving conditions by facilitating eventual control of aquatic weeds. No growth-inducing effects No irreversible or irretrievable effect		No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue RE-2: Increased Use of Tahoe Keys Marina	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable
Issue RE-3: Inconsistency with TRPA Recreation Thresholds	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	Not applicable	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects	Potentially significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	No irreversible or irretrievable effect		No irreversible or irretrievable effect	No irreversible or irretrievable effect
Utilities				
Issue UT-1: Effects on Water Supply	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	Not applicable (issue applies to CMT herbicide treatment only)	Not applicable (issue applies to CMT herbicide treatment only)	Potentially significant unavoidable effects. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Traffic and Transportation				
Issue TR-1: Generation of New Daily Vehicle Trips	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue TR-2: Changes in Demand for Parking	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue TR-3: Effects on Roads and Level of Service	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Issue TR-4: Effects on Water Traffic	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Noise				
Issue NO-1: Short-Term Noise Associated with	No significant unavoidable effects; no mitigation required.	No significant unavoidable effects; no mitigation required.	No significant unavoidable effects after mitigation.	No significant unavoidable effects; no mitigation required.

Environmental Issue	Proposed Project	Action Alternative 1 (Testing Non-Chemical Methods Only)	Action Alternative 2 (Tahoe Keys Lagoons Suction Dredge and Substrate Replacement)	No Action Alternative
Dredging and Substrate Replacement.	No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect
Cultural Resources				
Issue CR-1: Traditional Native American Resources and Values	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects after mitigation. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect	No significant unavoidable effects; no mitigation required. No effect on the relationship between short-term uses and long-term effects, and enhancement of long-term productivity No growth-inducing effects No irreversible or irretrievable effect

6.0 COMPLIANCE, CONSULTATION, AND COORDINATION

This chapter describes the Proposed Project's compliance with applicable federal statutes and executive orders in Section 6.1, and with state statutes and regulations in Section 6.2. Regulatory setting sections in Chapter 3 discuss applicable federal, state, and local laws and regulations. Consultation and coordination undertaken to involve public and agencies and stakeholders in scoping and identifying key issues, advising on goals and objectives, identifying the range of alternatives, and advising on potential environmental impacts and appropriate mitigation measures is covered in Section 6.3. These efforts included consultation, public scoping meetings, and the ongoing stakeholder process described below. Tahoe Regional Planning Agency (TRPA) and LWB will continue to solicit public and agency input on the Project through the review of this DEIR/DEIS and beyond.

6.1 FEDERAL

6.1.1 Federal Endangered Species Act Of 1973, As Amended (16 USC Section 1531 Et Seq.)

The U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) are charged with oversight of species designated as threatened or endangered under the Federal Endangered Species Act (ESA) of 1973, as amended (16 U.S. Code (USC) 1531 et seq.). The act prohibits "take" of species listed as threatened or endangered. To "take" a species means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns also constitutes take. USFWS administers the ESA for terrestrial and freshwater species, and NMFS administers the ESA for marine and anadromous fish species.

Where a proposed project has a federal nexus, compliance with the ESA is through a process described by Section 7 of the ESA. Section 7(a)(2) of the ESA requires federal agencies to consult with USFWS to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species. Regulations jointly issued by USFWS and NMFS guide the consultation process.

When implementing Section 7(a)(2), a federal agency may make one of three possible determinations: no effect, not likely to adversely affect (NLAA), or may adversely affect (MAA). If the agency determines that implementing the proposed action would have no effect on listed species and provides a logical rationale for that determination, then ESA compliance for that action is complete. If the agency makes an NLAA determination, then it must seek concurrence with that determination from USFWS and/or NMFS. Projects that are wholly beneficial or have insignificant or unlikely adverse effects merit an NLAA determination. If the agency makes an MAA determination, then it must enter a formal consultation.

Under Section 7, the consultation process involves producing a biological assessment (BA) to describe the impact mechanisms and any adverse effects on the listed species. Based on the information contained in the BA, USFWS and/or NMFS may issue a biological opinion (BO), which states whether or not the federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Non-jeopardy BOs include an incidental take statement, describing the amount of "take" that is allowed to occur for otherwise lawful activities. BOs also identify "reasonable and prudent measures" that USFWS and NMFS believe are necessary and appropriate to minimize the effects of implementing a project, as well as terms and conditions to minimize incidental take or avoid take altogether.

As discussed in Section 3.3.6, "Terrestrial Biology and Ecology," TRC Solutions (TRC), on behalf of the TRPA, conducted a terrestrial biological resources field assessment in order to: record plant and animal species observed; map distinct plant communities and terrestrial wildlife habitat; map potential habitat for rare, threatened or endangered species; observe for special-status species; characterize vegetation communities and land cover types; search for animal signs and potential avian nest sites; and photograph the test sites and project vicinity. The assessment determined that implementing the proposed project would not result in take of a species federally listed by USFWS as threatened or endangered. Although initial surveys have been conducted, additional pre-test surveys for special status species and nesting birds would be conducted to further assess potential impacts of the final project. TRPA would coordinate with USFWS regarding the final design and pre-test survey results and would determine the need for formal consultation.

6.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA), first enacted in 1918, domestically implements a series of international treaties that provide protection for migratory birds. It authorizes the Secretary of the Interior to regulate the taking of migratory birds and provides that it shall be unlawful, except as permitted by regulations, to pursue, take, or kill any migratory bird or any part, nest, or egg of any such bird (16 USC 703). This prohibition includes both direct and indirect acts, although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. The current list of species protected by the MBTA includes several hundred species, which essentially includes all native birds.

Compliance with the MBTA is being addressed through compliance with the ESA and CEQA and through an additional measure. As discussed in Section 3.3.6, "Terrestrial Biology and Ecology," adverse impacts on special-status migratory birds would be avoided and effects on other migratory species reduced through MM-BIO-1 which includes conducting pre-test surveys and establishing exclusion zones. In addition to these measures, to comply with the MBTA, a pre-test survey for migratory bird nests would be conducted to locate and avoid or minimize the loss of active nests during testing. For test site activities during the nesting season (approximately February 1 to August 15) and within suitable nesting habitat, a pre-test survey for active nest sites of migratory birds would be conducted within 14 days before testing begins. If a migratory bird nest or likely nest site is located, a buffer around the nest would be avoided until the nest is no longer active and/or a biological field monitor with stop work authority if impacts to receptors are possible would be utilized.

6.1.3 Federal Water Pollution Control Act Of 1977 (33 USC 1251 Et Seq.)

Section 303(D)

The Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), provides for the restoration and maintenance of the physical, chemical, and biological integrity of the nation's waters. Section 303(d) of the CWA requires states to compile a list of impaired water bodies that do not meet water quality standards and establish total maximum daily loads (TMDLs) for such waters. The deep water transparency standard for Lake Tahoe is 29.7 meters, the average annual Secchi disk depth measured between 1967 and 1971 (LRWQCB and NDEP 2010). Because of the decline in water transparency over the past five decades, Lake Tahoe is listed under Section 303(d) as impaired by input of nitrogen, phosphorus and sediment, the primary factors contributing to the decline. A TMDL was established with a plan to restore Lake Tahoe's deep water transparency to 29.7 m annual average

Secchi depth. The Lake Tahoe TMDL Implementation Plan is the most comprehensive water quality restoration effort underway in the Lake Tahoe Basin, and defines the highest priorities for water quality protection and improvement. The National Pollutant Discharge Elimination System (NPDES) permits issued by the states to regulate the discharge of pollutants under Section 402 of the CWA must be consistent with allocations prescribed in the TMDL.

Section 401

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification for the discharge. The certification must be obtained from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over the affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the regional water quality control board (RWQCB) with local jurisdiction—in this case, the Lahontan Water Board. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States. The Federal government delegates water pollution control authority under Section 401 to the State of California. Refer to Section 5.2.8, "Porter-Cologne Water Quality Control Act."

Section 402

Section 402 of the CWA establishes the NPDES permit program to regulate point source discharges of pollutants into waters of the United States. A NPDES permit sets specific discharge limits for point sources discharging pollutants into waters of the United States and establishes monitoring and reporting requirements, as well as special conditions. The Federal government delegates water pollution control authority under Section 402 to the states, so the states oversee compliance. Refer to Section 6.2.6, "Porter-Cologne Water Quality Control Act."

Section 404

Section 404 of the CWA prohibits the discharge of fill material into waters of the United States, including wetlands, except as permitted under separate regulations by the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA). Section 404 requires projects to receive authorization from the Secretary of the Army, acting through USACE, to discharge dredged or fill material into waters of the United States, including wetlands, whether the discharge is temporary or permanent. Waters of the United States are generally defined as "waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; territorial seas and tributaries to such waters." Section 404 is generally applicable to projects for which fill material would be placed within or below the ordinary high-water mark of a stream. In conjunction with USACE's CWA Section 404 permits, CWA Section 401 requires that water quality certifications or waivers be issued by EPA, the states, or both (see below).

Before the detailed design used for test site implementation is approved, a delineation of waters of the United States (including wetlands) that would be affected by project implementation would be conducted by a qualified biologist through the formal Section 404 wetland delineation process. The delineation would be submitted to and verified by the Sacramento District of USACE. Authorization for fill or reconstruction of jurisdictional waters of the United States, including wetlands, would be secured from the Sacramento District of USACE through the Section 404 permitting process. Section 404 permitting usually requires the following items:

- a determination of the volume and types of material to be placed into waters of the United States;
- a determination of the total area of waters of the United States to be directly and indirectly affected;
- a wetland delineation in accordance with the 1987 Wetland Delineation Manual (Environmental Laboratory 1987) and the Western Mountain Regional Supplement (USACE 2008) when a project would impact wetlands;
- a description of habitats, including plant communities, located in the study area;
- a description of any environmental impacts that are expected to occur, including methods to avoid, minimize, or mitigate adverse impacts on water quality or aquatic functions at the project site;
- any other information pertinent to the wetland, stream, or water body involved;
- for projects involving the restoration of greater than 3 acres of wetlands, evidence that USFWS has been provided with a courtesy copy of the project notification; and
- a copy of the Section 401 water quality certification or waiver issued for the project.

TKPOA would coordinate with USACE as appropriate and obtain the appropriate permit for all relevant aspects of the project. All general terms required for permit compliance would be implemented. Because the project would identify the location of sensitive habitats, minimize impacts, and compensate for any losses through the permit process, it would comply with Section 404 of the CWA.

6.1.4 Federal Antidegradation Policy

The Tier III designation of Lake Tahoe (including the West and East lagoons) under the federal Antidegradation Policy provides that states may allow some limited activities that result in temporary and short-term changes to water quality, but such changes should not adversely affect existing uses or alter the essential character or special uses for which Lake Tahoe was designated as an outstanding national resource water (ONRW). As discussed in Section 1.4.1.1, if detectable concentrations of applied aquatic herbicide active ingredients or select degradation byproducts are present longer than “weeks to months, not years” the discharges would be assessed to cause long-term water quality degradation. The LWB has discretion in determining the allowable time frames for what constitutes long-term and short-term existing water quality degradation within the “weeks to months, not years” guidance from USEPA. The State Water Board established California’s antidegradation policy in State Water Board Resolution 68-16, which incorporates the requirements of the federal antidegradation policy. In addition to proposed aquatic herbicide products, injection of acetic acid under bottom barriers would be considered a chemical discharge subject to antidegradation policies.

6.1.5 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) (42 USC 300f et seq.) was established to protect the quality of drinking water in the United States. This law focuses on all waters actually or potentially designated for drinking use, whether from aboveground or underground sources. The SDWA authorized EPA to establish water quality standards and required all owners or operators of public water systems to comply with primary (health-related) standards. State governments are delegated authority to implement SDWA and also encourage attainment of secondary (nuisance-related) standards. Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are regulated by EPA using primary and secondary maximum contaminant levels (MCLs). As directed by the SDWA amendments of 1986, EPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants. Furthermore, water used for domestic purposes is required to be treated by the local or regional water supplier in accordance with federal and sState standards, and the proposed project would not change existing license requirements, impede enforcement of standards, or otherwise affect drinking water quality. Therefore, the project would be in compliance with any applicable drinking water standards. Federal government delegates water pollution control authority under the SDWA to the State of California which oversees compliance. Refer to Section 5.2.8, "Porter-Cologne Water Quality Control Act."

6.1.6 Federal Clean Air Act

EPA has been charged with implementing national air quality programs. EPA's air quality mandates are drawn primarily from the Federal Clean Air Act (CAA), which was enacted in 1970. The most recent major amendments made by Congress were in 1990.

The CAA required EPA to establish national ambient air quality standards (NAAQS). EPA has established primary and secondary NAAQS for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, respirable particulate matter, fine particulate matter, and lead. The primary standards protect the public health, and the secondary standards protect public welfare. The CAA was enacted to protect and enhance the nation's air quality to promote public health and welfare and the productive capacity of the nation's population. It requires an evaluation of any federal action to determine its potential impact on air quality in the project region. California has a corresponding law that also must be considered during the EIR/EIS/EIS process. (Refer to Section 5.2.1, "California Clean Air Act.") Proponents of specific projects must demonstrate that their actions will conform to the CAA and the State Implementation Plan (SIP). A federal action conforms with an applicable SIP if (1) the total of direct and indirect emissions from the action are compliant and consistent with the requirements of the SIP and (2) one of a list of enumerated, pollutant-specific requirements is satisfied (such as accounting for the Federal action's projected emission of any criteria pollutant in the SIP or offsetting ozone or nitrogen dioxide emissions in a nonattainment area) (42 Code of Federal Regulations (CFR) 93.158(a)).

Section 3.3.2, "Air Quality and Climate Change," provides an evaluation of the potential impacts on air quality and Environmental Commitments to reduce those impacts. As described in Section 3.3.2, emissions from the proposed project would be within the budgets established by the SIP for all criteria air pollutants. Because project alternatives were found to comply with the SIP and the project would not contribute substantially to a violation of the NAAQS, the proposed project would comply with the CAA.

6.1.7 Section 106 of the National Historic Preservation Act of 1966, as Amended (Public Law 89-665, 80 Stat. 915, 16 USC Section 470 et seq. and 36 CFR 18, 60, 61, 63, 68, 79, 800)

The National Historic Preservation Act requires agencies to take into account the effects of their actions on properties listed in or eligible for listing in the National Register of Historical Places (NRHP). The Advisory Council on Historic Preservation has developed an implementing regulation (36 CFR 800) that allows agencies to develop agreements for consideration of these historic properties. Section 106 review includes the scoping, identification, assessment, and consultation called for in its implementing regulation (36 CFR 800) to determine impacts on properties listed in or eligible for listing in the NRHP. Consultation under Section 106 takes place during preparation of an EIS to determine whether historic resources would be adversely affected and, if so, whether measures could be implemented to reduce adverse effects to a less-than-significant level. Section 106 does not address impacts on all types of cultural resources or all cultural aspects of the environment; it deals only with impacts on properties listed in or eligible for listing in the NRHP.

Section 106 requires federal agencies to consider the effects of their actions, including those they fund or permit, on properties that may be eligible for listing or are listed in the NRHP. To determine whether an undertaking could affect NRHP-eligible properties, cultural resources (archaeological, historic, and architectural properties) must be inventoried and evaluated for listing in the NRHP. Although compliance with Section 106 is the responsibility of the lead Federal agency, a qualified representative of the lead agency can conduct the necessary steps. The Section 106 review process involves a four-step procedure:

- Establish the undertaking, develop a plan for public involvement, and identify other consulting parties.
- Identify historic properties by determining the scope of efforts, identifying cultural resources, and evaluating their eligibility for inclusion in the NRHP.
- Assess adverse effects by applying the criteria of adverse effect on historic properties (resources that are eligible for inclusion in the NRHP).
- Resolve adverse effects by consulting with the State Historic Preservation Officer (SHPO) and other consulting agencies, including the Advisory Council on Historic Preservation if necessary, to develop an agreement that addresses the treatment of historic properties.

In accordance with Section 106 requirements, potentially interested tribes identified by the Native American Heritage Commission (NAHC) was contacted regarding the Proposed Project. The Proposed Project and Action Alternatives are primarily focused on actions occurring on or in the waters of the Tahoe Keys lagoons. One land site (at the mothballed Tahoe Keys Water Treatment Plant) would be utilized for staging and sediment and clean substrate handling under the Tahoe Keys Dredge and Replace Substrate Alternative, however that site is highly disturbed. There are currently no historic structures, sites, or artifacts identified in this area that would be affected.

On November 15, 2018, the United Auburn Indian Community provided a written request for consultation and recommendations for mitigation measures. These measures included an Unanticipated Discovery Plan, Awareness Training for consultants and construction workers, and an associated Tribal Cultural Resources Awareness brochure to be included in the Proposed Project Mitigation Monitoring Plan.

The Unanticipated Discovery Plan would include guidelines that a qualified cultural resources specialist, in conjunction with Native American Representatives and Monitors from traditionally and culturally affiliated Native American Tribes, will assess the significance of any unanticipated finds and make recommendations for further evaluation and treatment as necessary. Culturally appropriate treatment that preserves or restores the cultural character and integrity of a Tribal Cultural Resource may include Tribal Monitoring, culturally appropriate recovery of cultural objects, and reburial of cultural objects or cultural soil. If adverse impacts to tribal cultural resources, unique archeology, or other cultural resources occurs, then consultation with traditionally and culturally affiliated Native American Tribes regarding mitigation should occur.

Awareness Training for consultants and construction workers will be conducted in coordination with traditionally and culturally affiliated Native American Tribes. The Proposed Project proponent will develop and administer a consultant and construction worker training program for all personnel involved in project construction and implementation. The training will include relevant information regarding sensitive tribal cultural resources, including applicable regulations, protocols for avoidance, and consequences of violating State laws and regulations. The training will outline what to do and whom to contact if any potential resources or artifacts are encountered. The training will also underscore the requirement for confidentiality and culturally appropriate treatment of any find of significance to Native Americans.

The Associated Tribal Cultural Resources Awareness brochure was developed by the United Auburn Indian Community and provides guidelines for protection measures and protocols for unanticipated finds or the discovery of human remains, shows examples of potential cultural resources, and encourages respect for Native American Culture. The brochure will be provided in conjunction with Awareness Training.

In addition, the Lahontan Water Board has initiated the Section 106 process for the Proposed Project and will complete consultation with the SHPO before the record of decision is issued. For these reasons, the project would comply with Section 106 of the National Historic Preservation Act.

6.1.8 Indian Trust Assets

Indian Trust Assets (ITAs) are legal interests in property held in trust by the United States for Native American tribes or individuals. The Secretary of the Interior, acting as the trustee, holds many assets in trust. Examples of trust assets include lands, minerals, hunting and fishing rights, and water rights over which it has been determined that tribes have a historical legal claim. The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Native American tribes or individuals by treaties, statutes, and executive orders. This duty, founded in law and restated in departmental policy, requires the Federal lead agency to carry out its activities in a manner that avoids adverse impacts on ITAs when possible. When adverse impacts cannot be avoided, appropriate mitigation or compensation will be provided. However, there are no such lands in or in the immediate vicinity of the study area. For this reason, it was determined that the proposed project would have no impact on ITAs.

6.1.9 Executive Order 11988 (Floodplain Management)

Executive Order 11988 requires federal agencies to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains and to avoid development in floodplains whenever there is a practical alternative. If a project alternative is found to be in the applicable regulatory floodplain, the agency is required to prepare a floodplain assessment, known as a statement of findings. The executive order also directs federal agencies to restore and preserve the natural and beneficial values served by the floodplains (EPA 2010). Implementing the proposed project would restore portions of the Upper Truckee River floodplain and would not involve new development in a designated floodplain. In addition, implementing the proposed project would provide on-site storm drainage facilities and an accompanying stormwater drainage plan to prevent damage from increased stormwater runoff volumes. Therefore, the project would comply with Executive Order 11988.

6.1.10 Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 established the protection of wetlands and riparian systems as the official policy of the federal government. It requires all Federal agencies to consider wetland protection as an important part of their policies and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. As discussed above in Section 6.1.3, "Federal Water Pollution Control Act of 1977 (33 USC 1251 et seq.)," a wetland delineation would be prepared for the proposed project after a preferred alternative is selected, and a Section 404 permit would be obtained before testing begins. Because the location of sensitive habitats would be identified by a wetland delineation for all relevant aspects of the project, Section 404 permit requirements would be complied with, and any losses would be compensated for, all impacts on wetlands would be avoided, minimized, or mitigated. In addition, implementing any of the action alternatives would result in a net increase in the number of wetlands in the study area. Therefore, the proposed project would comply with Executive Order 11990.

6.1.11 Executive Order 13007 (Indian Sacred Sites)

Executive Order 13007 requires federal agencies with land management responsibilities to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners. It also requires that these agencies avoid adversely affecting the physical integrity of such sacred sites. Among other things, Federal agencies must provide reasonable notice of proposed actions or land management policies that may restrict future access to or ceremonial use of, or may adversely affect the physical integrity of, sacred sites. As described in Section 3.4.6, "Archaeological and Historical Resources," cultural resource investigations for the project included background research and Native American consultation which determined that no Indian sacred sites are located in the study area or its vicinity. Therefore, the proposed project would have no effect on any Indian sacred sites. Because there would be no impacts, the project would comply with Executive Order 13007.

6.1.12 Executive Order 13112 (National Invasive Species Management Plan)

Executive Order 13112 directs all federal agencies to prevent the introduction and control the spread of invasive, nonnative species in a cost-effective and environmentally sound manner to minimize economic, ecological, and human health impacts. It established a national Invasive Species Council made up of federal agencies and departments and a supporting Invasive Species Advisory Committee composed of State, local, and private entities. The Invasive Species Council and advisory committee oversee and facilitate implementation of the executive order. Because the invasive plant management practices included in EC 4, "Prepare and Implement Invasive Species Management Plan." would be implemented, the proposed project would comply with this executive order.

6.1.13 Hazardous Materials Management

EPA is the agency primarily responsible for enforcing and implementing federal laws and regulations pertaining to hazardous materials. Applicable federal regulations pertaining to hazardous materials are contained mainly in Titles 29, 40, and 49 of the CFR.

The Proposed Project includes testing aquatic herbicides at sites in the West Lagoon and Lake Tallac. Professional contractors would be licensed as pesticide applicators and required to follow all applicable regulations for safe transport and handling of herbicide products, including requirements to protect workers and the environment.

The Dredge and Replace Substrate alternative would include handling and disposal of lagoons sediments that contain elevated concentrations of aluminum. Past sediment sampling and analyses indicate that the aluminum concentrations present in West Lagoon sediments would not cause them to be classified as hazardous materials. Solid waste regulations applicable to Action Alternative 2 are summarized under State regulations.

6.1.14 Transport of Hazardous Materials

The U.S. Department of Transportation regulates hazardous materials transport between states and is responsible for protecting the public from dangers associated with transporting these materials. This responsibility is in part addressed through the training of persons responsible for regulatory compliance, enforcement, and response to accidents and incidents involving hazardous materials. The Dredge and Replace Substrate alternative would include transporting lagoons sediments that contain elevated concentrations of aluminum, likely trucking dewatered sediment to a disposal site in Nevada. Past sediment sampling and analyses indicate that the aluminum concentrations present in West Lagoon sediments would not cause them to be classified as hazardous materials. Solid waste regulations applicable to Action Alternative 2 are summarized under State regulations.

6.1.15 Worker Safety

As described in the Occupational Safety and Health Act of 1970 (29 USC 651 et seq.), the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor is responsible at the federal level for ensuring worker safety in the handling and use of chemicals. OSHA has adopted numerous regulations pertaining to worker safety, contained in CFR Title 29. Professional contractors would be licensed as pesticide applicators and required to follow all applicable regulations for safe transport and handling of herbicide products, including requirements for worker safety.

6.1.16 Wildlife Hazards to Airspace Safety

Collisions between aircraft and wildlife compromise the safety of passengers and flight crews. Damage to an aircraft resulting from a wildlife collision can range from a small dent in the wing to catastrophic engine failure and destruction of the aircraft, along with potential loss of life.

The Federal Aviation Administration (FAA) is responsible for enforcing 14 CFR 139, which prescribes rules regarding the operation of airports used by aircraft with seating capacity of more than 30 passengers. FAA roles and responsibilities relating to wildlife hazards and their associated human health and safety concerns are addressed in 14 CFR 139.337, Wildlife Hazard Management. An ecological study must be prepared by the certificate holder and submitted to FAA when multiple birds or other wildlife are struck by aircraft or ingested into aircraft engines or if the number of birds or other wildlife in an airport flight pattern is sufficient to result in such hazards. FAA then determines whether a wildlife hazard management plan is needed. FAA's Office of Airport Safety and Standards has published advisory circulars and program policy and guidance directives that further clarify this information. An advisory circular dated August 28, 2007 and titled "Hazardous Wildlife Attractants on or Near Airports" (Advisory Circular 150/5200-33B) provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or to the vicinity of public-use airports. FAA recommends the following separations when siting wildlife attractants (e.g., waste disposal operations, wastewater treatment facilities, and wetlands) (FAA 2007):

- 5,000 feet from airports serving piston-powered aircraft,
- 10,000 feet from airports serving turbine-powered aircraft, and
- 5 miles from airports where the wildlife attractant may cause hazardous wildlife movement into or across the approach or departure airspace.
- Bird strikes have not historically affected aviation safety at the Lake Tahoe Airport. There are no records of bird-related air strikes in the FAA Birdstrike Database, and no airport staff members recall any bird-related air strikes (CDM 2007). With or without project implementation, the likelihood of wildlife- aircraft accidents associated with the Lake Tahoe Airport is considered low. Because an increase in wildlife- related hazards is not expected and the proposed land uses are compatible with the CLUP, the proposed project complies with 14 CFR 139 and 14 CFR 139.337.

6.2 STATE

6.2.1 California Clean Air Act

The California Air Resources Board (ARB) is responsible for coordinating and providing oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA). The CCAA, which was adopted in 1988, required ARB to establish California ambient air quality standards (CAAQS). ARB has established CAAQS for sulfates, hydrogen sulfide, vinyl chloride, lead, visibility-reducing particulate matter, and criteria air pollutants. In most cases, the CAAQS are more stringent than the NAAQS. Differences in the standards are generally explained by the health effects studies considered during the standard- setting process and the interpretation of the studies. In addition, the CAAQS incorporate a margin of safety to protect sensitive individuals.

Because implementing and of the action alternatives (Alternative 1- 4) would not contribute substantially to a violation of the CAAQS through EC 1: Reduce the Generation of Construction-Related Emissions of ROG, NO_X, and PM_{10}, the proposed project would comply with the CCAA.

6.2.2 California Endangered Species Act

The California Endangered Species Act (CESA) was written to protect plant and animal species. Species are listed as endangered or threatened when their continued existence in California is in jeopardy. CESA and Sections 2050 and 2097 of the California Fish and Game Code prohibit activities that would result in "take" of State-listed and candidate species without prior authorization from the California Department of Fish and Wildlife (CDFW). Under CESA, "take" is defined as an activity that would directly or indirectly kill an individual of a species. Unlike under the federal ESA, the CESA definition of “take” does not include “harming” or “harassing”; therefore, habitat modification is not necessarily considered take under CESA.

CDFW authorization for take can be obtained through an incidental take permit under Section 2081(b) of the California Fish and Game Code. A 2081(b) permit will authorize take that is incidental to an otherwise lawful activity as long as the impacts of the authorized take are minimized and fully mitigated. Measures to minimize and fully mitigate impacts must (1) be roughly proportional in extent to the impact of the taking on the species, (2) maintain the applicant’s objectives to the greatest extent possible, (3) be implementable, and (4) be adequately funded to allow implementation and monitoring of compliance.

As discussed in Section 3.3.5, Aquatic Biology and Ecology and Section 3.3.6, Terrestrial Biology and Ecology, potential effects on species that are state listed as endangered or threatened have been evaluated. No aquatic plant species listed under the California Endangered Species Act have been identified in Tahoe Keys macrophyte surveys or are otherwise known to occur in the vicinity of the Tahoe Keys lagoons. This DEIR/DEIS/DEIS identifies two mitigation measures that are designed to avoid or fully mitigate the take of any State-listed plant and animal species: MM-BIO-1 “Field Reconnaissance and Monitoring” and MM-BIO-2 “Routine Monitoring of the Ecotonal Areas within Lake Tallac Outside and Adjacent to the Herbicide Treatment Areas.” In addition to implementing these two mitigation measures, TRPA is coordinating with CDFG and, if necessary, would consult with CDFW to obtain a Section 2081(b) permit. Because effects on listed species would be avoided or fully mitigated and a 2081(b) permit would be obtained before testing begins, the proposed project would comply with CESA.

6.2.3 California Fish and Game Code Section 1602—Streambed Alterations

Section 1602 of the California Fish and Game Code requires that a streambed alteration agreement be granted before any action is conducted that may divert or obstruct natural channel flow; substantially change the bed, channel, or bank of any river, stream, or lake designated by CDFW; or use any material from the streambed of a CDFW-designated waterway. Implementing the proposed project would require a streambed alteration agreement from CDFW for work on the bed and banks of the Lake Tahoe Lagoons. TRPA would obtain the streambed alteration agreement from CDFW and implement all terms required for permit compliance. Therefore, the project would follow California Fish and Game Code Section 1602.

6.2.4 California Fish and Game Code Sections 3503–3503.5—Protection of Bird Nests and Raptors

Section 3503 of the California Fish and Game Code states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Section 3503.5 specifically states that it is unlawful to take, possess, or destroy any raptors (i.e., hawks, owls, eagles, and falcons), including their nests or eggs. Typical violations of these codes include destroying active nests by removing the vegetation in which the nests are located. Disturbance of nesting pairs by nearby project testing that results in the failure of active raptor nests could also violate Section 3503.5. As discussed in Section 3.4, “Biological Resources: Vegetation and Wildlife,” without mitigation, the project’s testing activities could affect nesting birds. This document identifies mitigation measures designed to avoid potential impacts on the nests of special-status bird species and waterfowl, and these measures would also avoid or reduce effects on other nesting birds. In addition, as described above for the MBTA, a pre-testing survey for migratory bird nests would be conducted to locate and avoid or minimize the loss of active nests during testing. Through these measures, the project would comply with California Fish and Game Code Sections 3503–3503.5.

6.2.5 California Native Plant Protection Act

In addition to CESA, the California Native Plant Protection Act (CNPPA) provides protection to endangered and rare plant species, subspecies, and varieties of wild native plants in California. The CNPPA preceded CESA, and its definitions of “endangered” and “rare” closely parallel the CESA definitions of endangered and threatened plant species. With the passage of CESA in 1984, plant species determined to be endangered under the CNPPA were converted to endangered status under CESA. However, as discussed in Section 3.3.6, “Terrestrial Biology and Ecology,” implementation of the project would not involve potential take of plants listed as rare under the CNPPA.

6.2.6 Porter-Cologne Water Quality Control Act

The State Porter-Cologne Water Quality Control Act (California Water Code Section 13000 et seq.) requires the State of California to establish water quality objectives and standards to protect water quality for beneficial uses. The State Water Resources Control Board (SWRCB) is composed of nine RWQCBs that are responsible for preserving California’s water quality. The RWQCBs issue waste discharge permits, take enforcement action against violators, and monitor water quality. SWRCB and the RWQCBs jointly administer most of the CWA regulations in coordination with EPA and USACE. Under the act, the appropriate RWQCB must prepare and periodically update a water quality control plan.

The proposed project is under the jurisdiction of the Lahontan Water Board. The *Water Quality Control Plan for the Lahontan Region* (Basin Plan), adopted on March 31, 1995, and as amended, identifies the beneficial uses, water quality objectives, numerical standards, and waste discharge prohibitions for surface water and groundwater on the California side of the Lake Tahoe Basin (Lahontan RWQCB 1995:1-1). The Basin Plan incorporates water quality thresholds, programs, and regulations as developed and implemented by TRPA, along with state and federal regulations. It states specific water quality objectives (WQOs) for certain water bodies in the Lake Tahoe Hydrologic Unit. WQOs for water quality constituents of potential concern in the Tahoe Keys lagoons and Lake Tahoe are summarized in Chapter 5.

The Basin Plan also identifies prohibitions against discharges and threatened discharges in the 100-year floodplains or below the high-water rim of Lake Tahoe that apply to portions of the TRPA-defined shorezone. Administration of the State and federal Antidegradation Policy in California follows the Administrative Procedures Update on Antidegradation Policy Implementation for NPDES Permitting (State Water Board 1990), and Basin Plan policies, including those developed to guide consideration of exemptions to the prohibition on using aquatic pesticides and herbicides in the Lahontan Basin. The requirements for an exemption to the prohibition apply both to proposed aquatic herbicide testing in the West Lagoon, which is part of the Tier III designation of Lake Tahoe as an ONRW, and to herbicide testing in Lake Tallac, which has Tier II protection under the antidegradation regulations. As noted above and discussed in Section 1.4.1.1, if detectable concentrations of applied aquatic herbicide active ingredients or select degradation byproducts are present longer than “weeks to months, not years” the discharges would be assessed to cause long-term water quality degradation.

Following USEPA adoption of a new rule in 2008, an NPDES permit was no longer required for the transfer of water from the Tahoe Keys lagoons to Lake Tahoe, and the Lahontan Water Board replaced the NPDES permit for TKPOA with a CWA §401 Water Quality Certification and Waste Discharge Requirements (WDRs, LRWQCB 2014). The objective of the WDRs issued by the LRWQCB to TKPOA is to protect beneficial uses of receiving waters by requiring both water- and land-based management actions to reduce all potential sources of pollutants (LRWQCB 2014). Water-based sources are covered primarily in the Integrated Management Plan (IMP, TKPOA 2018a). Land-based sources include (1) stormwater discharges through shared stormwater collection and treatment facilities, which are maintained by TKPOA and covered by the City of South Lake Tahoe General Municipal Stormwater NPDES permit, and (2) surface flows and percolating groundwater that may flow directly to the Tahoe Keys lagoons. The WDRs require a Nonpoint Source Water Quality Management Plan to address land-based direct sources not captured by the stormwater system.

It is expected that the proposed project would require a new individual NPDES permit and 401 Water Quality Certification for Section 404 related activities regarding the discharge of aquatic herbicides and expanded use of bottom barriers, respectively as part of the Proposed Project, in addition to the existing WDRs for ongoing activities at Tahoe Keys. Injection of acetic acid under bottom barriers as a Group B aquatic weed control method would also require an individual NPDES permit and Section 401 certification to comply with Clean Water Act requirements. Even without using acetic acid, expansion of bottom barriers beyond the currently permitted 5-acre maximum would require a revised 401 Water Quality Certification.

6.2.7 California Code of Regulations Title 27 & Nevada Regulatory Statue 444 — Solid Waste

California Code of Regulations Title 27 includes Division 2 addressing solid waste, and Subdivision 1 that codifies consolidated regulations for treatment, storage, processing or disposal of solid waste (CDRRR 2019). Subdivision 1 includes a waste classification system which applies to solid wastes that cannot be discharged directly or indirectly into waters of the state and which therefore must be discharged to waste management units for treatment, storage or disposal. Waste classifications are based on an assessment of the potential risk of water quality degradation associated with each category of waste.

Solid waste from dredge spoils would likely occur at a compost or landfill facility in Nevada which are closer to the project site than California facilities; as such, disposal of these wastes would likely be regulated under Nevada Regulatory Statute 444 and Nevada Administrative Code 444 (NDEP 2020). Testing requirements for acceptance of the material at disposal facilities would likely include pH and aluminum, given the elevated aluminum concentrations that have been detected in Tahoe Keys sediments.

6.2.8 Hazardous Materials Management

The California Department of Toxic Substances Control, a division of the California Environmental Protection Agency (Cal/EPA), has primary regulatory responsibility over hazardous materials in California, working in conjunction with EPA to enforce and implement laws and regulations regarding hazardous materials. The project would comply with applicable Cal/EPA regulations by following all Best Management Practices (BMPs), monitoring, reporting, and contingency measures set forth in the Monitoring and Reporting Program developed for all aquatic herbicide applications.

6.2.9 Worker Safety

The California Occupational Safety and Health Administration (Cal/OSHA) assumes primary responsibility for developing and enforcing workplace safety regulations in the state. Cal/OSHA standards are more stringent than federal OSHA regulations and are presented in Title 8 of the California Code of Regulations. Cal/OSHA conducts on-site evaluations and issues notices of violation to enforce necessary improvements to health and safety practices. The project would comply with applicable Cal/OSHA regulations through compliance with permit and regulatory requirements for all workers performing project activities.

6.2.10 Lahontan Regional Water Quality Control Board (LWB)

The Porter-Cologne Water Quality Control Act (California Water Code, Section 13000 *et seq.*) authorizes the State Water Resources Control Board (State Water Board) and regional boards to regulate discharge of pollutants into waters of the State. As described above, the Lahontan Water Board has the NPDES issuance authority under Section 402, and the authority to review applications and issue permits for discharges to waters of the United States under Section 401 of the CWA, pursuant to a 1988 Memorandum of Agreement between the State Water Board and the U.S. Environmental Protection Agency. The Lahontan Water Board application for Section 401 Water Quality Certification must include information about the project, including area of disturbance and a description of the affected water body; measures to minimize or avoid impacts to waters of the State; and a NODES construction stormwater permit and pollution prevention plan (SWPPP) that outlines erosion control and stormwater treatment measures, best management practices, and post-construction treatment controls that would be implemented to ensure that stormwater quality is maintained during and after the project.

6.2.11 Tahoe Regional Planning Agency (TRPA)

Chapter 84 (Development Standards Lakeward of High Water) of the TRPA Code of Ordinances authorizes the TRPA to review all projects and activities involving placement of structures or earth disturbance in lagoons or in the nearshore or foreshore of a lake in the Lake Tahoe Region. TRPA Code of Ordinances Section 84.15 specifically covers dredge and fill activities and allows such activities subject to a determination by the TRPA that the dredge or fill activities would be beneficial to shorezone conditions, water quality or water clarity. Subsection 84.15.5 prohibits deposition of dredge materials in the lakezone or shorezone, in wetlands, or within the 100-year floodplain of lake tributaries. Prior to commencement of the activities pursuant to Action Alternative 2, the permittee would be required to submit to the TRPA a Shorezone Project permit application to demonstrate that the dredge and fill activity would be compliant with regulations in Chapter 84. The application must include a site plan and description of the proposed project, and must identify proposed dredge depth, prominent geologic features within the proposed area of disturbance, permanent and temporary best management practices, and staging areas and construction access points.

6.3 CONSULTATION AND COORDINATION

Consultation and coordination for the Proposed Project involved public and agency scoping, overviewed in Section 1.5.1, and consultation with stakeholders, agencies and organizations, overviewed in Section 1.5.2 and further described below. Future plans for consultation and coordination are also described.

6.3.1 Scoping

This section discusses the requirements of scoping under CEQA and TRPA regulations, and broadly outlines how these requirements were met by the Lead Agencies. The Project Scoping Report (posted at www.tahoekeysweeds.org), Notice of Preparation and Public Engagement Plan for Scoping (Appendix A), and summary in Section 1.5 provide additional background.

CEQA Requirements

Scoping is encouraged in the CEQA statute and State CEQA Guidelines. Scoping is recognized as a means to help identify the range of actions, alternatives, environmental effects, methods of assessment, and mitigation measures to be analyzed in depth in an EIR, and it is used to eliminate from detailed study those issues that would not be affected by the project. Scoping is also an effective way to bring together and resolve the concerns of interested Federal, State, and local agencies; the proponent of the action; and other interested persons, including project opponents.

Tools used to determine the scope of an EIR include early public and interagency consultation, the EIR Notice of Preparation (NOP), and scoping meetings with agencies and the public. Although only the NOP is a mandatory requirement under CEQA for the preparation of an EIR, the Lead Agencies have undertaken an extensive stakeholder process, summarized in Section 1.5.2.

The issuance of the project NOP serves as the trigger for soliciting comments on the Proposed Project. It is attached as Appendix A and is summarized in the project Scoping Report (Appendix B) and in Section 1.5.1.1) above. Scoping typically ends at the conclusion of a specified public comment period; the minimum comment period is 30 days under CEQA (but was extended to 45 days for this project). However, public involvement continues throughout the project review and approval cycle.

TRPA Requirements

TRPA is required to consult with and obtain the comments of any federal, state, and local agency that has jurisdiction by law or special expertise with respect to environmental impacts associated with the project. Although TRPA rules and ordinances do not require the release of an NOP or mandate conducting formal public scoping meetings, TRPA typically releases an NOP early in the environmental review process and holds scoping meetings before the Advisory Planning Commission (APC) and Governing Board (GB) to provide opportunity for APC and GB members, agencies, and members of the public to provide input on the project. TRPA requirements were met with release of the NOP, discussed above.

6.3.2 Agencies and Organizations Consulted

This section discusses agency consultation and coordination that occurred during the development of this DEIR/DEIS and summarizes the agency involvement activities undertaken by TRPA and the LWB to satisfy CEQA and TRPA requirements.

CEQA and TRPA Consultation

The LWB and TRPA contacted responsible agencies, as required under CEQA and TRPA regulations. The List of Agencies, Tribes and Stakeholders Consulted is provided after this chapter, below. Chapter 3.4.6 describes AB52 consultation with Tribes conducted by the LWB. LWB staff provided AB52 notification of the Project proposal to United Auburn Indian Community and Wilton Rancheria and non-AB52 notification to the Pyramid Lake Paiute Tribe and Washoe Tribe of Nevada and California. The United Auburn Indian Community responded 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. Comments from all parties are summarized in 6.3.4 below.

6.3.3 Public Outreach Efforts for the Aquatic Weeds Control Methods Test (CMT)

Outreach efforts undertaken to inform stakeholders, tribes and agencies about the Proposed Project were summarized in 1.5.2; they included interviews with stakeholders, public workshops, and the convening of Stakeholder Consultation Circle and Stakeholder Committee. This process began before the CEQA and TRPA EIR/EIS process were kicked off and included public meetings and communications during early study phases and development of the project alternatives, as well as the scoping process.

Initial Environmental Checklist (IEC; TRPA) and Initial Study (IS; CEQA): An IEC/IS was prepared for the lead agencies in 2017-2018. The IEC/IS found areas of potentially significant impacts for a "Tahoe Keys West Lagoon Integrated Control Methods Test" substantially similar to the present Proposed Project, as well as a number of areas of data insufficiency. A reference and link to the IEC/IS was sent with the NOP.

Early and Ongoing Public Involvement: From the onset of the development of the Proposed Project, the Lead Agencies pursued a robust collaborative stakeholder process to inform and guide the development of project alternatives and the environmental review process. In August 2018, an assessment of stakeholder interests, concerns and questions was initiated, and a Stakeholder Assessment Report was completed in October 2018, summarizing stakeholder interests and perspectives and including recommendations for a collaborative, transparent, inclusive stakeholder process to inform the EIR/EIS. Based on recommendations made in the Stakeholder Assessment, a Tahoe Keys Stakeholder Committee and a Tahoe Keys Stakeholder Consultation Circle were 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

The Lead Agencies worked with the Stakeholder Committee to design a project website to host all project information: www.tahoekeysweeds.org, on which is posted the NOP, public workshop announcements, and full project background information is all posted on the project website. Eleven meetings were held between October 2018 and March 2020, during which the SC helped shepherd the process, supplied information and feedback, and communicated information to their stakeholder networks. Among the key areas to which the SC contributed were:

- Supporting transparency throughout the process
- Communicating a diversity of perspectives to elucidate concerns and issues and help guide the development of the EIR/EIS
- Disseminating a range of information reflective of the range of concerns and interests in the group, and assuring that the EIR/EIS team and agencies understand that range of perspectives
- Building shared consensus on the project timeline
- Advising on the project description and project alternatives, including test sites
- Helping frame and explain technical issues, to assure that the underlying science and studies could be broadly understood
- Validating agreement with the reliability and soundness of baseline studies used in the environmental analysis, and in the baseline description of environmental conditions in the lagoons
- Helping Lead Agencies define and prioritize goals and objectives for the project
- Participating in scoping and debriefing comments heard in scoping meetings, as well as vetting comment responses
- Receiving presentations, including a workshop on how nutrient loads and responses to testing were modeled in the lagoons
- Assisting to refine a public communications and engagement plan for outreach for the remainder of the project, including the potential need for virtual meetings

Scoping: Scoping is an initial and critically important component of the environmental review process. It is used to help ensure that potential environmental issues and resources are identified early and are properly studied in the DEIR/DEIS. A Notice of Preparation was issued on June 17, 2020, opening a 45-day public comment period that closed on August 2, 2019. A scoping package accompanied the NOP, which identified the Proposed Project and action alternatives then under consideration and provided background for and location of the Proposed Project, notification of public meetings, and a list of potential environmental effects.

The NOP provided notice of the scoping meetings, presented an overview of the proposed project and alternatives, presented a statement of the purpose of and need for and objectives of the project, summarized the proposed alternatives, listed the issues anticipated to be addressed in this DEIR/DEIS, and provided contact information. The Lead Agencies issued the NOP on June 17, 2019, specifying August 2, 2019 as the closing date for submitting scoping comments. In addition to State Clearinghouse distribution to potentially interested state agencies in both California and Nevada, copies of the NOP were mailed to stakeholders and other parties known to have an interest in the proposed project.

Although Section 21083.9 of the CEQA statute requires at least one scoping meeting be held if a project is of statewide, regional, or areawide significance, an extensive outreach and meeting program was conducted for this project. The outreach program occurred during the formal scoping period (June 17-August 2) and gathered scoping input both through a formal scoping meeting and through other scoping activities, as follows:

- **Formal scoping meetings** jointly led by the Lead Agencies. Notices for this meeting met CEQA requirements to include specified recipients, including responsible agencies, trustee agencies, and members of the public who have requested notification.

- **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** 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** providing project information and opportunity to provide feedback to the public at large through a comment link.

- **Direct mailing or email** at tahoekeysweeds@trpa.org

Four public meetings were held in June and July of 2019 for the Proposed Project:

- June 25: LWB hosted a formal CEQA Scoping Meeting and public workshop at their offices on the South Shore of Lake Tahoe.
- June 26: TRPA’s Governing Board held a Public Hearing.
- June 27: Stakeholder Consultation Circle met to consider the NOP and provide scoping input.
- July 17: A public workshop was held on the North Shore of Lake Tahoe to provide accessibility to stakeholders and communities there.

The locations of meetings and places of publication of notices are provided in the Public Engagement Plan in Appendix H. These public meetings include PowerPoint presentations by the Lead Agencies, professional facilitation, and a background presentation by the project proponent (TKPOA). Open House stations were used after the presentations for discussions and input on Tahoe Keys History and Existing Conditions; General AIS Control Methods and Current Tahoe Keys Activities; and Environmental Analysis and Public Engagement.

Scoping meetings and comments were used to establish the final range of actions and alternatives to be considered in the EIR/EIS, as well as mitigation measures to be analyzed in the environmental document.

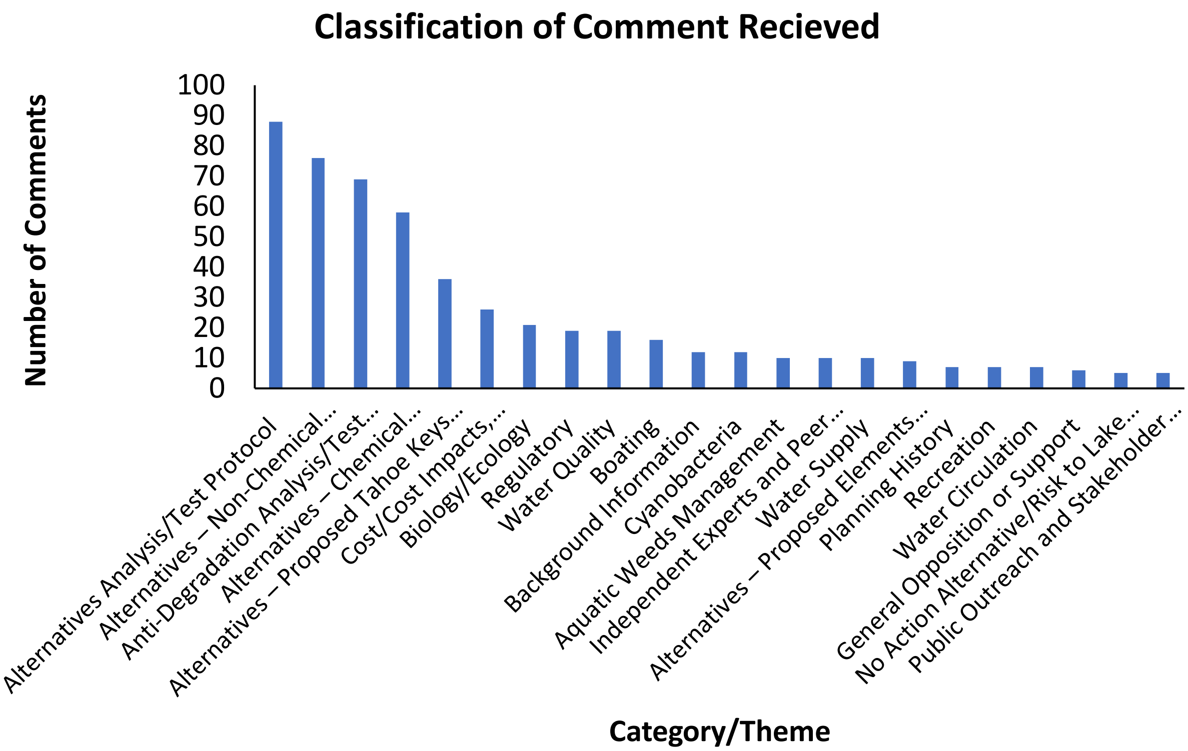
The Scoping Report prepared after the close of the public comment period provided history and context for the purpose and need of the Proposed Project; summarized project goals, objectives, and performance measures; described the Proposed Project and proposed action alternatives; located the project on a map; described the stakeholder outreach program; provided information on the distribution of the NOP and location of planned public meetings; identified tribal notification and consultation; discussed the potential environmental effects of the project; summarized comments received and appended all comments.

6.3.4 Issues and Major Areas of Controversy Identified During Scoping, Consultation and Public Outreach

Public and agency comments were gathered through all scoping activities, including formal scoping meetings, public and agency workshops, targeted meetings with key stakeholders, and the SCC and SC. In addition, scoping comments were solicited and facilitated through:

- Email to tahoekeysweeds@trpa.org (linked on website and advertised on postcards).
- Solicitation of written comments and documents during meetings
    - Recorded at podium/microphone at TRPA Board meeting
    - Recorded on flip charts during public workshop Q&A sessions
    - Comments on comment cards
- Post-meeting comments received by email, or using mail-back comment forms, or in letters sent to TRPA mailing address

The Scoping Report (Appendix B) provides a detailed breakdown of the numbers, formats, and substance of comments received. Figure 6.3.4-1 depicts the major areas of comment.



6.3.5 Future Public Involvement

In accordance with CEQA and TRPA regulations, this DEIR/DEIS will be circulated for public and agency review and comment for a 60-day period (July 6 to September 3, 2020). An overview of the DEIR/DEIS review process is provided in Section 1.5.3. As described in that section, announcements for public information meetings and Public Hearings will be posted on the project website and sent to the email distribution list used for the DEIR/DEIS by the Lead Agencies. Until further notice, meetings and Public Hearings will be held virtually due to current COVID-19-related guidelines for public meetings and best practices to protect public health. In addition, written comments will be accepted during the review period.

If public hearings are held, they would be conducted at:

Lahontan Water Board Annex
971 Silver Dollar Avenue
South Lake Tahoe, California

Tahoe Regional Planning Agency
128 Market Street
Stateline, Nevada

Following Lead Agency consideration of all comments received during the public review period of this DEIR/DEIS, the Lead Agencies will prepare a response to comments and a Final Draft EIR/EIS, which will be posted and circulated for review in the same general manner as the DEIR/DEIS. The Lead Agencies will hold Public Hearings to consider certification of the Final EIR/EIS and decide whether to approve one of the alternatives. A notice of determination under CEQA documenting the decision will then be issued. To support a decision on the proposed project, TRPA will prepare and adopt written findings of fact for each environmental impact identified in this DEIR/DEIS that would remain significant after mitigation; a statement of overriding considerations, if needed; and a mitigation monitoring and reporting program for implementing the mitigation measures and project revisions, if any, identified in this DEIR/DEIS.

The public distribution of this DEIR/DEIS emphasizes the use of electronic media to ensure cost-effective, broad availability to the public and interested parties. This DEIR/DEIS is available on the Internet at tahoekeysweeds@trpa.org. It is also available for review at the locations listed below.

All parties named in the List of Agencies, Tribes and Stakeholders Consulted below have been informed of the availability of and locations to obtain this DEIR/DEIS, as well as the timing of the 60-day public and agency comment period. These parties have received hard or electronic copies of the full DEIR/DEIS and appendices, including the Executive Summary and a Notification of Availability of this DEIR/DEIS.

Copies of this DEIR/DEIS/DEIS are available for public review at the following locations:

Lahontan Water Board
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150
530-542-5400

Tahoe Regional Planning Agency
89449 Market Street
Stateline, NV 89410
775-589-5255

Due to current COVID-19-related guidelines, a review appointment needs to be made by calling the numbers above.

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List of Acronyms

Acronyms and Terms

AA = Antidegradation Analysis

Action Alternatives = use Action Alternative 1 and Action Alternative 2, not Alternative 1 etc.

AIS = Aquatic Invasive Species (generally not a preferred term for the target aquatic species: for these, use "aquatic weeds"; see below)

AIS Plan = Lake Tahoe Aquatic Invasive Species Management Plan

American manna grass

Anatoxin-a

Antidegradation, not Anti-degradation

ACHP = Advisory Council on Historic Preservation

APAP = Aquatic Pesticide Application Plan

Aquatic weeds = target species **=** Eurasian water milfoil, curlyleaf pondweed, coontail; do **not** refer to these target species as aquatic invasive species or similar terms

ARB = California Air Resources Board

ATCM = air toxic control measures

Basin Plan = Water Quality Control Plan for the Lahontan Region

BLM = Bureau of Land Reclamation

BMI = benthic macroinvertebrates

BMP = Best Management Practice

BOD = biochemical oxygen demand

Bottom barriers = benthic barriers

CAA = Clean Air Act

CAAA = Federal Clean Air Act Amendments of 1990

CAAQS = California Ambient Air Quality Standards

CAFE = corporate average fuel economy

CARB = California Air Resources Board

CalEPA = California Environmental Protection Agency

Caltrans = California Department of Transportation

CCC = criterion continuous concentration

CCR = California Code of Regulations

CDFW = California Department of Fish and Wildlife

CDOM = colored dissolved organic matter

CDPH = California Department of Public Health

CDPR = California Department of Pesticide Regulation

CESA = California Endangered Species Act

CEQA = California Environmental Quality Act

CFR = Code of Federal Regulations

cfs = Cubic feet per second

CH_4 = Methane

Chlorophyll-a

CIMIS = California Irrigation Management Information System

CMC = Criterion Maximum Concentrations

CMT = Control Methods Test = Proposed Project

CNDDB = California Natural Diversity Database

CNPS = California Native Plant Society

CO = carbon monoxide

CO_2 = carbon dioxide

CO_2e = carbon dioxide equivalence

COD = chemical oxygen demand

Combination Test

Combination Treatment

Compact = TRPA Compact (PL 96-551 94 Statute 3233)

CPUC = California Public Utilities Commission

CRAM = California Rapid Assessment Method

Crème-flowered bladderwort

Criteria is the plural form of **criterion**

CRHR = California Register of Historic Resources

CTC = California Tahoe Conservancy

Cumulatively Considerable Net Increase

Curlyleaf pondweed

CVC = California Vehicle Code

CWA = Clean Water Act

cy = Cubic yard

Cyanobacteria

Data is the plural form of **datum**

DDW = Division of Drinking Water

Degradates, not "degradation products"

Dewatering effluent

DO = dissolved oxygen

DPH = Department of Public Health

DPM = Diesel particulate matter

DPR = California Department of Pesticide Regulation

Dredge spoils

Dredge and replace substrate alternative = bottom substrate removal and replacement in Tahoe Keys lagoons

DWP = Drinking water program

Eagle Act = The Bald and Golden Eagle Protection Act

Ecosystem not "system"

EDCAQMD = El Dorado County Air Quality Management District

Edgewood = Edgewood Water Company

EIP = TRPA Environmental Improvement Program

Elutriate

EIR/EIS = CEQA Environmental Impact Report/TRPA Environmental Impact Statement

Environmental Science Associates

ESA = Endangered Species Act

FIFRA = Federal Insecticide, Fungicide and Rodenticide Act

Flat-leaved bladderwort

florpyrauxifen-benzyl = ProcellaCOR (commercial name)

Fragment control

GHG = greenhouse gases

Glenbrook = Glenbrook Water Cooperative

Group A methods

Group B methods

GWP = global warming potential

HAB = harmful algal bloom

HABs = harmful algal blooms

Herbicide, not herbicidals and **not** "chemicals"; in general avoid the use of "chemical" unless required by context

HRA = Health Risk Assessment

IEC/IS = TRPA Initial Environmental Checklist and CEQA Initial Study

IMP = Integrated Management Plan

IPM = Integrated Pest Management

IMT = Integrated Methods Test – old term from IEC/IS; use "CMT"

lagoons = Tahoe Keys Marina lagoons (not capitalized)

lb/day = Pounds per day

IVGID = Incline Village General Improvement District

KGID = Kingsbury General Improvement District

Lead agencies = TRPA and LWB

LFA = laminar flow aeration

LiDAR = light detection and ranging

LOS = level of service, also level of significance

LTAB = Lake Tahoe Air Basin

LSAA = Lake and Streambed Alteration Agreement

LWB = Water Board = California Regional Water Quality Control Board, Lahontan Region = Lahontan Regional Water Quality Control Board

Main Lagoon = West Lagoon = the entire water body bounded by L Tahoe to the N, Marina Lagoon to the E, L Tallac to the S, and Pope Marsh to the W, including the West Channel entrance and all side channels

Marina Lagoon = East Lagoon

Marsh willowherb

MCL's = Maximum contaminant levels

Mechanical harvesting

µg/L = micrograms per liter

mg/L = milligram per liter

MMRP = Mitigation, monitoring and reporting program

MPO = Metropolitan planning organization

MT = Metric Tons

MTBA = Migratory Bird Treaty Act

NAAQS = National Ambient Air Quality Standards

NDEP = Nevada Division of Environmental Protection

NHPA = National Historic Preservation Act

NHTSA = National Highway Traffic Safety Administration

No Action Alternative

NOD = Notice of Determination

Non-Herbicide Treatments = all Group A methods other than herbicides

Non-herbicide, not non-herbicidal

NOX = Oxides of nitrogen

NPDES = National Pollutant Discharge Elimination System

NPPA = Native Plant Protection Act

NPS = Nonpoint source

Nearshore

NO_2 = Nitrogen dioxide

NOP = Notice to Proceed/ Notice of Preparation

NPS Plan = Nonpoint Source Water Quality Management Plan

NRCS = Natural Resources Conservation Service

NRHP = National Register of Historic Places

NTPUD = North Tahoe Public Utility District

NTU = Nephelometric Turbidity Units

Nutall's ribbon-leaved pondweed

Numbers less than 10 = spell out in text (whole numbers only)

NWI = National Wetlands Inventory

NWP = Nationwide Permit

O_3 = Ozone

OEHHA = Office of Environmental Health Hazard Assessment

ONRW = Outstanding National Resource Water

Ortho-phosphate

PAS = TRPA Plan Area Statement for Tahoe Keys (PAS-102) adopted as part of the City of South Lake Tahoe Zoning Ordinance.

Pb = Lead

Phoslock = **bentonite clay with lanthanum** (commercial term)

PCAPCD = Placer County Air Pollution Control District

PCE = Tetrachloroethylene

Percent = spell out in text (not in tables)

PLS = Plan Area Statement

PM_{10} and $PM_{2.5}$ = Particulate matter

ppb = parts per billion

ppm = parts per million

PRC = California Public Resources Code

Proposed Project = Tahoe Keys Lagoons Aquatic Weed Control Methods Test = Control Methods Test = CMT

psi = pounds per square inch

PWSSP = Public Water System Supervision Program

QA = Qualified Applicator

QAL = Qualified Applicator Certificate Holder

Regional Water Boards = the nine Regional Water Quality Control Boards, under the SWB

Robbin's pondweed

ROG = Reactive organic gases

RTGA = Reno Tahoe Geo Associates

RTP/SCS = Regional Transportation Plan/Sustainable Communities Strategy

RWQCB = Regional Water Quality Control Board

SAFE = Safer, Affordable, Fuel-Efficient

SAV = submerged aquatic vegetation

Sea Bin = commercial term, no known equivalent

SB = Senate Bill

SC = Stakeholder Committee

SCAQMD = Sacramento Air Quality Management District

SCC = Stakeholder Consultation Circle

SDS = Material Safety Data Sheets

SEZ = Stream Environment Zone

SHC = California Streets and Highways Code

SIP = State implementation plan

Slender-leaved pondweed

SLT = South Lake Tahoe (also City of South Lake Tahoe)

SO_2 = sulfur dioxide

State Water Board = State Water Resources Control Board

STPUD = South Tahoe Public Utility District Board

Suction Dredging

SWB = California State Water Board

SWTR = Surface Water Treatment Rule

TAC = toxic air contaminents

Tahoe Keys lagoons = Tahoe Keys = Main Lagoon, Marina Lagoon and Lake Tallac = lagoons

NOT "lagoon" unless a single lagoon is meant in context and never "Tahoe Keys lagoon"

Target Aquatic Plants = target species = Eurasian watermilfoil, curlyleaf pondweed, coontail

T-BACT = Best Available Control Technology for TACs

TBTR = Terrestrial Biological Technical Report

TCP = Trichloropyridinol

Test Sites

TGAI = Technical-grade active ingredient

TKN = Total Kjeldahl nitrogen

TKPOA = Tahoe Keys Property Owners Association

TKWC = Tahoe Keys Water Company

TMDL = Total Maximum daily load

TMP = methoxypyridine

TMPO = Tahoe Metropolitan Planning Agency

TN = Total nitrogen

TP = Total phosphorus

Treatment Areas

TRPA = Tahoe Regional Planning Agency

Trustee and Responsible Agencies

TWSA = Tahoe Water Suppliers Association

TVS = Tahoe Valley South

UAIC = United Auburn Indian Community

Ultraviolet, not Ultra-violet (on first definition, ultraviolet-C)

USACE = U.S. Army Corps of Engineers

USEPA = United States Environmental Protection Agency

USFS = United States Forest Service

USFWS = United States Fish and Wildlife Service

USGS = U.S. Geological Survey

UV light = Ultraviolet (UV-C) light (see above)

VMT = Vehicle miles traveled

Waterbody

Water bulrush

Watershield, not water shield

WDRs = Waste discharge requirements

WIP = Wetland Inventory Report

WQC = Water Quality Certification

WQO = Water quality objective

WTP = Tahoe Keys Water Treatment Plant

ZWUD = Zephyr Water Utility District

µg/L = microgram per liter

°C = Degrees Celsius

List of Preparers

List of Preparers

Name/Affiliation	Qualifications	Role
Tahoe Regional Planning Agency		
Kim Caringer	Environmental Improvement Division Manager M.S. Public Administration, Natural Resource Management B.S. Public Management and Policy 15 years of experience	Lead Agency Manager Executive Summary
John Marshall	TRPA General Counsel Doctor of Jurisprudence (J.D.) B.A. Population Biology 31 years of Experience	3.4.2 Recreation
Paul Nielsen	Special Projects Manager B.A. Geography & Water Resource Policy 29 years of Experience	Lead Agency Staff
Dennis Zabaglo	Aquatic Resources Program Manager B.S. Environmental Resources Management 25 years of experience	Lead Agency Staff
Lahontan Regional Water Quality Control Board		
Laura Korman	M.S. Environmental Science 2 years of experience	Environmental Scientist
Russell Norman	B.S. Environmental Engineering, 26 years of experience	Water Resource Control Engineer
Bruce Warden	Ph.D. Soil Science 27 years of experience	Environmental Scientist
EIR/EIS Managers		
Jeremy Pratt TRC	M.S. Environmental Science 44 years of experience	Project Manager 1.0 Introduction 2.0 Alternatives 3.4.2 Utilities 4.0 Cumulative Impacts 5.0 Summary of Impacts 5.7 TRPA Thresholds
Jim Good Environmental Science Associates	M.S. Aquatic Ecology 34 years of experience	Technical Program Manager 2.0 Alternatives 3.3.4 Water Quality 4.0 Cumulative Impacts 5.0 Summary of Impacts 5.7 TRPA Thresholds

TRC Technical Team		
Casey Anderson TRC	M.S. Earth Science B.S. Atmospheric Science 13 years of experience	1.3 Regulatory Requirements 3.3.2 Air Quality and Greenhouse Gas 4.0 Cumulative Impacts 5.7 TRPA Thresholds 6.0 Compliance, Coordination and Consultation
Rosalie Annand TRC	B. S. Environmental Management 1 year of experience	Project Support
Dana Ayers TRC	B.A. Urban Studies 21 years of experience	3.4.1 Land & Shoreline Use 3.4.3 Traffic & Transportation 4.0 Cumulative Impacts 5.7 TRPA Thresholds
Sarah Bilchak TRC	Proposal Quality Coordinator B.A. Integrative Biology 1 year of experience	Graphics and Document Production
Donald L. Craig TRC	M.A. Anthropology 17 years of experience	3.4.5 Cultural Resources
Kevin Freeman TRC	M.S. Geology 48 years of experience	3.3.1 Earth Resources General review
Stephen V. Huvane, PE TRC	B.S. Civil Engineering 30 years of experience	3.4.4 Noise 4.0 Cumulative Impacts 5.7 TRPA Thresholds
Rena Merritt TRC	Document Production Specialist 20 years of experience	Senior Editor
Jacqueline Milbank TRC	M.S. Natural Resources; B.S. Environmental Science; B.S. Environmental Policy and Planning 8 years of experience	3.3.6 Terrestrial Biology and Wetlands 4.0 Cumulative Impacts 5.7 TRPA Thresholds
Brenda Peters TRC	Master of Public Administration 40 years of experience	3.4.6 Recreation
Tsunami Van Winkle TRC	Office Administrator 11 years of experience	Project Support
Environmental Science Associates Technical Team		
Dane Behrens Environmental Science Associates	Ph. D. Civil and Environmental Engineering 8 years of experience	3.3.3 Hydrology
Peter Carr Environmental Science Associates	B.S. Journalism 25 years of experience	Senior Editor
Chris Fitzer Environmental Science Associates	M.S. Environmental Planning 24 years of experience	3.3.5 Fisheries and Benthic Macroinvertebrates 4.0 Cumulative Impacts 5.7 TRPA Thresholds

Emily Keenan Environmental Science Associates	M.S. Oceanography and Coastal Sciences 15 years of experience	Data Analysis
Toni Pennington Environmental Science Associates	Ph. D. Environmental Science and Resources 22 year of experience	3.3.4 Water Quality 3.3.5 Aquatic Macrophytes 4.0 Cumulative Impacts 5.7 TRPA Thresholds
Dave Tomasko Environmental Science Associates	Ph. D. Biology 35 years of experience	3.3.4 Limnology, Nutrients Modeling
Other Consultants		
Caelen McGee Zephyr	Principal & Senior Mediator M.A. Energy & Environmental Analysis B.A. Biology 20 years of experience	1.5 Outreach 6.3 Coordination and Consultation
Jonathan Pease, Ph.D., PE, GE Reno Tahoe Geo Associates	B.S. Civil Engineering M.S. Civil Engineering Ph.D. Civil Engineering 25 years of experience	2.6 Action Alternative 2: Tahoe Keys Dredge and Replace Substrate
Jeff Wirtz Compliance Services International	M.S. Land Resources 20 years of experience	3.2 Environmental Health (Aquatic Toxicology and Human Health) 4.0 Cumulative Impacts

List of Agencies, Tribes and Stakeholders Consulted

LIST OF AGENCIES, TRIBES AND STAKEHOLDERS CONSULTED

Organization	Name, Title (if Available)
Federal Agencies	
U.S. Army Corps of Engineers	Jennifer Thompson
U.S. Army Corps of Engineers	Laura Whitney, Program Manager
U.S. Environmental Protection Agency	Jacques Landy, Lake Tahoe Basin Coordinator
U.S. Fish & Wildlife Service	Stephanie Byers, Senior Fishery Biologist
U.S. Fish & Wildlife Service	Corene Jones, Fish Biologist
U.S. Fish & Wildlife Service	Roger Peka, Fish Biologist
U.S. Forest Service	Jeff Marsolais, Lake Tahoe Basin Management Unit Forest Supervisor
State Agencies	
California Attorney General's Office	
California Department of Fish & Wildlife	Patrick Moeszinger, Senior Environmental Scientist
California Department of Fish & Wildlife	Gabriele Quillman, Scientific Aid
California Natural Resources Agency	Robert Larson
California State Lands Commission	Jason Ramos, Senior Environmental Scientist
Nevada Department of Environmental Protection	Jennifer Carr, Deputy Director
Nevada Division of State Lands	Elizabeth Kingsland, Tahoe Program Manager
Tribes	
United Auburn Indian Community	
Washoe Tribe	
Regional and Local Agencies/Organizations	
California Tahoe Conservancy	Patrick Wright, Executive Director
City of South Lake Tahoe	Jason Burke, Stormwater Program Coordinator
Lahonton Regional Water Quality Control Board	Russel Norman, Water Resources Control Engineer
Lahonton Regional Water Quality Control Board	Harold Singer, former Executive Officer
Lahonton Regional Water Quality Control Board	Doug Smith, Assistant Executive Officer and Ombudsman
Lahonton Regional Water Quality Control Board	Bruce Warden, Environmental Scientist
Lake Tahoe Marina Association	Jim Phaelan, General Manager
Lakeside Park Association	Bob Loding, Water Manager
League to Save Lake Tahoe	Darcie Goodman, Chief Executive Officer
League to Save Lake Tahoe	Jesse Patterson, Chief Strategy Officer
Mother Lode	Laurel Ames
North Lake Tahoe Resort Association	Cindy Gustafson, CEO
Sierra Club and Friends of West Shore	Jennifer Quashnick, Consultant
Sierra Club Tioyabe	Tobi Tyler
Southshore Tahoe Chamber	
Tahoe Fund	Amy Berry, CEO
Tahoe Keys Beach and Harbor Association	Betsy Sommerfeldt, Manager
Tahoe Keys Marina	Mike Herron, Manager
Tahoe Keys Property Owners Association	Bonnie Halleran, Board President

Organization	Name, Title (if Available)
Tahoe Keys Property Owners Association	Greg Hoover, Water Quality Manager
Tahoe Keys Property Owners Association	Jim Jones, Water Quality Committee
Tahoe Keys Property Owners Association	Andy Kopania, Chair of Water Quality Committee
Tahoe Keys Property Owners Association	Jo Ann Wilson, Administrative Assistant
Tahoe Keys Property Owners Association	Kirk Wooldridge, General Manager
Tahoe Lakefront Homeowners Association	Jan Brisco, Executive Director
Tahoe Regional Planning Agency	Kim Caringer, Environmental Improvement Division Manager
Tahoe Regional Planning Agency	Joanne Marchetta, Executive Director
Tahoe Regional Planning Agency	Paul Nielsen, Environmental and Land Use Consultant
Tahoe Regional Planning Agency	Julie Regan, External Affairs Chief
Tahoe Regional Planning Agency	Dennis Zabaglo, Aquatic Resources Program Manager
Tahoe Resource Conservation District	Nicole Cartwright, Executive Director
Tahoe Resource Conservation District	Mollie Hurt, Director of Programs
Tahoe Water Suppliers Association	Madonna Dunbar, Executive Director
TIE Steering Committee	
Universities	
University of California Davis	Dr. Geoff Schladow, Professor of Civil and Environmental Engineering and Director of the Tahoe Environmental Research Center
University of Nevada Reno	Dr. Sudeep Chandra, Associate Professor of Biology
General Public	
	Harold Singer, Former Executive Officer LRWQCB
	Elise Fett

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
P.O. Box 5310
128 Market Street
Stateline, Nevada 89449

Lahontan Regional Water Quality Control Board
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)

Stations Staffing:

- 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.

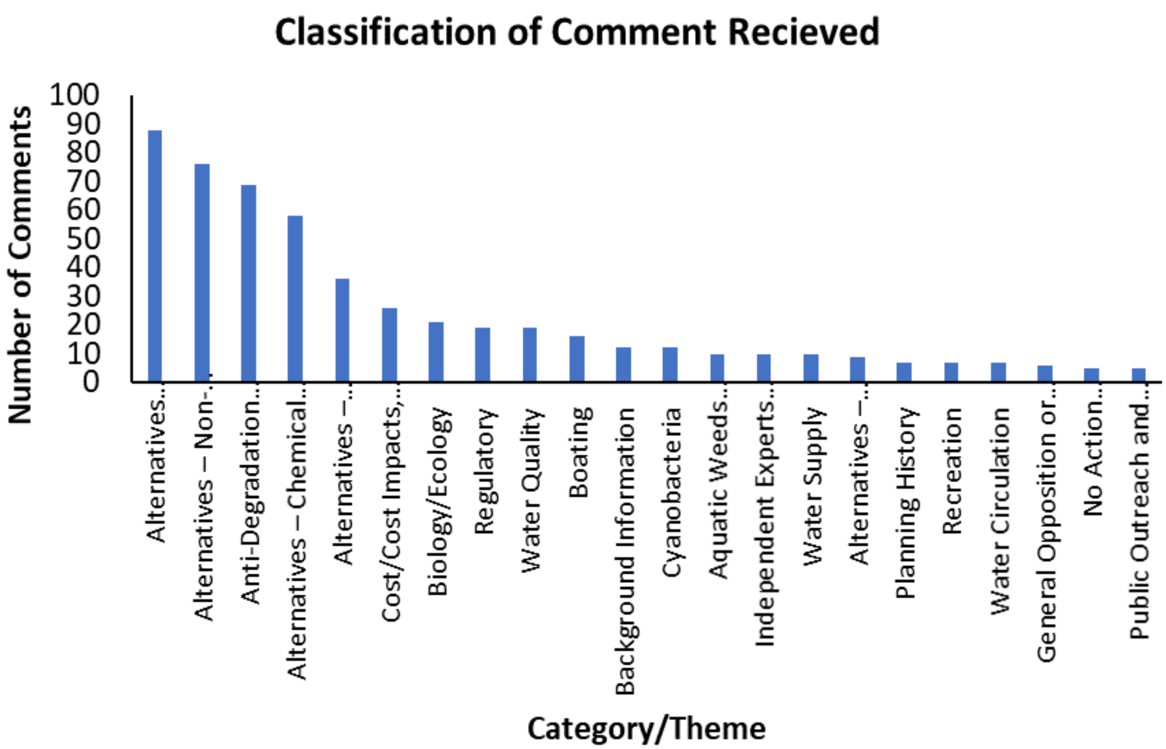

Figure 1. Comment classifications by number of comments received during the scoping period. Note: only classifications with five (5) or more comment are displayed. The following classifications received fewer than 5 comments: history, protection, jurisdiction, mitigation, risk assessment, cumulative & 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
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In association with

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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 x 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

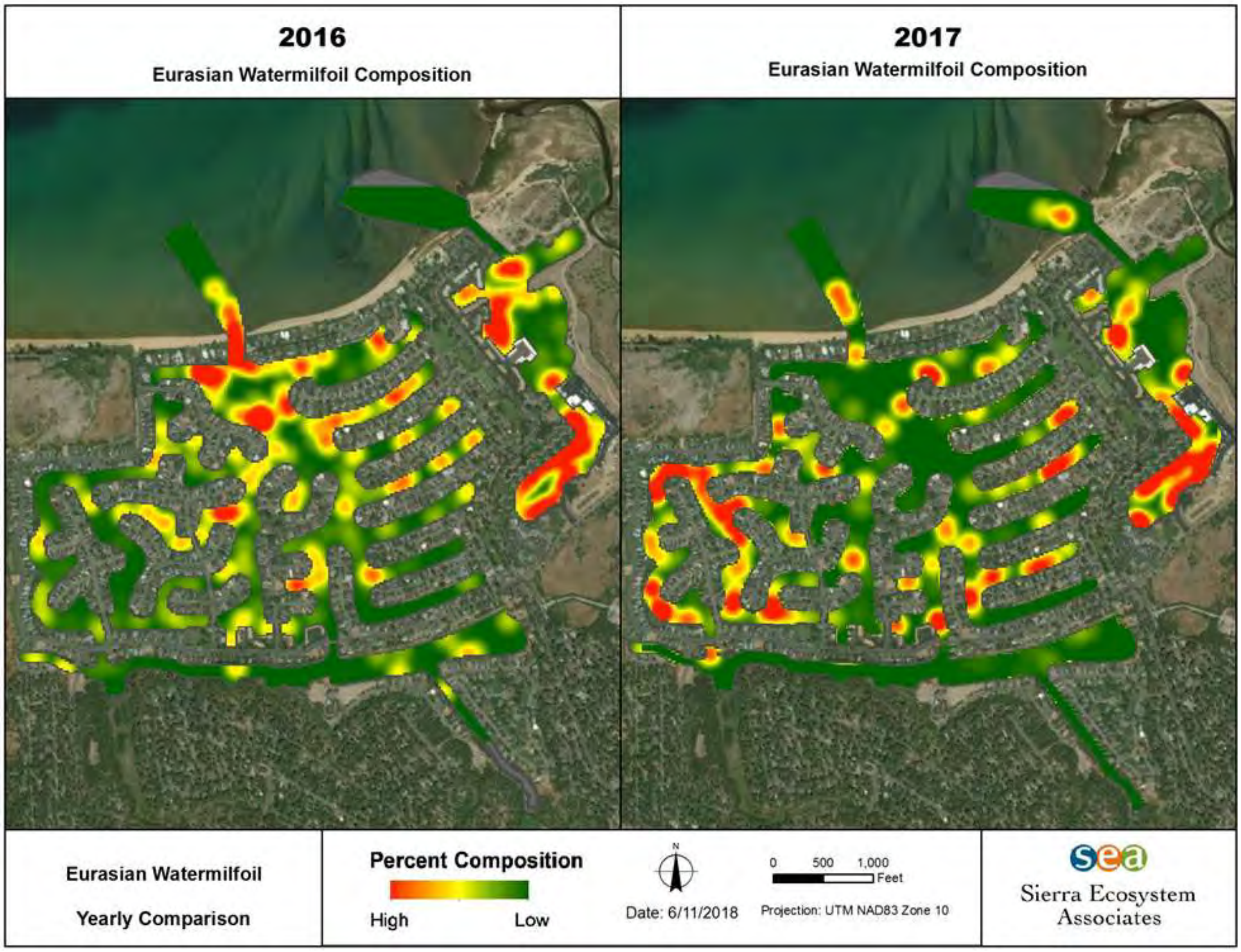
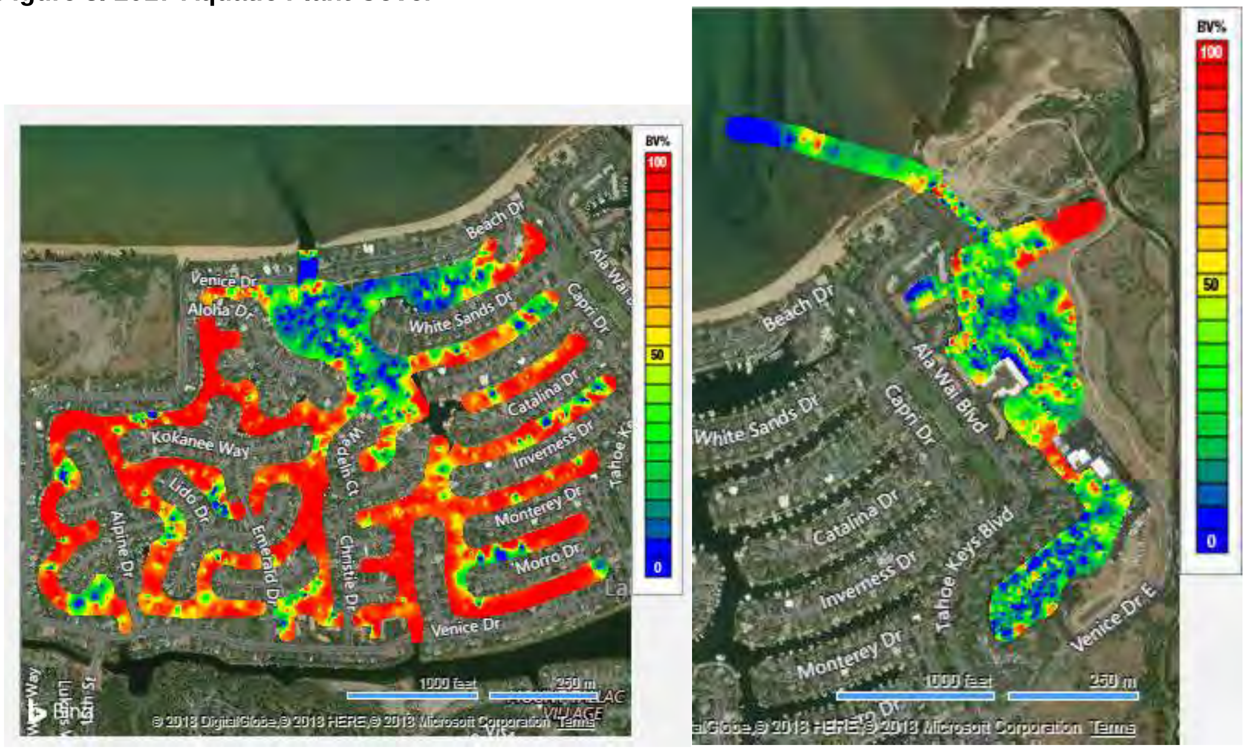


Figure 3. 2017 Aquatic Plant Cover



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).

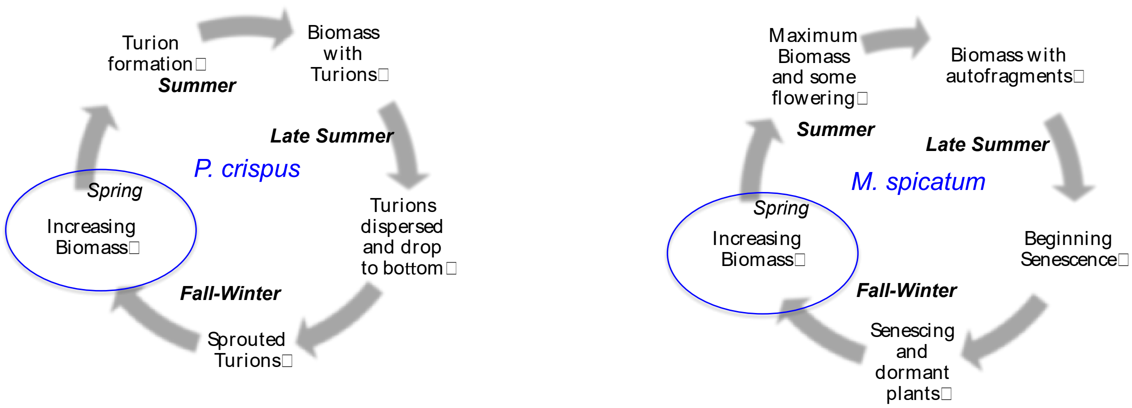
Ceratophyllum demersum

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 12ºC. 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

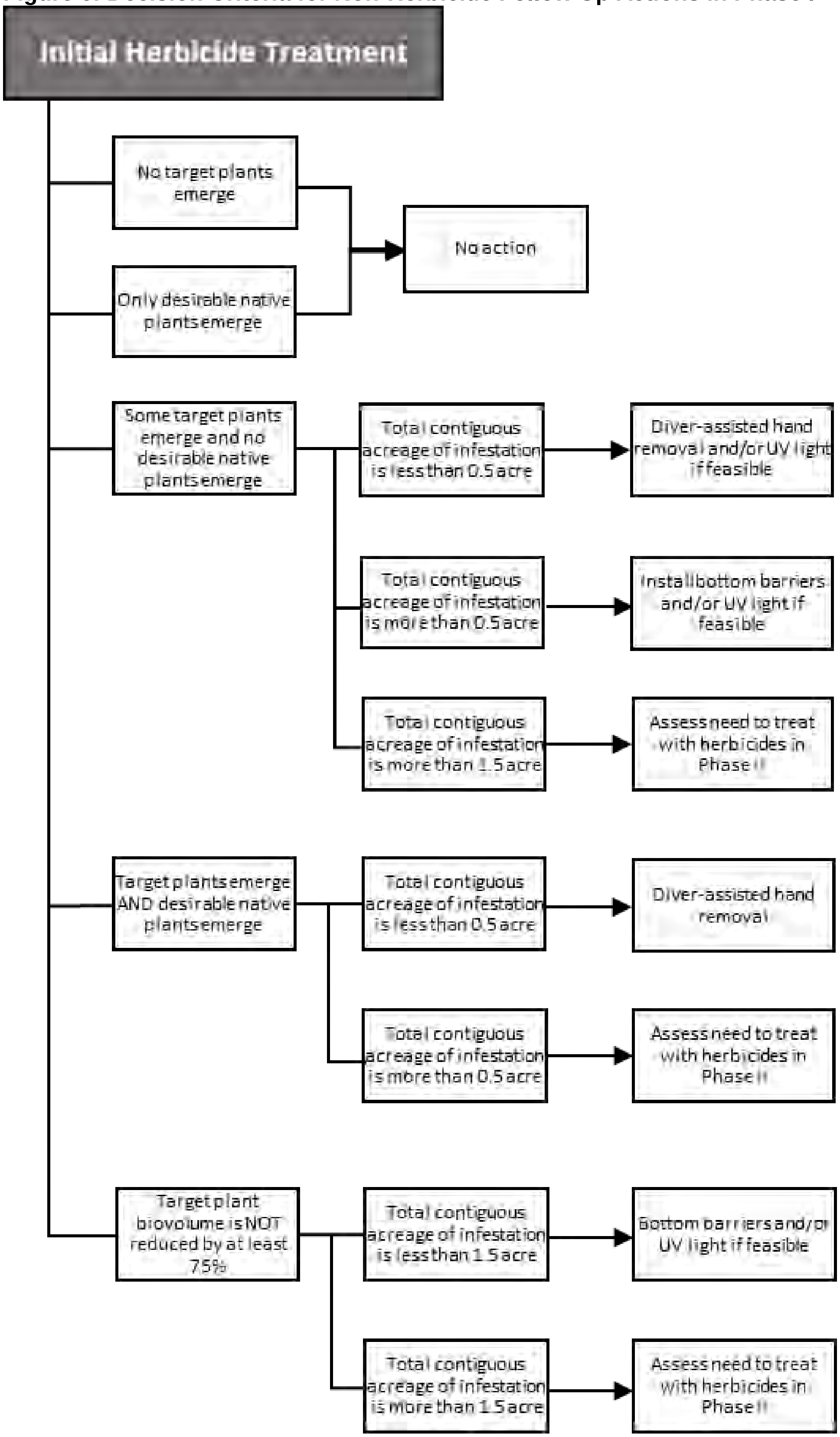
Sites	1	2	3	4	5	6	7	8	9	10	11	12	Total Acres
Surface Area, Acres	1.5	1.35	1.3	1.45	2.2	1.25	1.62	1.5	1.5	1.5	1.5	1.5	18.17
Endothall													6.0
Application Rate, ppm	2.0							2.0	2.0	2.0			
+bottom barrier	X							X	X	X			
+hand removal	X							X	X				
Triclopyr													5.55
Application Rate,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

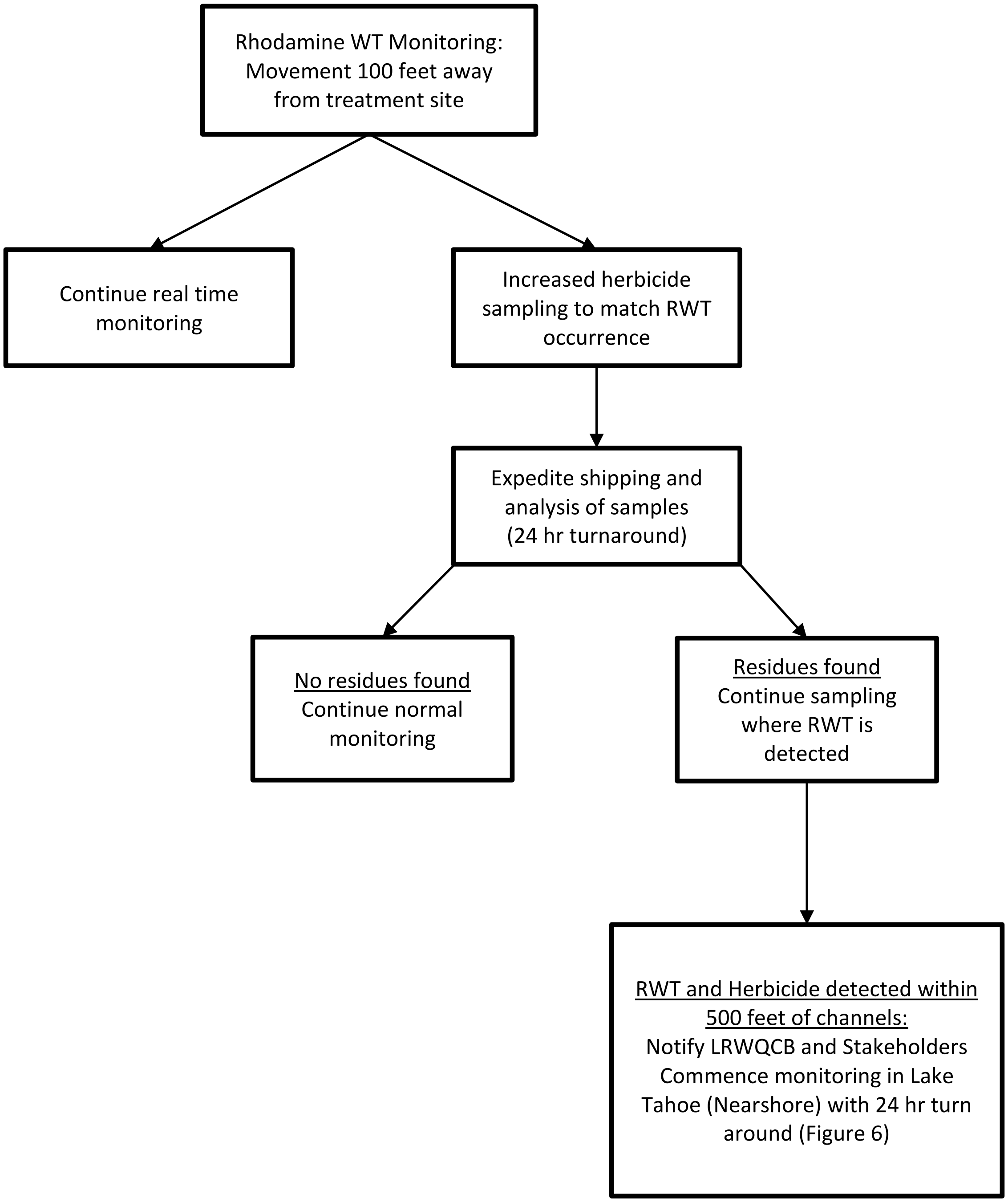
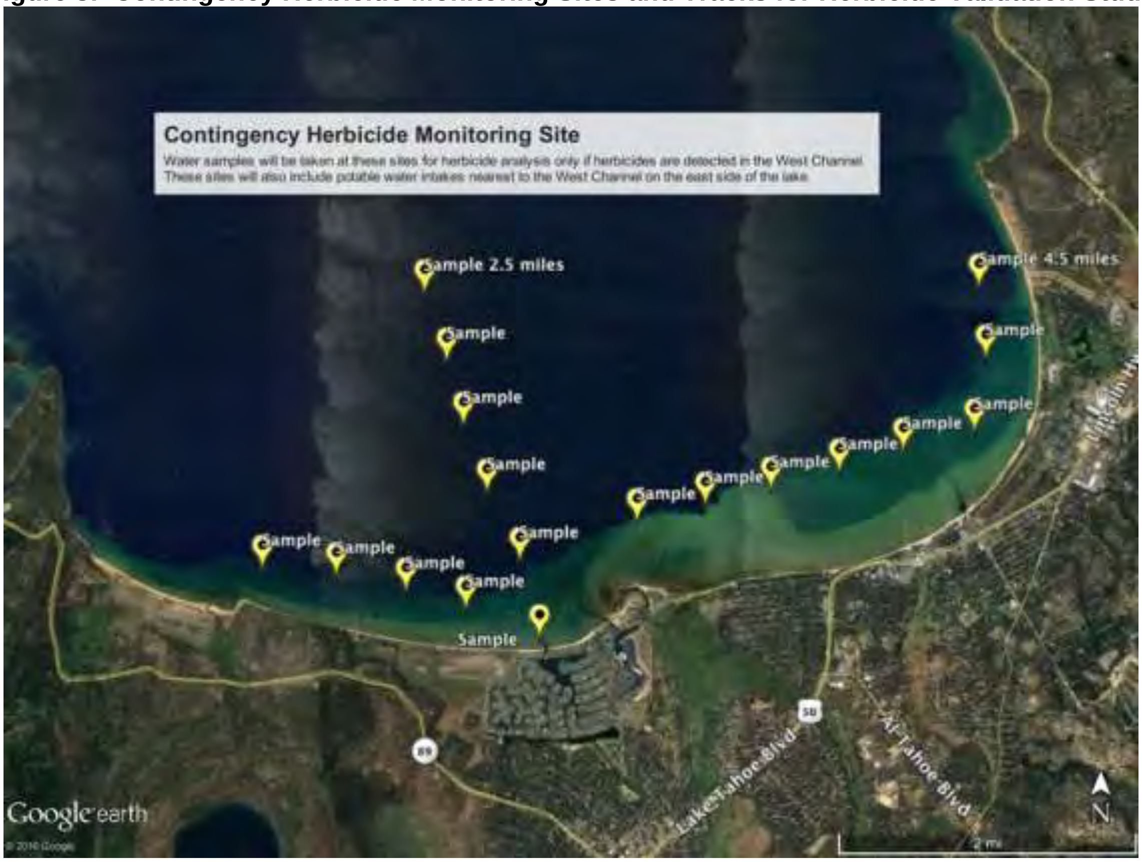


Figure 8: Contingency Herbicide Monitoring Sites and Tracks for Herbicide Validation Study



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.

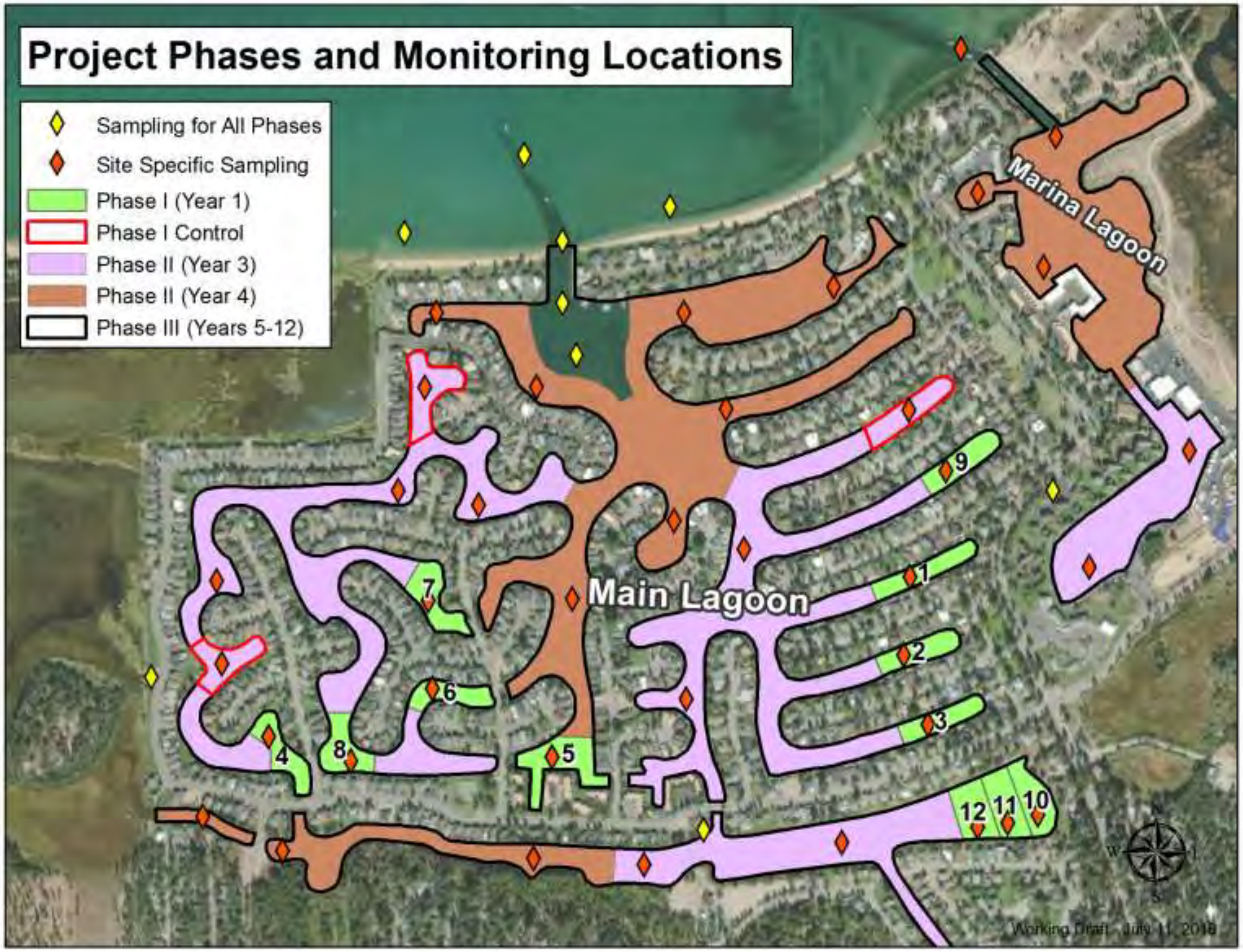
This sampling protocol will be followed at all 12 sites. However for the “within treatment sampling”, only one set of samples will be analyzed for each type of herbicide. The unanalyzed samples from the other replicate treatments will be maintained and preserved frozen and archived as a contingency for 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

			Construction Equipment			Equipment Use				Material Export		Material Import	
Site	Construction Phase	Activities	Quantity	Type	HP	Hours per day	Weeks	Start Date	End Date	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 -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	230.00	42.00
tblConstructionPhase	NumDays	230.00	42.00
tblConstructionPhase	NumDays	230.00	21.00
tblConstructionPhase	NumDays	230.00	36.00
tblConstructionPhase	NumDays	230.00	36.00
tblConstructionPhase	NumDays	230.00	18.00

tblConstructionPhase	NumDays	230.00	18.00
tblConstructionPhase	NumDays	230.00	18.00
tblConstructionPhase	NumDays	230.00	12.00
tblConstructionPhase	NumDays	10.00	6.00
tblConstructionPhase	NumDays	10.00	6.00
tblConstructionPhase	NumDays	10.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblLandUse	LotAcreage	0.00	8.14
tblOffRoadEquipment	HorsePower	158.00	60.00
tblOffRoadEquipment	HorsePower	158.00	60.00
tblOffRoadEquipment	HorsePower	158.00	60.00
tblOffRoadEquipment	HorsePower	158.00	60.00
tblOffRoadEquipment	HorsePower	158.00	60.00
tblOffRoadEquipment	HorsePower	158.00	60.00
tblOffRoadEquipment	HorsePower	88.00	140.00
tblOffRoadEquipment	HorsePower	88.00	140.00

tblOffRoadEquipment	HorsePower	88.00	140.00
tblOffRoadEquipment	HorsePower	88.00	140.00
tblOffRoadEquipment	HorsePower	88.00	140.00
tblOffRoadEquipment	HorsePower	88.00	140.00
tblOffRoadEquipment	HorsePower	88.00	140.00
tblOffRoadEquipment	HorsePower	88.00	140.00
tblOffRoadEquipment	HorsePower	88.00	140.00
tblTripsAndVMT	HaulingTripLength	20.00	55.00
tblTripsAndVMT	HaulingTripLength	20.00	31.00
tblTripsAndVMT	HaulingTripLength	20.00	3.00
tblTripsAndVMT	HaulingTripLength	20.00	3.00
tblTripsAndVMT	HaulingTripLength	20.00	55.00
tblTripsAndVMT	HaulingTripLength	20.00	31.00
tblTripsAndVMT	HaulingTripLength	20.00	3.00
tblTripsAndVMT	HaulingTripLength	20.00	3.00
tblTripsAndVMT	HaulingTripLength	20.00	55.00
tblTripsAndVMT	HaulingTripLength	20.00	31.00
tblTripsAndVMT	HaulingTripLength	20.00	3.00
tblTripsAndVMT	HaulingTripLength	20.00	3.00
tblTripsAndVMT	HaulingTripLength	20.00	3.00
tblTripsAndVMT	HaulingTripNumber	0.00	210.00
tblTripsAndVMT	HaulingTripNumber	0.00	70.00
tblTripsAndVMT	HaulingTripNumber	0.00	140.00
tblTripsAndVMT	HaulingTripNumber	0.00	40.00
tblTripsAndVMT	HaulingTripNumber	0.00	130.00
tblTripsAndVMT	HaulingTripNumber	0.00	45.00
tblTripsAndVMT	HaulingTripNumber	0.00	85.00

tblTripsAndVMT	HaulingTripNumber	0.00	20.00
tblTripsAndVMT	HaulingTripNumber	0.00	90.00
tblTripsAndVMT	HaulingTripNumber	0.00	30.00
tblTripsAndVMT	HaulingTripNumber	0.00	60.00
tblTripsAndVMT	HaulingTripNumber	0.00	20.00
tblTripsAndVMT	HaulingTripNumber	0.00	40.00
tblTripsAndVMT	WorkerTripNumber	5.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	5.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	0.00	18.00
tblTripsAndVMT	WorkerTripNumber	5.00	18.00

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	4,674.1594	4,674.1594	0.5722	0.0000	4,688.4643
Maximum	**1.9012**	**19.0879**	**20.8069**	**0.0473**	**0.7687**	**0.7325**	**1.5012**	**0.2036**	**0.7015**	**0.9052**	**0.0000**	**4,674.1594**	**4,674.1594**	**0.5722**	**0.0000**	**4,688.4643**

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	4,674.1594	4,674.1594	0.5722	0.0000	4,688.4643
Maximum	**1.9012**	**19.0879**	**20.8069**	**0.0473**	**0.7687**	**0.7325**	**1.5012**	**0.2036**	**0.7015**	**0.9052**	**0.0000**	**4,674.1594**	**4,674.1594**	**0.5722**	**0.0000**	**4,688.4643**

	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).

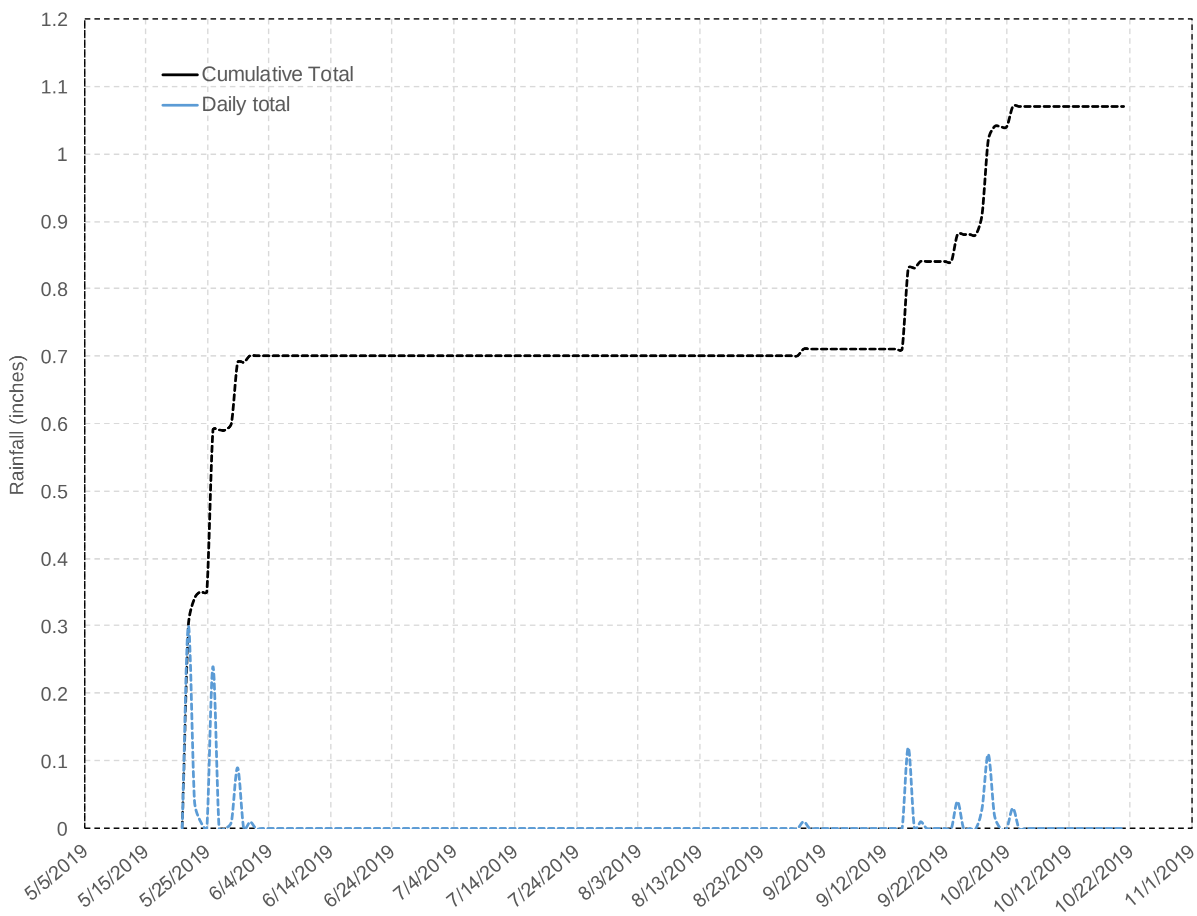

Figure 3. Daily and cumulative rainfall totals at Tahoe Keys during the baseline study period.

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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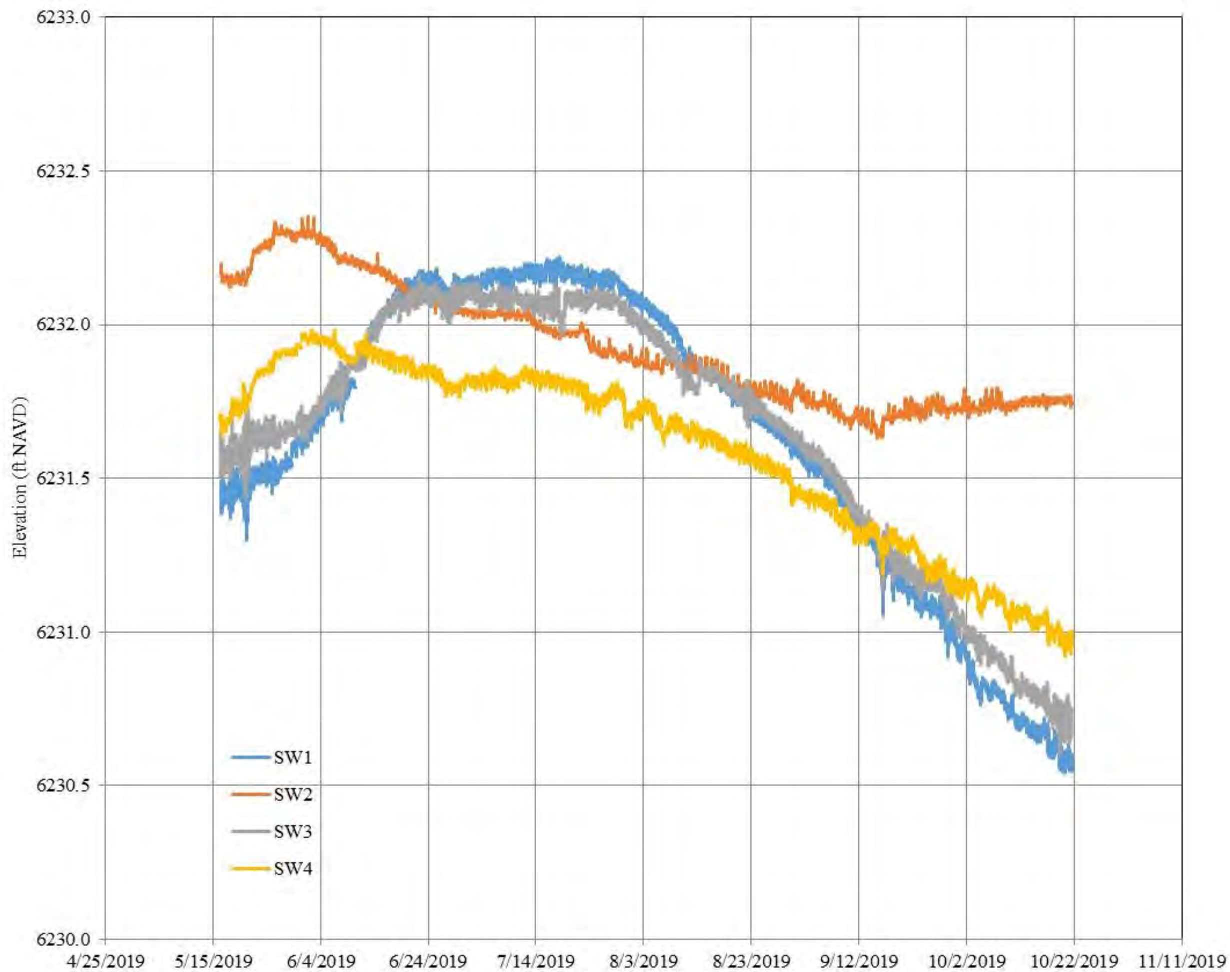

Figure 4. Time series of surface water levels at the Main Lagoon (SW1), Lake Tallac (SW2), Marina Lagoon (SW3), and Pope Marsh (SW4) in 2019.

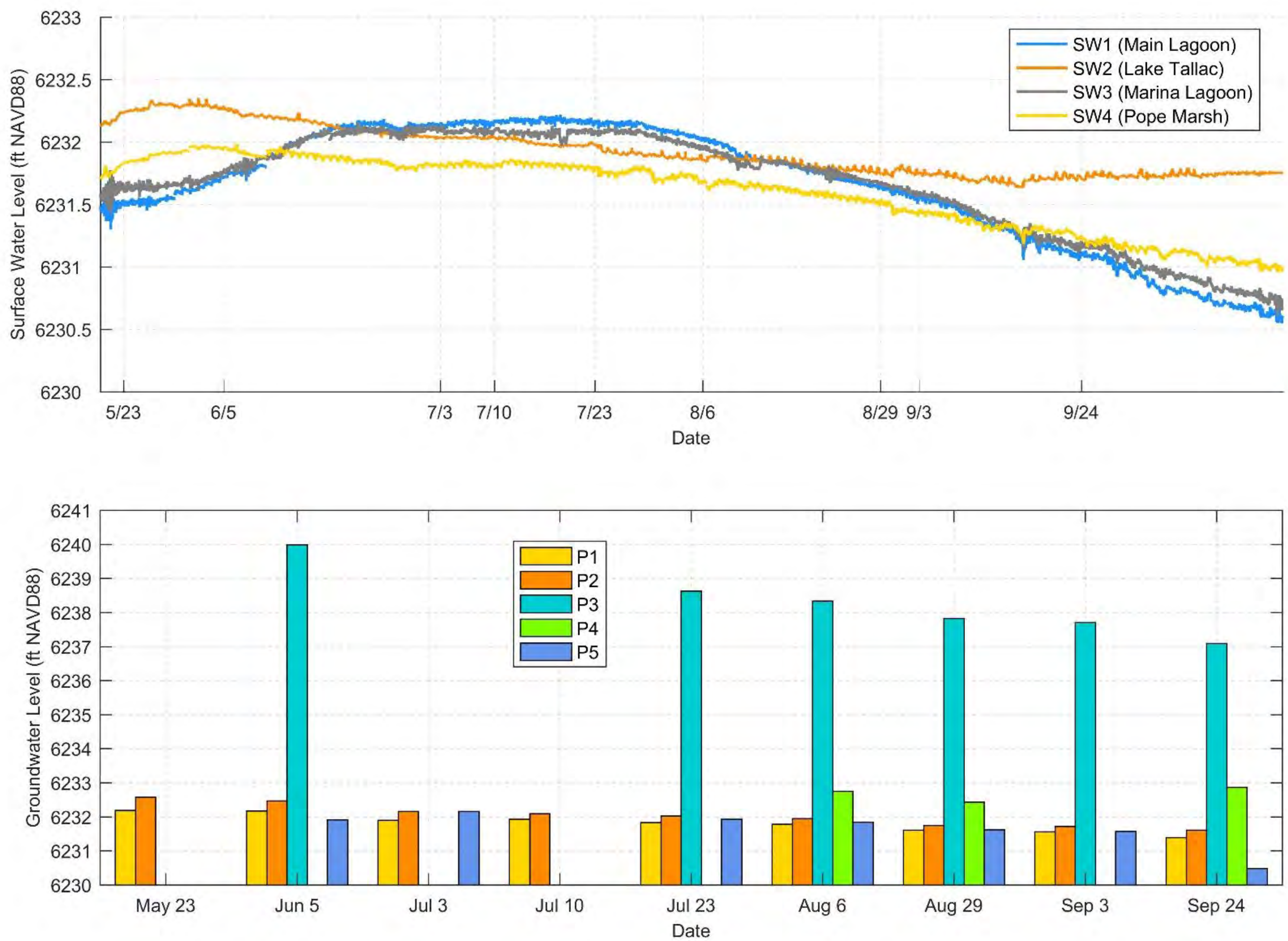

Figure 5. Continuous 2019 surface water levels (top) and discrete groundwater elevation measurements (bottom).

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

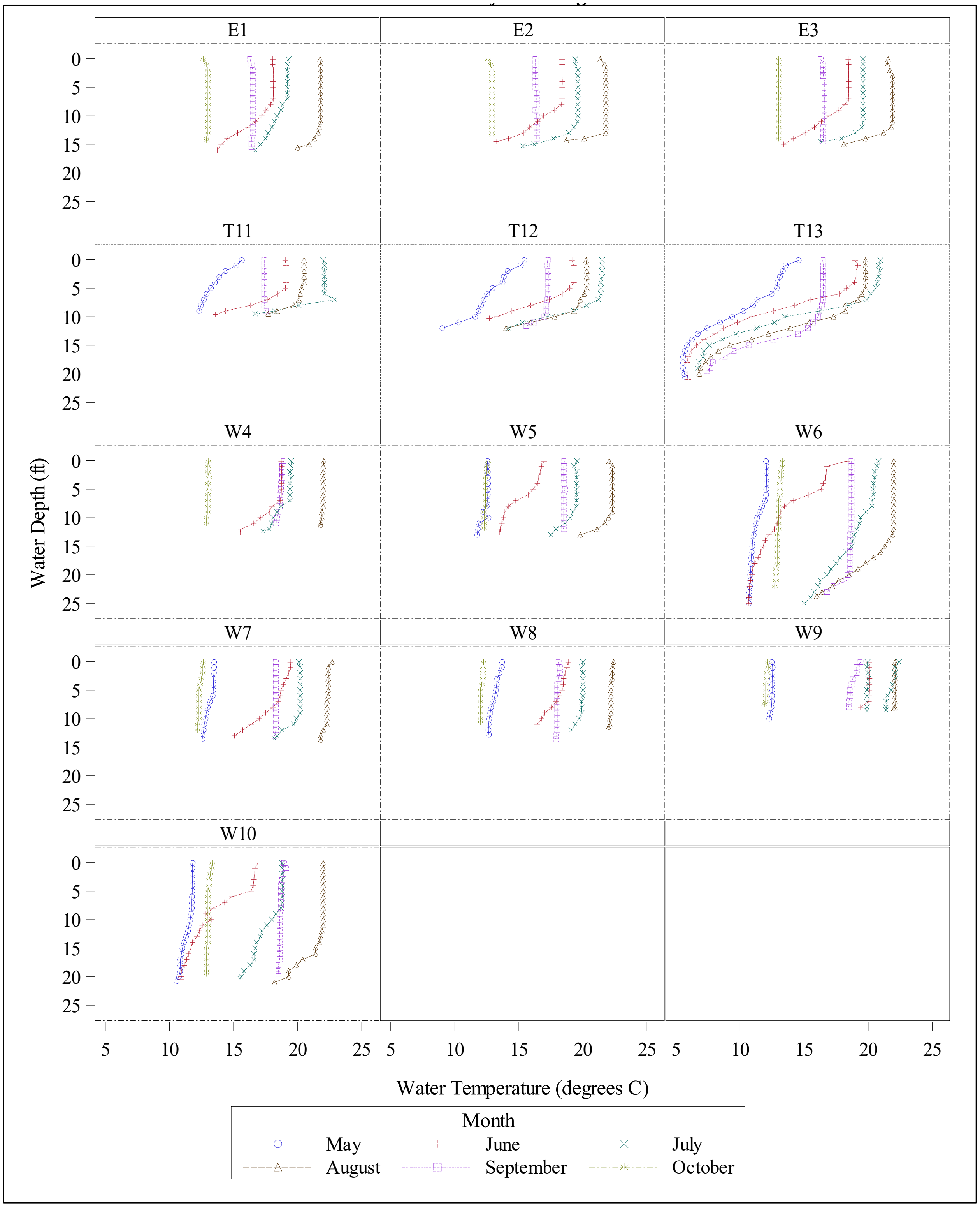

Figure 6. Vertical profile morning water temperature (^{o}C) readings in Tahoe Keys lagoons from May to October 2019.

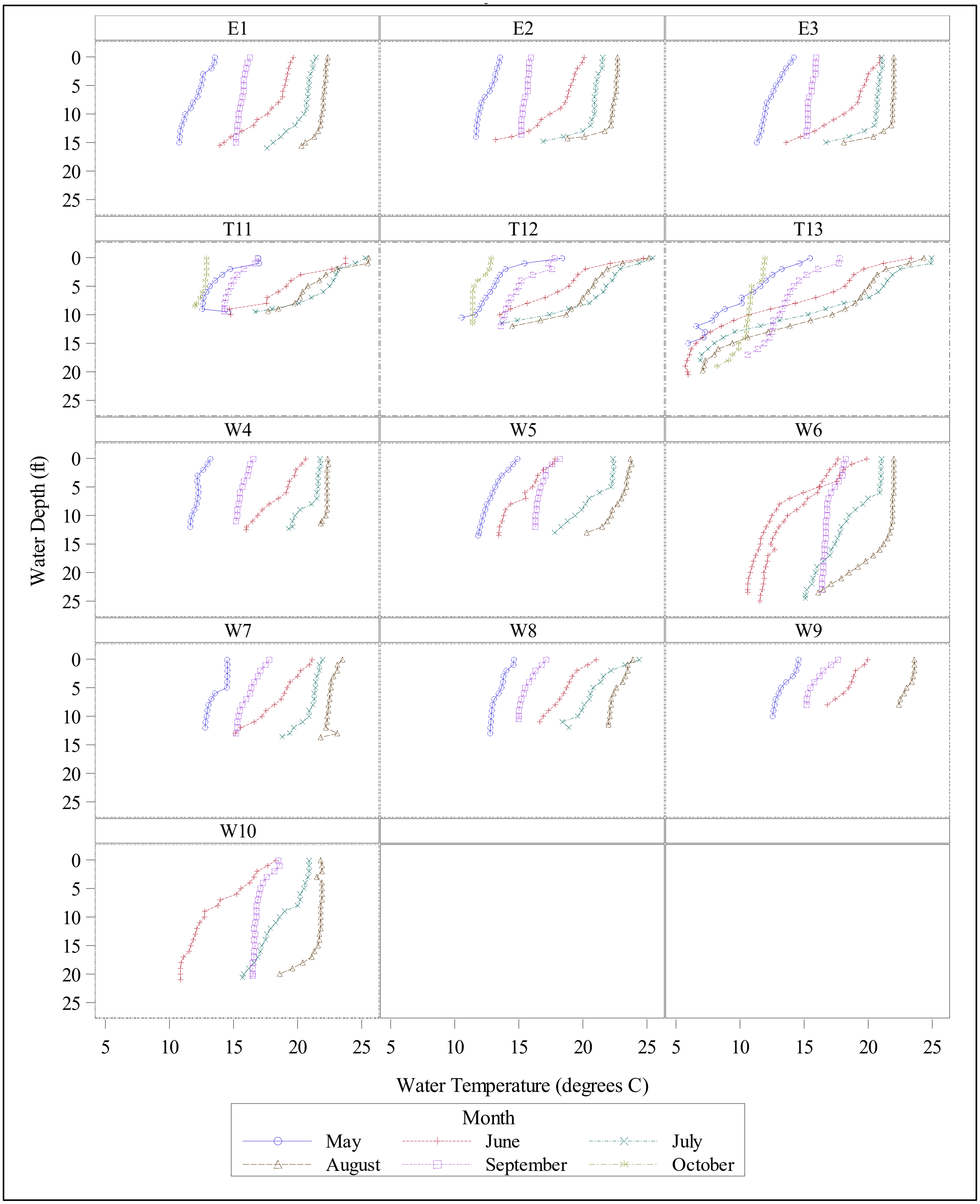

Figure 7. Vertical profile afternoon water temperature (°C) readings in Tahoe Keys lagoons from May to October 2019.

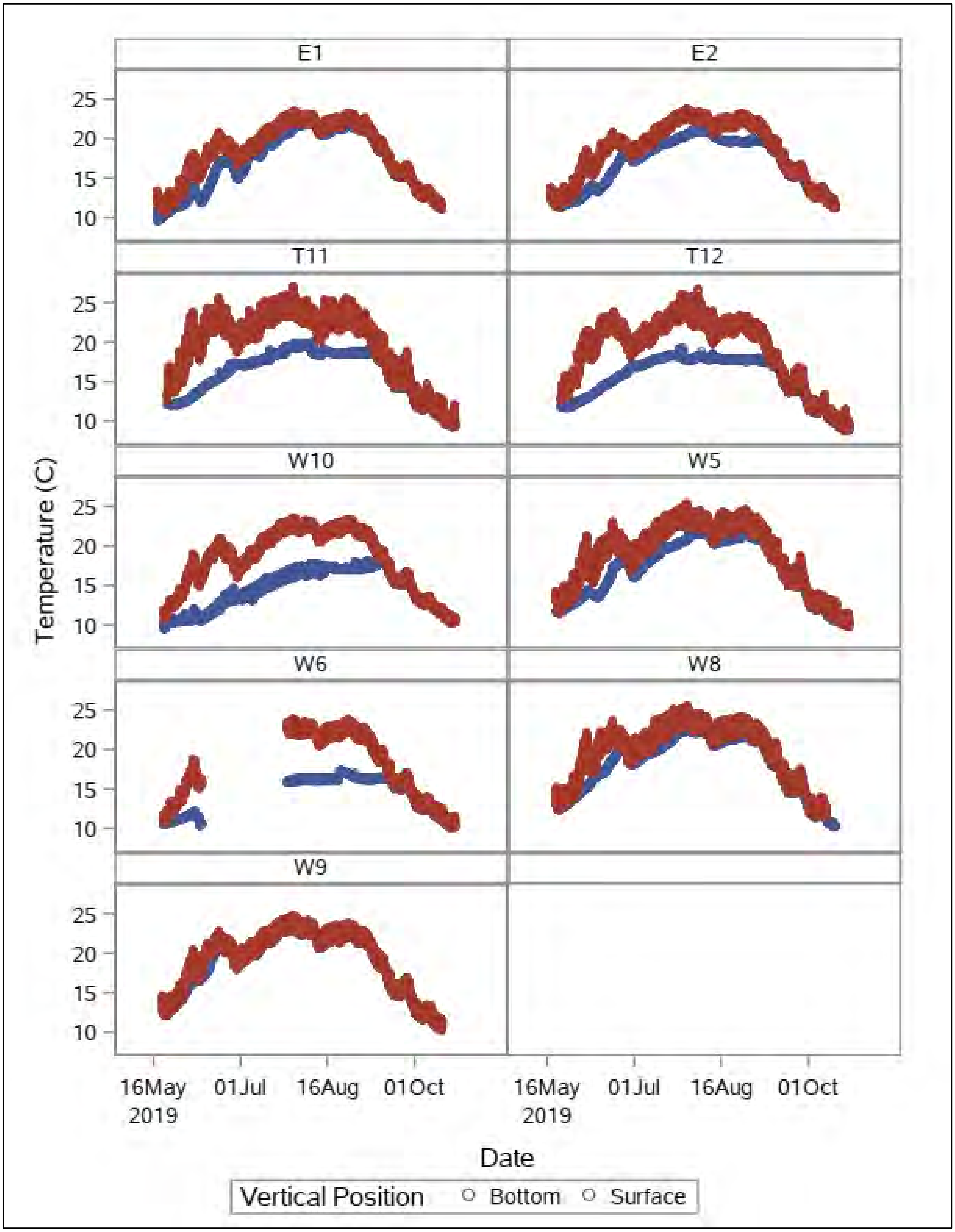

Figure 8. Continuous 15-minute water temperature (°C) readings from near-surface and near-bottom water depths at each Tahoe Keys monitoring site.

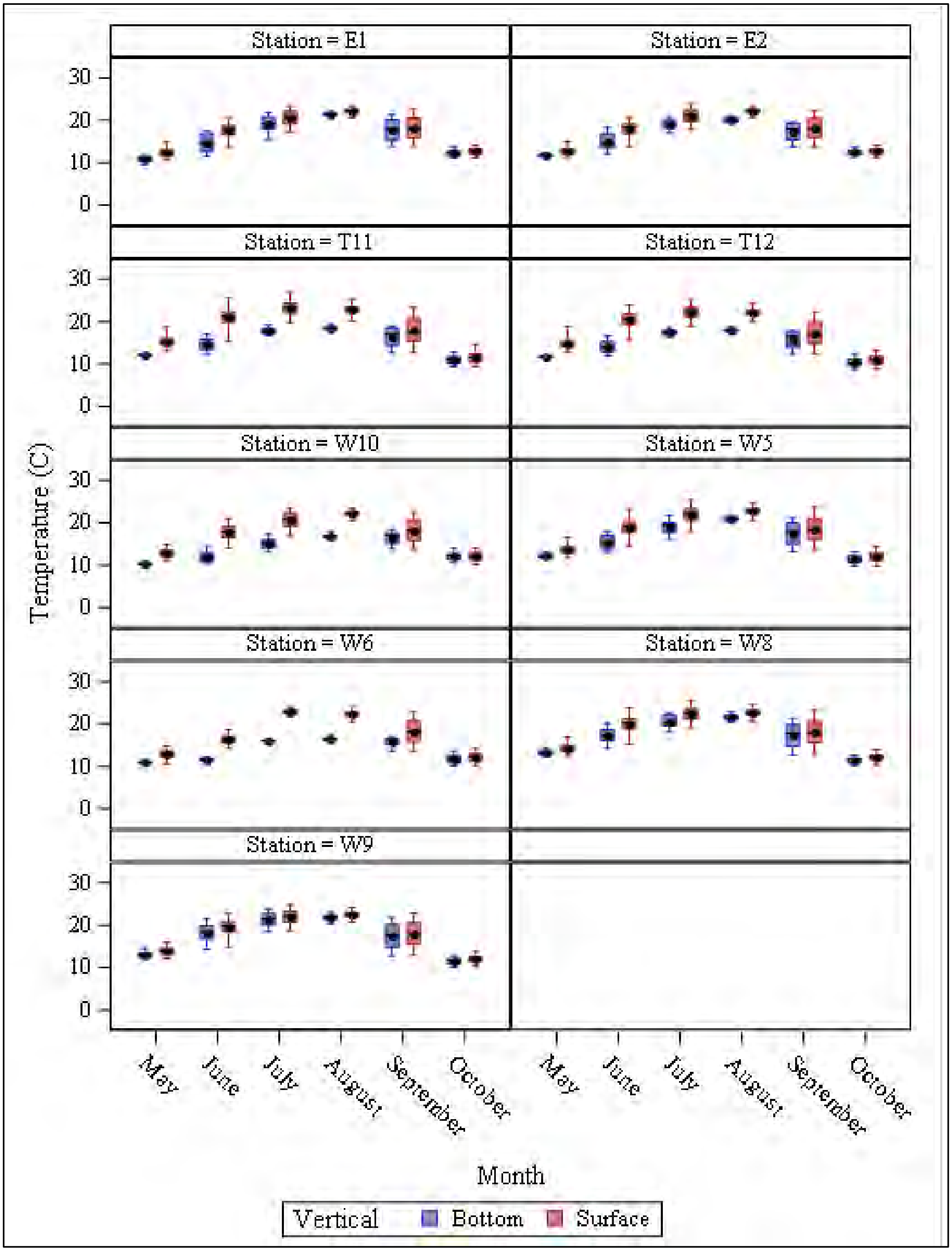

Figure 9. Continuous 15-minute data: water temperature monthly box-and-whisker plots for near-surface and near-bottom depths at each Tahoe Keys monitoring station in 2019 (dot denotes mean, black horizontal line denotes median, and whiskers indicate the 10th and 90th percentiles).

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).

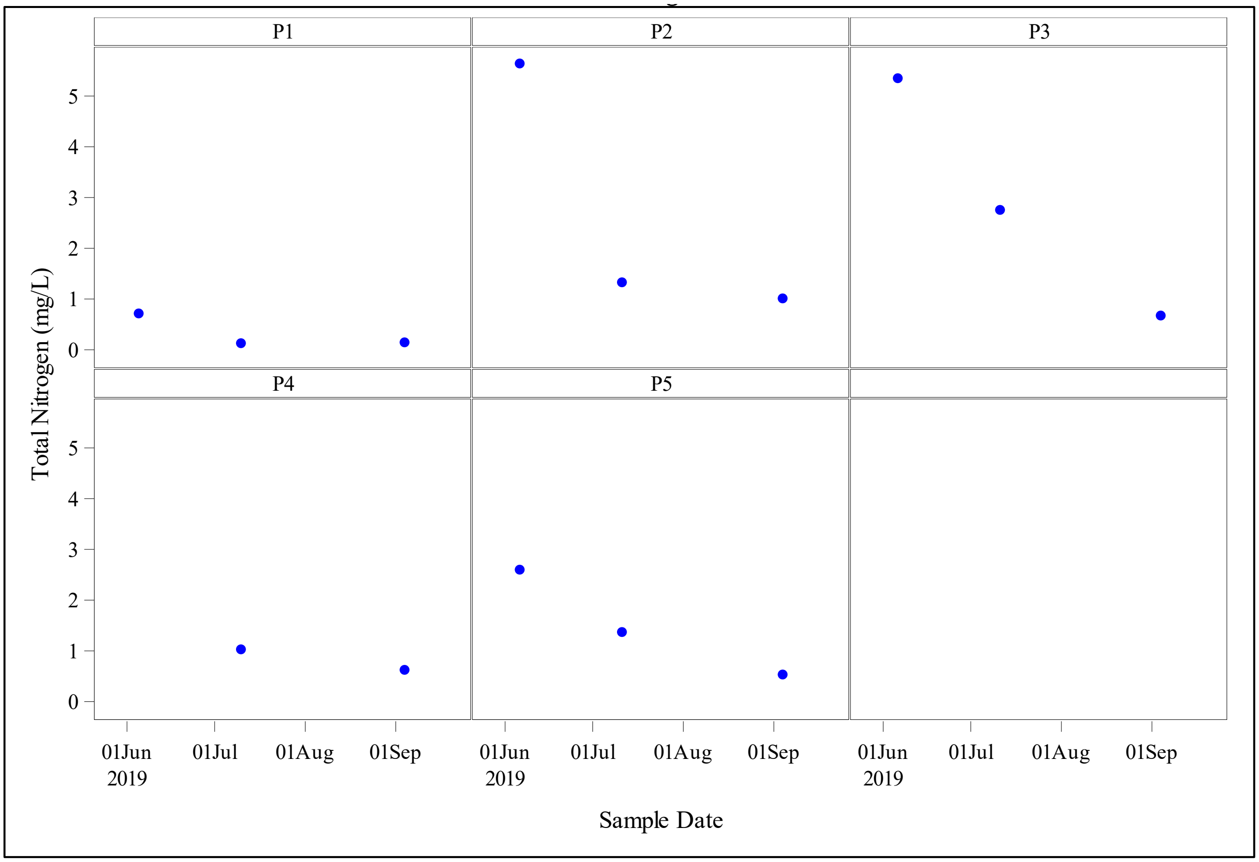

Figure 10. Total nitrogen (mg/L) concentrations in groundwater samples near Tahoe Keys over the 2019 baseline sampling period.

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

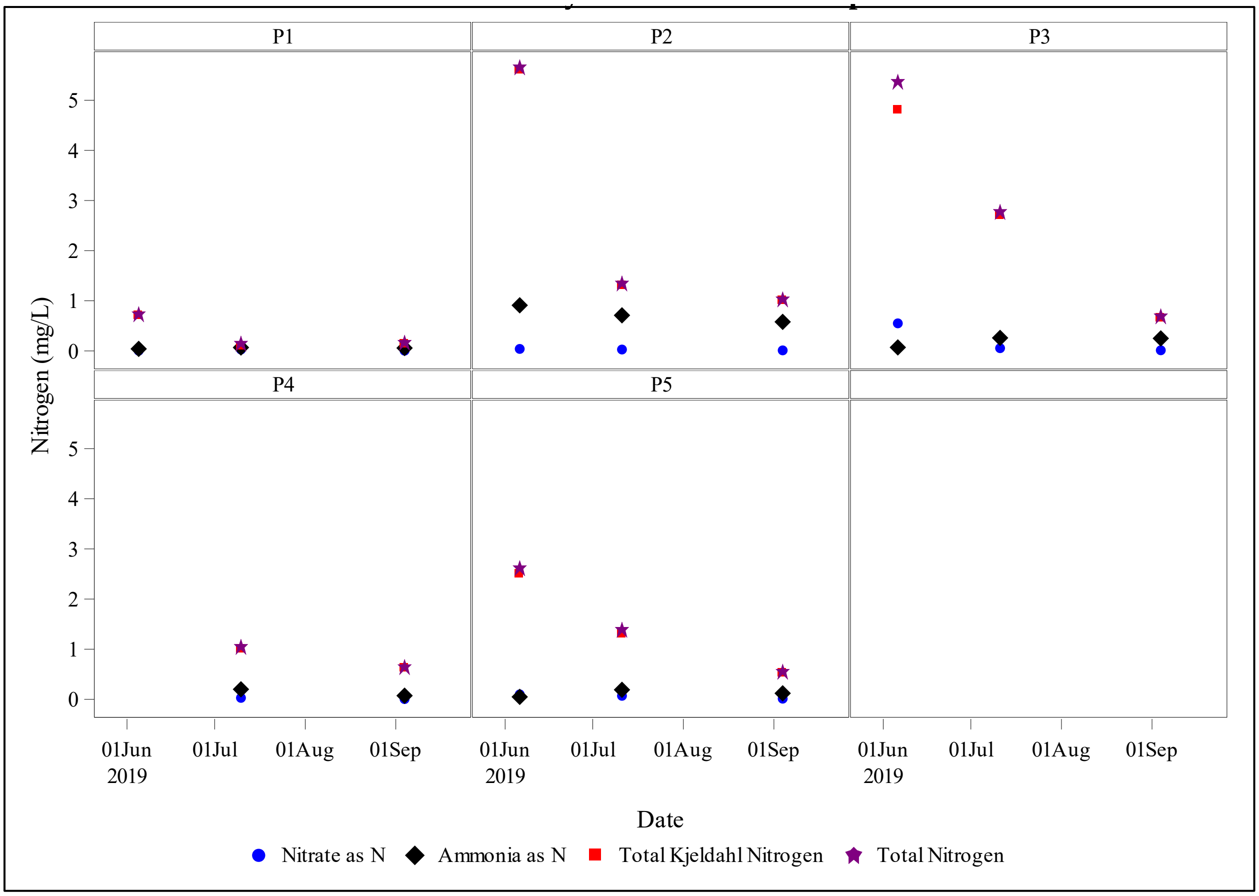

Figure 11. Concentrations of primary nitrogen forms (nitrate, ammonia, TKN; mg/) and total nitrogen (mg/L) in groundwater samples from piezometers near Tahoe Keys in 2019.

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.

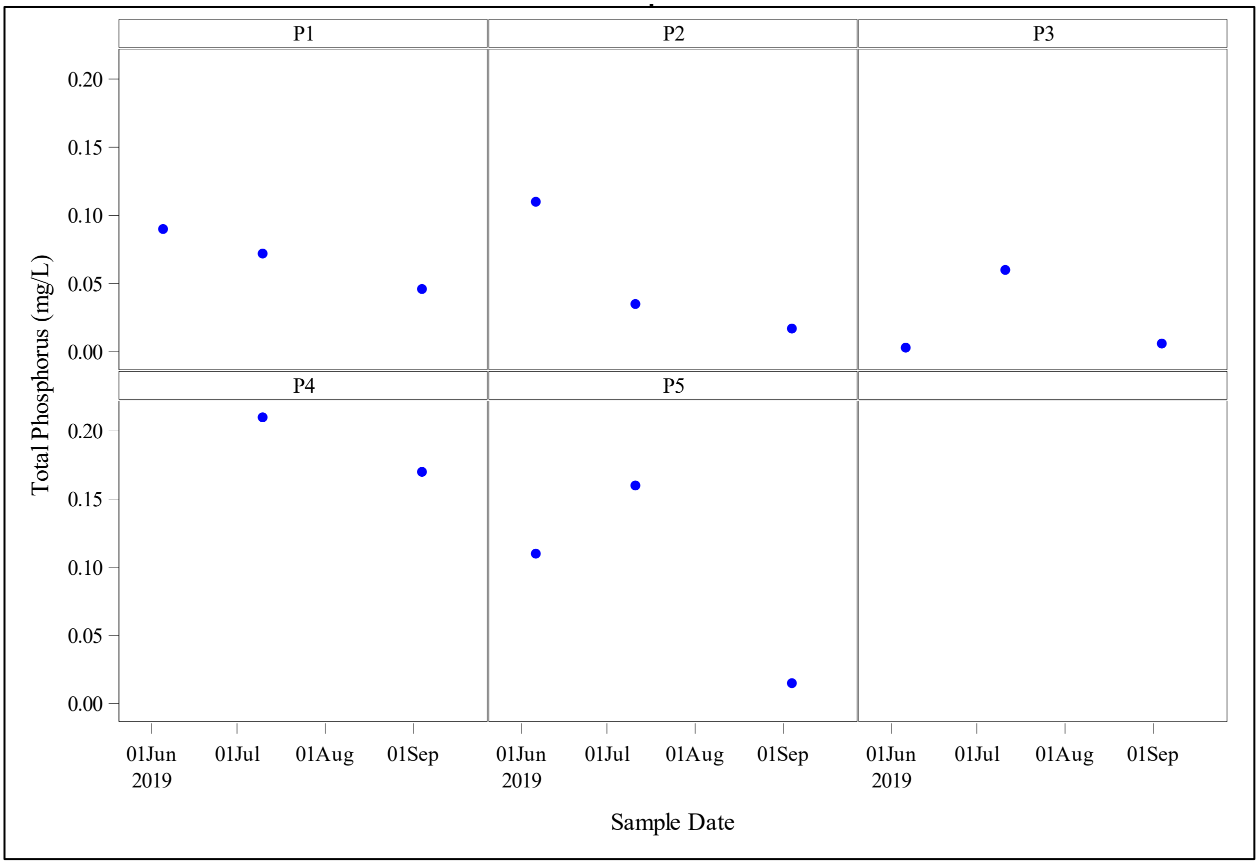

Figure 12. Total phosphorus (mg/L) concentrations in groundwater samples from piezometers near Tahoe Keys over 2019 sampling period.

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

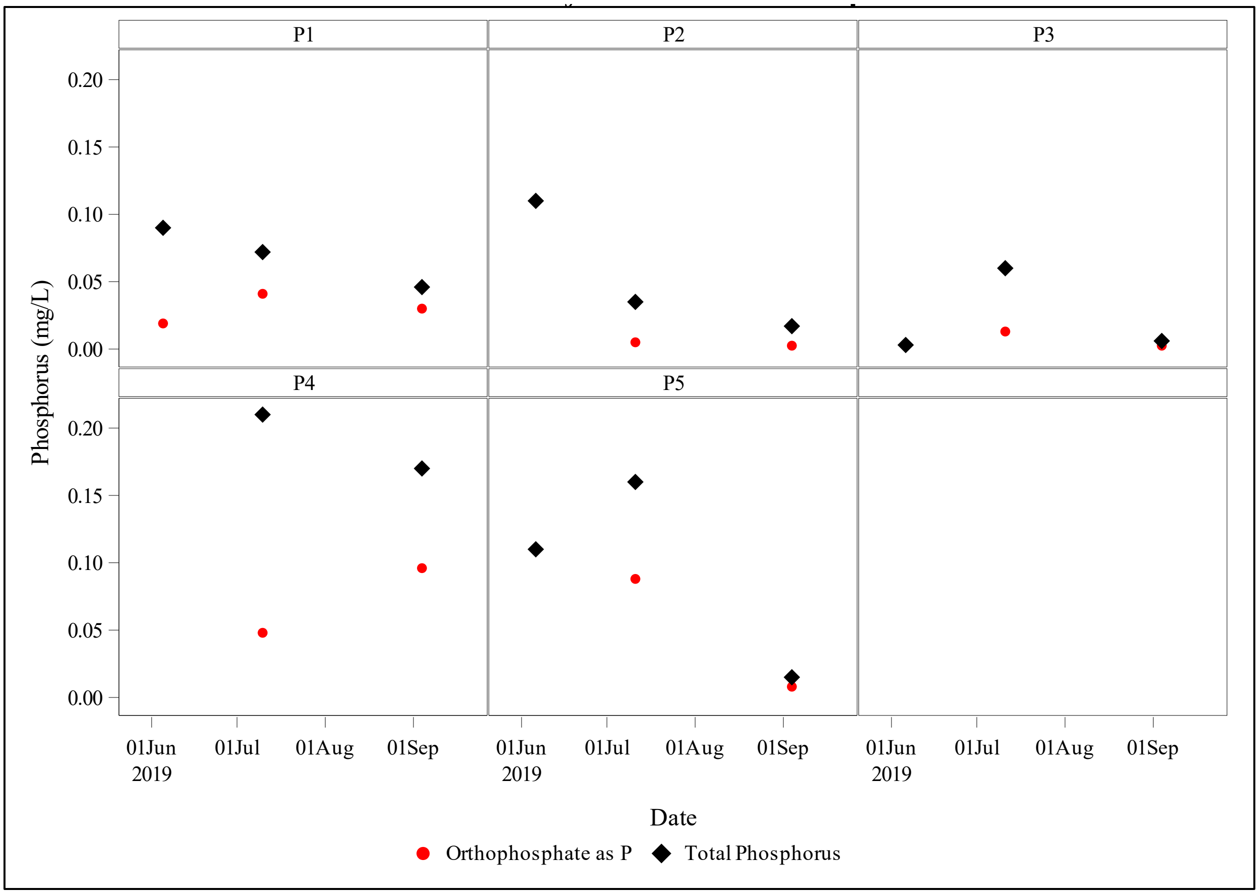

Figure 13. Concentrations of orthophosphate and total phosphorus (mg/L) in groundwater samples collected from piezometers near Tahoe Keys in 2019.

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).

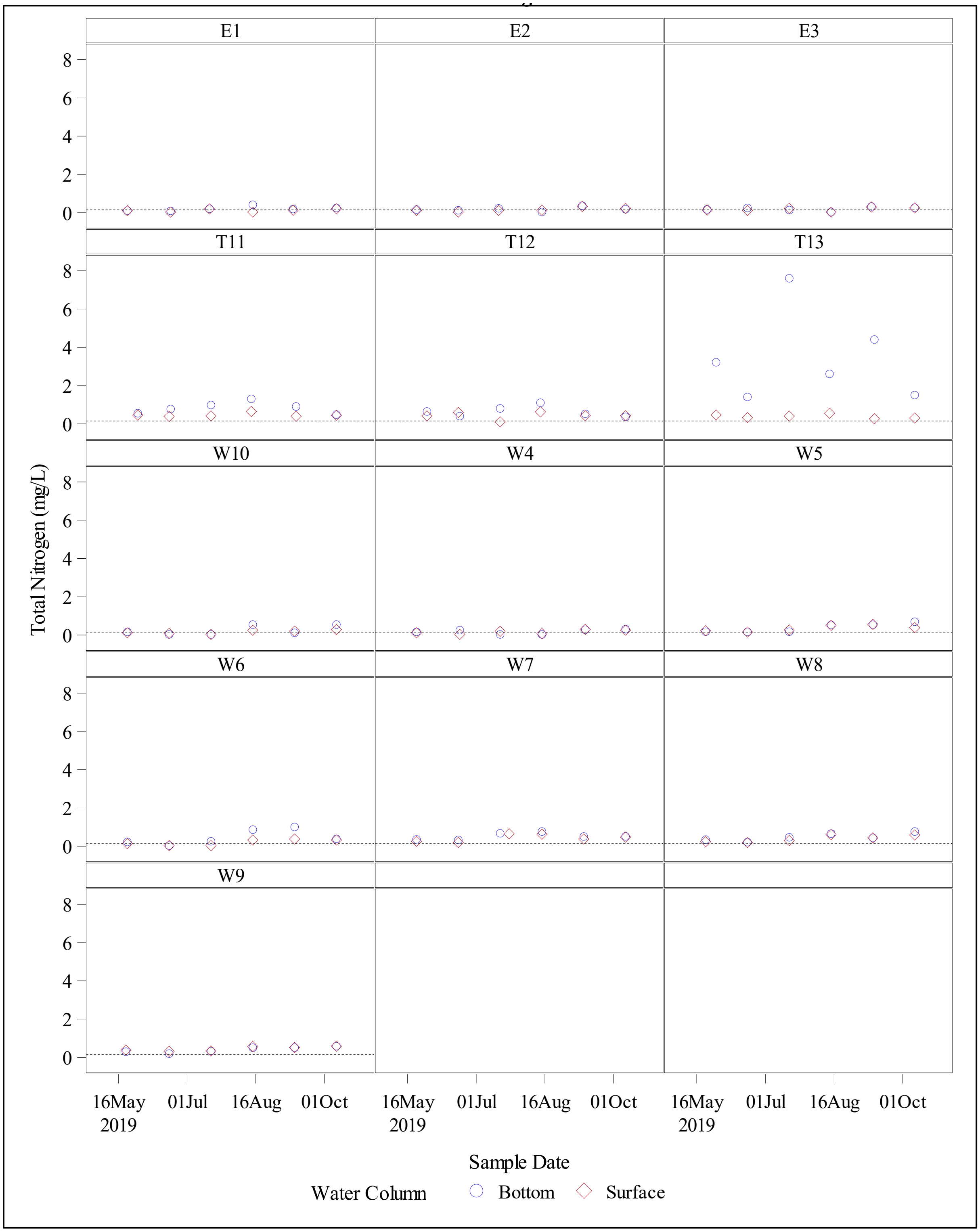

Figure 14. Total nitrogen (mg/L) concentrations in near-surface and near-bottom Tahoe Keys lagoon water samples over the 2019 sampling period (horizontal dashed lines indicate 0.15 mg/L maximum criterion).

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

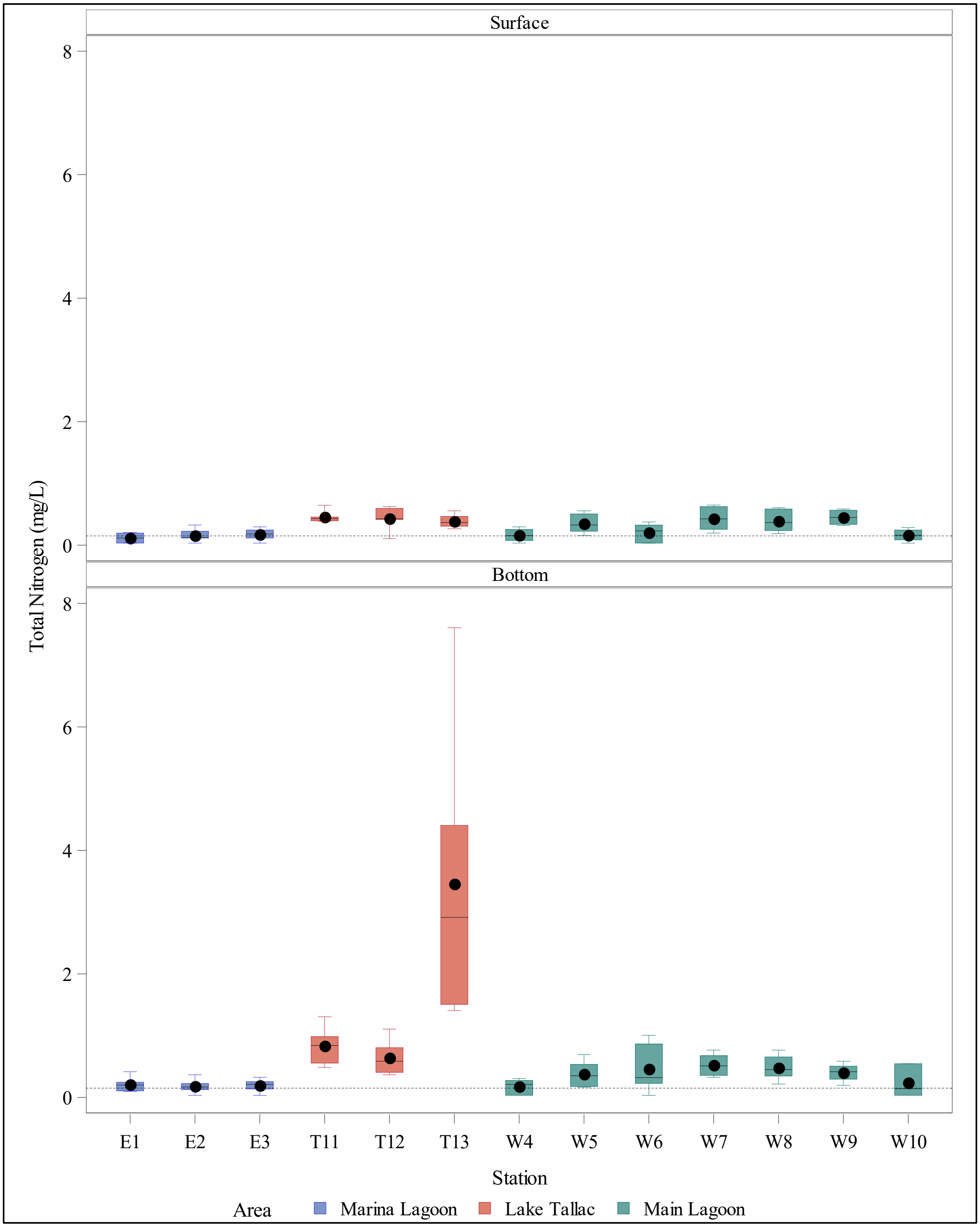

Figure 15. Total nitrogen (mg/L) box-and-whisker plots for near-surface (top) and near-bottom (maximum depth, bottom panel) sample concentrations by station (ot denotes mean, black horizontal line denotes median, and horizontal dashed line indicates 0.15 mg/L maximum criterion).

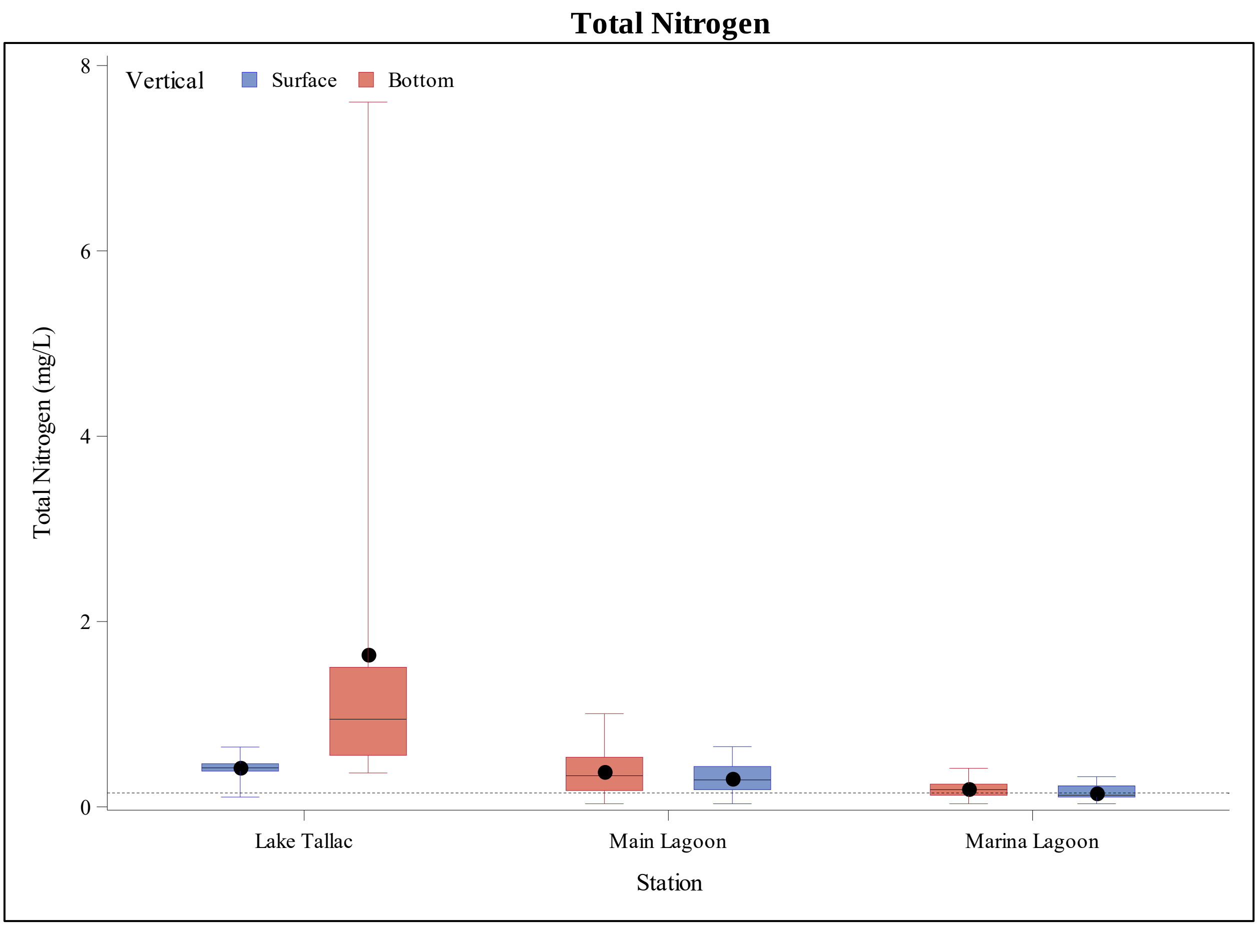

Figure 16. Total nitrogen (mg/L) box-and-whisker plots for sample concentrations by lagoon (dot denotes mean, black horizontal line denotes median, and horizontal dashed line indicates 0.15 mg/L maximum criterion).

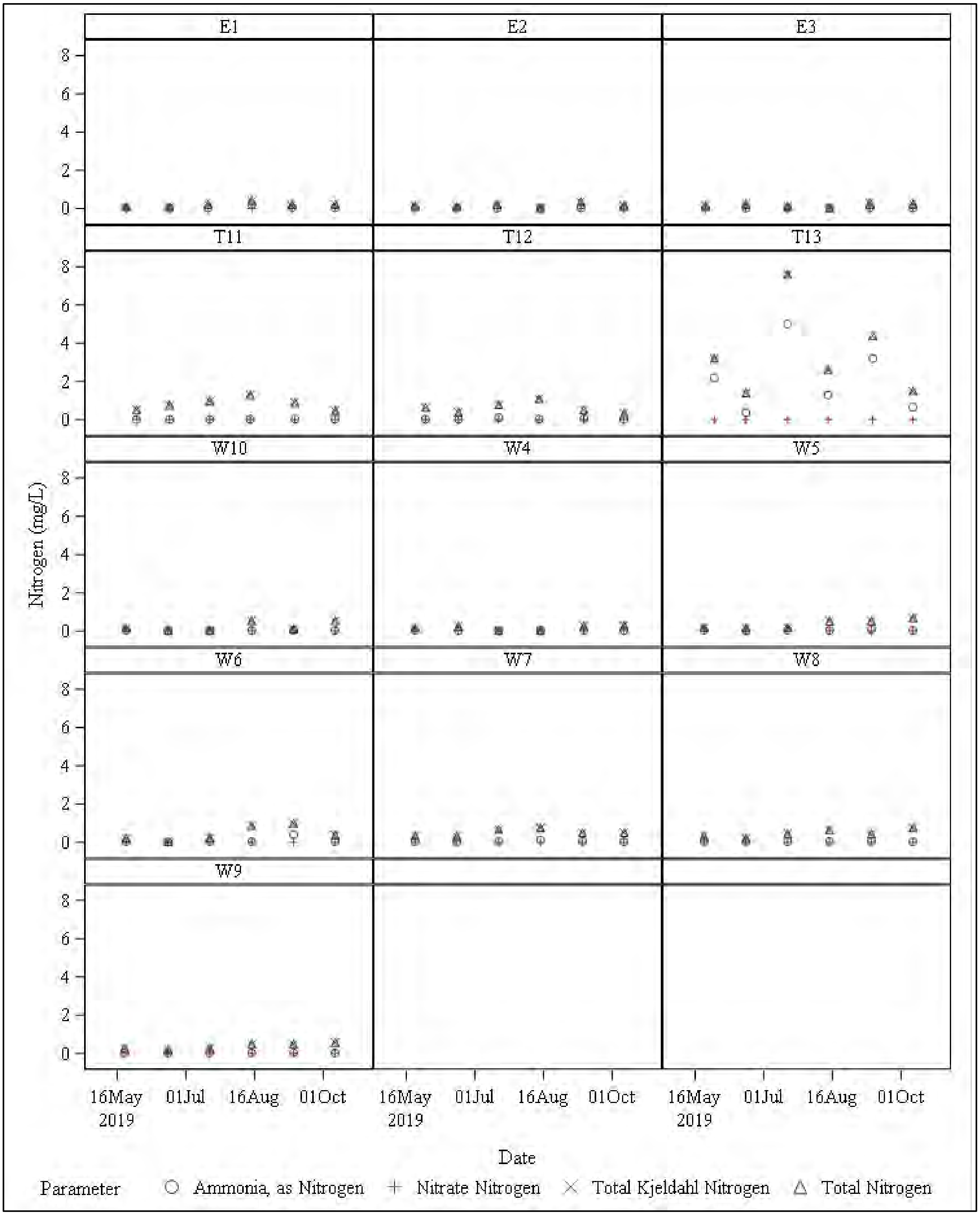

Figure 17. Concentrations of primary nitrogen forms (nitrate, ammonia, TKN; mg/L) and total nitrogen (mg/L) in near-bottom samples from the Tahoe Keys lagoons in 2019.

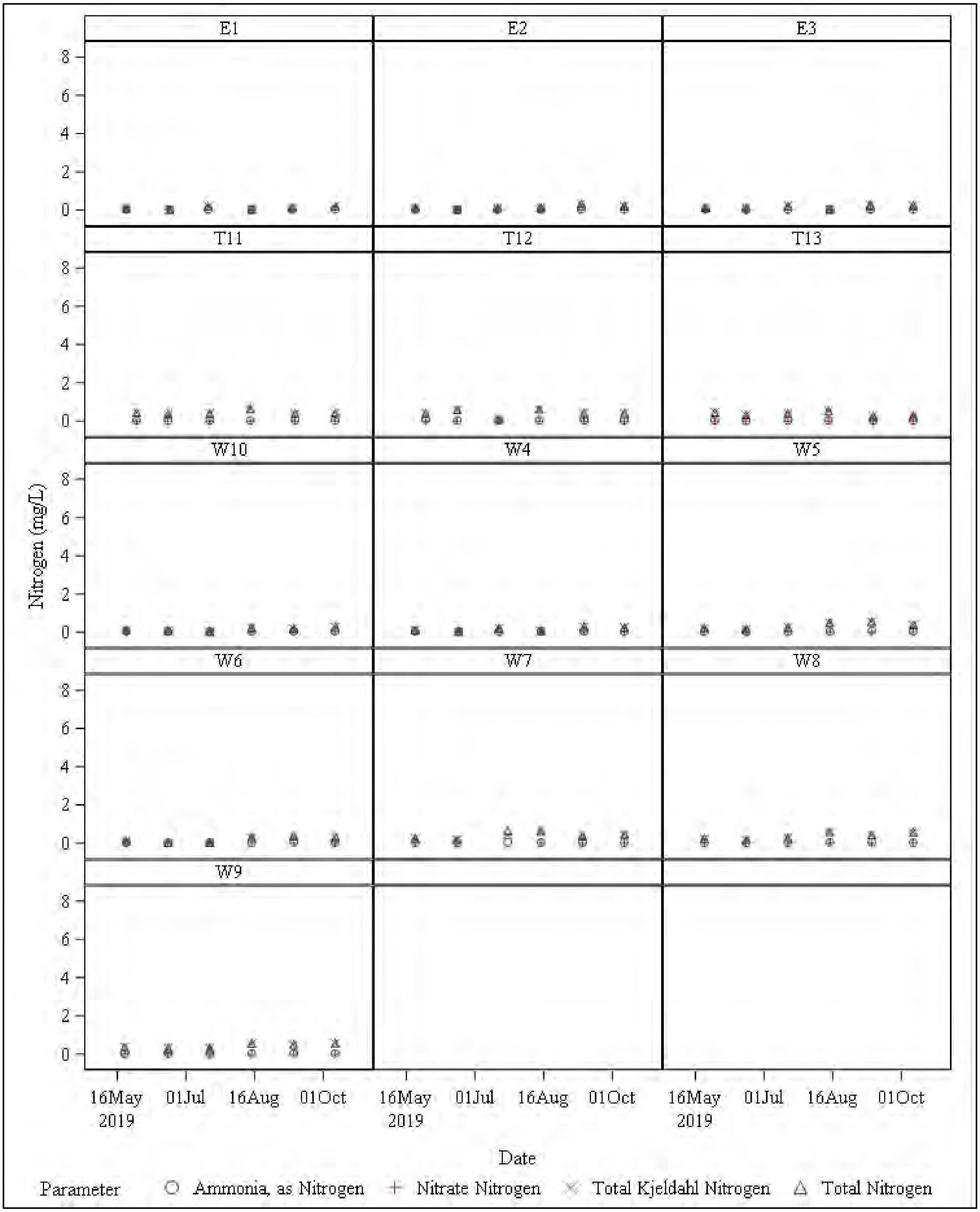

Figure 18. Concentrations of primary nitrogen forms (nitrate, ammonia, TKN; mg/L) and total nitrogen (mg/L) in near-surface samples from the Tahoe Keys lagoons in 2019.

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.

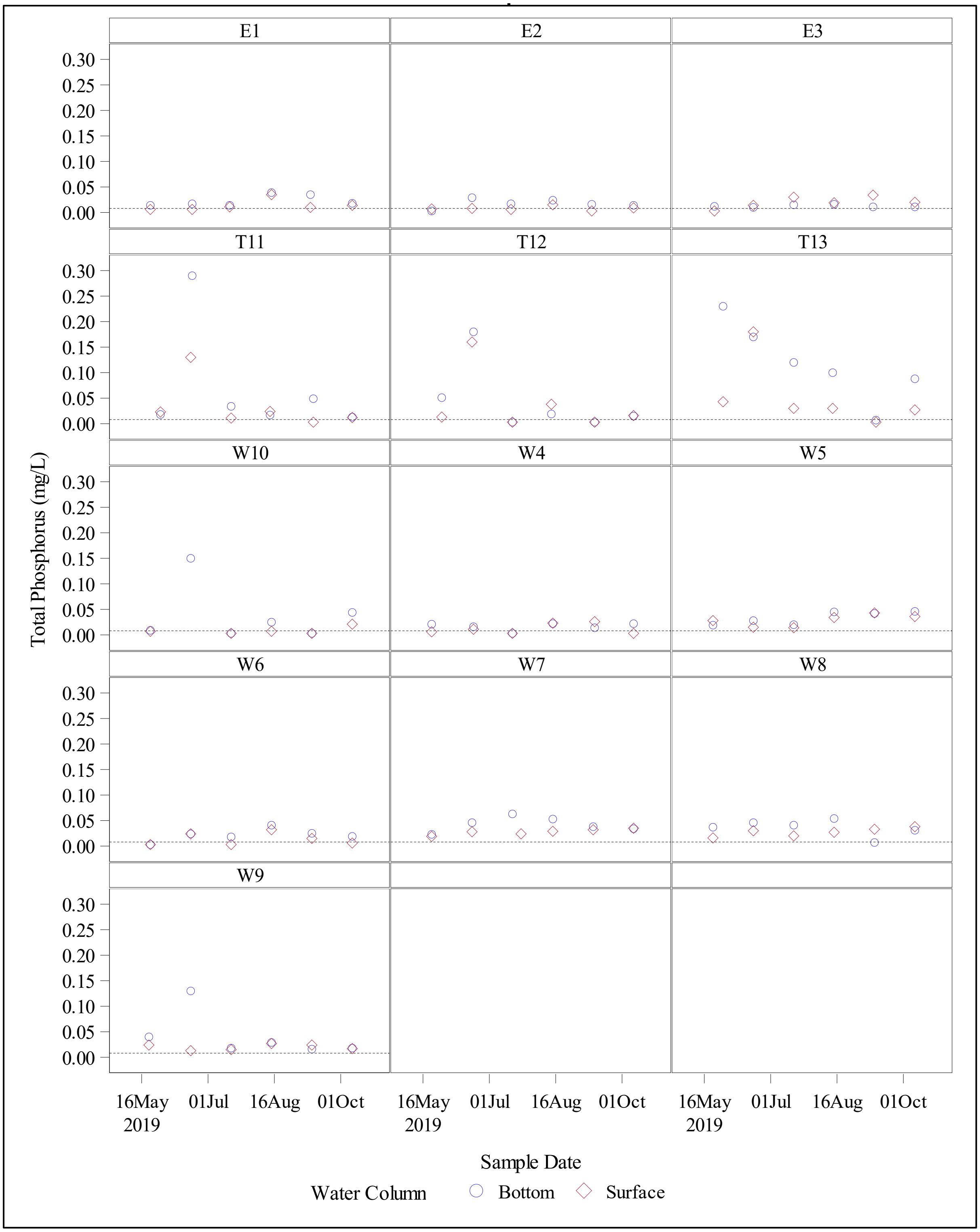

Figure 19. Total phosphorus (mg/L) concentrations in near-surface and near-bottom Tahoe Keys lagoon water samples in 2019 (horizontal dashed line indicates 0.008 mg/L maximum criterion).

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

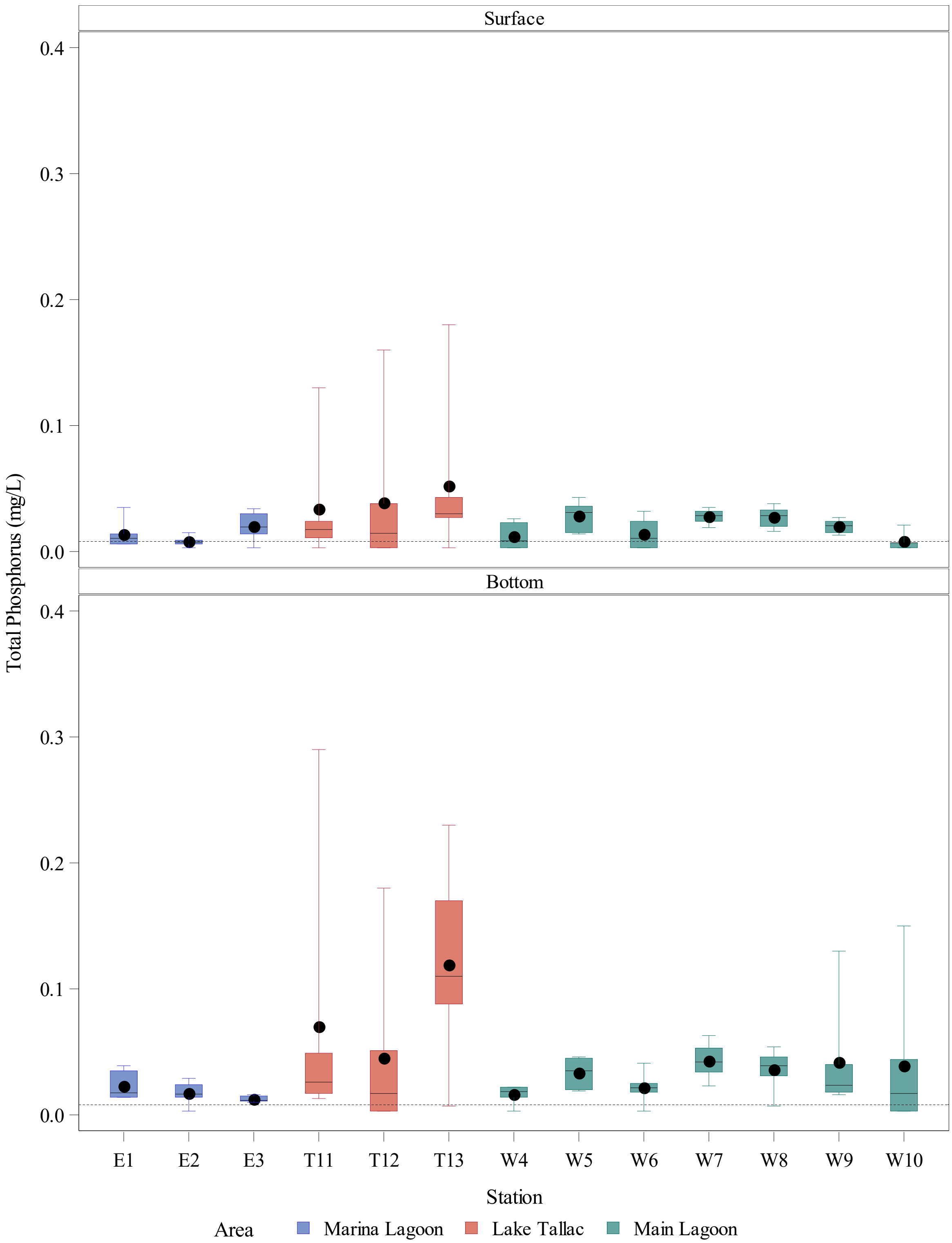

Figure 20. Total phosphorus (mg/L) box-and-whisker plots for near-surface (top) and near-bottom (maximum depth, bottom panel) sample concentrations by station (dot denotes mean, black horizontal line denotes median, horizontal dashed line indicates 0.008 mg/L maximum criterion).

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.

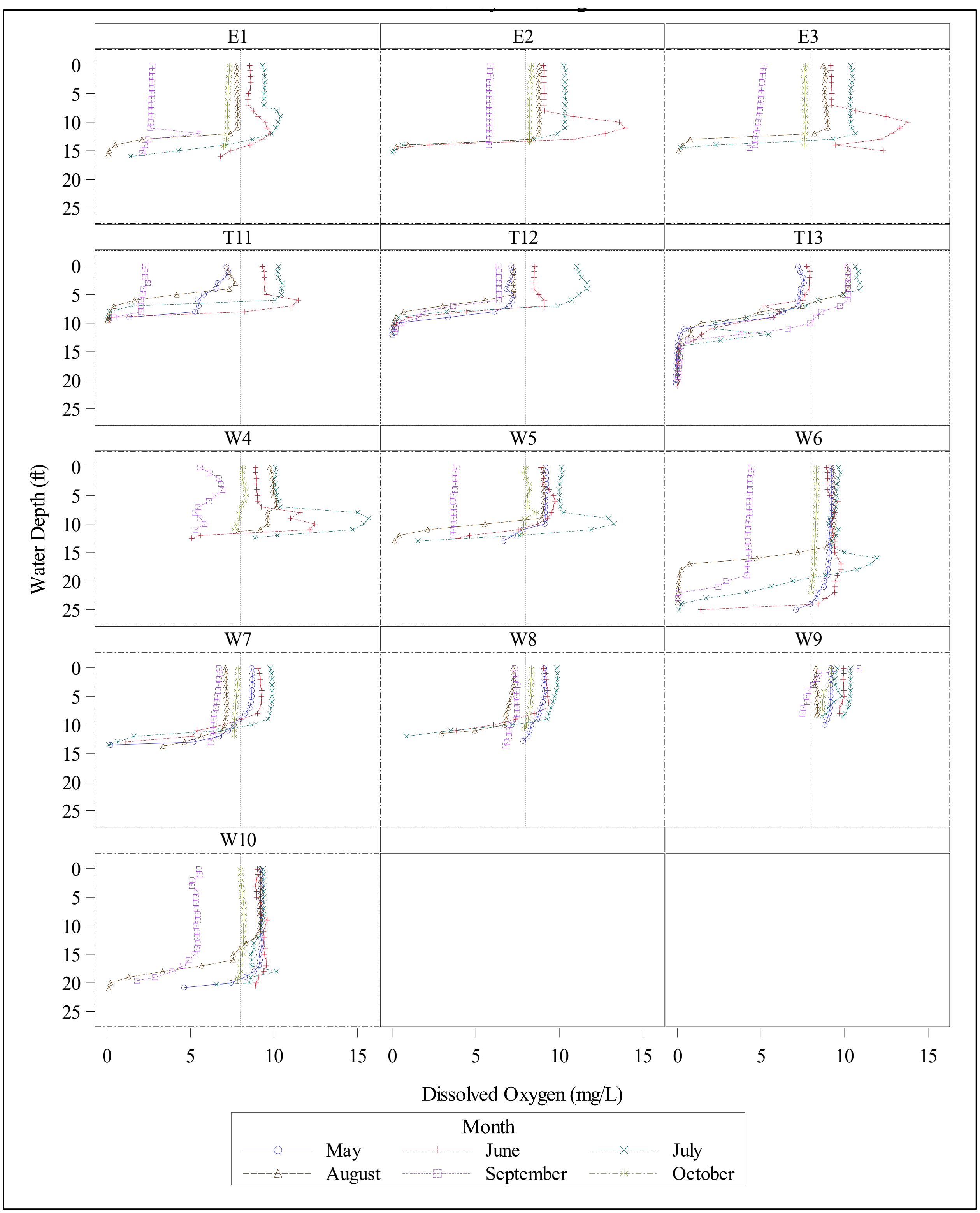

Figure 21. Vertical morning DO (mg/L) profile measurements in the Tahoe Keys lagoons from May to October 2019 (vertical dashed lines indicate the 8.0 mg/L minimum criterion).

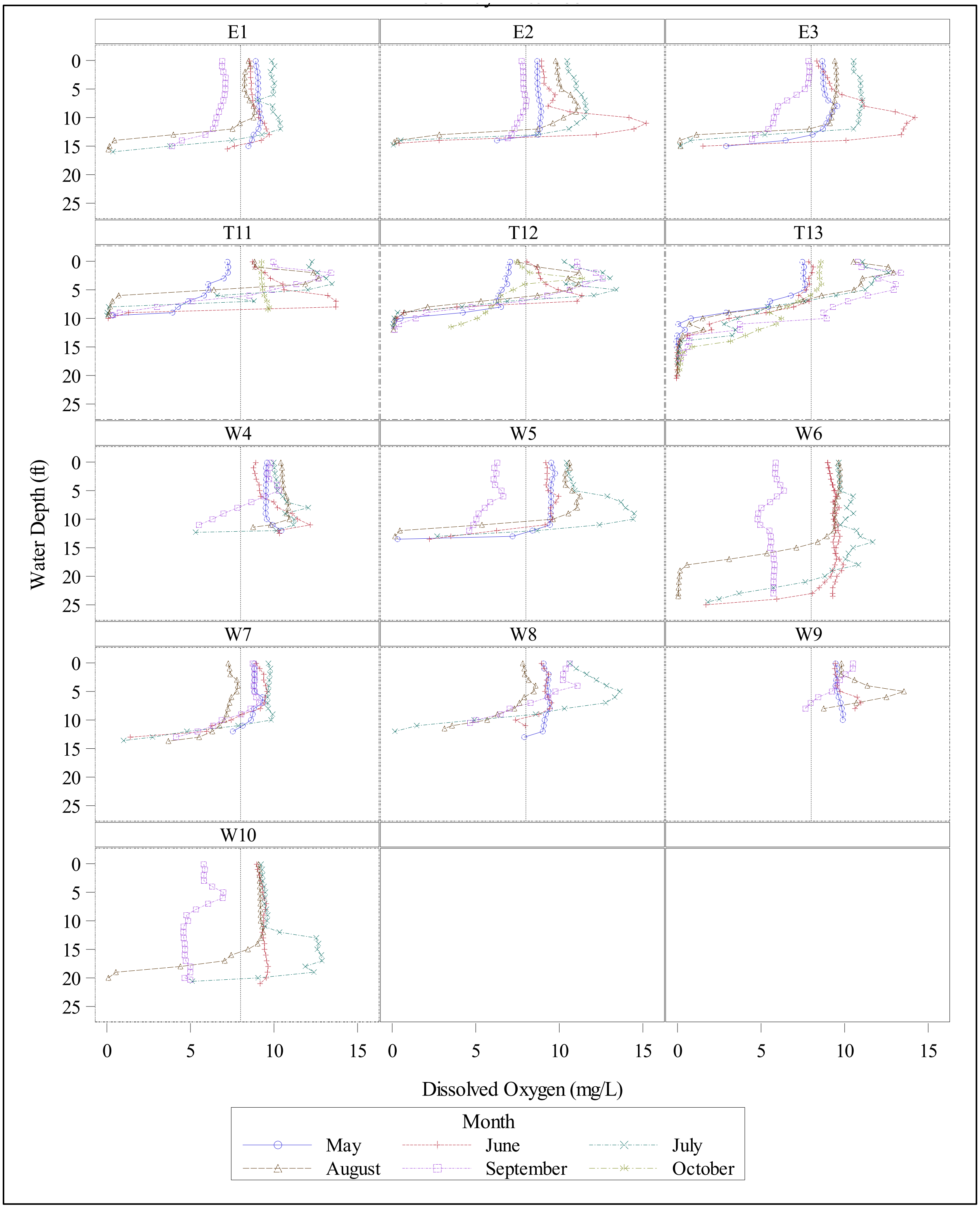

Figure 22. Vertical afternoon DO (mg/L) profile measurements in the Tahoe Keys lagoons from May to October 2019 (vertical dashed lines indicate the 8.0 mg/L minimum criterion).

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.

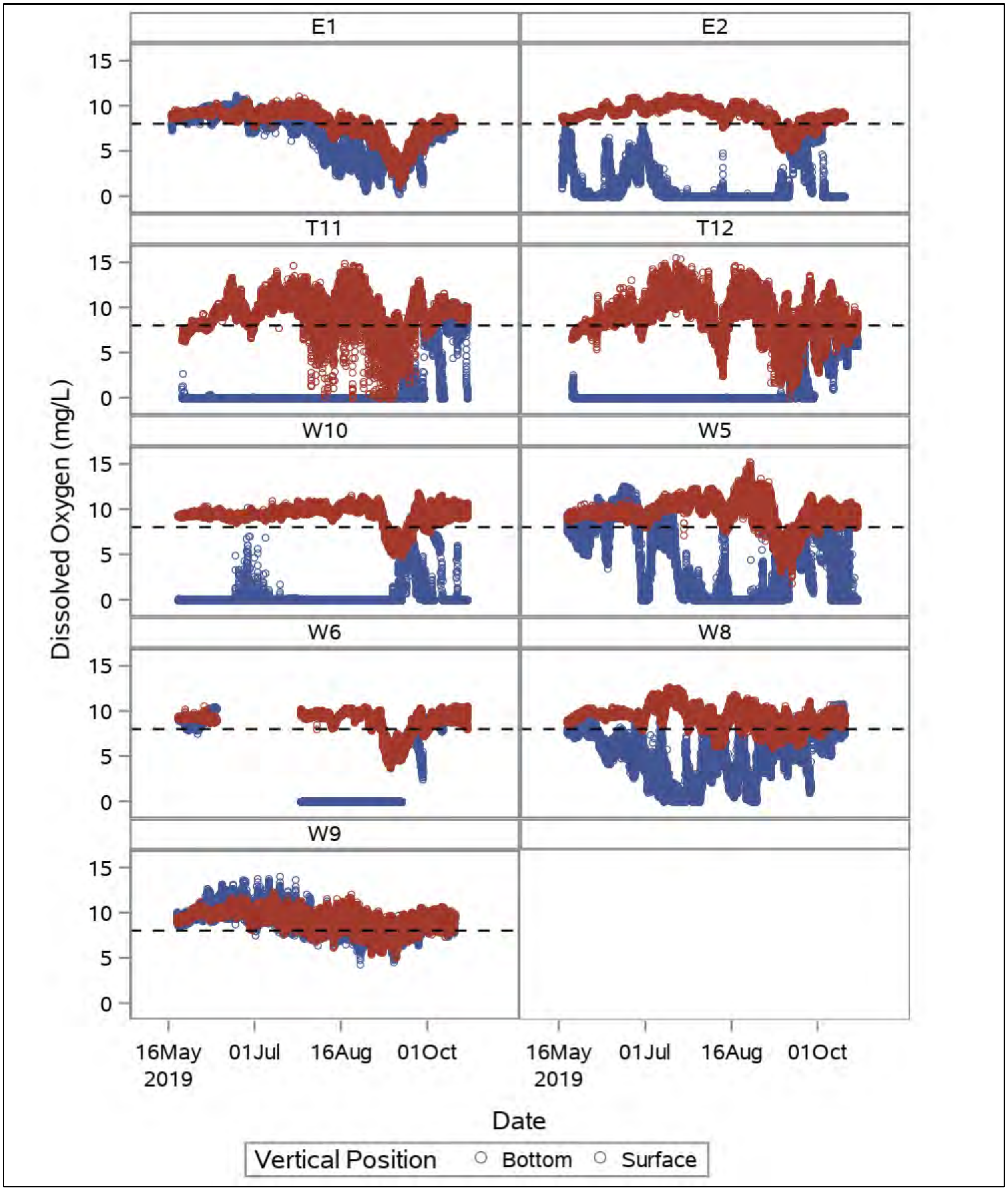

Figure 23. Continuous 15-minute water DO (mg/L) measurements for the near-surface and near-bottom water depths in Tahoe Keys lagoons in 2019 (horizontal black dashed lines indicate minimum [8.0 mg/L] criterion).

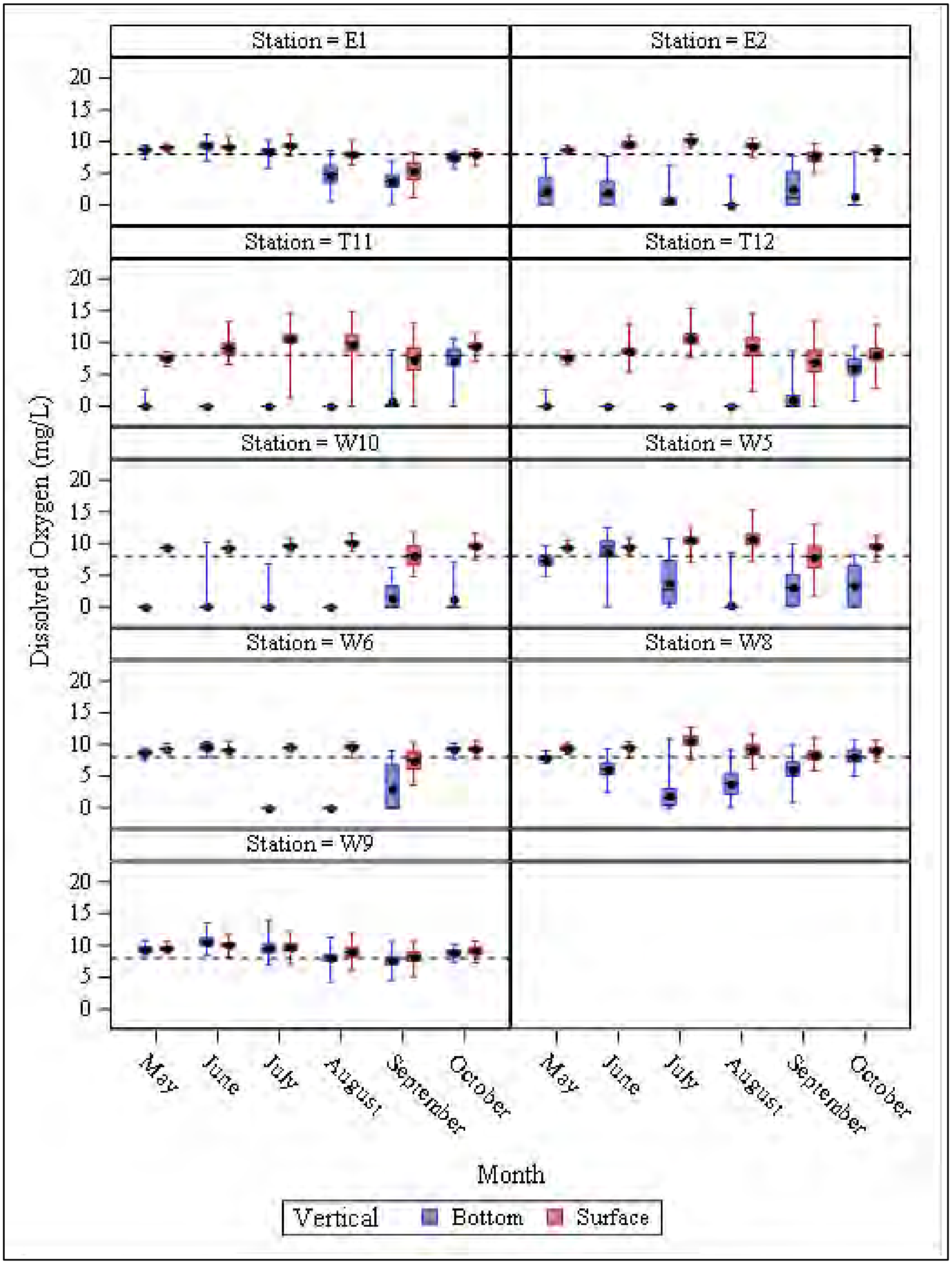

Figure 24. Continuous 15-minute DO (mg/L) measurements monthly box-and-whisker plots for near-surface and near-bottom depths in Tahoe Keys lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal black dashed lines show the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

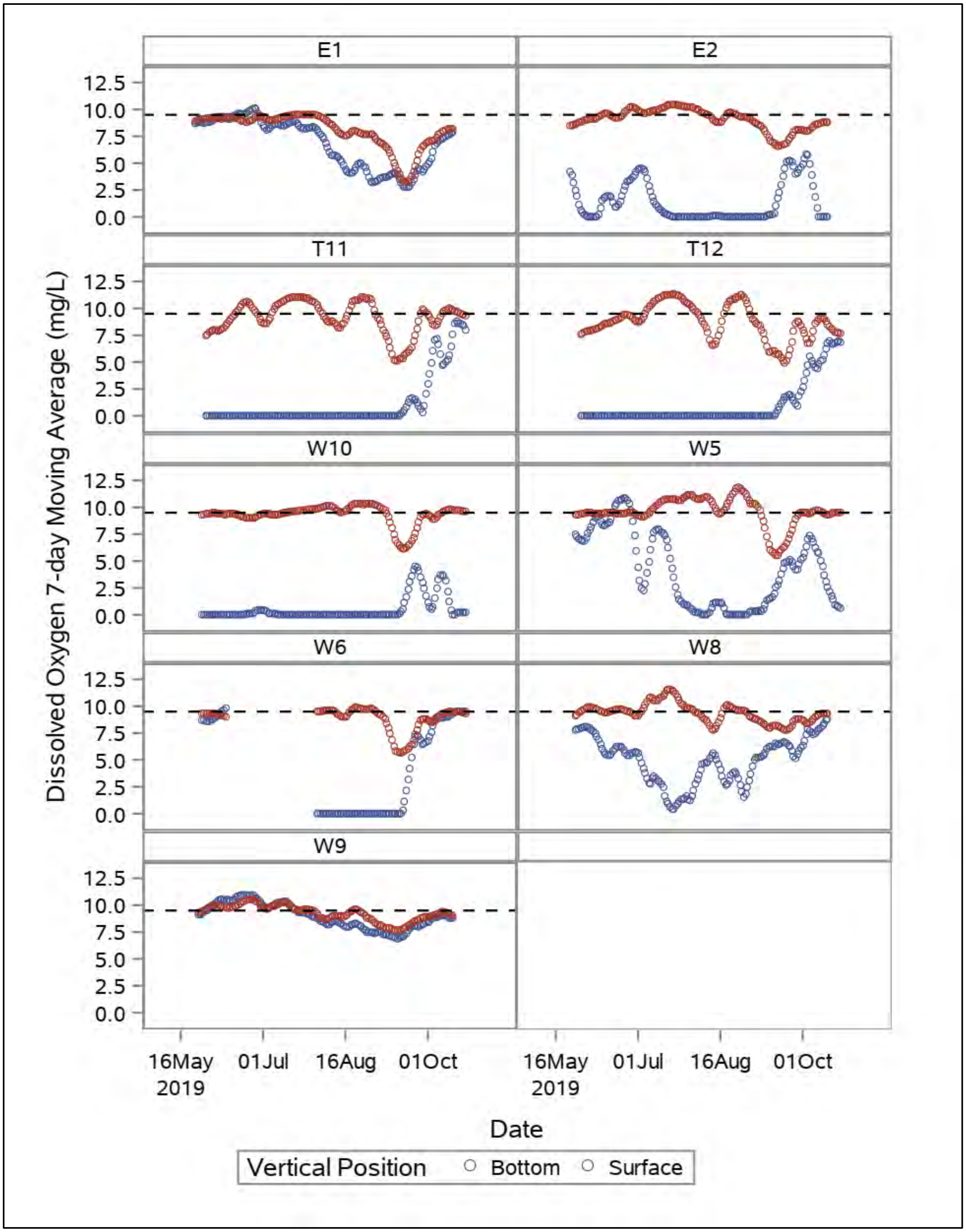

Figure 25. Seven-day moving average DO (mg/L) measurements calculated from continuous 15-minute readings for near-surface and near-bottom water depths in the Tahoe Keys lagoons in 2019 (horizontal black dashed lines indicate the seven-day mean minimum criterion [9.5 mg/L]).

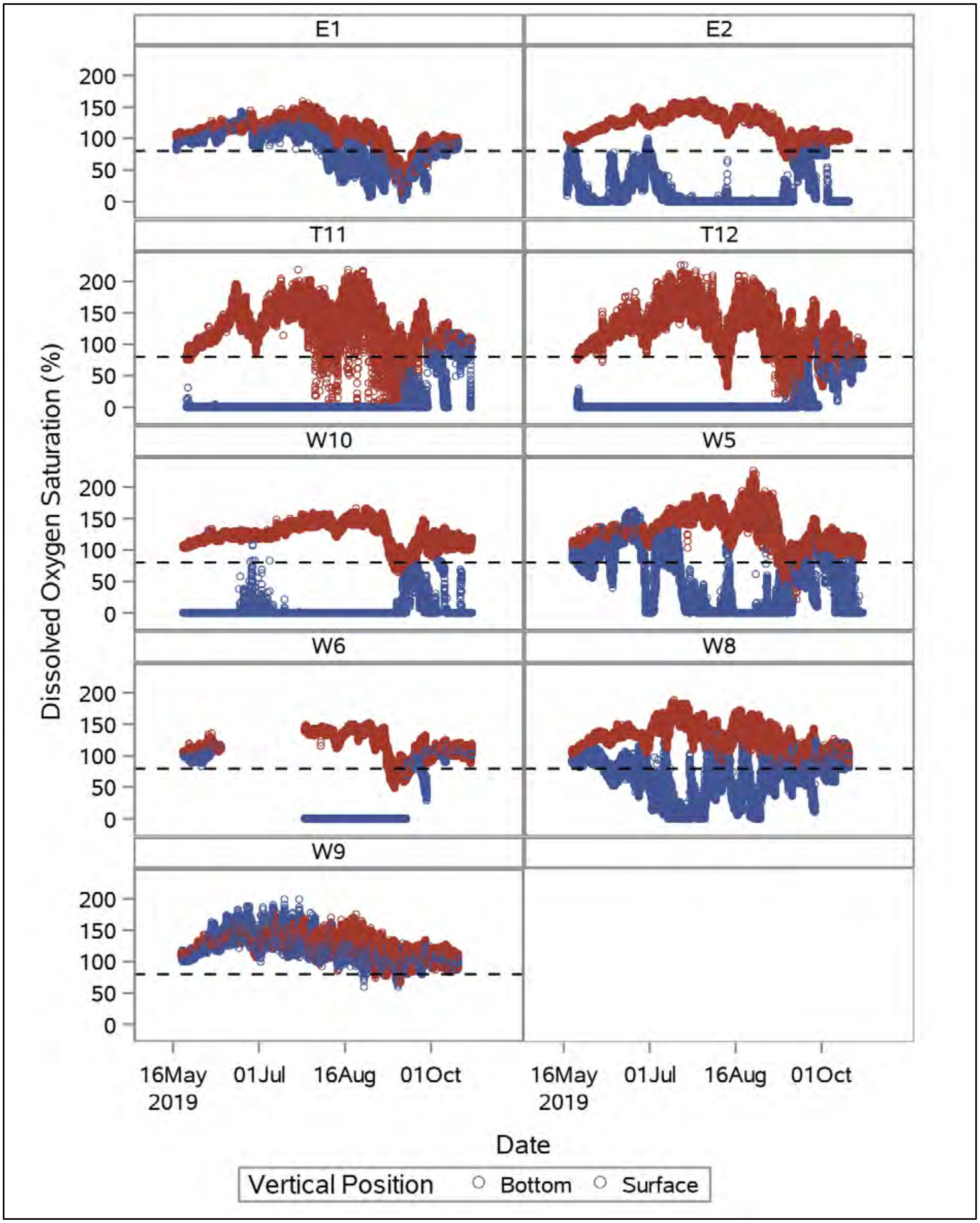

Figure 26. Continuous 15-minute DO (percent saturation) measurements for the near-surface and near-bottom water depths in the Keys lagoons in 2019 (horizontal black dashed lines indicate the percent saturation minimum criterion [80 percent]).

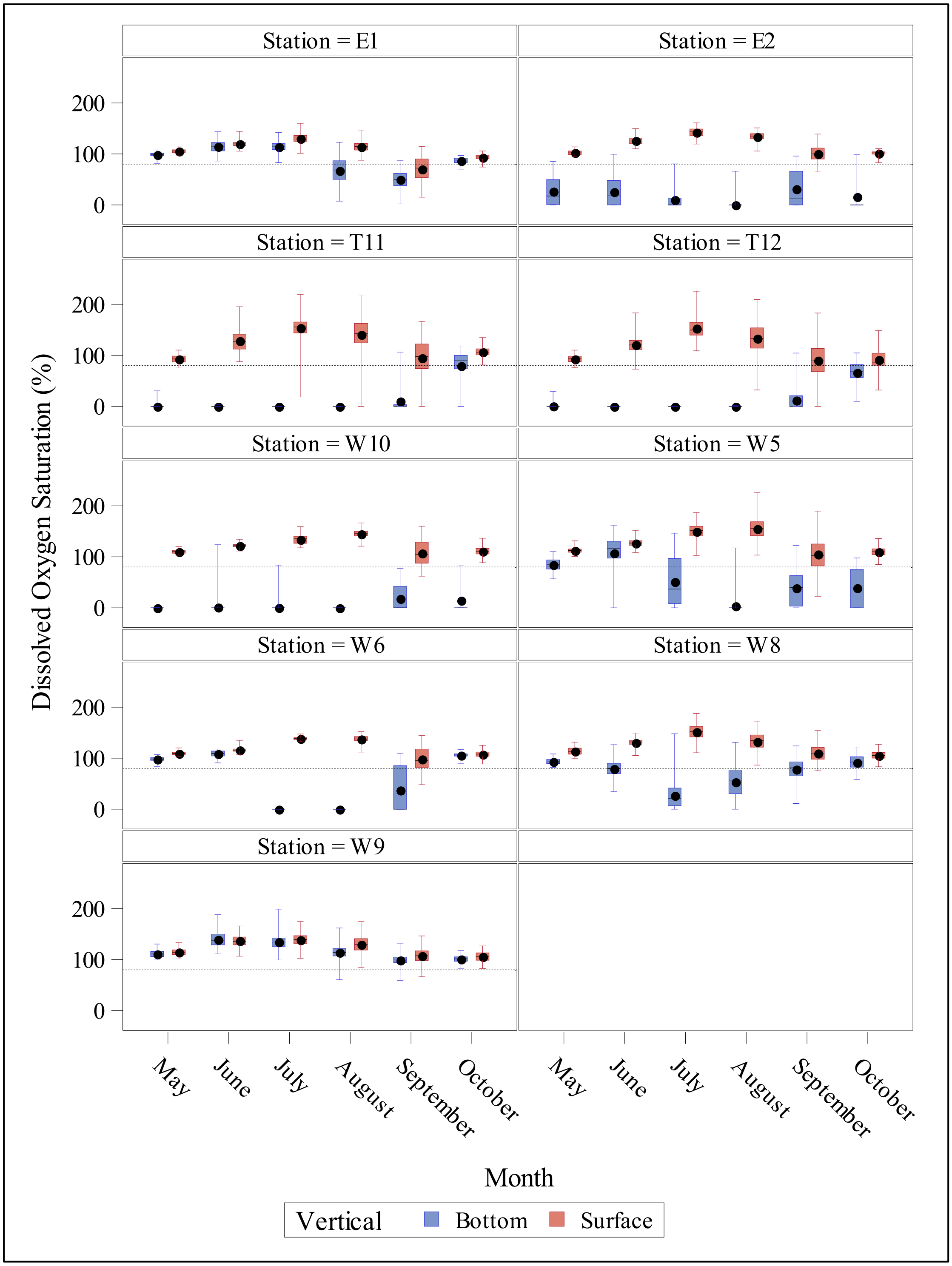

Figure 27. Continuous 15-minute DO (percent saturation) measurements monthly box-and-whisker plots for near-surface and near-bottom depths in the Tahoe Keys lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal black dashed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

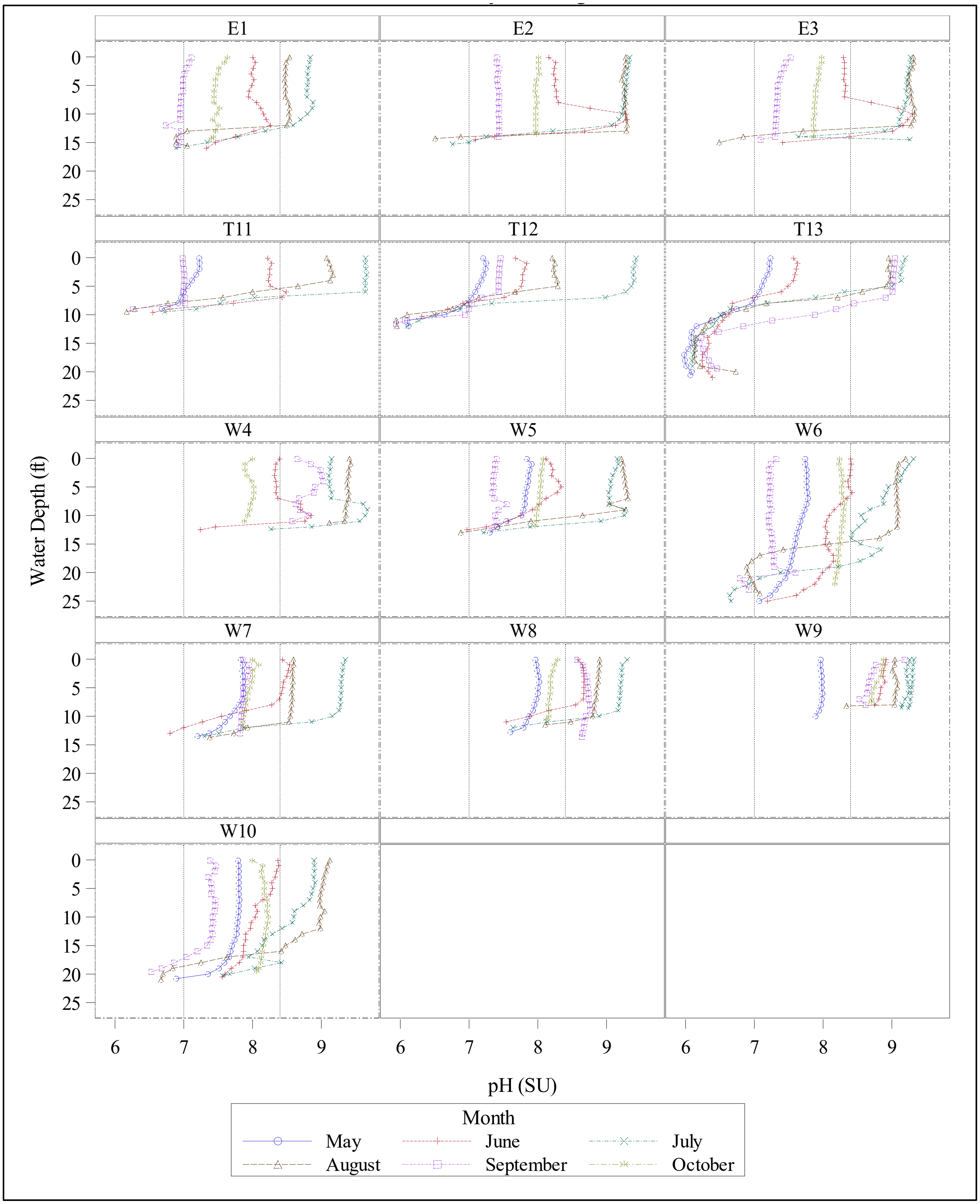

Figure 28. Vertical morning pH profiles in the Tahoe Keys lagoons from May to October 2019 (vertical dash lines show lower [7.0] and upper criteria [8.4]).

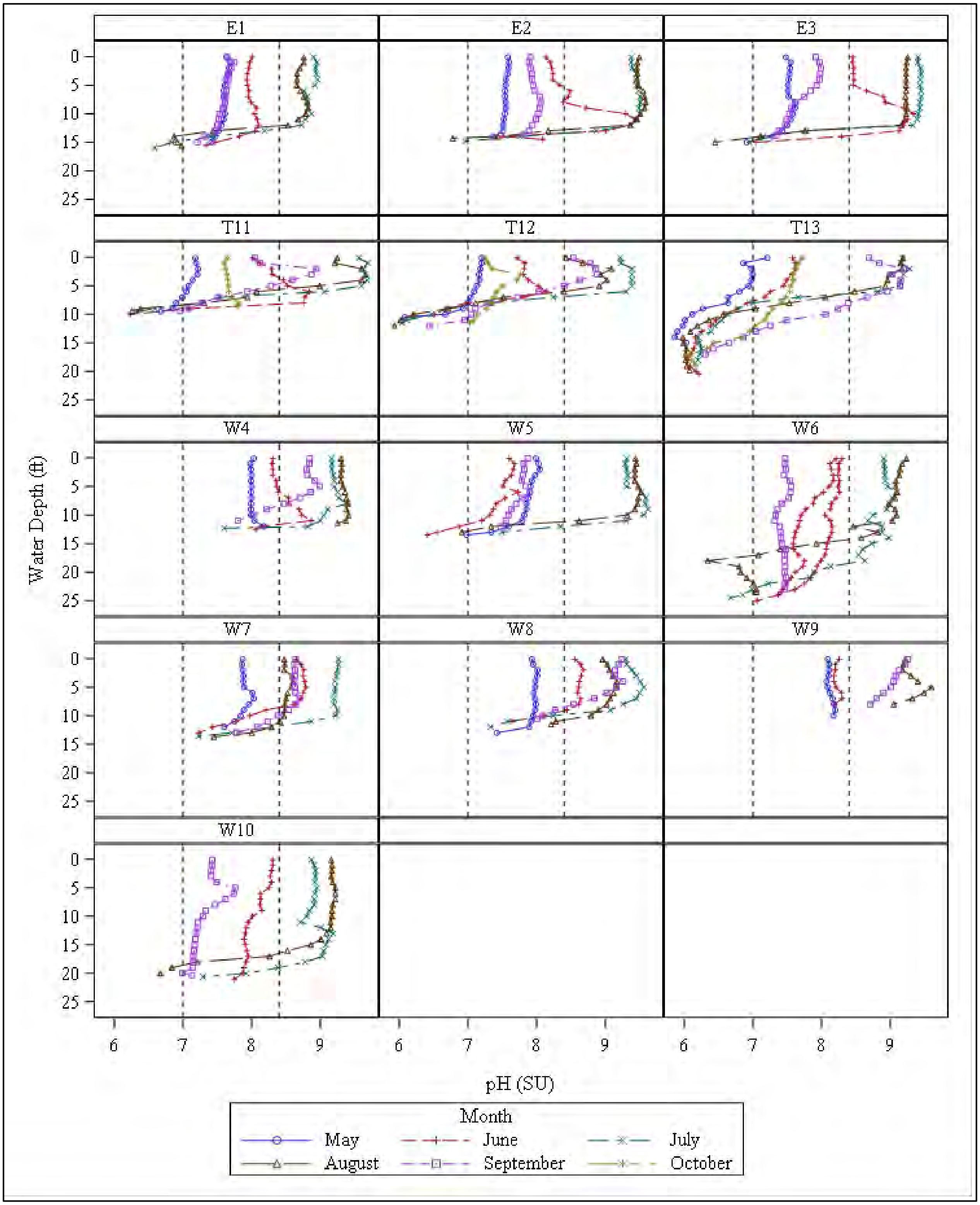

Figure 29. Vertical afternoon pH profiles in the Tahoe Keys lagoons from May to October 2019 (vertical dash lines show lower [7.0] and upper [8.4] criteria).

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 10th and 90th 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.

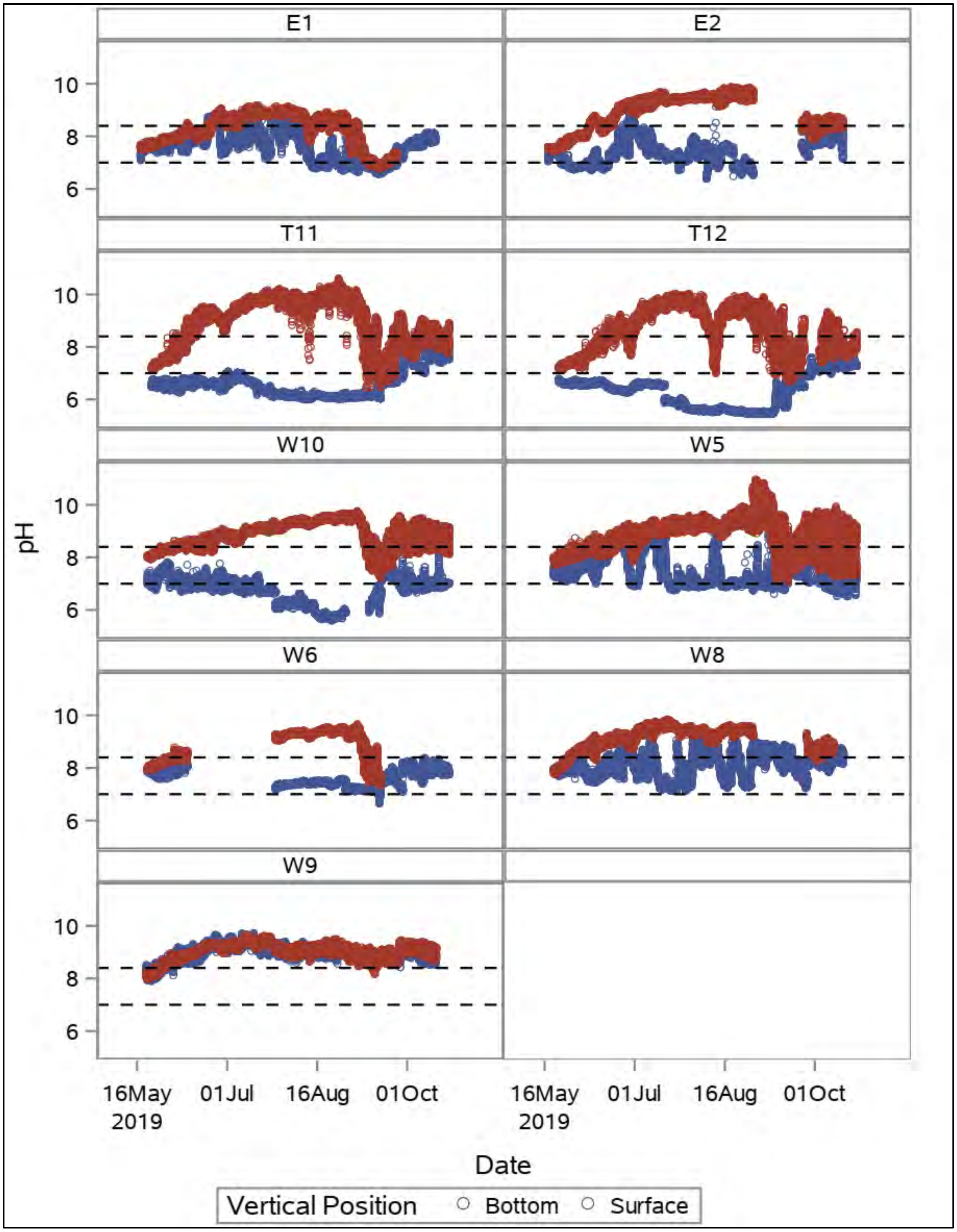

Figure 30. Continuous 15-minute pH measurements for the near-surface and near-bottom water depths in the Tahoe Keys lagoons in 2019 (horizontal dashed lines show lower [7.0] and upper [8.4] criteria).

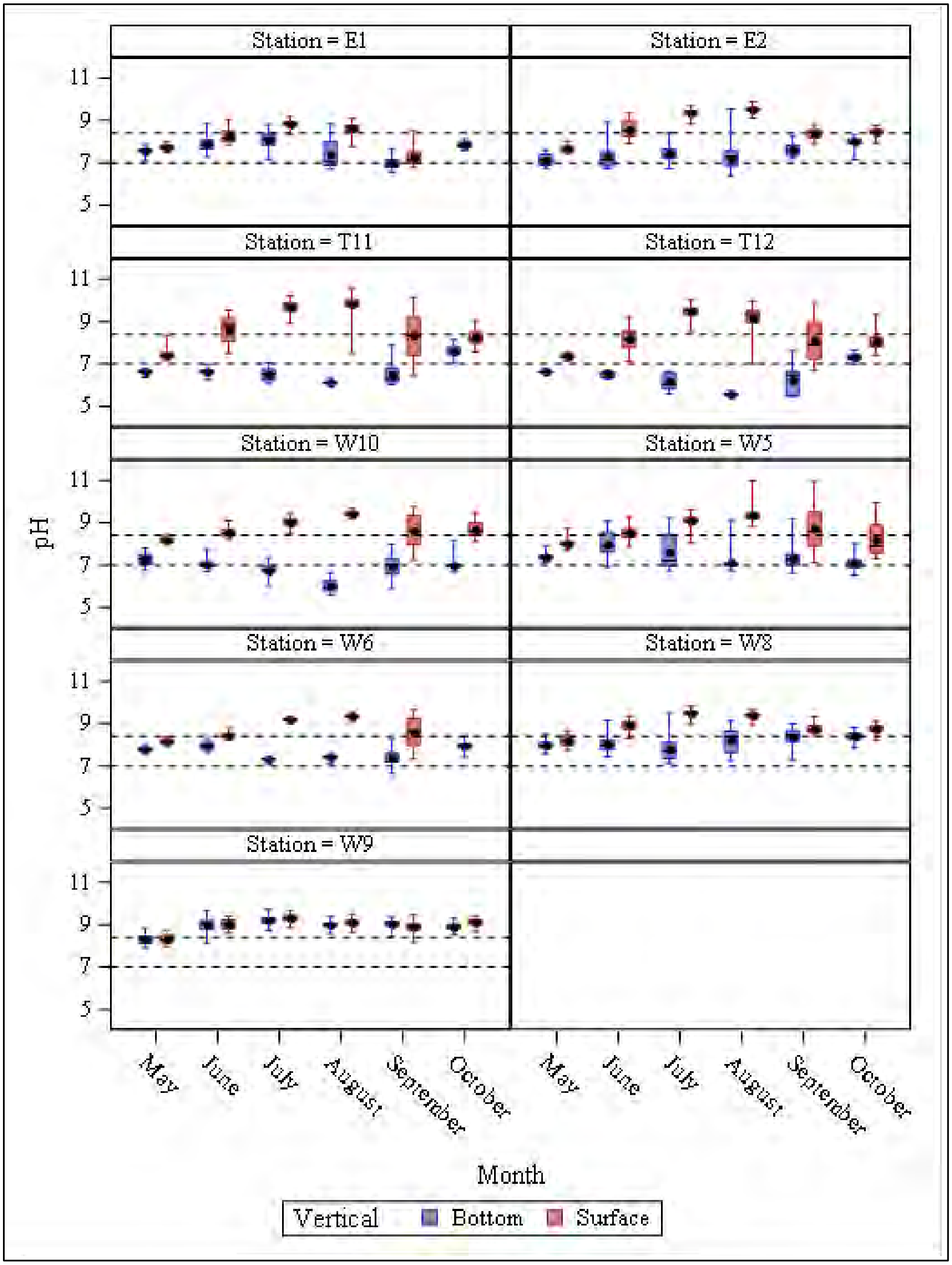

Figure 31. Continuous 15-minute pH monthly box-and-whisker plots for near-surface and near-bottom depths in the Tahoe Keys lagoons in 2019 (dot denotes mean, black horizontal line denotes median, whiskers indicate the 10th and 90th percentiles, and horizontal dashed lines show lower [7.0] and upper [8.4]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

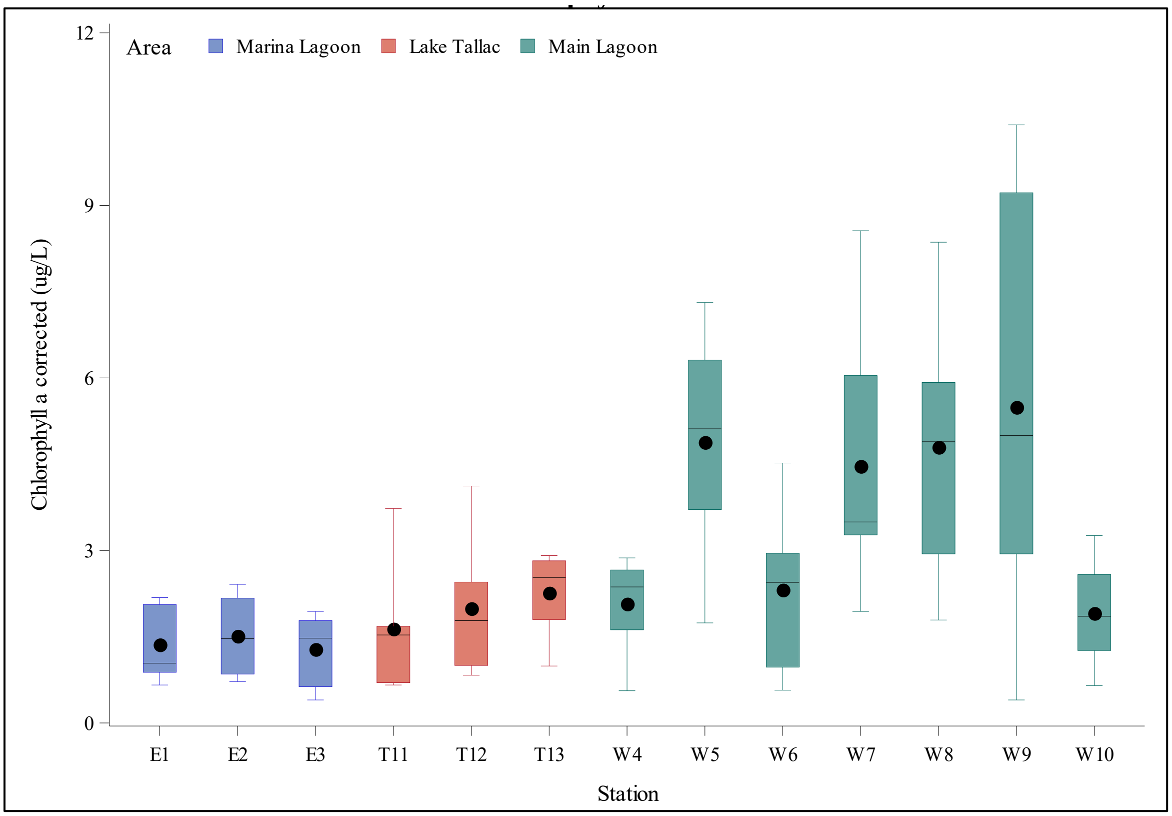

Figure 32. Chlorophyll *a* box-and-whisker plots for near-surface (1-foot below surface) samples collected from the Tahoe Keys lagoons in 2019 (dot denotes mean and black horizontal line denotes median).

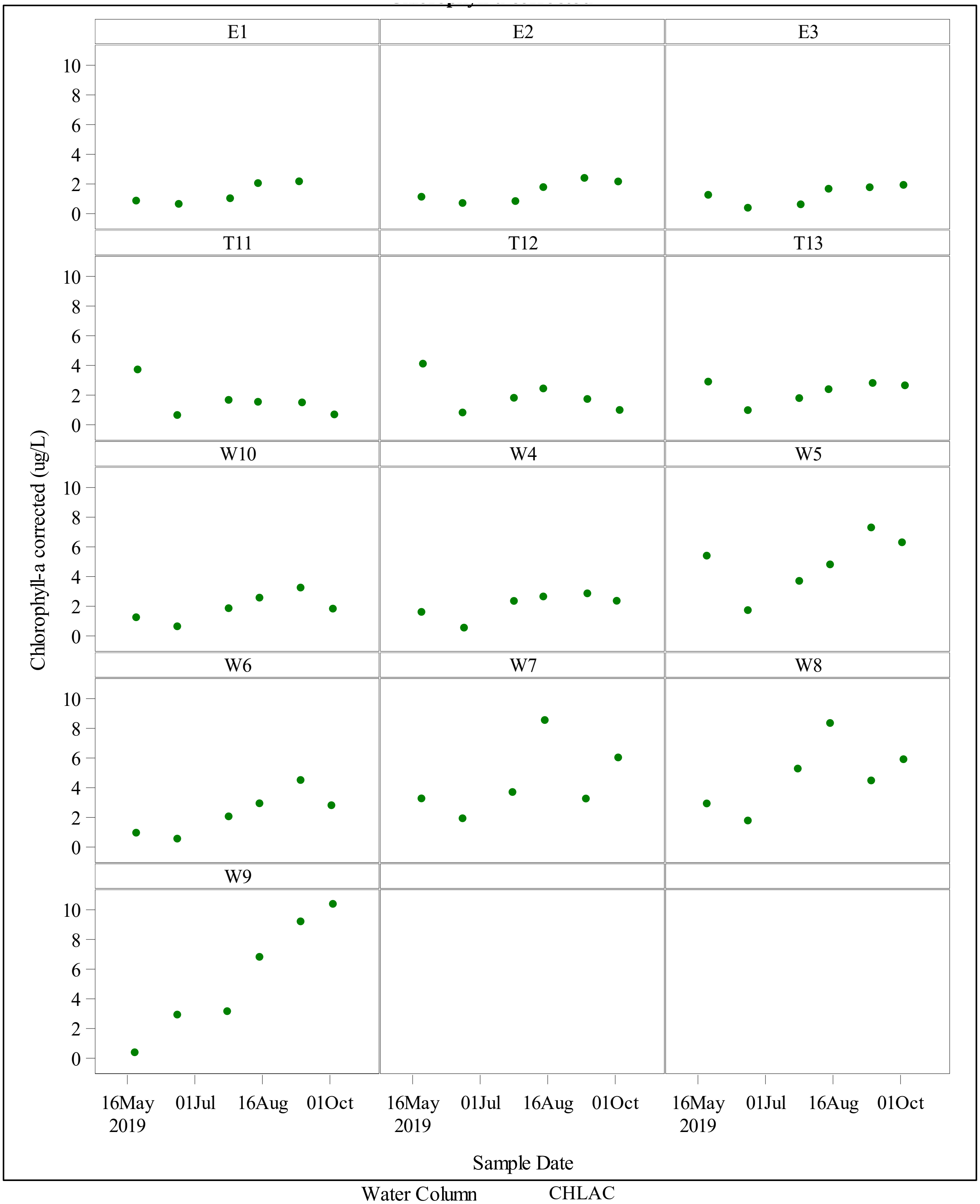

Figure 33. Monthly chlorophyll *a* near-surface sample concentrations from the Tahoe Keys lagoons in 2019.

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).

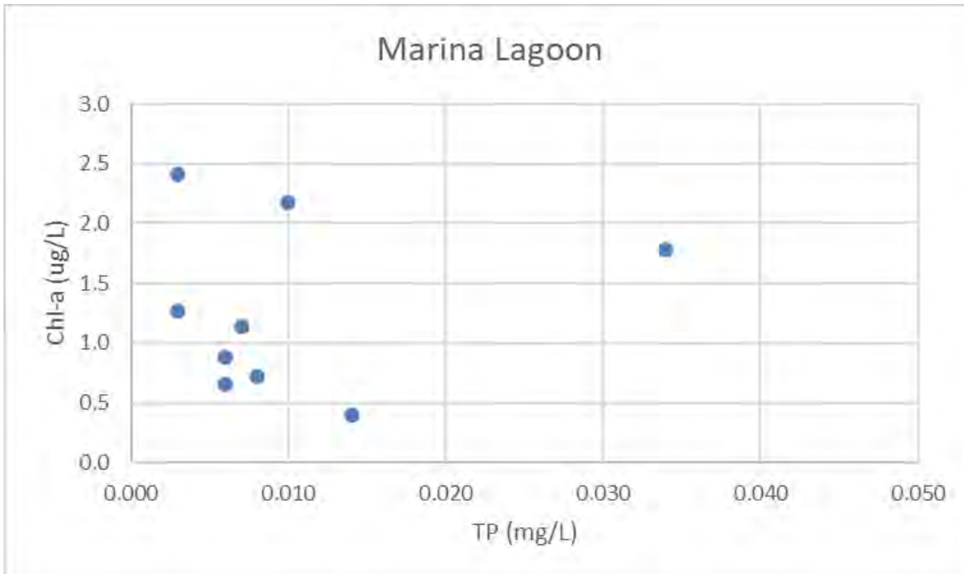
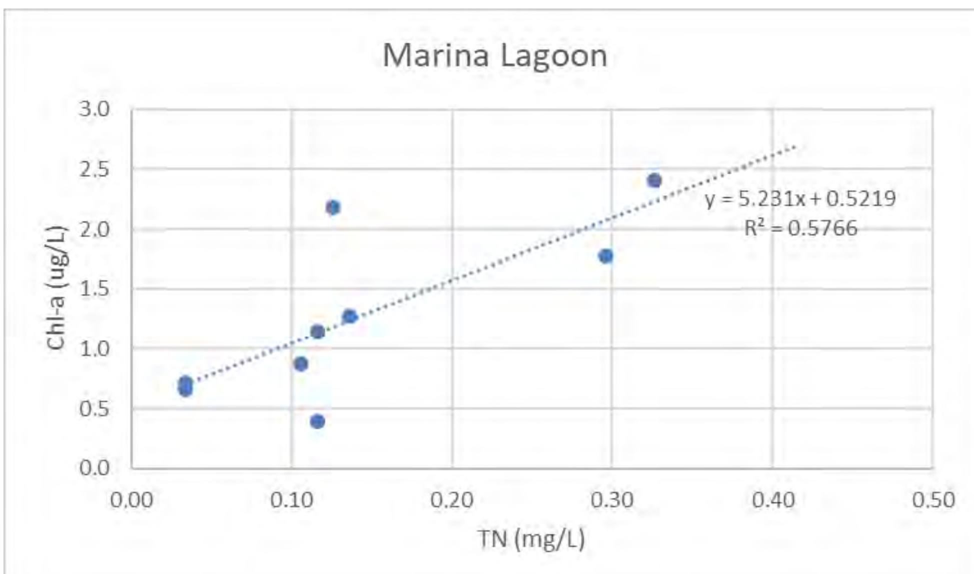


Figure 2 – Relationship between TN (mg/L) and Chl-a (µg/L) in the near-surface waters of the Marina Lagoon in 2019 (data from ESA).



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).

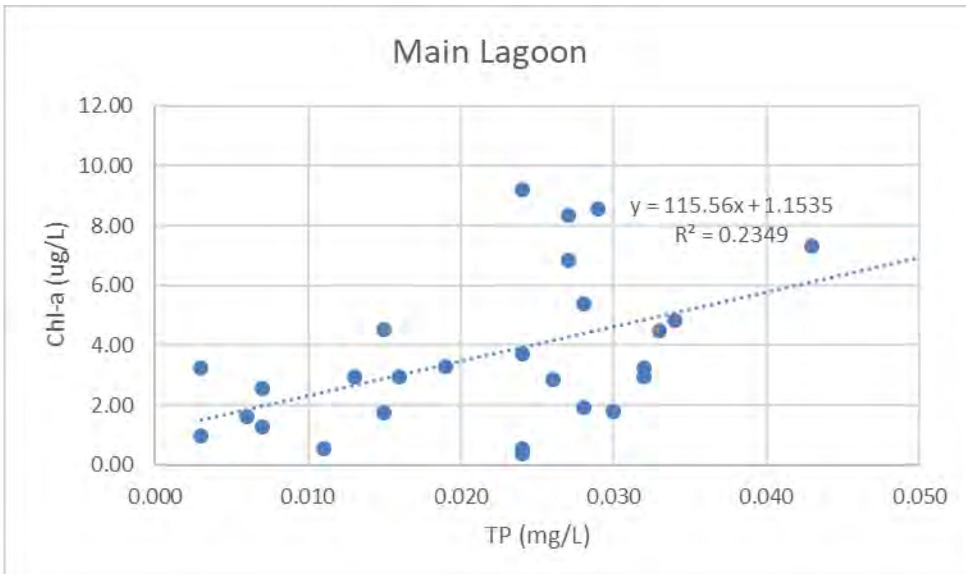
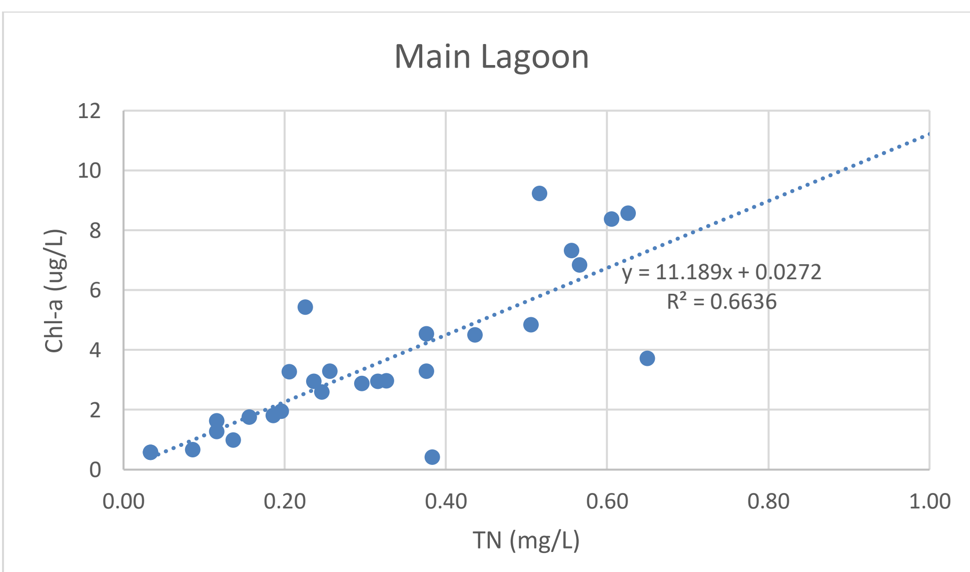


Figure 4 – Relationship between TN (mg/L) and Chl-a (µg/L) in the surface waters of the Main Lagoon in 2019 (data from ESA).



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).

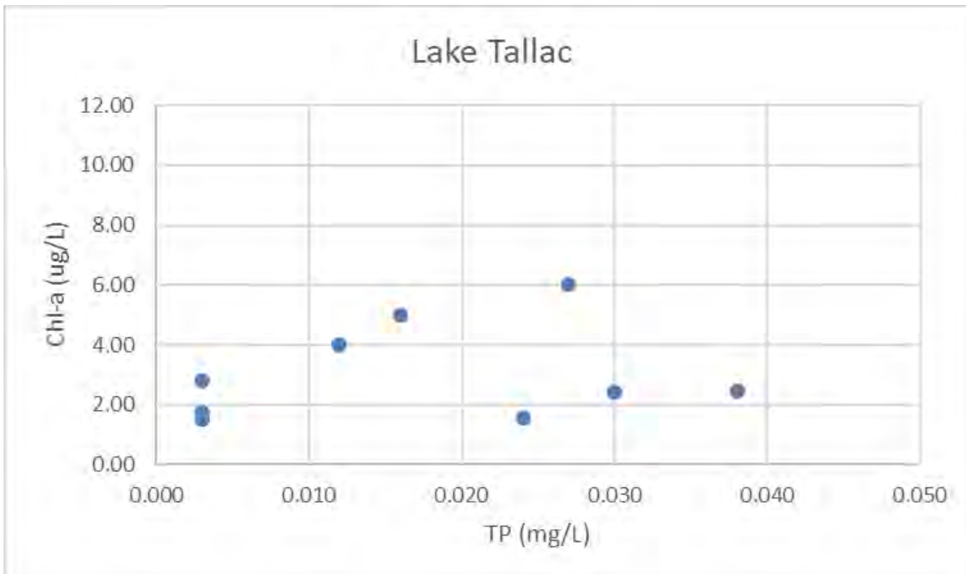
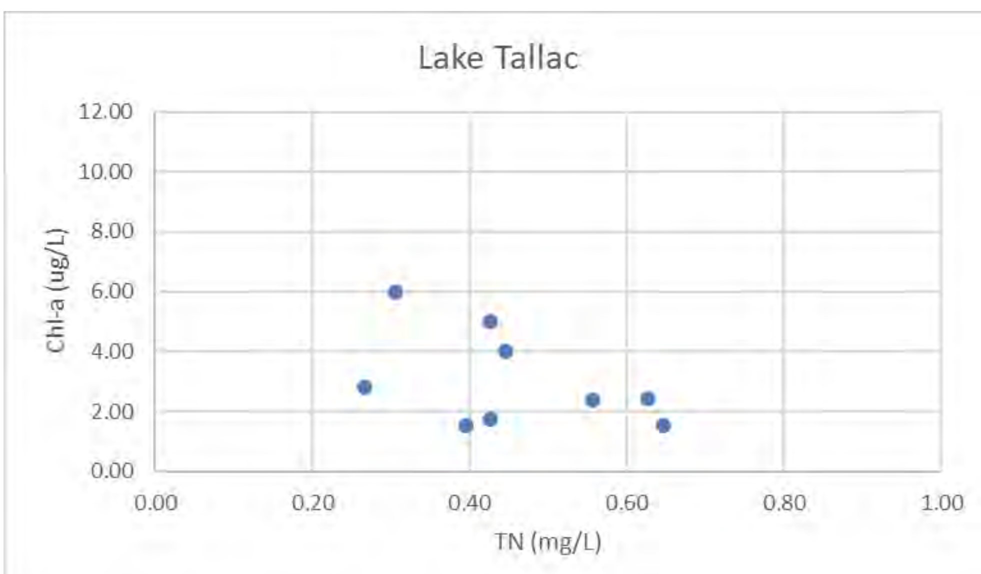


Figure 6 – Relationship between TN (mg/L) and Chl-a (µg/L) in the surface waters of Lake Tallac in 2019 (data from ESA).



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.

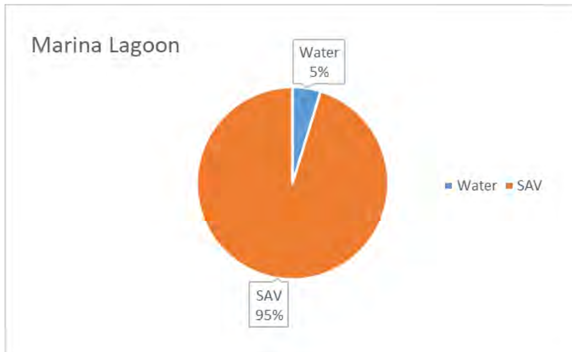


Figure 8 – Percentage of TP content in the water column and SAV in the Main Lagoon.

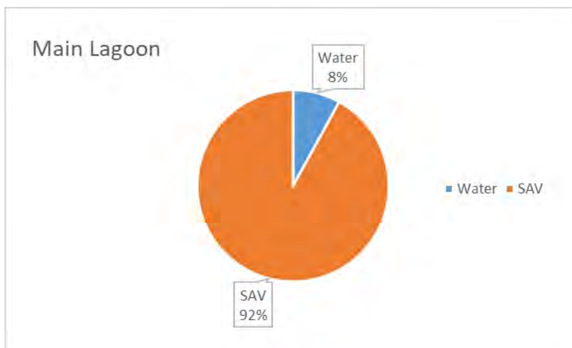
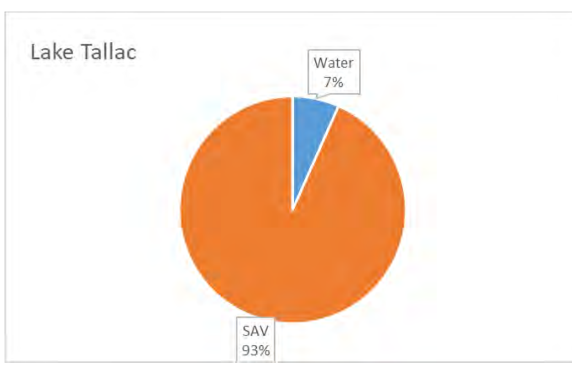


Figure 9 – Percentage of TP content in the water column and SAV in Lake Tallac.



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.

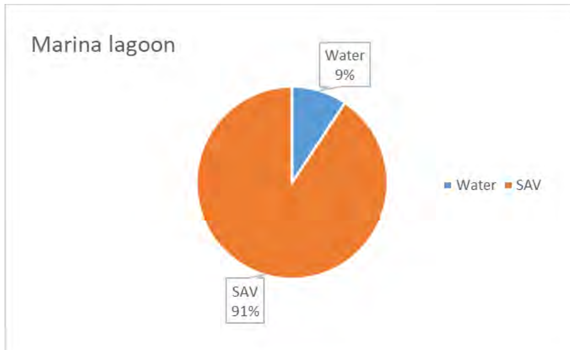


Figure 11– Percentage of TN content in the water column and SAV in the Main Lagoon.

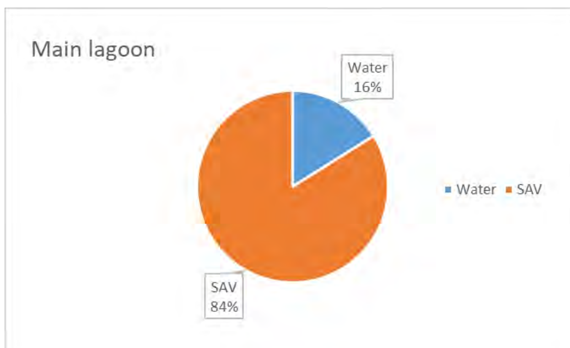
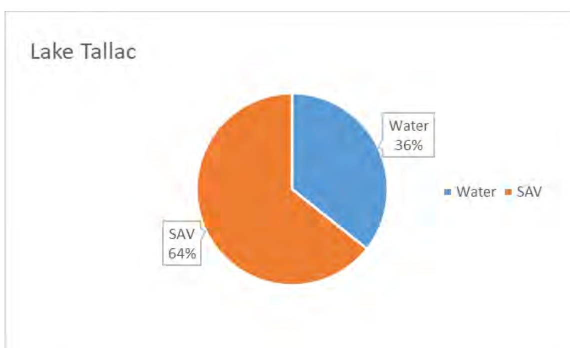


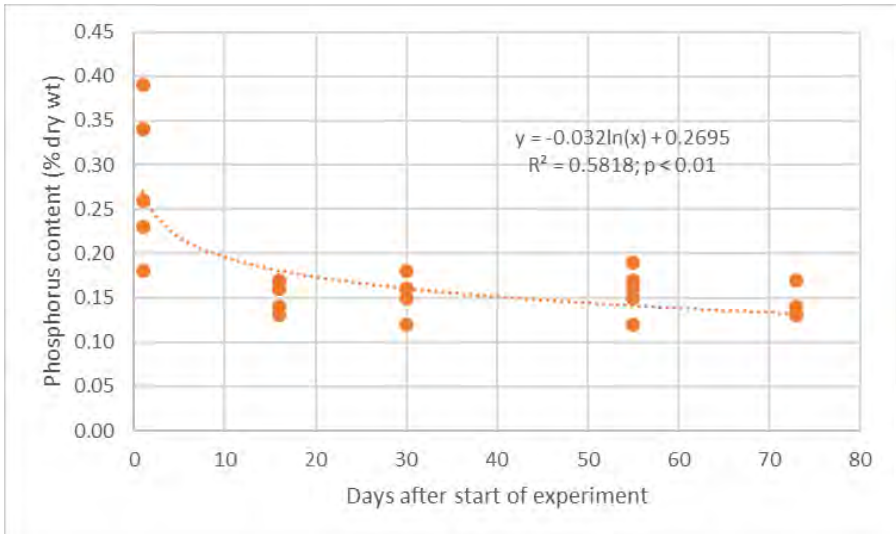
Figure 12 – Percentage of TN content in the water column and SAV in Lake Tallac.



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.

<u>Groundwater TP and TN Loads</u>

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.

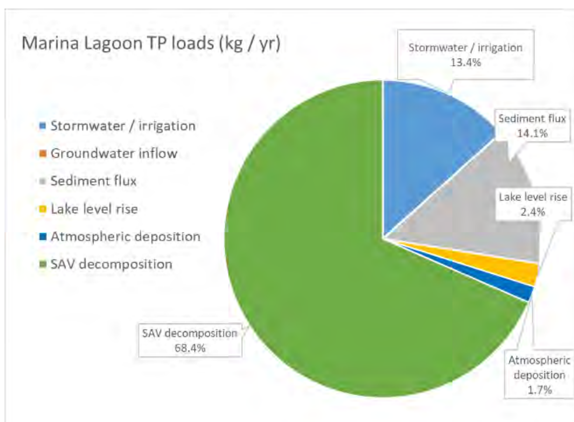


Figure 15 – Estimates of TP loads from stormwater runoff and irrigation, groundwater inflow, sediment flux, lake level rise, atmospheric deposition, and SAV decomposition for the Main Lagoon.

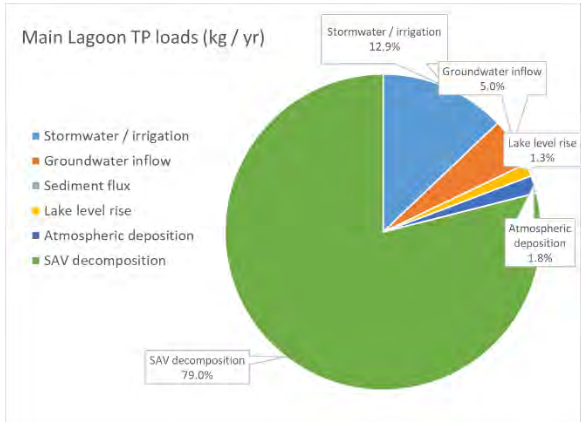
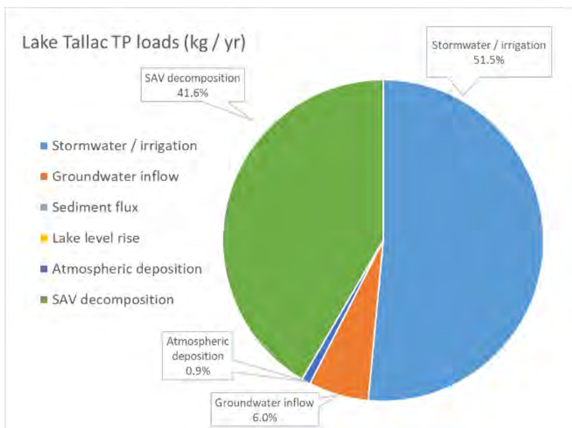


Figure 16 – Estimates of TP loads from stormwater runoff and irrigation, groundwater inflow, sediment flux, lake level rise, atmospheric deposition, and SAV decomposition for Lake Tallac.



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.

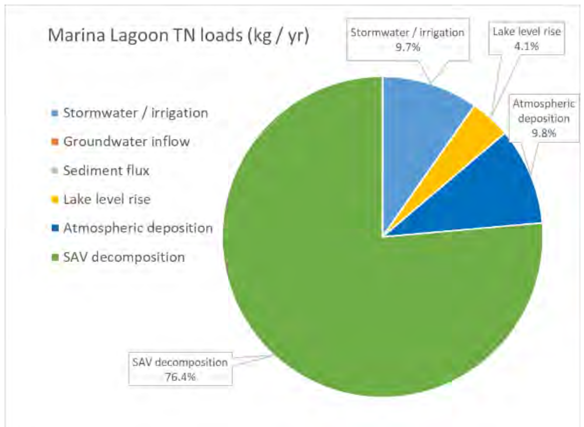


Figure 18 – Estimates of TN loads from stormwater runoff and irrigation, groundwater inflow, lake level rise, atmospheric deposition, and SAV decomposition for the Main Lagoon.

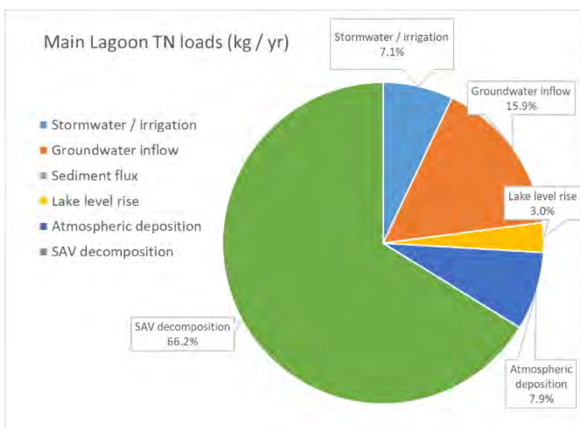
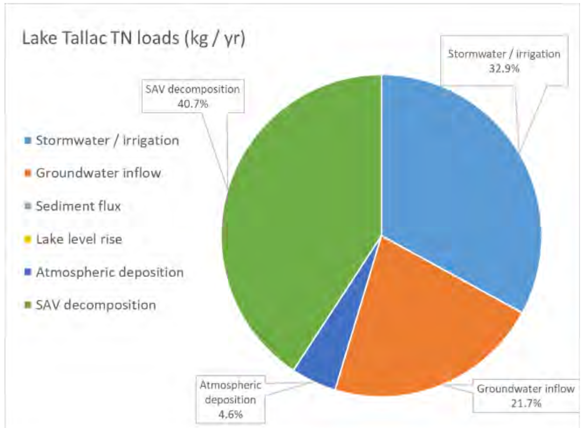


Figure 19 – Estimates of TN loads from stormwater runoff and irrigation, groundwater inflow, lake level rise, atmospheric deposition, and SAV decomposition for Lake Tallac.



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.

Water Quality Responses to SAV Management Strategies

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

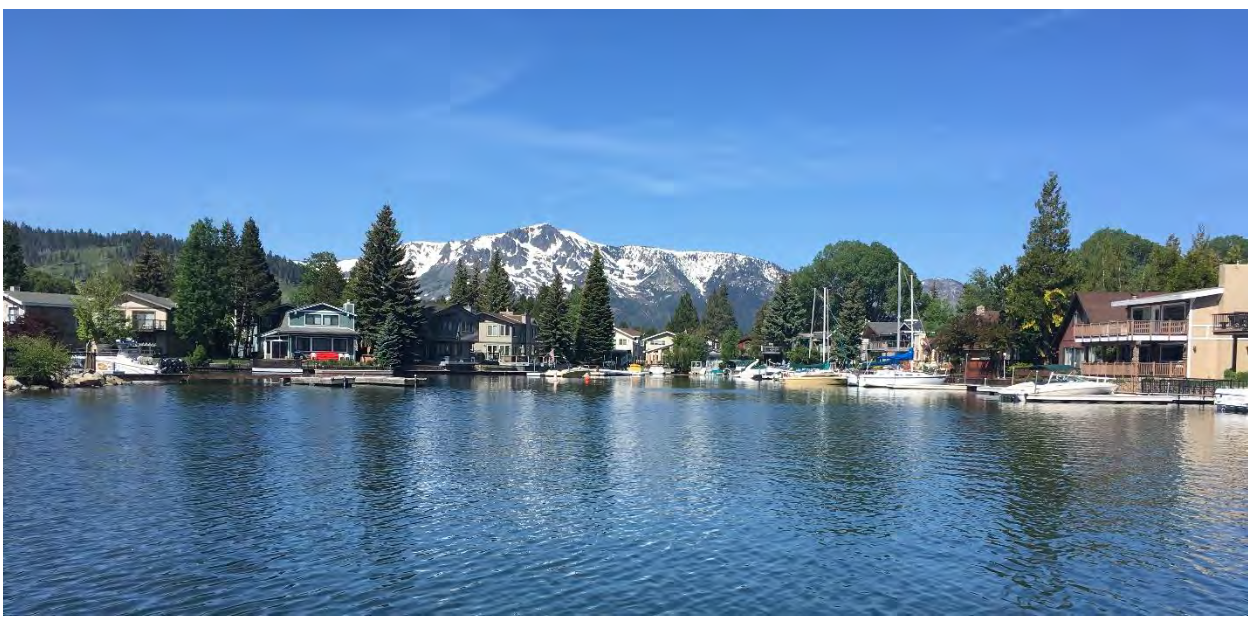
2019 FISH AND BENTHIC MACROINVERTEBRATE SURVEYS IN TAHOE KEYS LAGOONS

Final Report

Prepared for

Tahoe Regional Planning Agency

April 2020



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2019 FISH AND BENTHIC MACROINVERTEBRATE SURVEYS IN TAHOE KEYS LAGOONS

Draft Report

Prepared for

Tahoe Regional Planning Agency

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.

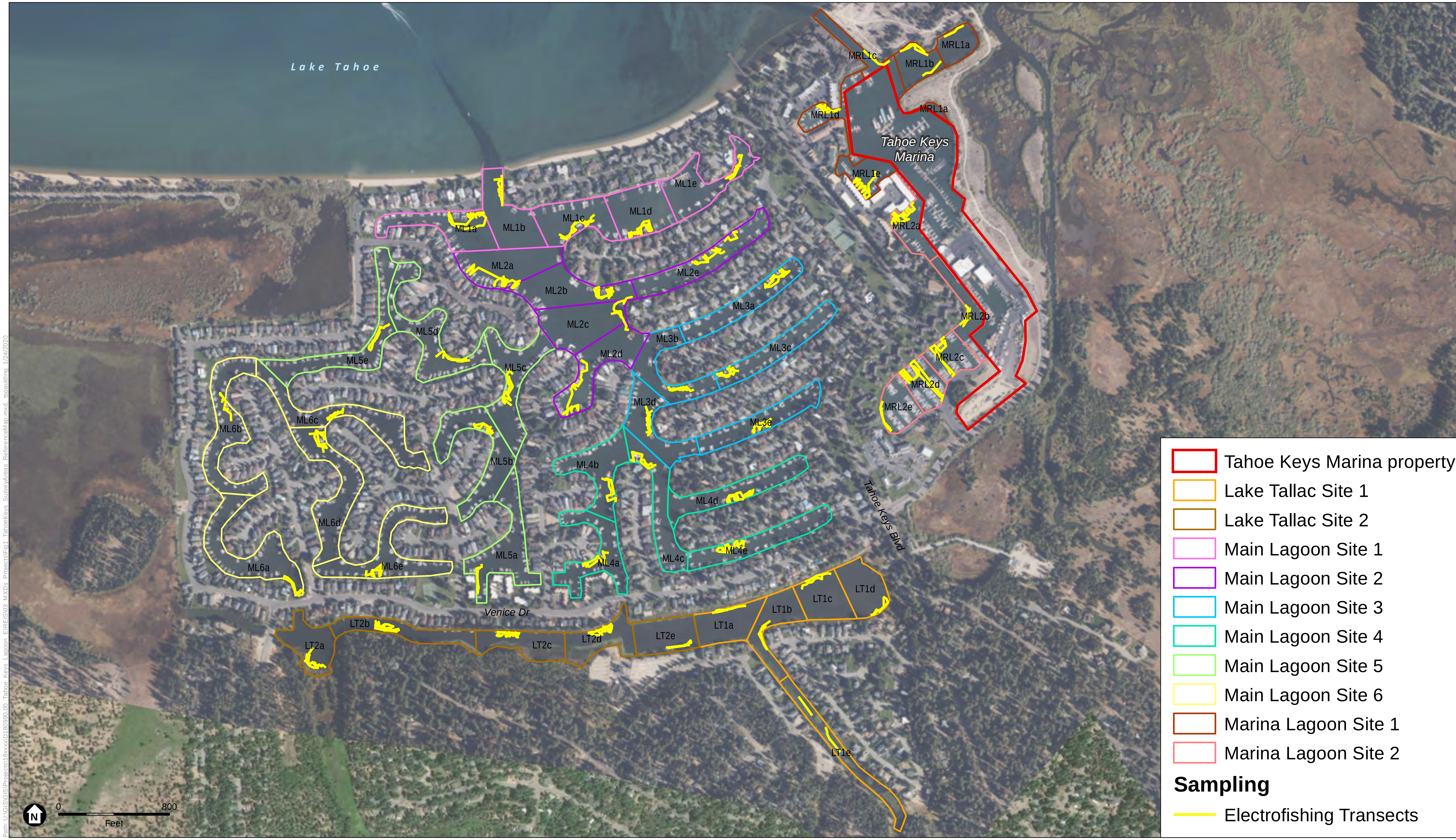
2.2.1 Boat Electrofishing

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.

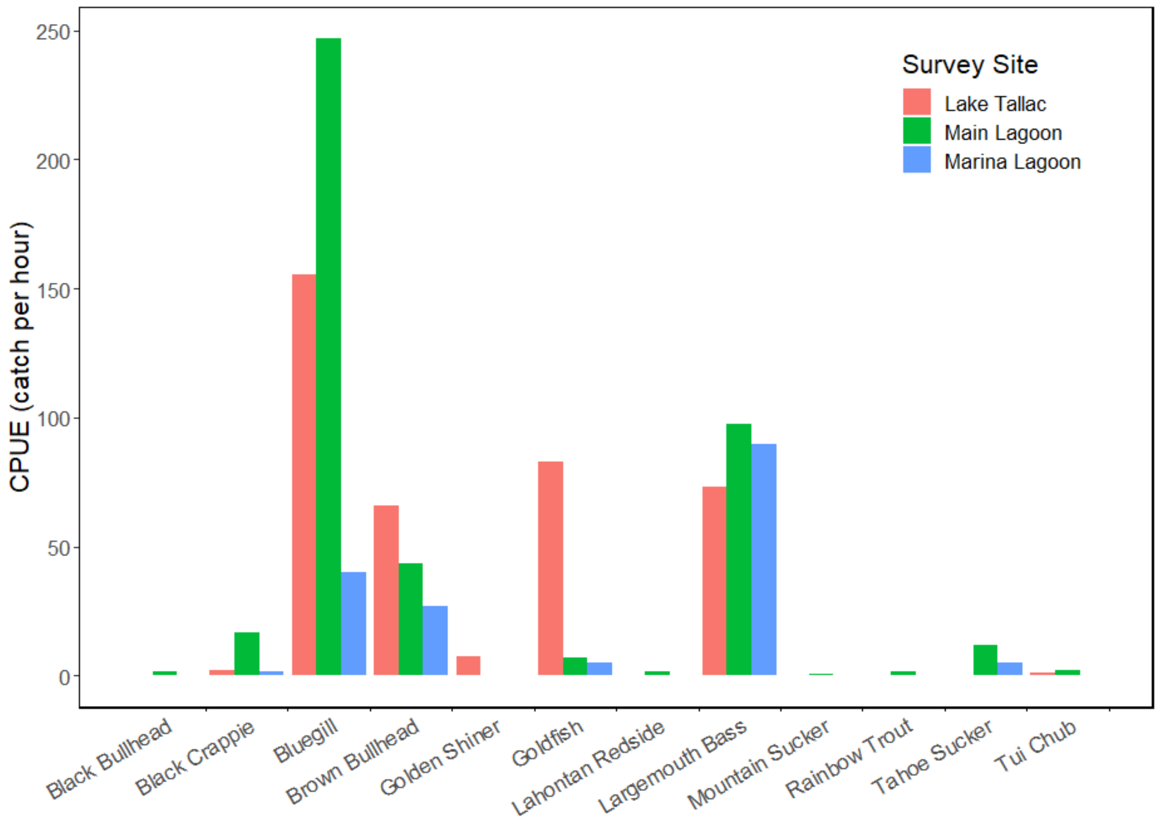

Figure 7
Boat Electrofishing Catch Per Hour By Site

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.

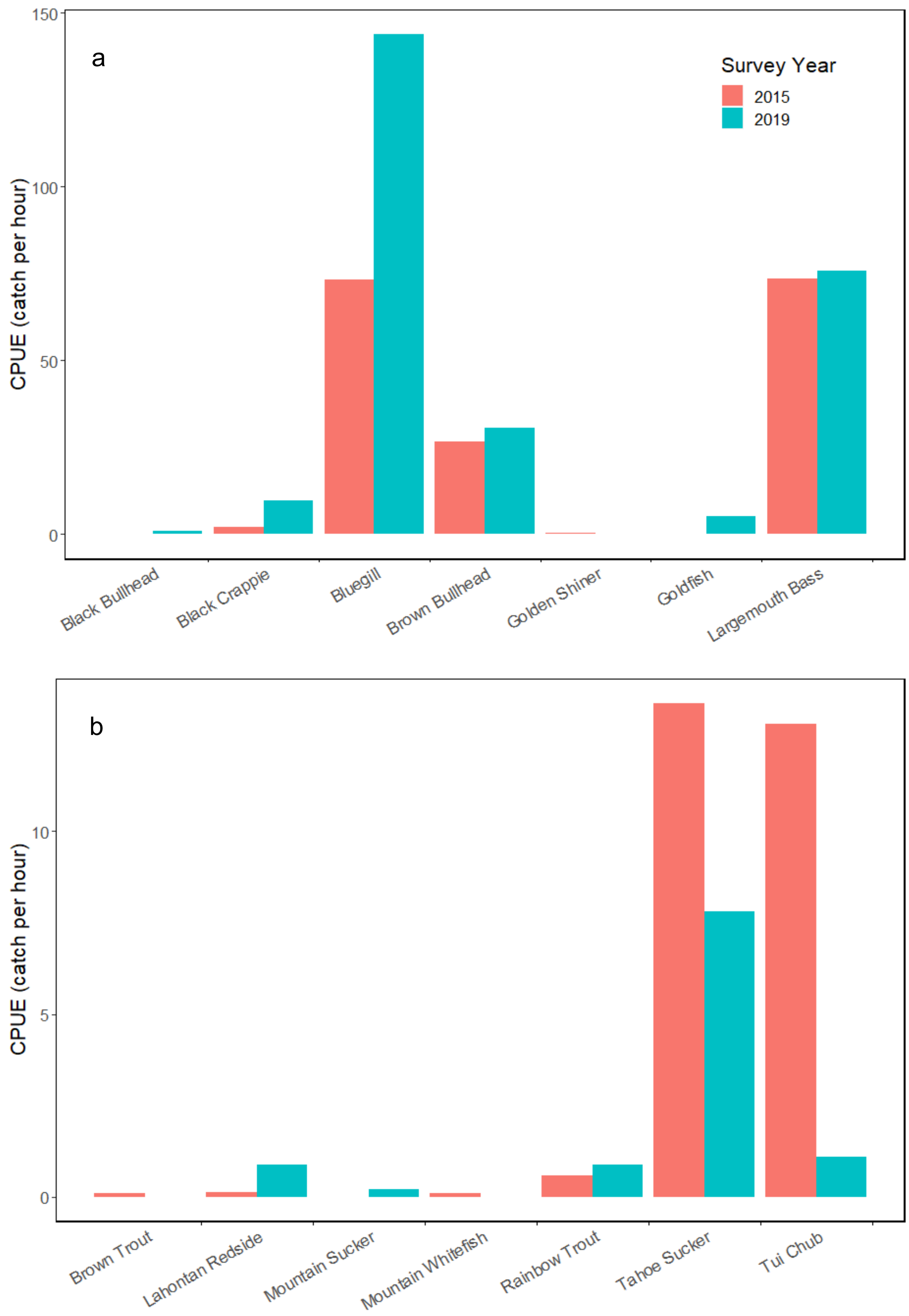

Figure 8
Boat Electrofishing Catch Per Hour a) Non-native Species b) Native and Cold Water Species

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
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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

Prepared for:
Tahoe Regional Planning Association

June 2019

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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 ML1	ML2	ML3	ML4	ML5	ML6	Marina Lagoon MRL1	MRL2	Lake Tallac 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
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

- 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

- 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		