

An aerial photograph of a lake with numerous houses and docks along its shores. In the background, there are forested hills and mountains under a clear blue sky. The text is overlaid on the center of the image.

# **Tahoe Keys Weeds Project Overview**

**TRPA Governing Board Meeting  
December 15, 2021**

**Dennis Zabaglo, TRPA**

**Rick Lind, TKPOA**

**Dr. Lars Anderson, TKPOA**

**Jim Good, ESA**



**LAKE TAHOE**

ENVIRONMENTAL  
IMPROVEMENT  
PROGRAM

**Aquatic Invasive Species  
prevention and control  
has been a top priority  
initiative for more than a  
decade**







**Invasive aquatic weeds in  
the Keys lagoons are the #1  
AIS control threat**

**Tahoe Keys  
homeowners  
have been  
fighting the  
weeds problem  
for decades**





**This decision comes to you differently than a typical land use or natural resource planning process**





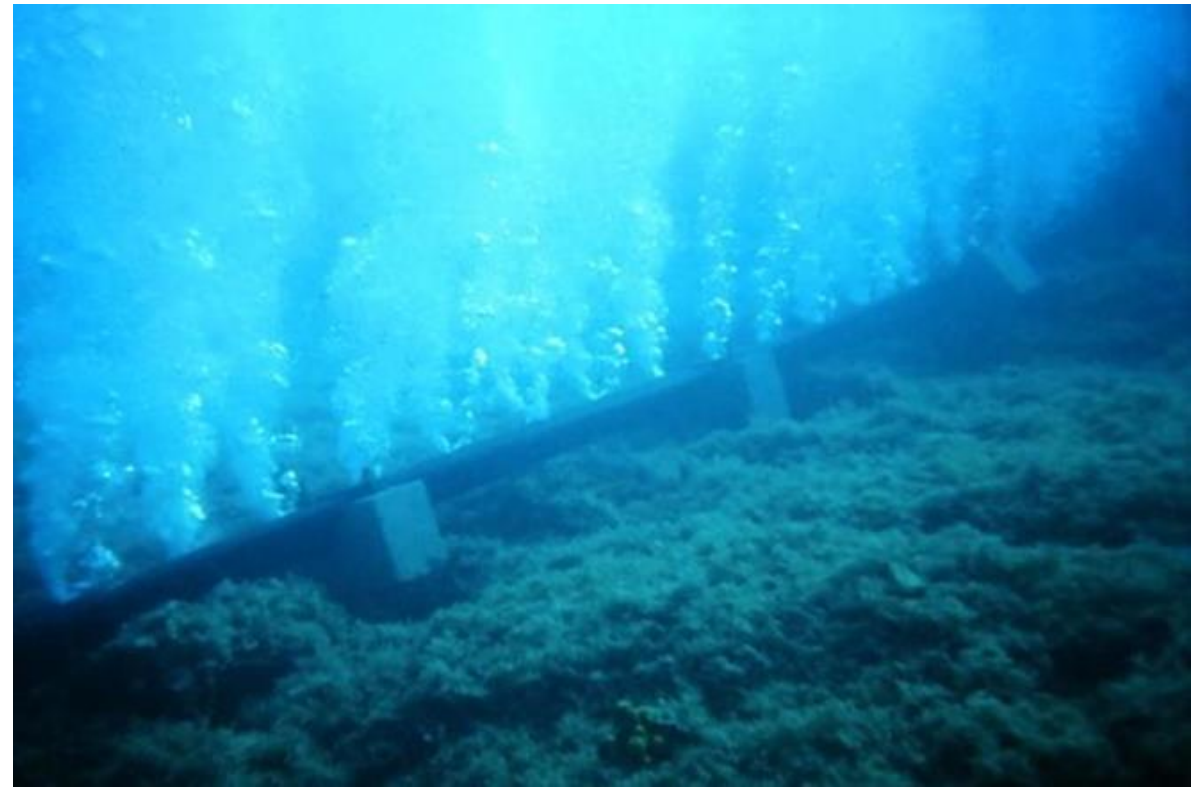
**To break the log jam,  
we regrouped around a more collaborative approach.**



**The need to  
act is urgent.  
The problem is  
getting away  
from us**







**The stakeholders agreed to address unknowns  
with a carefully designed test**



An aerial photograph of a lake with numerous houses and docks along its shores. In the background, there are forested hills and mountains under a clear blue sky. The water is a deep blue-green color.

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# Overview

- Challenge and Urgency
- Collaboration
- Environmental Analysis & Public Engagement
- Regulatory Framework
- Property Owner Weed Management
- Project Elements
- Environmental Considerations
- Next Steps



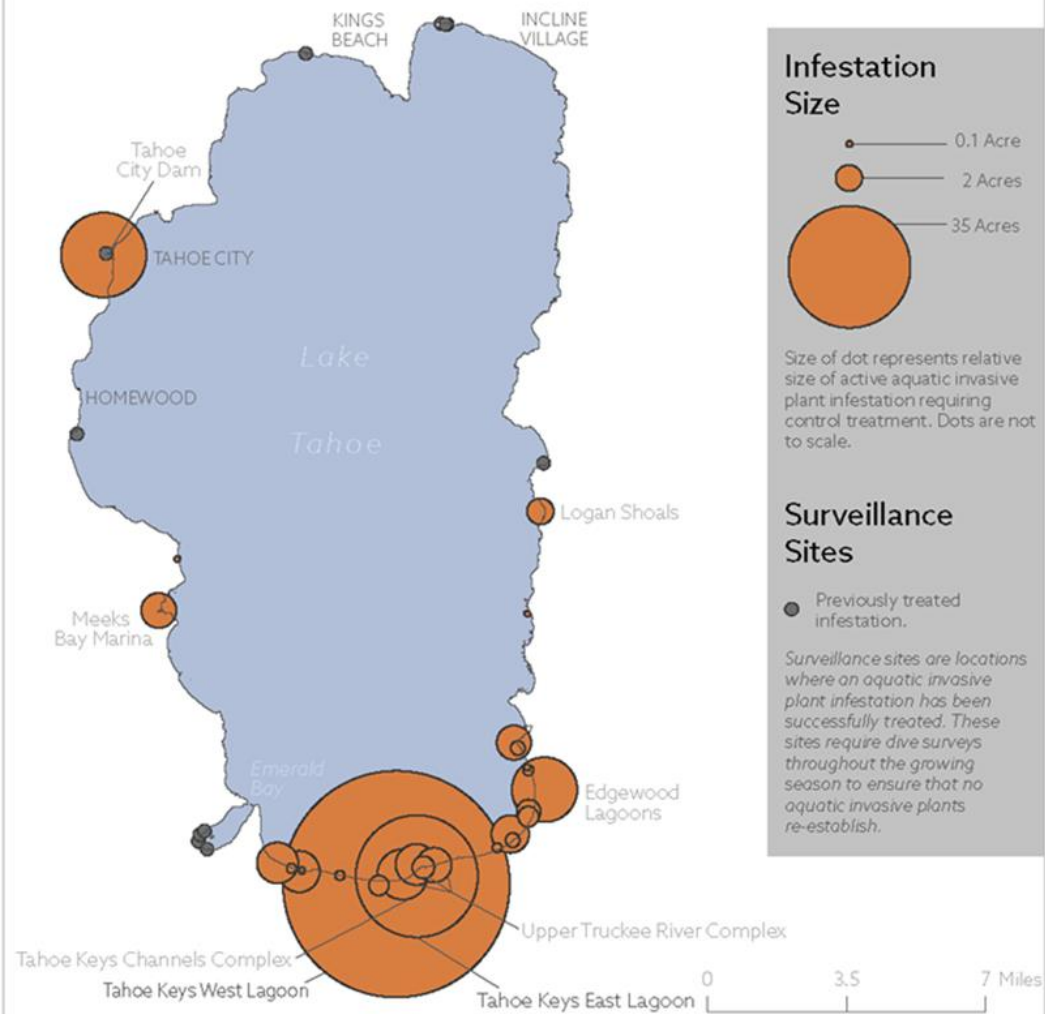


# Challenge and Urgency

- #1 priority of AIS program
- Largest and most complicated infestation
- Major threat for all of Lake Tahoe



## Aquatic Invasive Plant Infestations 2019



## The Tahoe Keys Challenge

Based on acreage, the Tahoe Keys comprise 70 percent of all aquatic plant infestations in Lake Tahoe. The size of these infestations and the complexity associated with the geography of the Tahoe Keys make identifying and implementing control treatments a challenge. Although most marinas contain one or two embayments, the Tahoe Keys complex contains a myriad of connected waterways equalling approximately 170 acres.

Map produced by S. Matthews, Tahoe RCD 2019.



## Collaboration

- Complexity of the problem
- Stakeholder Committee
  - Transparency
  - Diverse perspectives
- A test is needed

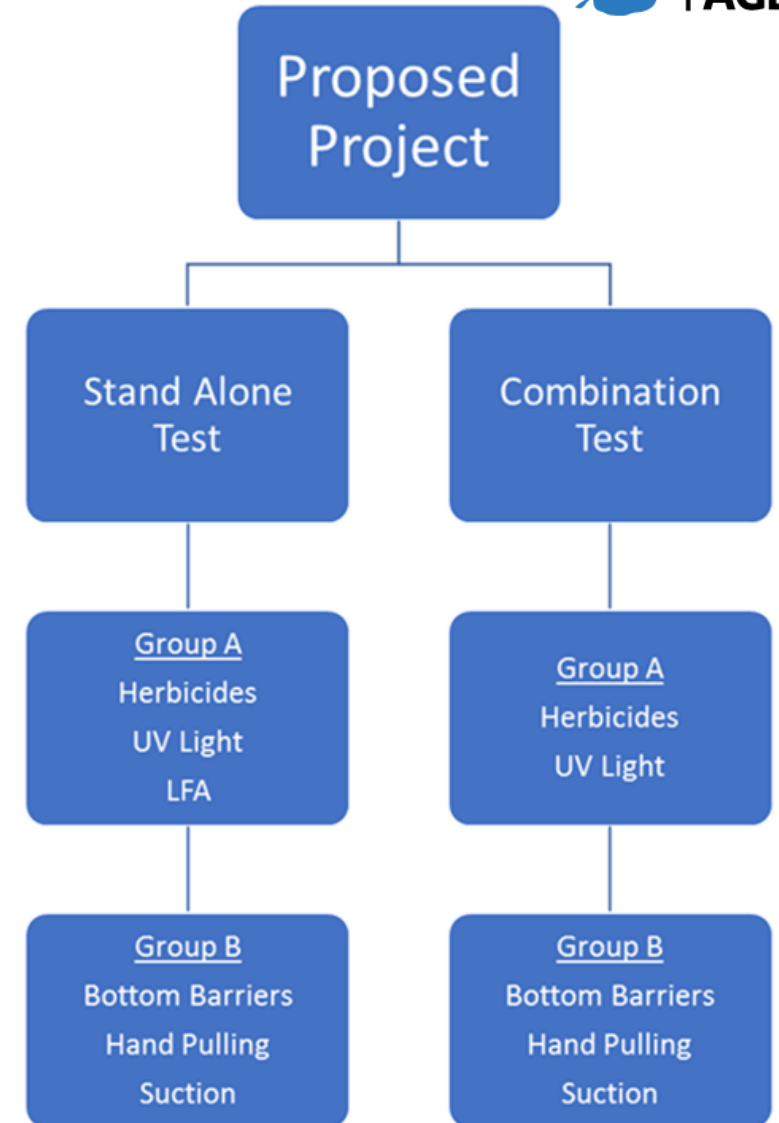


**TAHOE**  
RESOURCE CONSERVATION DISTRICT



# Collaboration

- Development of a Test project
  - Initial treatment to provide **knockback**
    - Group A- Ultraviolet light (UV), targeted aquatic herbicides, Laminar Flow Aeration (LFA)
  - Follow-up methods that can be used to **maintain** manageable levels
    - Group B- UV, bottom barriers, hand pulling and diver suction
  - Goals of the test
    - Achieve 75% reduction in biomass
    - What methods can be successful for the long-term?



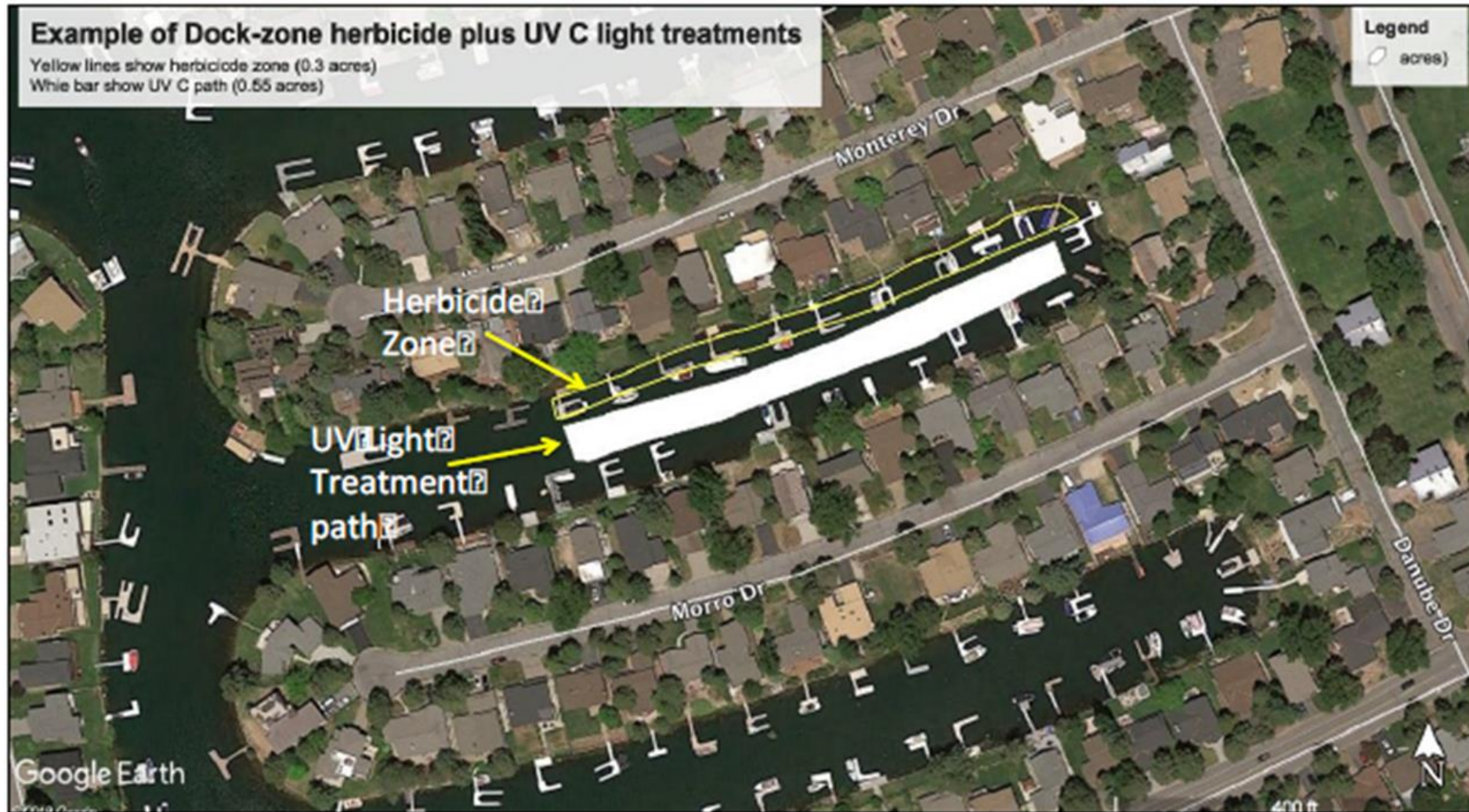


# LAKE TAHOE

ENVIRONMENTAL  
IMPROVEMENT  
PROGRAM



TAHOE  
REGIONAL  
PLANNING  
AGENCY





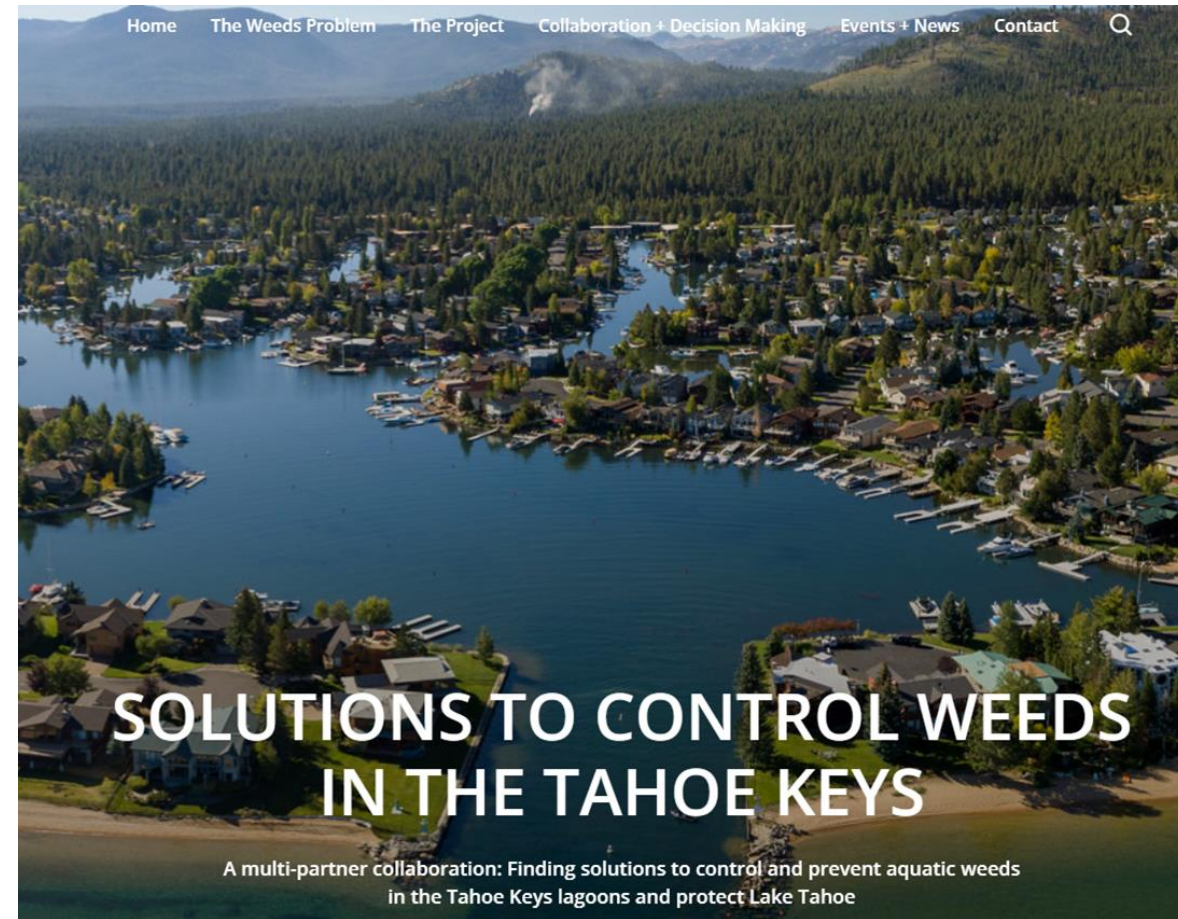
# Environmental Analysis and Public Engagement

- Independent consultant
- Public scoping
  - Input on the proposed test project and alternatives to be analyzed
  - No project alternative



# Environmental Analysis and Public Engagement

- Draft analysis
  - Identify potential environmental impacts from the test project and alternatives
- Public comment and outreach
  - Public input on potential impacts and the analysis
  - Expanded outreach
    - Webinars, project website, field tours
    - ~3,000 comments
  - Tahoe Science Advisory Council (TSAC)
    - Comprehensive and thorough



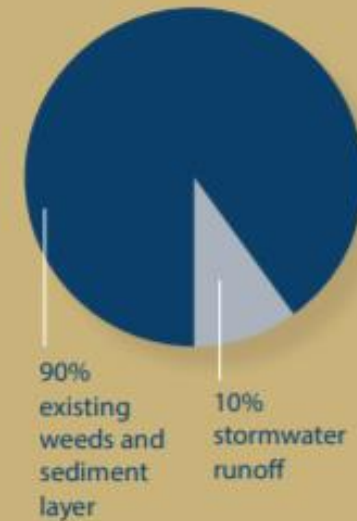


# Environmental Analysis and Public Engagement

- Highlights from the analysis
  - Weeds drive the nutrient cycling and availability for continual weed growth
  - Test can be implemented safely with proper mitigations and protective measures
  - No project alternative- significant and unavoidable impacts

Over  
**90%**  
of nutrients

that feed weed and algal growth in the Tahoe Keys come from the existing weeds and sediment layer.



Source: 2019 water quality baseline data, ESA

# Regulatory Framework & Considerations

- Agencies require permits for the proposed test project if approved
  - National Pollutant Discharge Elimination System (NPDES)- Lahontan
    - Tentative permit included a public comment period
  - EIP Permit- TRPA
- Does the test project comply with the Basin Plan- Lahontan
  - Outstanding National Resource Water considerations
- Is the test project consistent with the Regional Plan- TPRA



# TKPOA Proposed Control Methods Test

Rick Lind

TKPOA Water Quality Committee  
Sierra Ecosystem Associates



# TKPOA Presentation Outline

- Brief History of Aquatic Weed Management in Tahoe Keys
- Regulatory Basis for Evaluating and Testing Control Methods
- Summary of Past Decade of Data Collection and Studies
- Scope of Control Methods Test Project and Monitoring Program



# Tahoe Keys – History of Aquatic Weeds Management

- 1970s – Water circulation & treatment system installed to remove phosphorous and 1<sup>st</sup> weed harvester purchased
- 1988 – Rotovating field trial
- 1990s – First mesocosm study of herbicide effects on Eurasian watermilfoil
- 1995 – Application to LRWQCB for small scale herbicide test – denied
- 2003 – Curlyleaf pondweed first occurrence in Tahoe Keys
- 2010s – Curlyleaf pondweed becomes dominant aquatic invasive plant

# July 17, 2014 Lahontan RWQCB (LRWQCB) Order R6T-2014-0059

- **Integrated Management Plan (IMP)**
  - Evaluate approved methods (harvesting, bottom barriers, divers)
  - Test new methods (LFA, bubble curtains, initial UV)
  - Monitor and report (water quality, sediment, invasive plants, circulation system if used)
  - Education and outreach
- **Non-Point Source (NPS) Plan**
  - Phosphorus fertilizer ban
  - Homeowner education
  - “Lunch and Learn” for landscape contractors/managers
- **Annual Updates to IMP and NPS**
- **End of Season Reports**
  - Bottom barriers, harvesting, plant surveys, plant fragment collection



# Objectives of the IMP Required under the WDRs

1. Minimize the potential spread of aquatic invasive weeds from the Tahoe Keys lagoons to Lake Tahoe
2. Enhance habitat for native fish, waterfowl, and other native wildlife species and reduce habitat for non-native fish in the Tahoe Keys lagoons
3. Restore recreational uses in the Tahoe Keys lagoons and commercial and institutional uses in the Marina Lagoon

# Decade of TKPOA Studies and Actions

- 2011-2013 – TRPA/TRCD/TKPOA literature research and bottom barriers field tests
- 2013-2017 – Significant field studies and alternative control method analyses
  - Large scale bottom barriers test and homeowners bottom barriers program
  - Dye studies (multiple years - began in 2010)
  - Channel dredging data collection
  - Bench and mesocosm studies on herbicide effects on native/invasive plants
  - Agency review of rotovating and biological controls (not permissible)
  - Greenhouse gas emissions study
  - Goose droppings nutrient study
  - Atmospheric deposition of nutrients study
  - Benthic Macro-Invertebrates (BMI) study (worms, snails, bugs in the sediment)
  - Stormwater nutrient inputs sampling



# Decade of TKPOA Studies and Actions (Cont.)

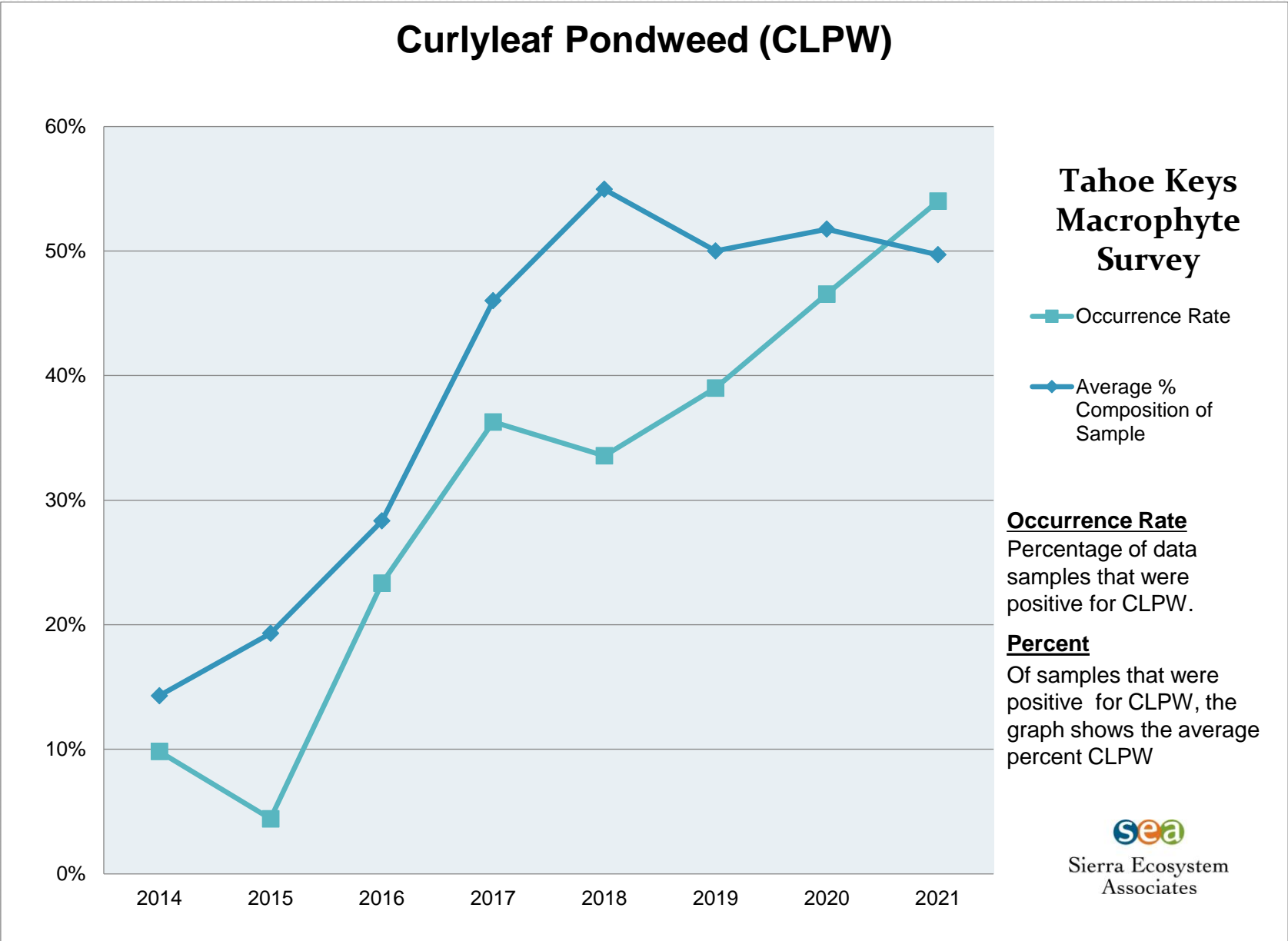
- 2014 – Convened expert panel
  - Joel Trumbo – *Sr. Env Scientist, Cal Fish & Wildlife*
  - Dr. Kurt Getsinger – *Team Lead, US Army Corps of Engineers*
  - Dr. Pat Akers – *Supervising Scientist, Aquatic Weed Eradication, CA Dept of Food & Agriculture*
  - Dr. Sudeep Chandra – *Assoc. Prof. of Limnology, UNR*
  - Dr. Joe DiTimaso – *Dept. of Plant Sciences, UC Davis*
- 2015 – Presented expert panel findings at Public Meeting at STPUD office
- 2016/2017 – TKPOA conducts stakeholders' meetings and submits first application to Lahontan for Control Methods Test

# Decade of TKPOA Studies and Actions

Monitoring Activity	Pre-2014	2014	2015	2016	2017	2018	2019	2020	2021
Harvesting	-----	-----	-----	-----	-----	-----	-----	-----	-----
Fragment Control									
Boat Backup Station				-----	-----	-----	-----	-----	-----
Bubble Curtain						-----	-----	-----	-----
Omni Cat					-----	-----	-----	-----	-----
Water Quality				-----	-----	-----	-----	-----	-----
Sediment				-----	-----				
Macrophyte Point Sampling	-----	-----	-----	-----	-----	-----	-----	-----	-----
Harmful Algal Blooms (HABs)					-----	-----	-----	-----	-----
Hydroacoustic Scans			-----	-----	-----	-----	-----	-----	-----
Benthic Macroinvertebrates (BMI)				-----			-----		-----

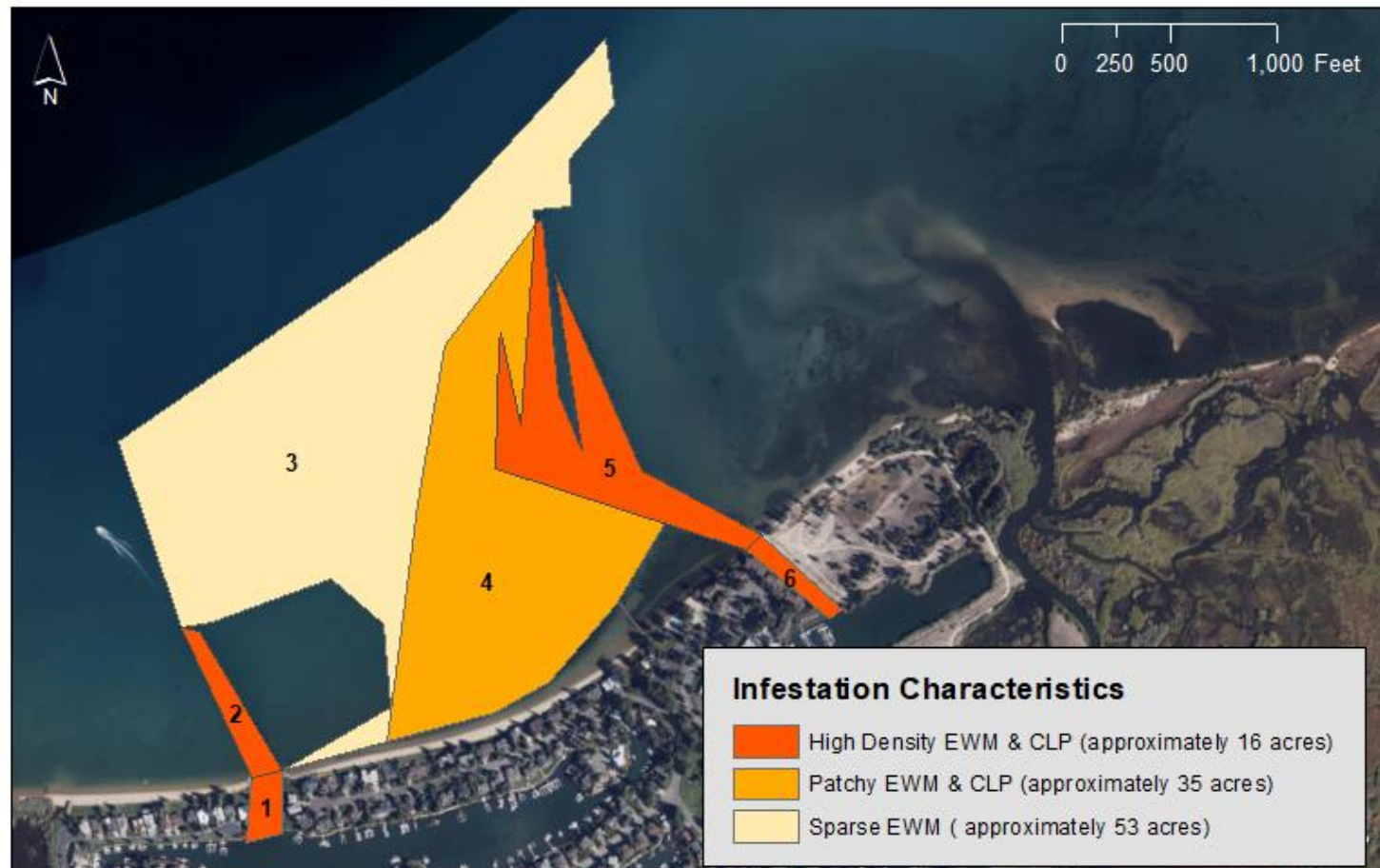


# Curlyleaf Pondweed (CLPW)



# TRCD Mapping of Spread Into Lake Tahoe

Tahoe Keys Offshore Survey June 2020





# TKPOA Control Methods Test

- Rapid spread of CLPW prompted TKPOA's 2017 proposal to Lahontan to test herbicides in the Tahoe Keys, based on proven success of the herbicides in similar settings
- Stakeholder Committee collaborative in 2018 added experimental UV-C light as a possible second, primary control option (along with laminar flow aeration)
- If approved by Lahontan/TRPA Boards in January 2022, the 3-year Control Methods Test will begin in May 2022
- Criteria for control methods test success are 75 percent reduction in biomass of invasive plants and maintaining 3-foot vessel hull clearance

# Proposed Tahoe Keys Lagoons Control Methods Test Program

Dr. Lars Anderson  
TKPOA Consultant





# Overview

- Strategy for Evaluation of Control Methods
- Treatment and Monitoring Components of the CMT
- Timeline for CMT Project Actions

# Strategy and Objectives of the CMT

## Year One

Group A Methods:  
UV-C, LFA,  
Herbicides,  
Combinations

## Year Two

Group B Methods:  
Diver removal  
UV-C  
Bottom barriers

## Year Three

Group B Methods:  
Diver removal  
UV-C  
Bottom barriers

### Strategy:

- **Knock down biomass**
- **Arrest spring growth**
- **Prevent turion formation**

### Strategy:

- Evaluate Year 1 effects
- **Sustain control**
- Prevent turion formation

### Strategy:

- Evaluate Year 2 effects
- **Sustain control**
- Prevent turion formation

**Environmental Monitoring: herbicides, water quality, non-target organisms**

# Tahoe Keys “Scale” – 172 Acres

## Comparison to Other Lake Tahoe Marina Sites





# Control Methods Test- Project Summary

## Goals

- 1. Reduce aquatic invasive plant infestations and protect Lake Tahoe.**
- 2. Assess control methods that are feasible and environmentally safe.**
- 3. Reestablish and maintain high quality native aquatic life habitat, and navigation, recreation, and aesthetic uses.**
- 4. Reduce the potential for aquatic invasive plant re-infestations after initial treatment.**
- 5. Inform and improve management methods to control aquatic invasive plants**

# Control Methods Test- Project Summary (Cont.)

## Measurable Objectives

- 1. Achieve and maintain at least a 75% reduction** of invasive plant biovolume (biomass) from baseline (pre-CMT conditions)
- 2. Reduce navigation transport of invasive plants** from lagoon channels
- 3. Increase occurrence of desirable native plants** in the treatment areas from baseline (pre-CMT conditions)

# Tahoe Keys – Typical Spring Conditions April 2018

- Hydroacoustic scan
- All species
- Hydrologic inflow to lagoons





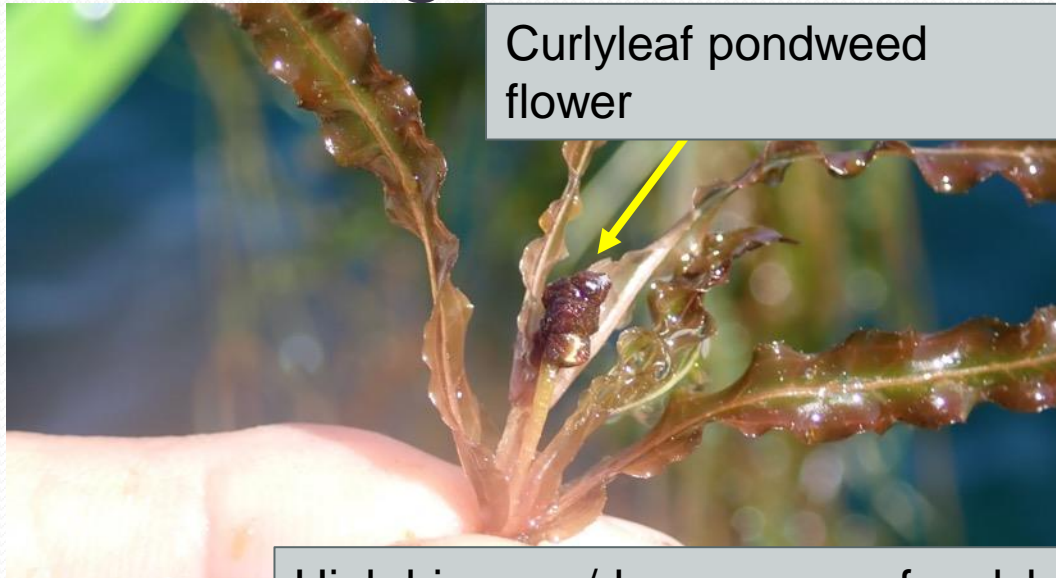
# Tahoe Keys – Typical Summer Conditions July 2018

- Hydro-acoustic scan
- All species
- **RED** = 100% Cover!





# Increasing Threat from Curlyleaf Pondweed



Curlyleaf pondweed flower



turion

High biomass/dense cover of curlyleaf pondweed



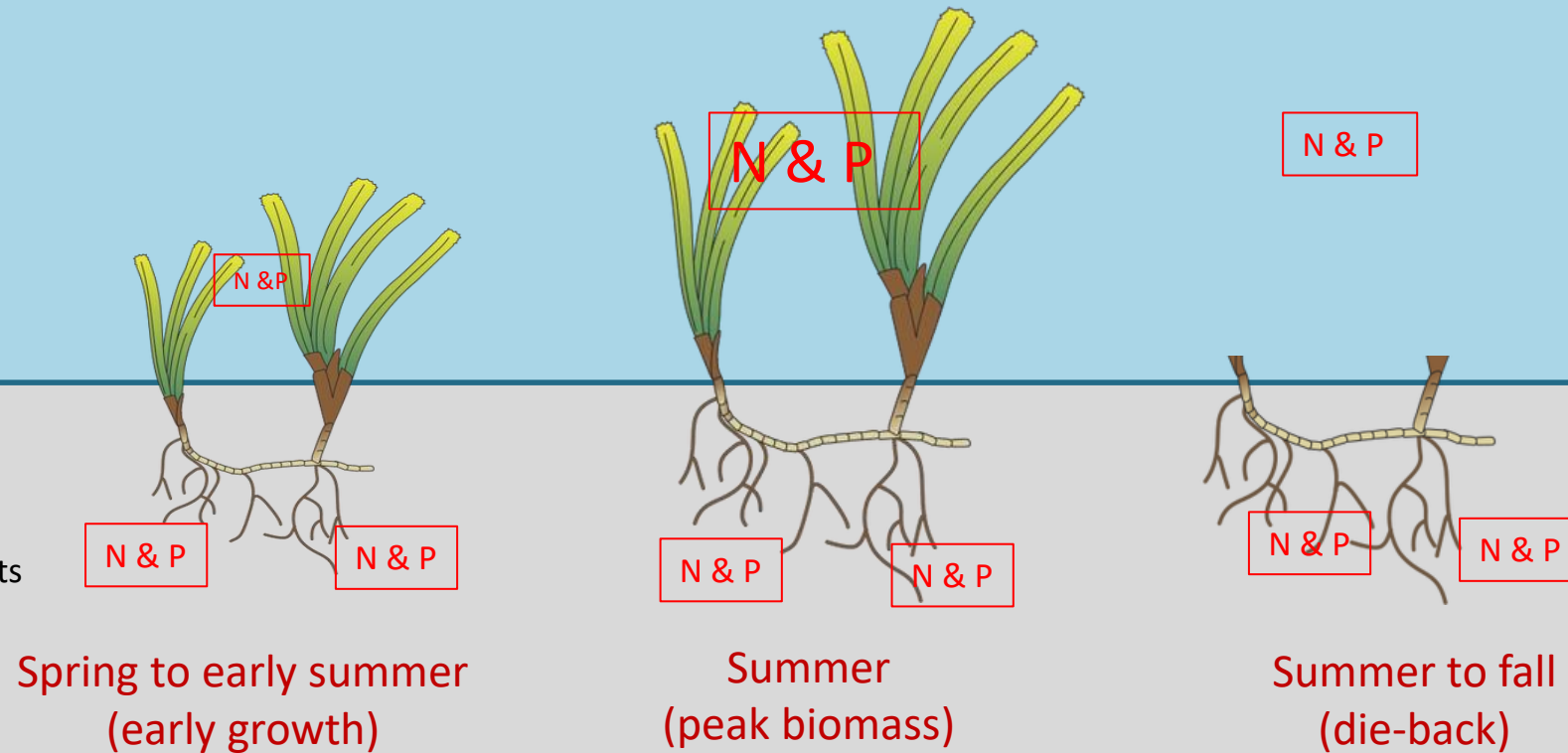
Sprouting turions

Air

## Nutrient Loading Caused by Aquatic Plants

Water

Sediments





# Role of Harvesting



# Summary of Proposed Actions to Implement Control Methods Test (CMT)

CMT Proposed Treatments	CMT Proposed Follow-Up Treatments	
<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
<ul style="list-style-type: none"><li>• Use “<b>Group A</b>” methods described in DEIR/EIS):<ol style="list-style-type: none"><li>1. Stand-alone treatments with <b>herbicides, Laminar Flow Aeration (LFA), and UV-C light</b></li><li>2. <b>Combination herbicide and UV-C light treatments</b></li></ol></li><li>• Effectiveness of control methods monitored at each treatment site</li><li>• Document results relative to Performance Criteria and Measures</li><li>• Proceed to Group B follow-up methods</li></ul>	<ul style="list-style-type: none"><li>• Use “<b>Group B</b>”, non-herbicide follow-up Methods described in the DEIR/EIS: (At all sites (except control sites))<ol style="list-style-type: none"><li>1. spot treatments of diver-assisted suction</li><li>2. hand pulling</li><li>3. bottom barriers</li><li>4. UV-C light</li></ol></li><li>• Continuation of LFA treatments at Sites 25, 26, &amp; 27</li><li>• Document results relative to Performance Criteria and Measures</li></ul>	

# Summary of Testing Methods and Sites in Key Main Lagoon

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 / UV-C Light	2.0	0.7
11	Herbicide / UV-C Light	1.6	0.5
12	Herbicide / UV-C Light	1.9	0.7
13	Herbicide / UV-C Light	1.7	0.6
14	Herbicide / UV-C Light	2.0	0.7
15	Herbicide / UV-C Light	1.2	0.4
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	1.0
21	Herbicide	0.9	0.9
22	UV-C Light	1.5	0.00
23	UV-C Light	1.6	0.00
24	UV-C Light	1.8	0.00
25	LFA	4.1	0.00
26	LFA	6.1	0.00
27	LFA	2.7	0.00
Total acreage:		41.7	16.9

COMBO  
Treat.

Source: Table 2-1 of the Draft EIR/EIS

Note: The numbers 4, 6, and 7 are not used in the site numbering; there will be 24 sites

Note: Final test sites and proposed test methods for each site may change depending on Spring 2022 conditions and final agency approvals/permits.



# Control Methods Test: Monitoring Actions

## Monitoring Working Group (MWG)

- Coordination with lead agencies
- Develop consistent monitoring methods
- Develop master schedule
- Technical Review
- Weekly meetings

EIR/EIS

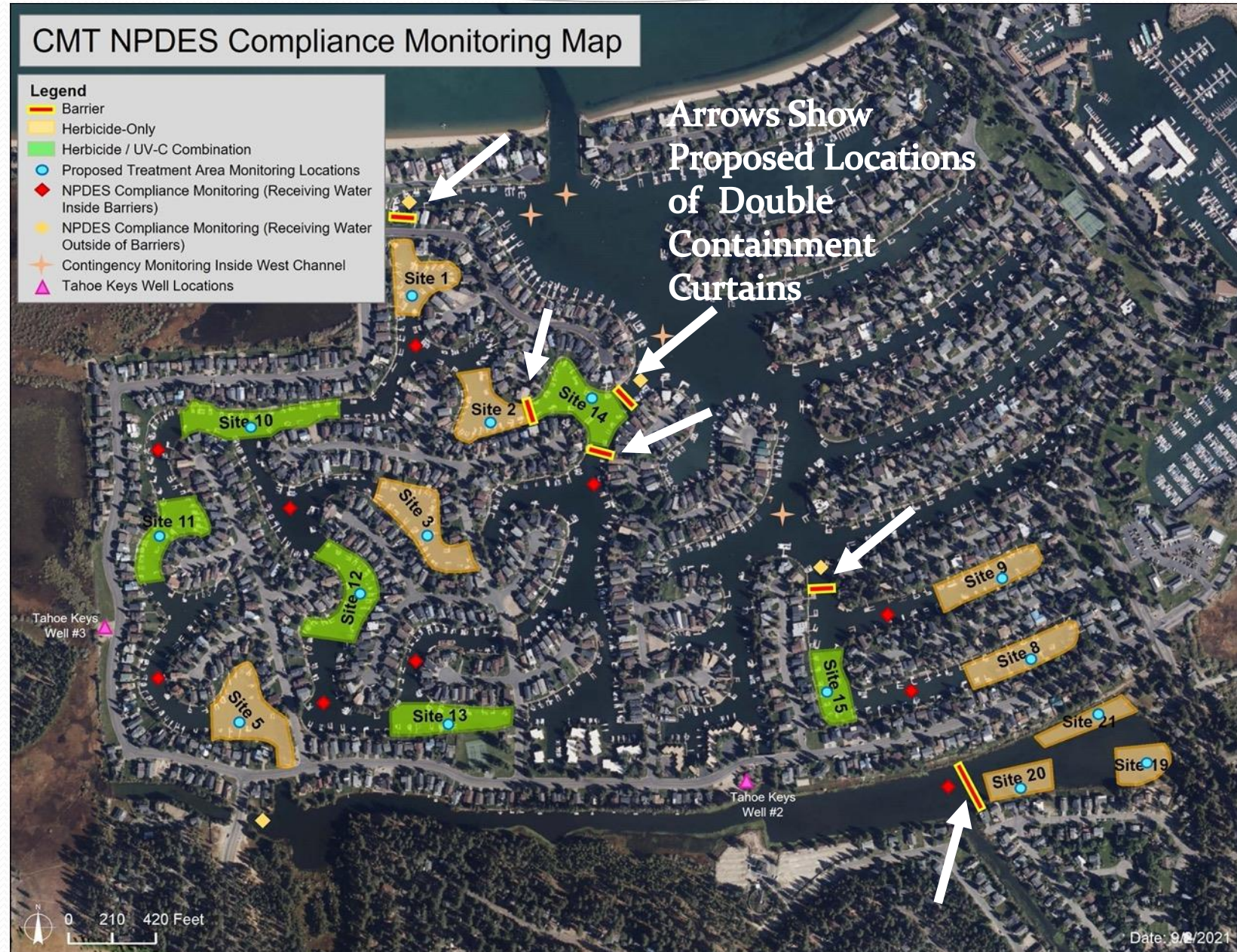
Permits

## Proposed Monitoring Components

- Target and non-target plants
- Water quality
- Herbicide residues & degradants
- Cyanobacteria (HAB's)
- Benthic Macroinvertebrates
- RWT Dye (real-time indication of Herbicide movement)
- Quality Assurance/Quality Control

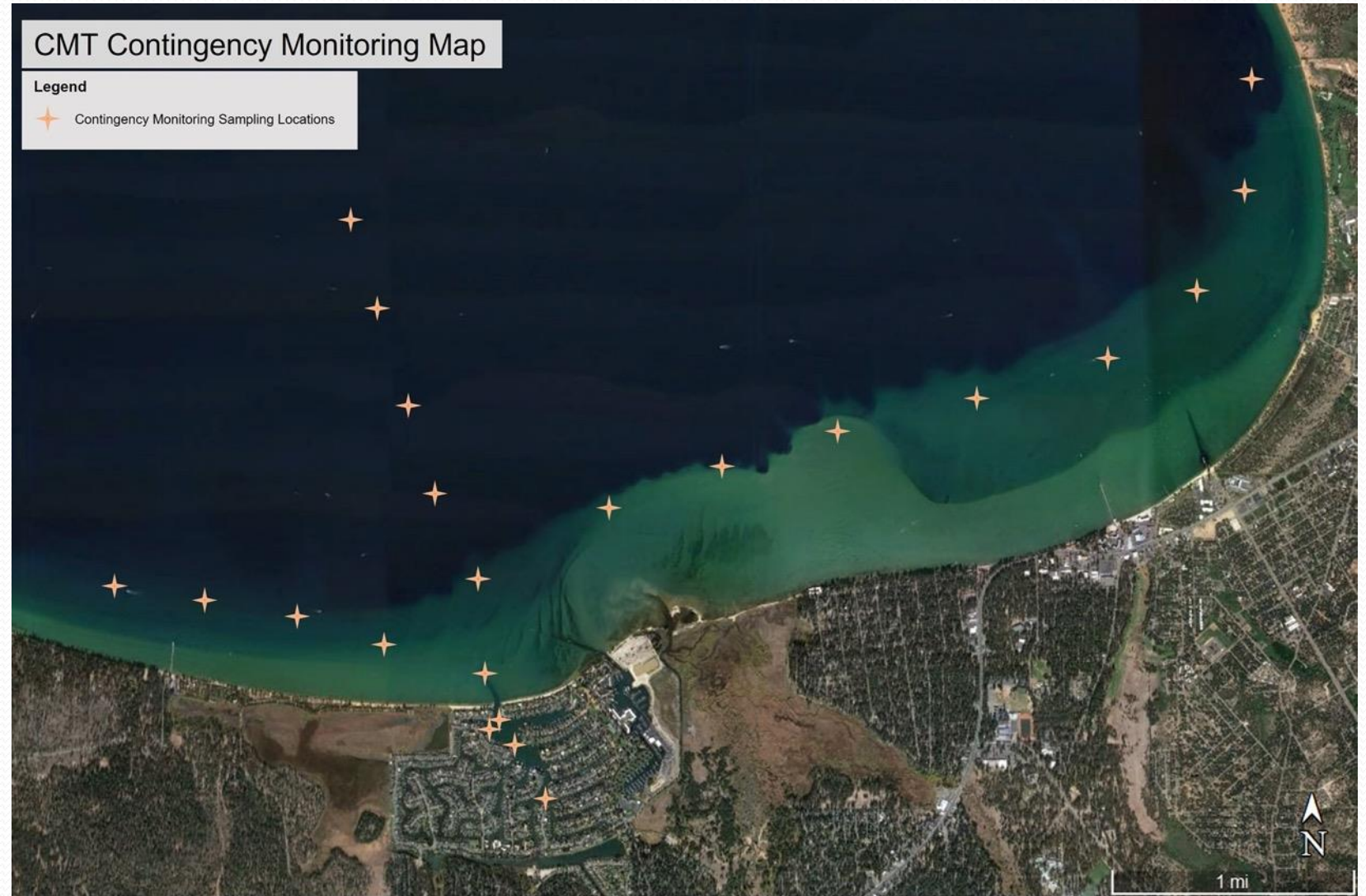


# Proposed Control Methods Test Project: Monitoring Stations and Containment Curtains





# Additional Contingency Monitoring Stations





# Summary: Strategy and Objectives of the CMT

## Year One

Multiple methods  
including  
herbicides

## Year Two

## Year Three

### Strategy:

- **Knock down biomass**
- **Arrest spring growth**

### Strategy:

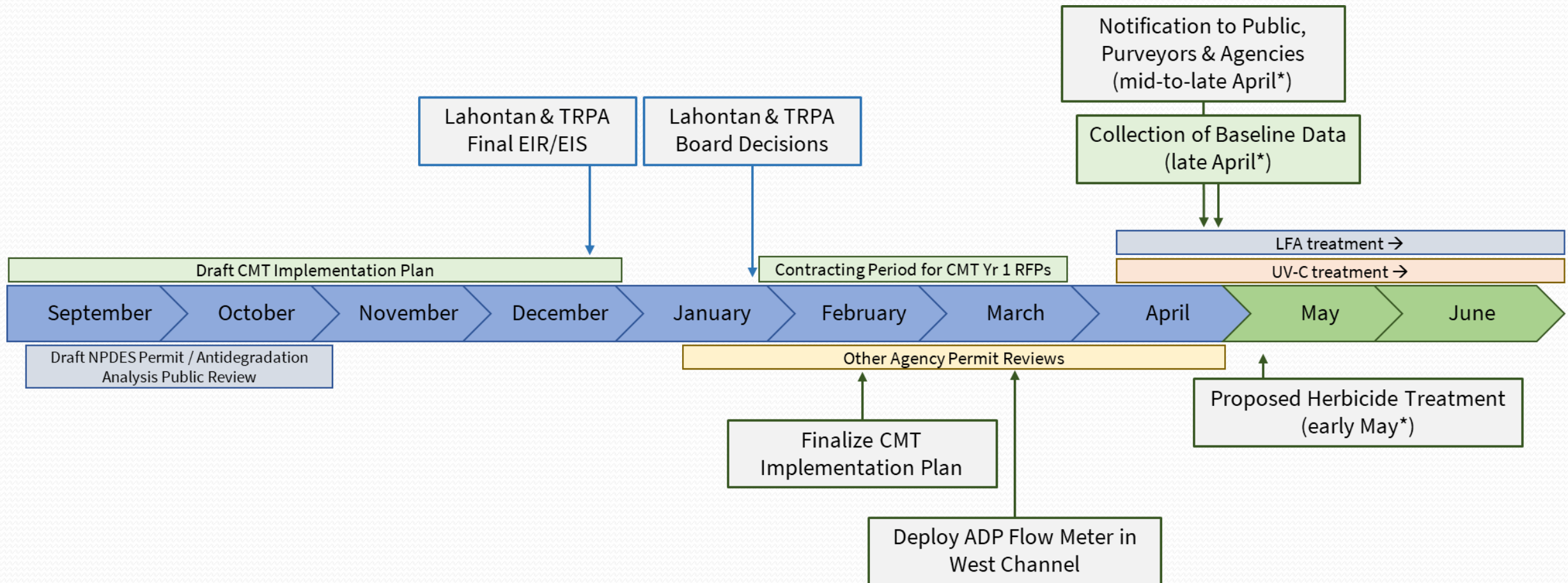
- **Sustain control**
- Non-herbicide methods

### Strategy:


- **Sustain control**
- Non-herbicide methods

**Environmental Monitoring: herbicides, water quality, non-target organisms**

# Remaining Steps for CMT Implementation

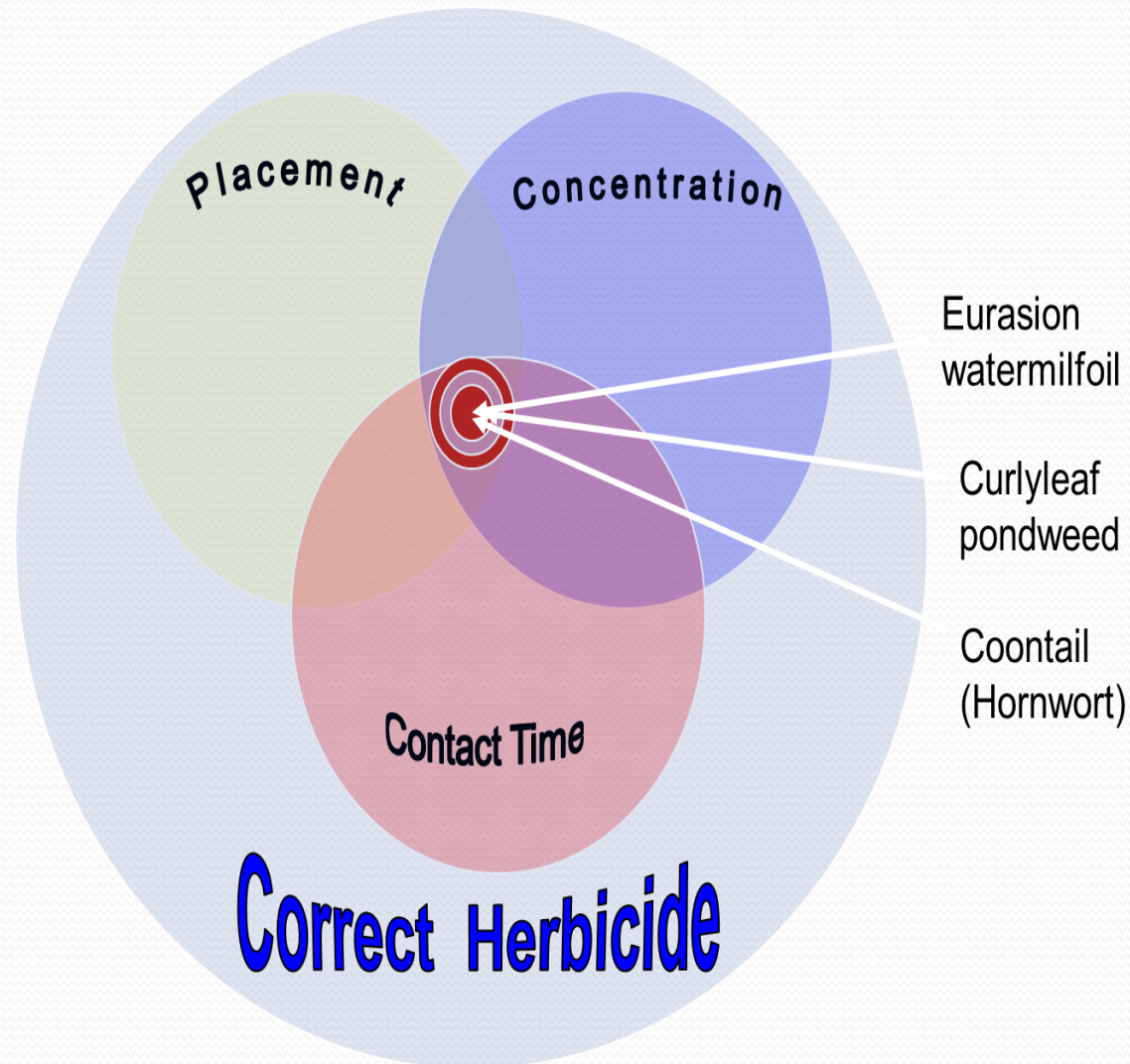


\*Dates are approximate and may change based on weather, lake level, and lagoon conditions.

- 
- Transition to Dennis for TRCD and Jim Good for TRPA
  - Back up slide follows



## Obtaining Optimal Effectiveness of Aquatic Herbicides



### Proposed Selective Aquatic Herbicides:

- **Endothall:** Controls all target plants (contact type)
- **Triclopyr:** Controls Eurasian watermilfoil (systemic type)

**NOTE:** These herbicides do not affect native plant: *Elodea canadensis*)

# Study of Environmental Impact Issues

- 43 Issues were identified and evaluated
  - Most issues in the lagoons where the activities would occur
    - 6 Environmental Health (people, aquatic life)
    - 1 Hydrology
    - 7 Water Quality
    - 9 Aquatic Ecology
  - Also evaluated Earth Resources, Air Quality, Greenhouse Gas Emissions, Terrestrial Ecology, Land Use, Recreation, Utilities, Traffic/Transportation, Noise, and Cultural
- Except for No Action, impacts can be mitigated to be less than significant for each issue

# Environmental Impacts of Control Methods Test

- Resource protection measures addressed many issues
- 10 Issues were Potentially Significant without mitigation
  - Exposure and health risks to workers applying herbicides
  - Detectable concentrations of herbicide chemicals in lagoon water
  - Short-term increases of aluminum in lagoon water
  - Increased harmful algal blooms (HABs)
  - Oxygen depletion in lagoon water
  - Increased phosphorus and nitrogen in lagoon water
  - Effects on non-target aquatic plants, including sensitive species
  - Changes in aquatic plant communities
- Impacts for all issues were Less Than Significant after mitigation



# Mitigation for Control Methods Test

- **Herbicides**
  - Applicator training and licensing
  - Application rates < label rates, chemical breakdown, other resource protection measures = less than significant risk of persistence
  - Spill prevention & response plan requirements to prevent excess concentrations
  - Aeration if needed to accelerate aerobic degradation
- **Aluminum – best management practices to minimize sediment disturbance**
- **Phosphorus, nitrogen, and harmful algal blooms**
  - Timing and size of treatments minimize decomposing plant tissue
  - Lanthanum-modified clay if needed to remove phosphorus from lagoon water
  - Aeration if needed to make conditions less favorable for HABs

## Mitigation for Control Methods Test (cont.)

- **Dissolved oxygen**
  - Timing and size of treatments minimize decomposing plant tissue
  - Aeration if real-time DO monitoring indicates the need
- **Spring macrophyte surveys to adjust test site boundaries**
  - Concentrate on target species
  - Avoid impacts to non-target plants, including sensitive species
  - Avoid adverse impacts to aquatic plant community composition

# Environmental Impacts and Mitigation for Action Alternative 1

- Most of the potentially significant issues and mitigation as proposed project
  - Aluminum: BMPs to minimize sediment disturbance
  - Phosphorus, Nitrogen and HABs: timing and limited size of treatments, use of aeration or lanthanum-modified clay if need indicated by monitoring
  - Dissolved oxygen: timing and limited size of treatments, use of aeration if needed
  - Non-target aquatic plant species and community composition: spring macrophyte surveys to adjust test site boundaries



# Environmental Impacts and Mitigation for Action Alternative 2

- Potentially significant impacts and mitigations different from other alternatives
- Greater risk from aluminum in sediments drives the need for more mitigation
  - Spill prevention during dredge spoils transport & handling
  - Treatment and testing dewatering effluent
  - Leak prevention, spill control, containment plans
  - Turbidity curtain barriers at test sites
- Potential contribution to flooding from discharge of dewatering effluent: discharge to sanitary sewer or discharge to Lake Tallac when water levels are low
- Turbidity controls for dredging, substrate replacement, dewatering
- Dissolved oxygen depletion: timing and limited size of treatments, use of aeration if needed, turbidity controls

## Environmental Impacts and Mitigation for Action Alternative 2 (cont.)

- Increases in phosphorus and nitrogen
  - Turbidity controls for dredging, substrate replacement, dewatering
  - Effluent treatment to remove P and N
- Spring macrophyte surveys to adjust test site boundaries
- Effects on non-target riparian and wetland habitats and species
  - discharge to sanitary sewer or discharge to Lake Tallac when water levels are low

# Environmental Impacts for No Action Alternative

- Ongoing risk of short-term aluminum increases during sediment disturbance
- Ongoing potential risks from harmful algal blooms
- Long-term risks of water quality impacts from growing aquatic invasive weed problem
  - Increased water temperature
  - Increased turbidity = reduced water clarity
  - Increased floating weed fragments
  - Increased changes in pH
  - Lower dissolved oxygen
  - Increased phosphorus and nitrogen cycling from sediments into the water

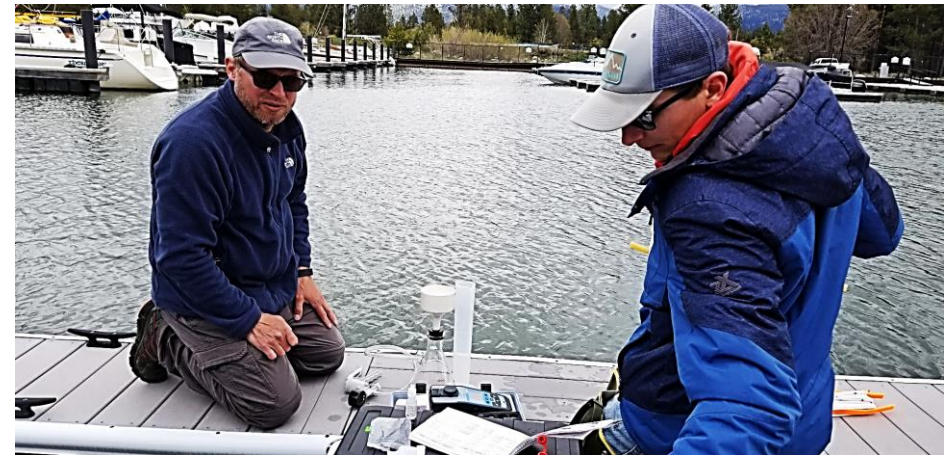


## Environmental Impacts for No Action Alternative (cont.)

- Increased long-term impacts to aquatic ecology
  - Displacement of native plant species with invasive species
  - Shifts in aquatic plant communities
  - Reduced health of benthic invertebrate community
  - Increased risks to special status fish species
  - Reduced suitability of habitat for native or recreationally important fish species
  - Increased spread of aquatic invasive species
- Reduced quality of recreational boating in Lake Tahoe
- Long-term impacts to TRPA recreation thresholds
- Potential long-term impacts to water supplies at Lake Tahoe

# Environmental Impact Evaluation Process


- Initial Study and Environmental Checklist
  - Reviewed existing information
  - Identified potential issues, need for EIS and EIR
- 2019 Baseline Study
- Team of 5 PhD specialists evaluated aquatic impacts:
  - Environmental Toxicologist
  - Limnologist
  - Aquatic Plant Specialist
  - Fisheries Biologist
  - Hydrologist
- Nutrient loading/nutrient cycling model



# Summary

- Extensive collaboration on project development
- Strong scientific foundation
  - Test design
  - Technical expert analysis
  - TSAC input
- Balanced urgency
- Difficult decisions on what is included in a test
  - Lahontan Board decisions **January 12-13, 2022**
  - TRPA APC meeting **January 18, 2022**
  - TRPA Governing Board decisions **January 26, 2022**
- Implementation would begin in Spring 2022





Thank You!  
[www.TahoeKeysWeeds.org](http://www.TahoeKeysWeeds.org)

<https://www.trpa.org/document/projects-plans/>