Tahoe Keys Lagoons Aquatic Weed Control Methods Test Project Update

TRPA Advisory Planning Commission

June 14, 2023

Dennis Zabaglo, TRPA
Pete Wolcott, TKPOA
Dr. Lars Anderson, TKPOA
Jesse Patterson, League to Save Lake Tahoe

LAKE TAHOE INVASIVE SPECIES PROGRAM

Tahoe Keys CMT Update

TAHOE REGIONAL PLANNING AGENCY

- Project Overview
  - *Dennis Zabaglo, TRPA*
- Tahoe Keys Property Owners Commitment
  - *Pete Wolcott, TKPOA*
- CMT Progress and Next Steps
  - *Dr. Lars Anderson, TKPOA Science Consultant*
- League Perspective
  - *Jesse Patterson, Keep Tahoe Blue*

LAKE TAHOE INVASIVE SPECIES PROGRAM

CMT Project Overview

TAHOE REGIONAL PLANNING AGENCY

Tahoe Keys Lagoons Aquatic Weed Control Methods Test

- Critical Need
  - *Find solutions to the largest infestation*
  - *Threat to Lake Tahoe*
- Innovative approach
  - *New tools for control*
  - *One time use of aquatic herbicides*
  - *Physical methods for long-term maintenance*

LAKE TAHOE INVASIVE SPECIES PROGRAM

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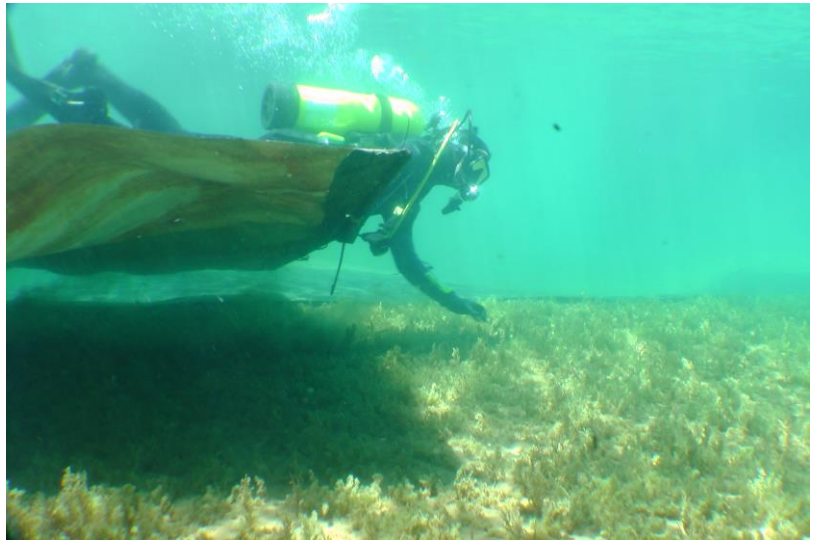


LAKE TAHOE INVASIVE SPECIES PROGRAM

CMT Milestones

TAHOE REGIONAL PLANNING AGENCY

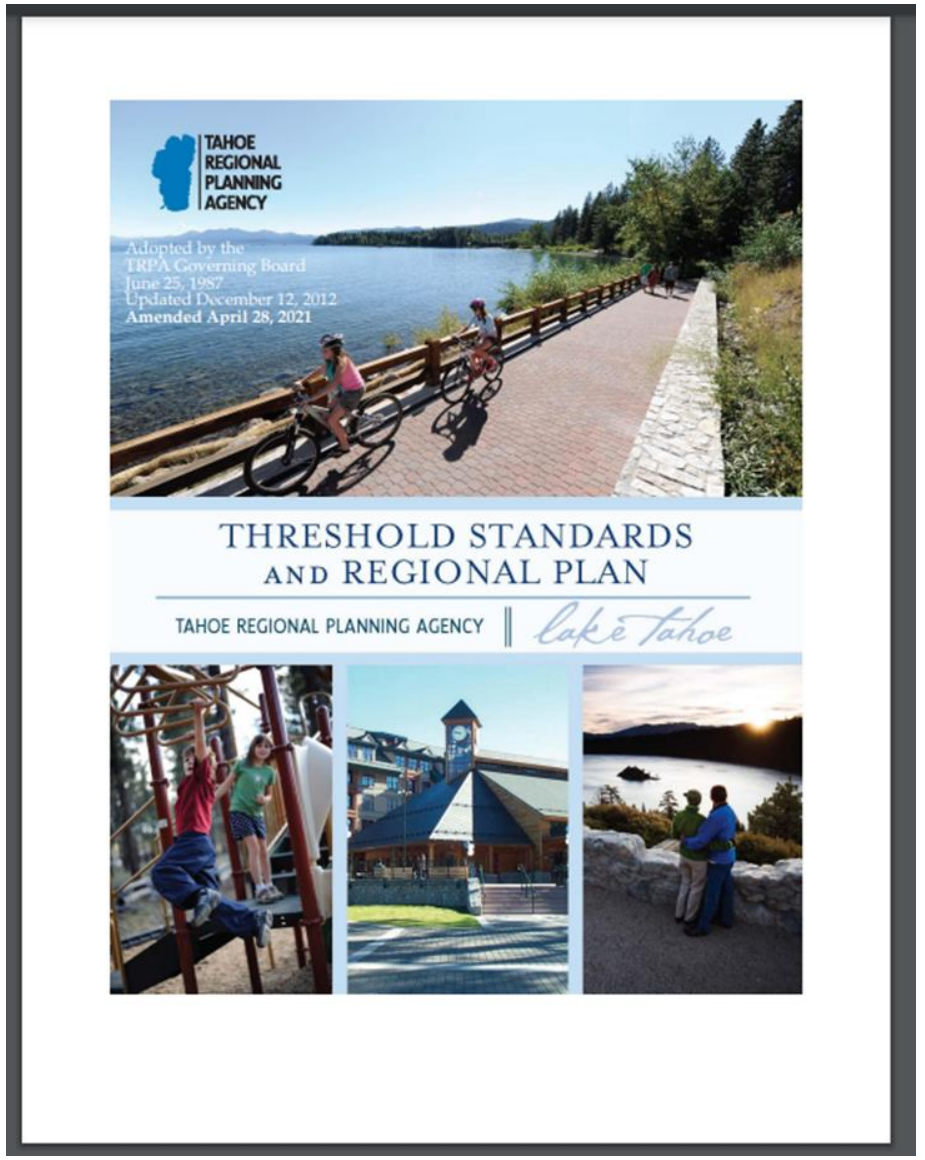
- AIS Program Success
  - *Prevention*
  - *Localized eradication*
  - *Funding*
  - *Tackle bigger infestations*
- TKPOA Commitment
  - *Collaboration*
  - *Funding*
- Stakeholder Committee
  - *Transparency*
  - *Public input*
  - *Start with a test*
- Comprehensive Environmental Analysis
  - *Alternatives*
  - *Doing nothing is not an option*
  - *CMT can be implemented safely*
- Redundant protections & mitigations
  - *Treat early*
  - *2X turbidity curtains*
  - *On-call divers*
  - *Tracer dye*
  - *Duplicate sampling*
  - *Aeration*
  - *Phoslock*
  - *Independent*
- Unanimous decisions
- Year 1 begins

LAKE TAHOE
INVASIVE SPECIES
PROGRAM

TRPA Role

TAHOE
REGIONAL
PLANNING
AGENCY

- Regulatory
  - *EIP Permit & Thresholds*
- AIS Program Goals
  - *Localized eradication*
- Engage stakeholders and the public
  - *Public meetings & webinars*
- Independent monitoring
  - *Water quality*
  - *Mitigation triggers*
  - *Efficacy*



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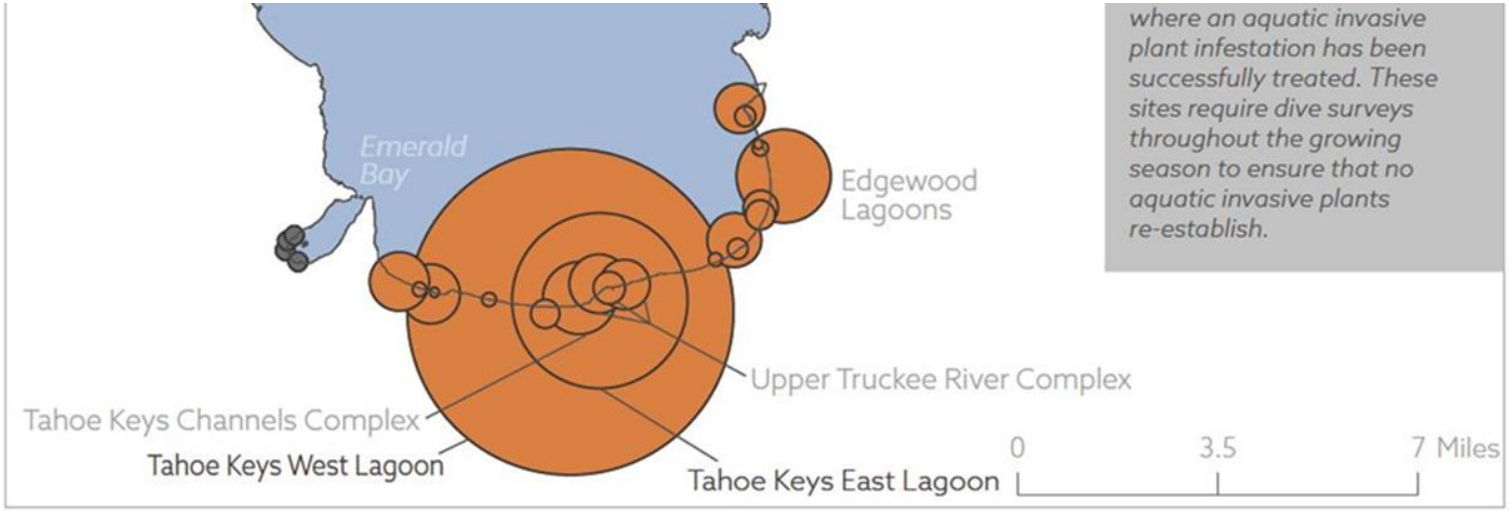
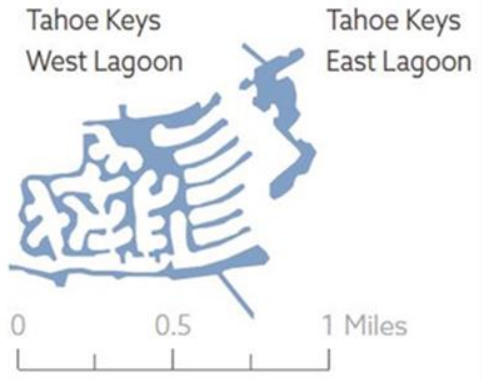


where an aquatic invasive plant infestation has been successfully treated. These sites require dive surveys throughout the growing season to ensure that no aquatic invasive plants re-establish.

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.



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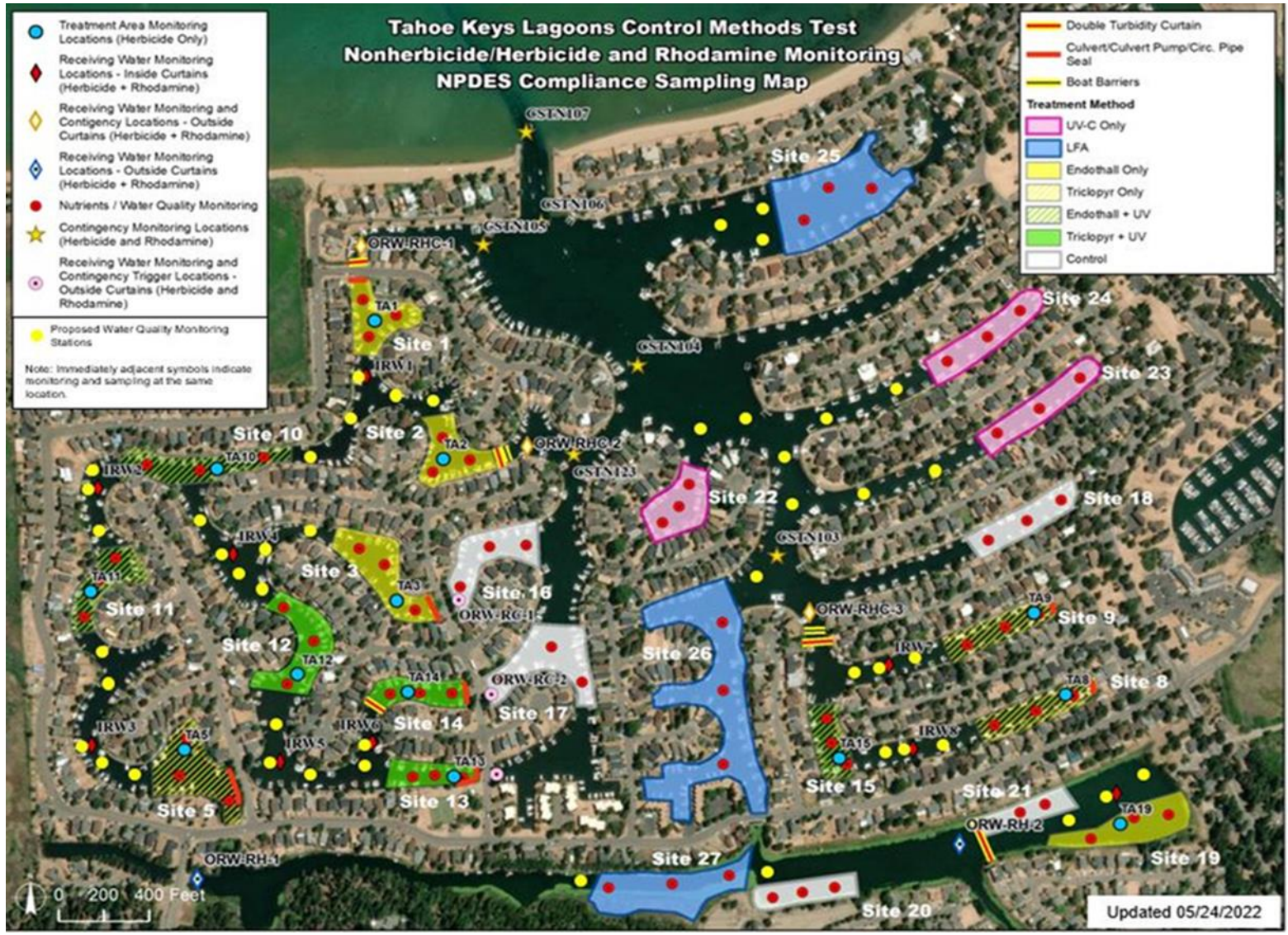


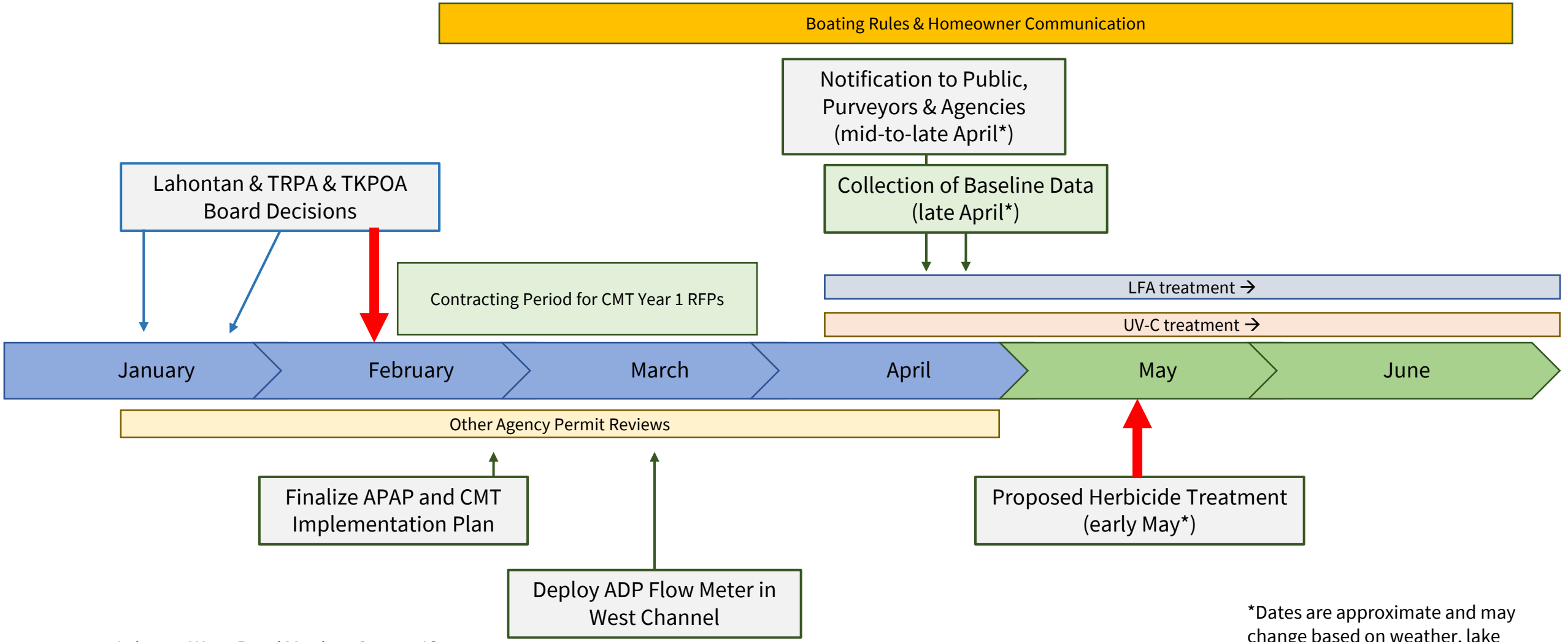
From Permit(s) to the Start Line for CMT

- **45 Years Battling Weeds**
- **2 Decades of Advocacy**
- **5 Years of Planning and Test Design**
- **Only 12 Weeks to Implement?**

- 5 TKPOA Go/No Go's Feb thru May

Should we commit $1-2M of our neighbors $ on a 50-50 shot at 2022 implementation of the test?

CMT Implementation



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

From Permit(s) to the Start Line for CMT

- 2 Decades of advocacy
- 5 Years of Planning and Test Design
- 12 Weeks to Implement?

- **5 TKPOA "Go/No Go" Reviews Feb thru May**

Should we commit $1-2M of our neighbors $ on a 50-50 shot at 2022 implementation of the test?

- Last Minute Nudge from Joanne Marchetta

Getting to the Start Line: The 7 Miracles

1. **Water Depth (Lake Height > 6224')**
2. Water Temperature > 16^{o} C by early May
3. Lake water level is rising
4. Contractors are selected, briefed, and ready
5. Turbidity Curtains and Boat Barriers are Installed
6. Monitoring & Mitigation specs finalized
7. Proof of Flow into the Lagoons

Getting to the Start Line: The 7 Miracles

1. Lake Height > 6224’
2. **Water Temperature > 16^{o} C by early May**
3. **Lake water level still rising in late May**
4. Contractors are selected, briefed, and ready
5. Turbidity Curtains and Boat Barriers are Installed
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7. Proof of Flow into the Lagoons

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#5: Boating Restriction, Curtains, Barriers

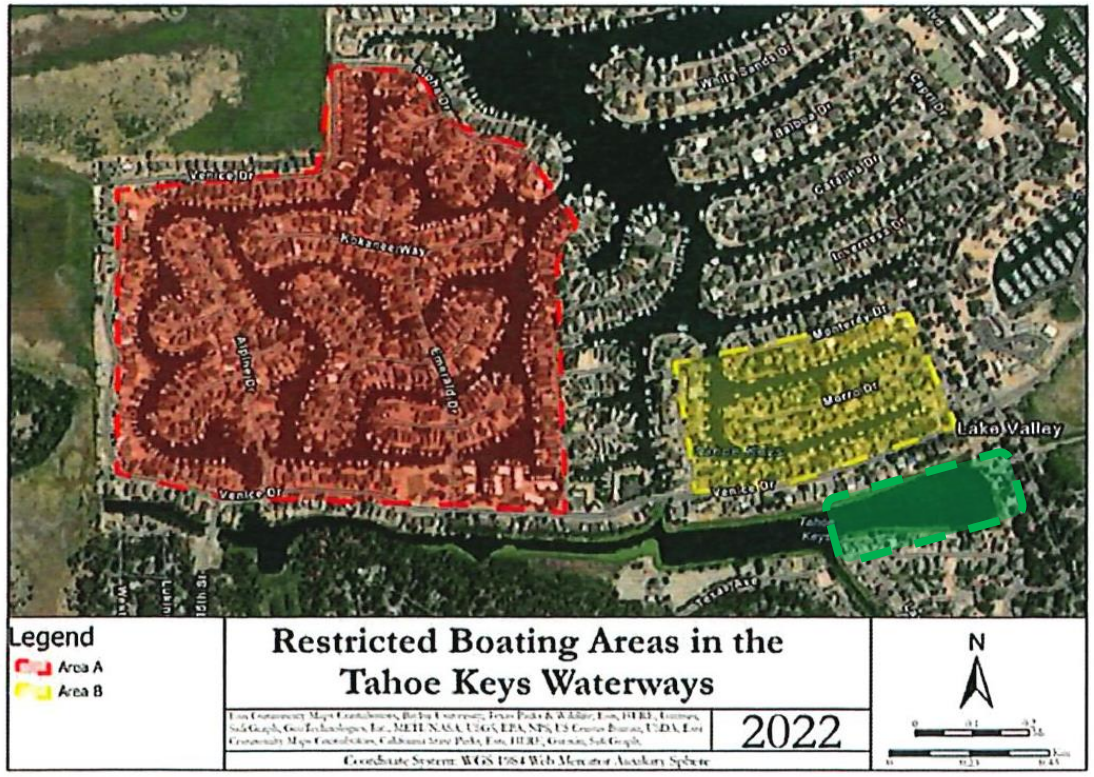
Boat Closure from:

~~**April 18**~~

~~**April 25**~~

May 9

Restricted Boating Areas
April 18-Latest Mid-July (Draft- 2022 Only)



Area A (Red)

Area B (Yellow)

Lake Tallac (Green)

not connected to Lake Tahoe

Test Area B:

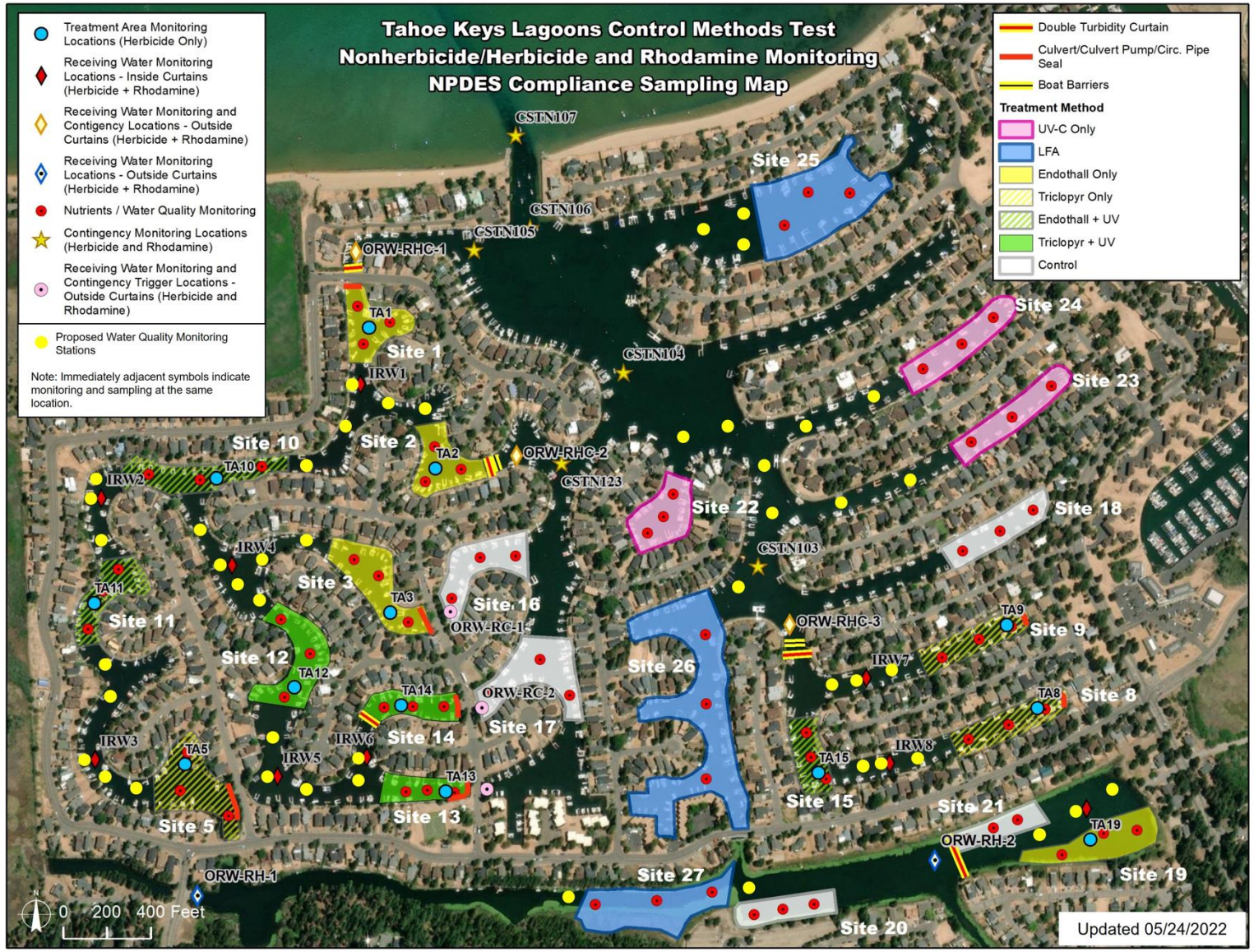
Turbidity Curtains and Boat Barrier Installed 5/16

One week before Scheduled Start of Test

Getting to the Start Line: The 7 Miracles

1. Lake Height > 6224’
2. Water Temperature > 16^{o} C
3. Lake water level is rising
4. Contractors are selected, briefed, and ready
5. Turbidity Curtains and Boat Barriers are Installed
6. **Monitoring specs finalized**
7. Proof of Flow into the Lagoons

#6: Final Monitoring Spec Finalized 5/24 (T-1)



Getting to the Start Line: The 7 Miracles

1. Lake Height > 6224’
2. Water Temperature > 16^{o} C
3. Lake water level is rising
4. Contractors are selected, briefed, and ready
5. Turbidity Curtains and Boat Barriers are Installed
6. Monitoring & Mitigation specs finalized
7. **Proof of Flow into the Lagoons**

CMT – How did we do?

- We successfully navigated the 7 Miracles to the starting line

Meteorological Good Fortune	Hard Work Perseverance Teamwork Solid Science
• Water Depth (Lake @ 6224.5’)	• Contractors selected & ready to go
• Lake Rising until June 14th	• Curtains & Barriers installed
• Water Temperature > 16^{o} C by May 15th	• Monitoring Specifications Agreed
	• Proof of Flow into Lagoons

A Job Well Done by CMT Project Team!

CMT – How did we do?

- We successfully navigated the 7 Miracles to the starting line
- Monitoring: 75K data points compiled, > 90% of target
- Mitigation: No Herbicides detected anywhere near the lake

We Met Important Commitments to Stakeholders & the Public

CMT Year 1 Problems/Challenges:

- 5 Wind Events in the first 3 weeks of the test
- 3-Year Cost @ ~4X TKPOA's Original Funding Level
- Non-detect for Triclopyr set @ 1PPB, a high bar
  - Turbidity Curtains remain in place until late September
  - Water Quality behind the curtains erodes markedly in August

60% of TKPOA Boaters lose entire season

Boat Closure to:

- ~~**3-5 weeks**~~
- ~~**Mid-July**~~
- ~~**August 19**~~
- **Sept 2 for Area B**
- **Sept 23 for Area A**

Restricted Boating Areas
April 18-Latest Mid-July (Draft- 2022 Only)

Treatment Area A (Red) Barrier Placement will impact all homeowners on the following streets:

- All streets off Emerald Drive (Garmish Court, Marconi Way, Lido Way, Kokanee Drive)
- Southern side of Aloha Drive (Aloha Drive, Daggett Court, Carson Court)
- All streets off Alpine Drive (Alpine Drive, Cascade Court, Cathedral Court, Genevieve Court)
- Waterway side of Venice Drive from Lighthouse Shores to Christie Drive
- West Side of Christie Drive and Wedeln Court

Treatment Area B (Yellow) Barrier Placement will impact all homeowners on the following streets:

- Eastern side of Lucerne Way
- Northern side of Venice Drive from the Corner of Lucerne Way and Ala Wai Blvd
- All of Morro Drive
- Southern side of Monterey Drive
- Western side of Danube Drive from the corner of Venice to Monterey

Significant Algae Bloom behind curtains

TKPOA Commitment to CMT

Goal of CMT is long-term management solution for invasive weeds

- **Environmentally Sound**
- **Economically Viable**
- **Permittable**

- Despite rough summer, members approve Year 2 funding > 4:1
- Pursuing 2nd collaborative effort to address water quality in lagoons

Toughest Question from Homeowners

What guarantee is there that this Test will lead to a solution?

Failure is not an option

“Progress Runs at the Speed of Trust”

TRPA Support & Leadership

https://www.keysweedsmanagement.org/

Summary of CMT Year One Results

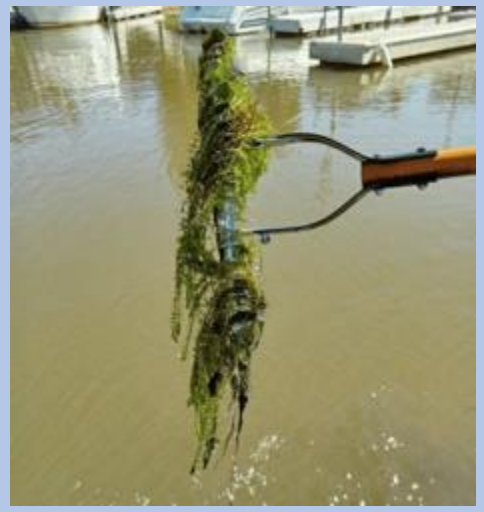
- Effectiveness of CMT Treatments
- Monitoring: Nutrients and Water Quality
- Permit Compliance and Reporting
- Year Two Planning:
  “Group B”
  non-herbicide methods

Summary of Year- One CMT Treatment Effectiveness

Metric (Goal) → / Treatment ↓	Vessel Hull Clearance (3 feet)	Biovolume (Reduce by 75%)	Encourage Desirable Native Plants (Increase Occurrence)
Endothall Only (Controls all 3 target weeds)	100% ↑	Near or above 75% throughout season ↑ All target plants controlled!	>No consistent increase in native plants > Native Elodea healthy ↑
Triclopyr Only (Very selective against Eurasian Watermilfoil)	50% ↓	For all target plants: Highest reduction was 50% ↓ >90% Control of Eurasium watermilfoil ! ↑	>Native plant community similar to controls ↑ > Native Elodea healthy ↑
UV (mid-Site/deep)	100% ↑	Highest reduction was 66%; greater following treatments (near 75%) →	Native plant community generally reduced compared to controls ↓
Endothall (+ UV) (Combination)	66% →	2/3 sites had ≥75% reduction →	Response of native plant community inconsistent between sites →
Triclopyr (+ UV) (Combination)	83% →	1/3 sites had ≥75% reduction →	Native plant community similar to controls in 2/3 sites ↑

Triclopyr 14 days after treatment:
Only Eurasian watermilfoil is affected

Controls (untreated) (July 6, 2022)
All plants are robustly growing

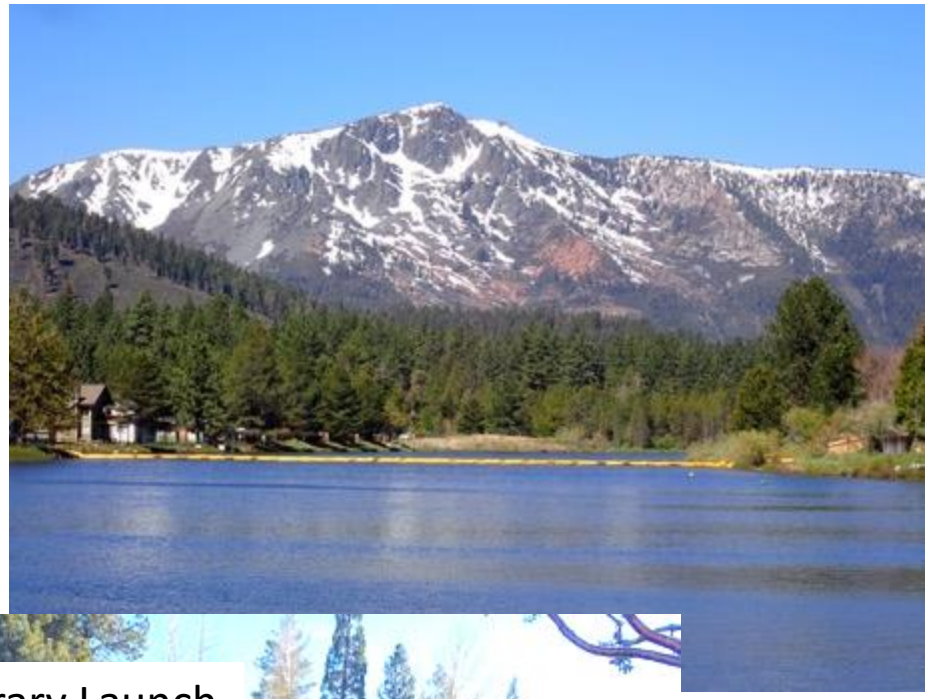


Endothall only 6 weeks after treatment (July 6 2022): **Only native Elodea is thriving**

Examples of Year 1 Herbicide Effects

Endothall only 6 weeks after treatment (July 6, 2022):
Native Elodea is growing well

Double Curtain Installations

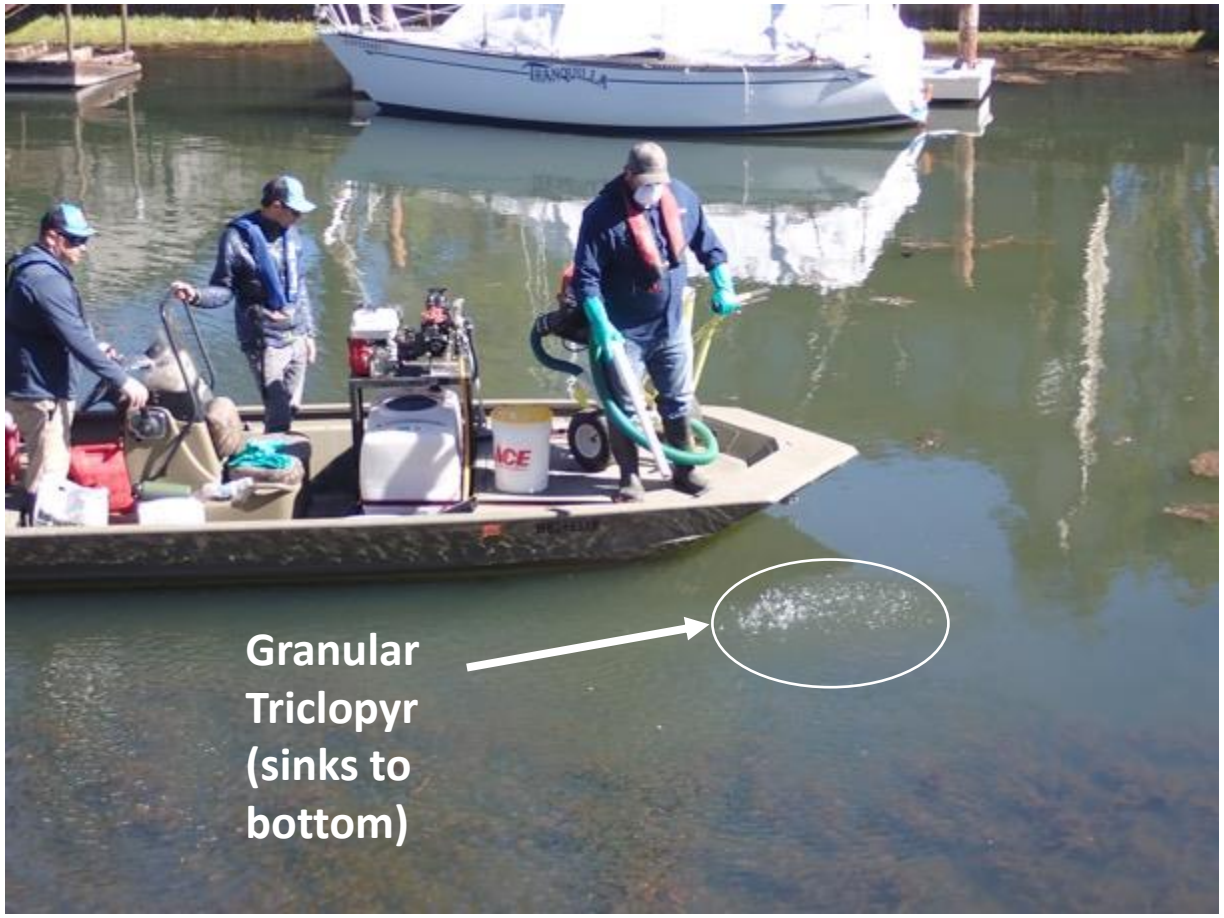


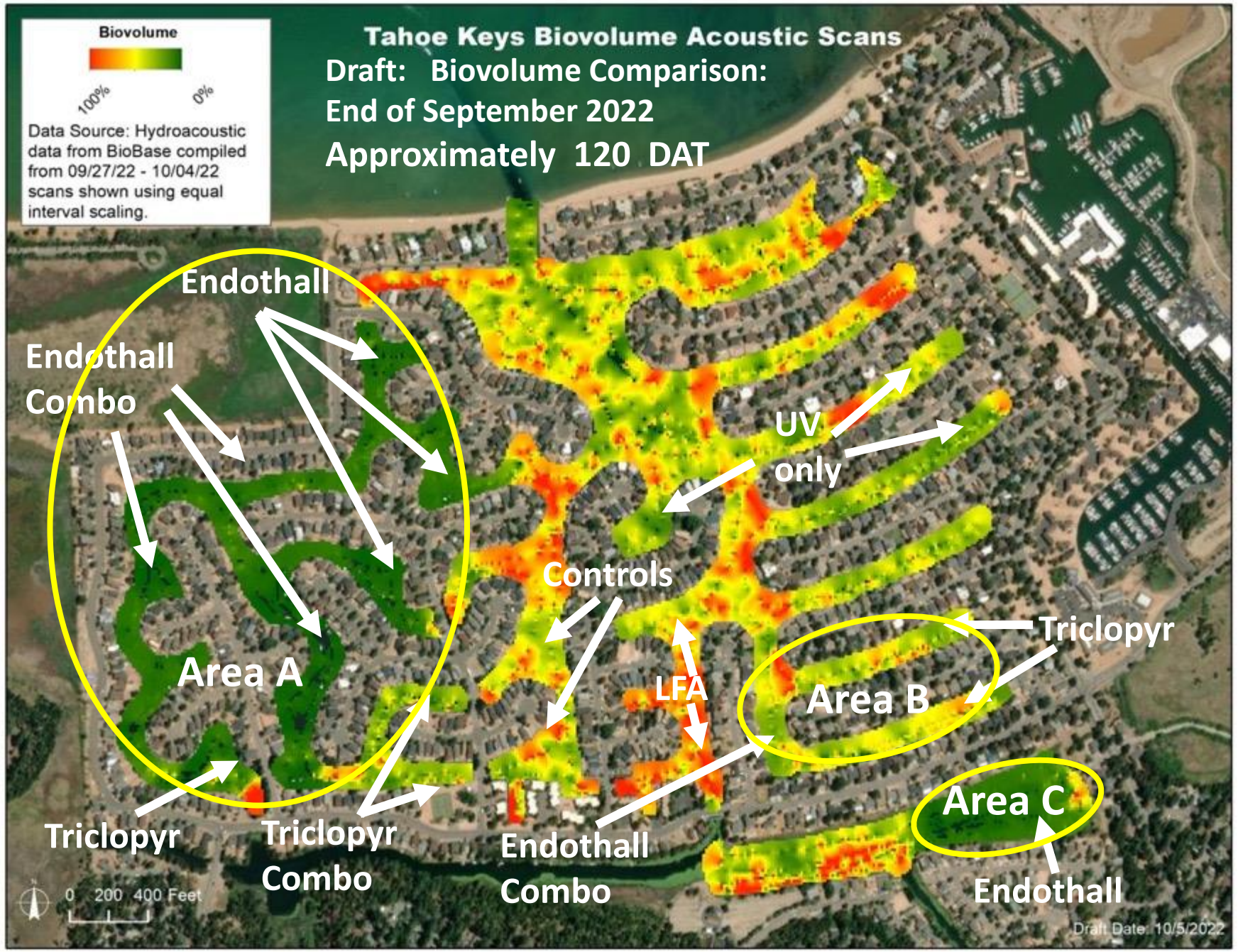
Spill Response Team

Temporary Launch Ramp

Pumped /Dropline Application of Liquid Endothall Herbicide
Mixed with Rhodamine Dye Tracer
May, 2022

Blower Application of Pelleted Triclopyr Herbicide
Rhodamine Dye Was Applied Immediately afterword
May 2022





CMT Year One Treatments:
Note: All treatments were replicated three times

- Controls (No treatments)
- Endothall herbicide- alone
- Triclopyr herbicide- alone
- UV light- alone
- Combinations:
  Endothall/UV Light
  Triclopyr/UV Light
- Laminar Flow Aeration (”LFA”)
  Note: Effects expected to take multiple seasons:
  Sediment “muck” reduction
  Reduced available nutrients

Monitoring: Herbicide Levels Summary

- **Herbicides never entered Lake Tahoe and never reached the West Channel.**
- Rhodamine dye worked well to indicate likely presence of herbicides.
- Endothall became “non-detect” (5 µg/L) by 45 Days after treatment.
- Triclopyr was above “non-detect” levels (1 µg/L) until >100 DAT.
  > *This prevented removal of turbidity curtains until September.*

NOTE: Triclopyr is photo-degraded (light dependent) and high turbidity in Area A probably greatly impeded normal photodegradation.

Year Two: Strategy of the CMT

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

Goal/Strategy:
- **Knock down biomass**
- **Arrest spring growth**
- **Prevent turion formation**
- ***Do this Selectively !***

Year Two
Group B Methods:
Diver removal
UV-C
Bottom barriers

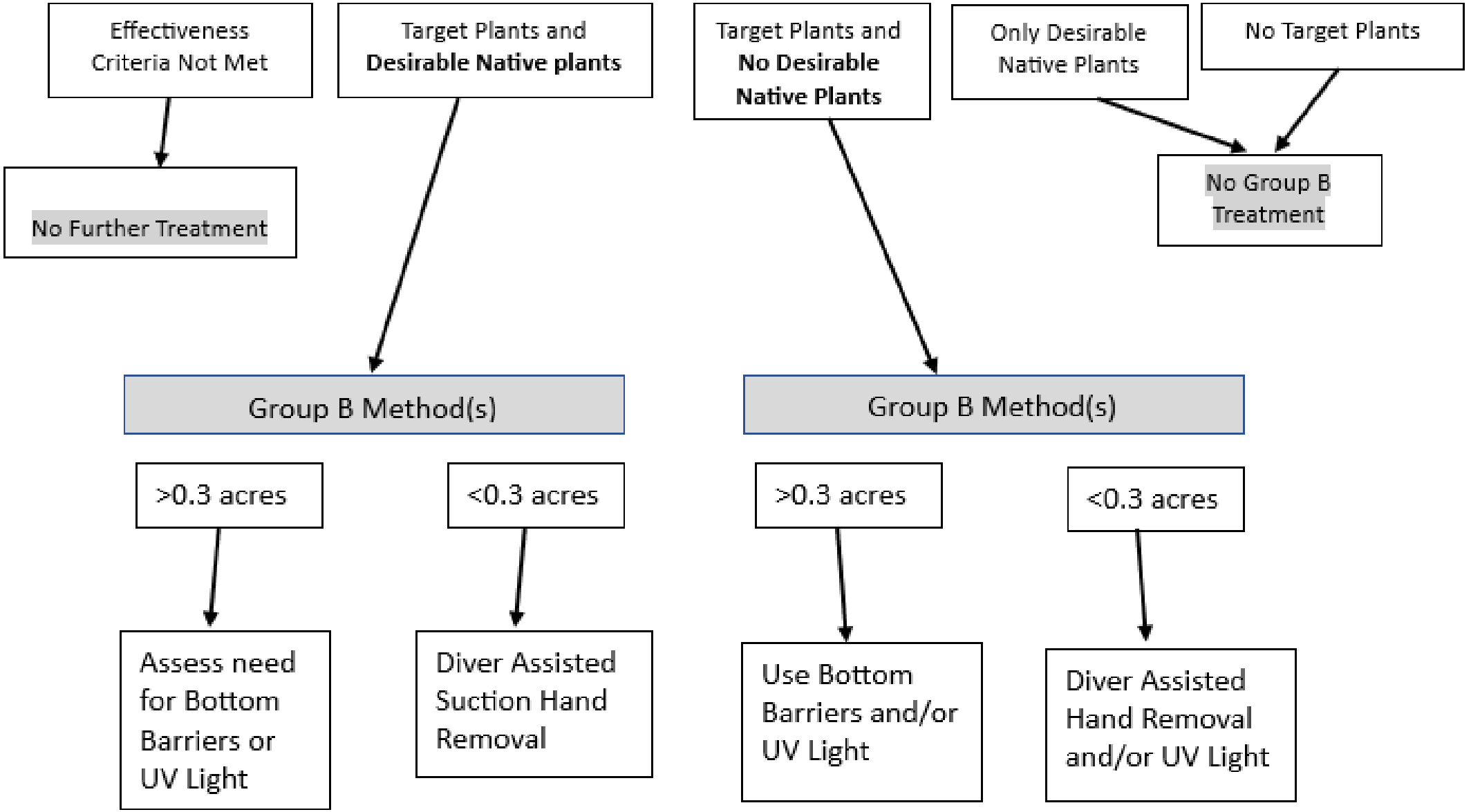
Goal/Strategy:
- Evaluate Year 1 effects
- Select Group B sites
- **Sustain control**
- Prevent turion formation

Year Three
Group B Methods:
Diver removal
UV-C
Bottom barriers

Goal/Strategy:
- Evaluate Year 2 effects
- Select Group B sites
- **Sustain control**
- Prevent turion formation

Environmental Monitoring: TKPOA Staff and Contractors, TRPA Staff and Contractors

Decision Framework for CMT Year-One Group A Methods Results



Next Steps- Implement CMT Year Two

- Contractor Orientations and Coordination: Done in early June
- Prep equipment and finalize monitoring schedules: Done!
- Spring (baseline) surveys for site selection: Started mid-May/ Continuing
- Identify Group B test site locations: On-going-
  The first Bottom Barriers were installed last week!

KEEP TAHOE BLUE®
League to Save Lake Tahoe

A Control Methods Test to Keep Tahoe Blue

Jesse Patterson
Chief Strategy Officer
May 25, 2023

KEEP TAHOE BLUE®

League to Save Lake Tahoe

65 years of protecting Lake Tahoe

Mission

To protect and restore the environmental health, sustainability and scenic beauty of the Lake Tahoe Basin. We focus on ***water quality and its clarity*** for the preservation of a pristine Lake for ***future generations***.

A decade long journey to the Control Methods Test

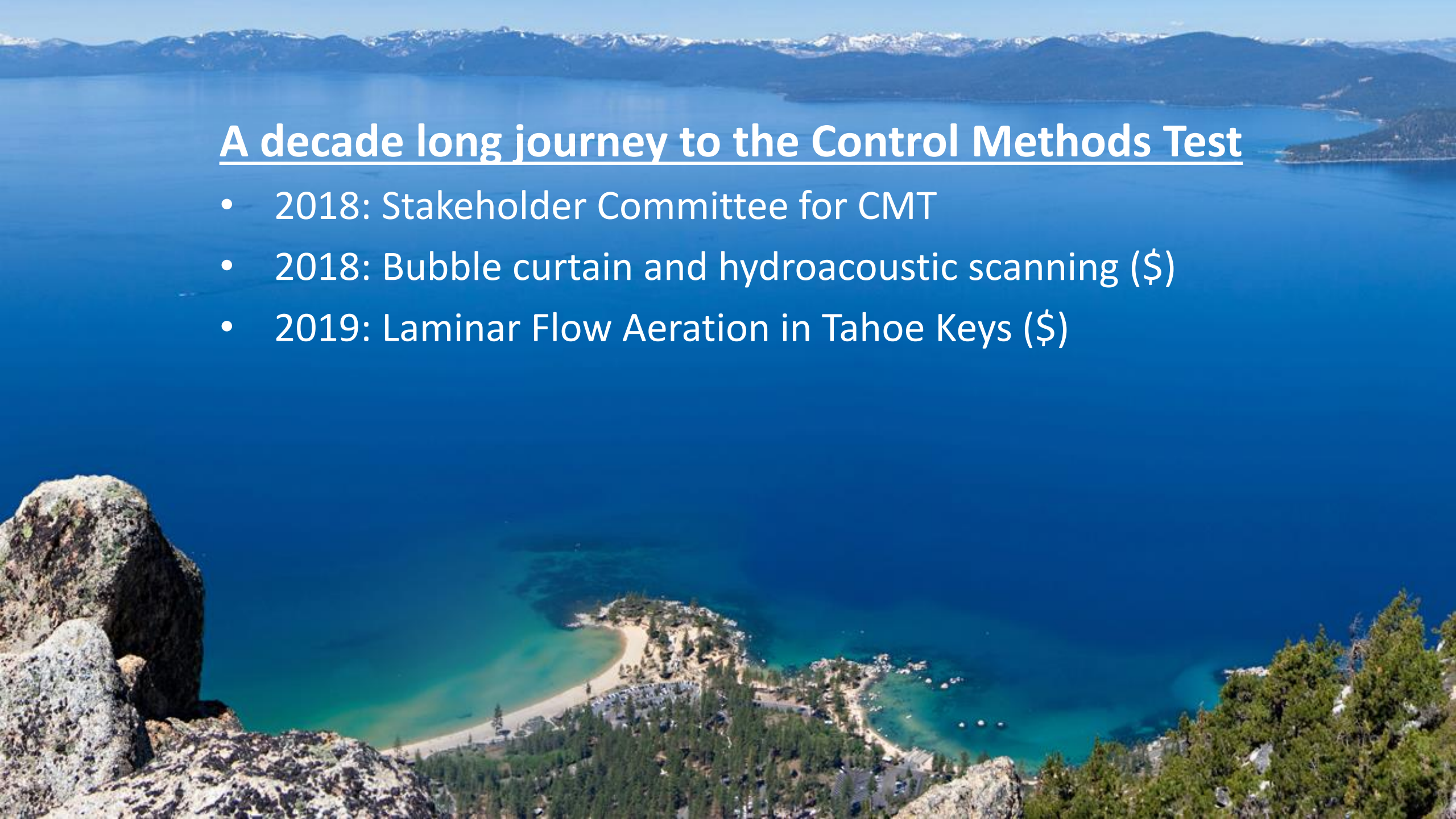
- 2012: Learn about the Tahoe Keys through LTAIS Program
- 2013: Eyes on the Lake + Pipe Keepers @ the Tahoe Keys
- 2017: League financial commitment to non-chemical control methods, containment, WQ improvements, monitoring
- 2017-present: HABs in Tahoe Keys lagoons

A decade long journey to the Control Methods Test

- 2018: Stakeholder Committee for CMT
- 2018: Bubble curtain and hydroacoustic scanning ($)

Bubble Curtain

September 2018



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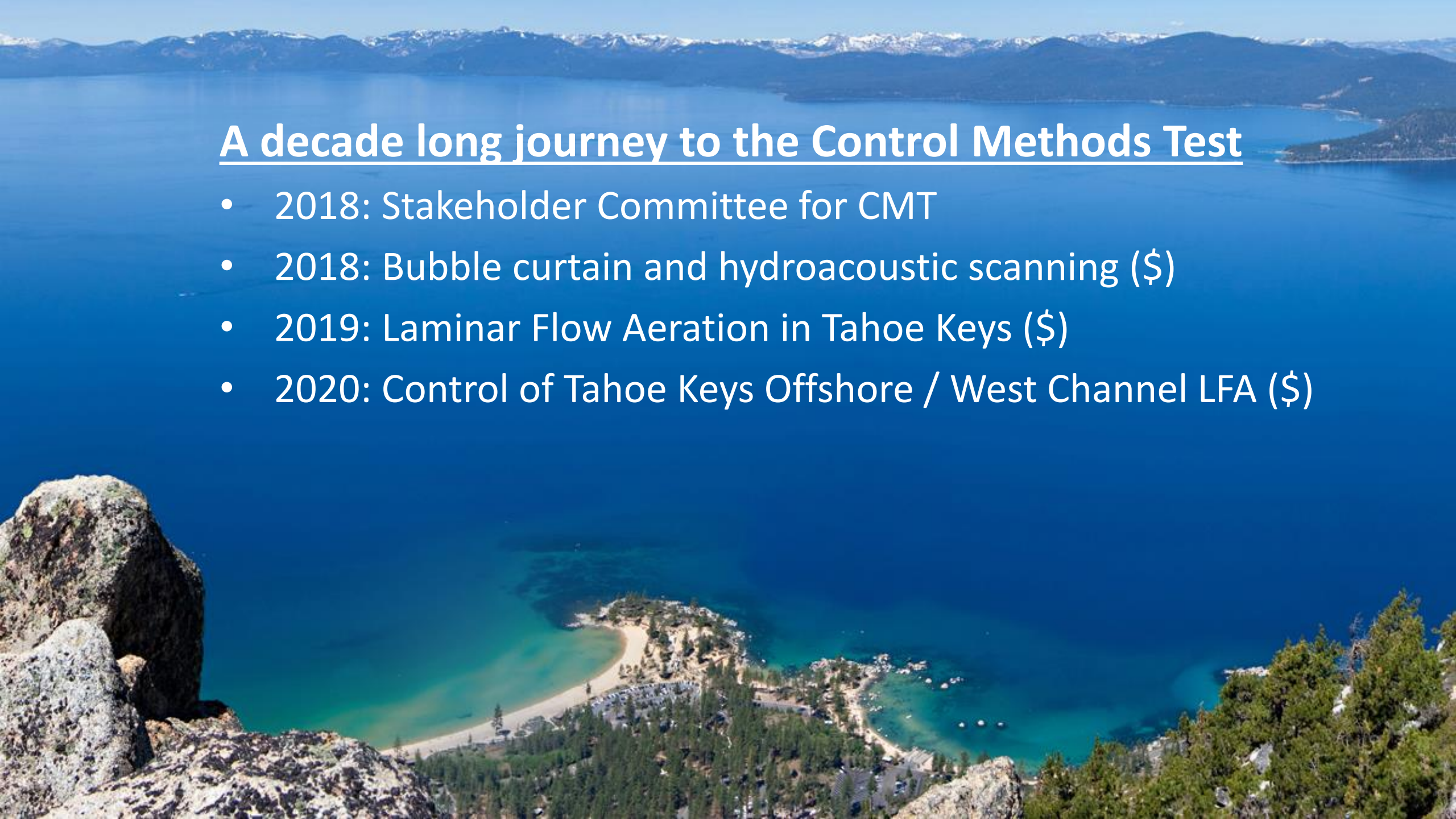
25
April 2019



A decade long journey to the Control Methods Test

- 2018: Stakeholder Committee for CMT
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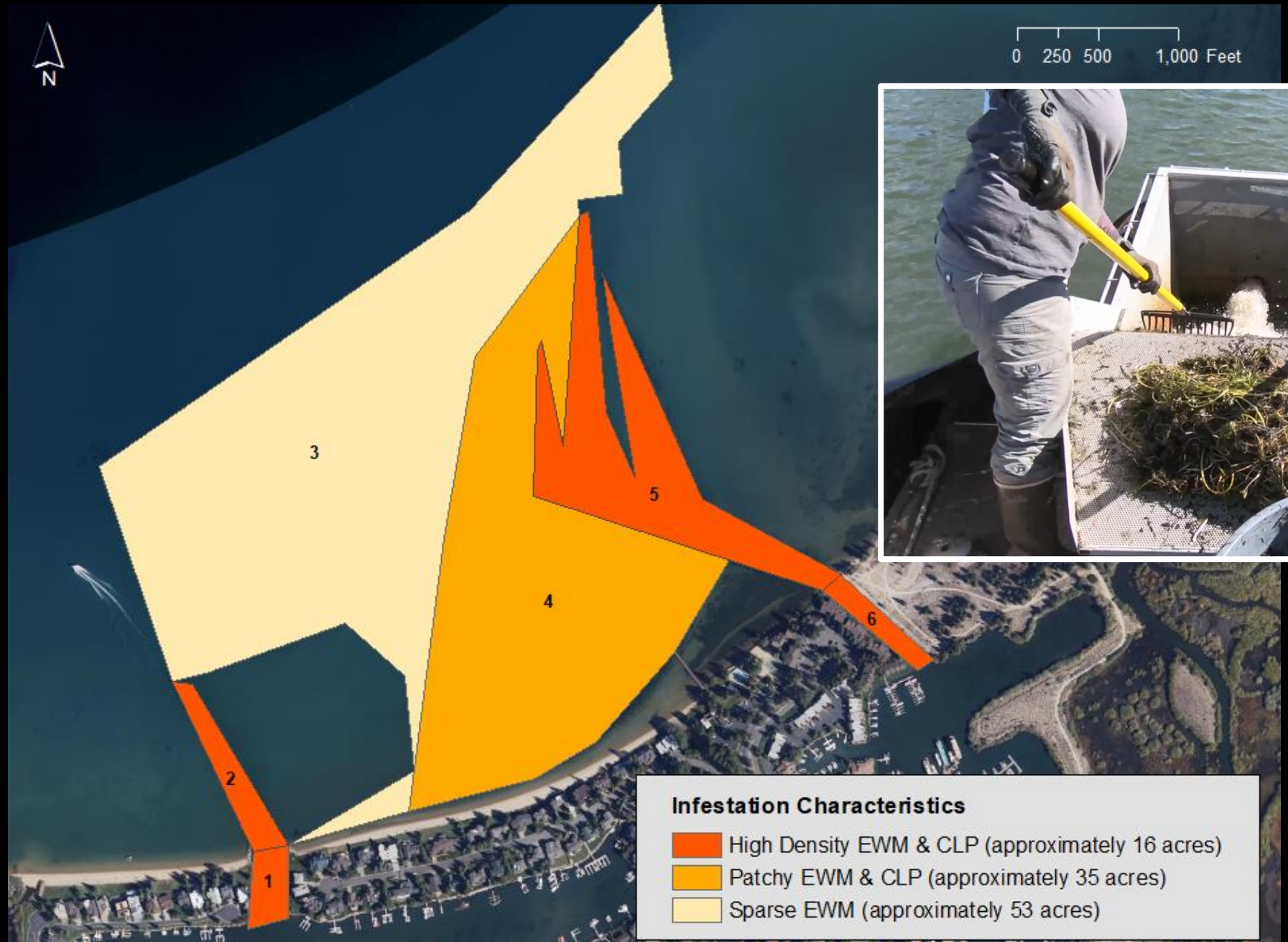
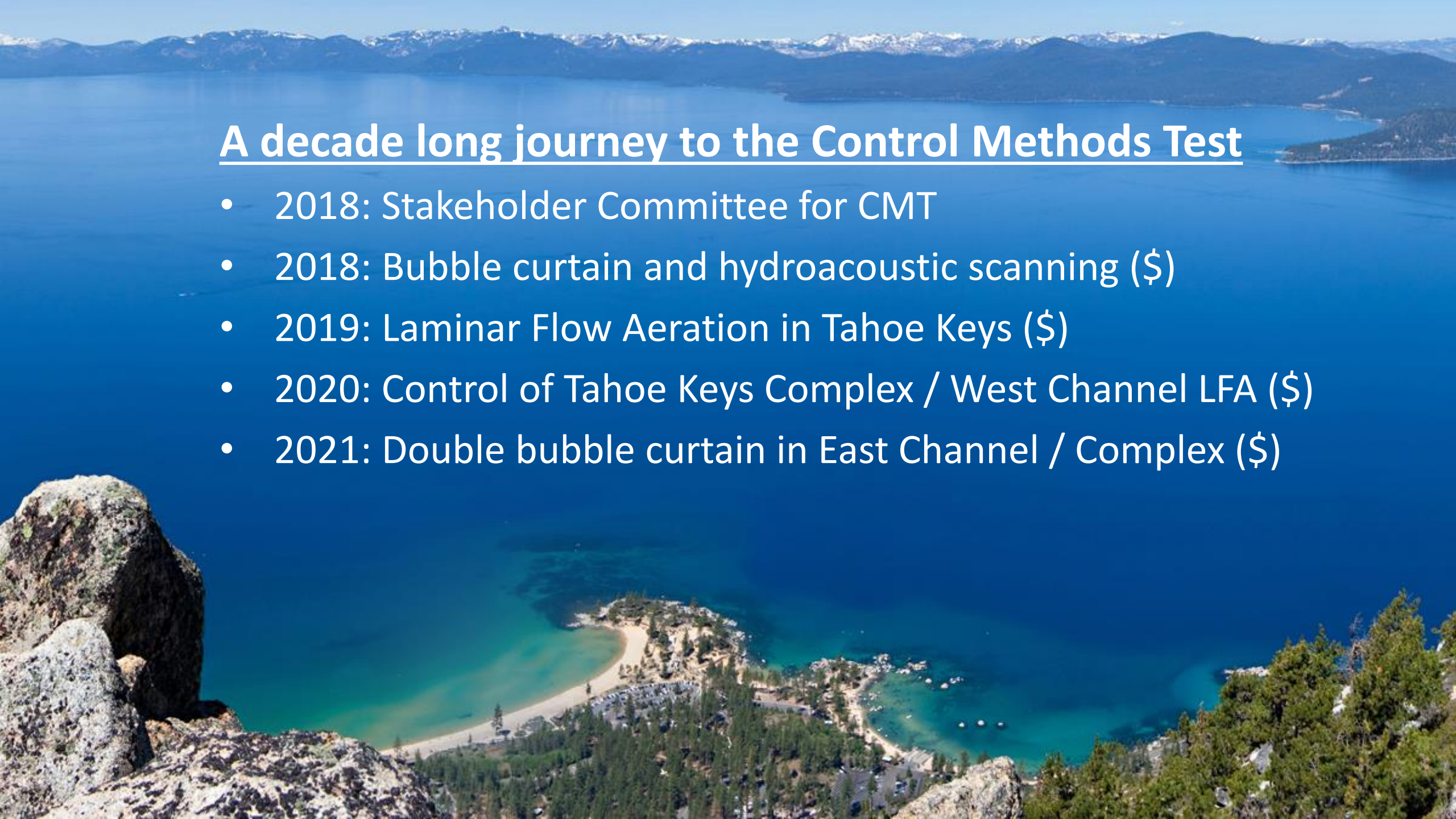
- 2019: Laminar Flow Aeration in Tahoe Keys ($)
- 2020: Control of Tahoe Keys Offshore / West Channel LFA ($)

Tahoe Keys Offshore

August 2020

Tahoe Keys Offshore





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- 2019: Laminar Flow Aeration in Tahoe Keys ($)
- 2020: Control of Tahoe Keys Complex / West Channel LFA ($)
- 2021: Double bubble curtain in East Channel / Complex ($)

Containment

Bubble Curtain 2.0

East Channel Bubble Curtain

April 2021

A decade long journey to the Control Methods Test

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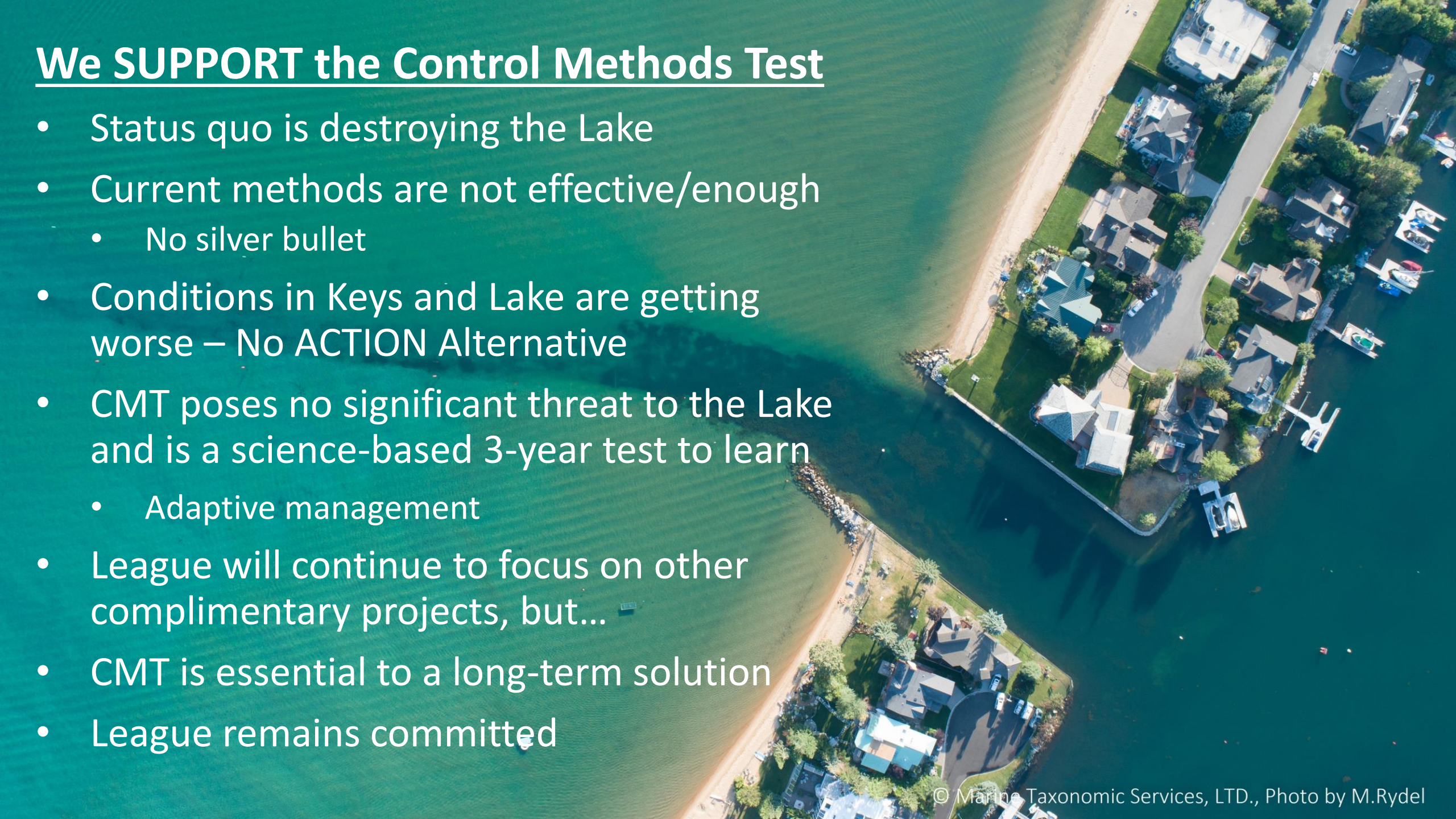
- 2019: Laminar Flow Aeration in Tahoe Keys ($)
- 2020: Control of Tahoe Keys Complex / West Channel LFA ($)
- 2021: Double bubble curtain in East Channel / Complex ($)
- 2022: CMT year-1 implementation

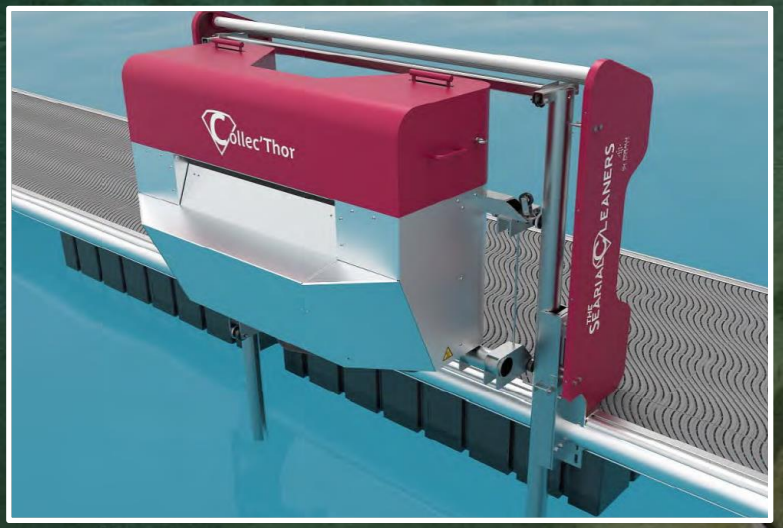
We SUPPORT the Control Methods Test

- Status quo is destroying the Lake
- Current methods are not effective/enough
  - No silver bullet
- Conditions in Keys and Lake are getting worse – No ACTION Alternative
- CMT poses no significant threat to the Lake and is a science-based 3-year test to learn
  - Adaptive management
- League will continue to focus on other complimentary projects, but…
- CMT is essential to a long-term solution
- League remains committed



Tahoe Keys Complex - East Channel Containment

Complete AIP removal, maintenance and monitoring with improved fragment control

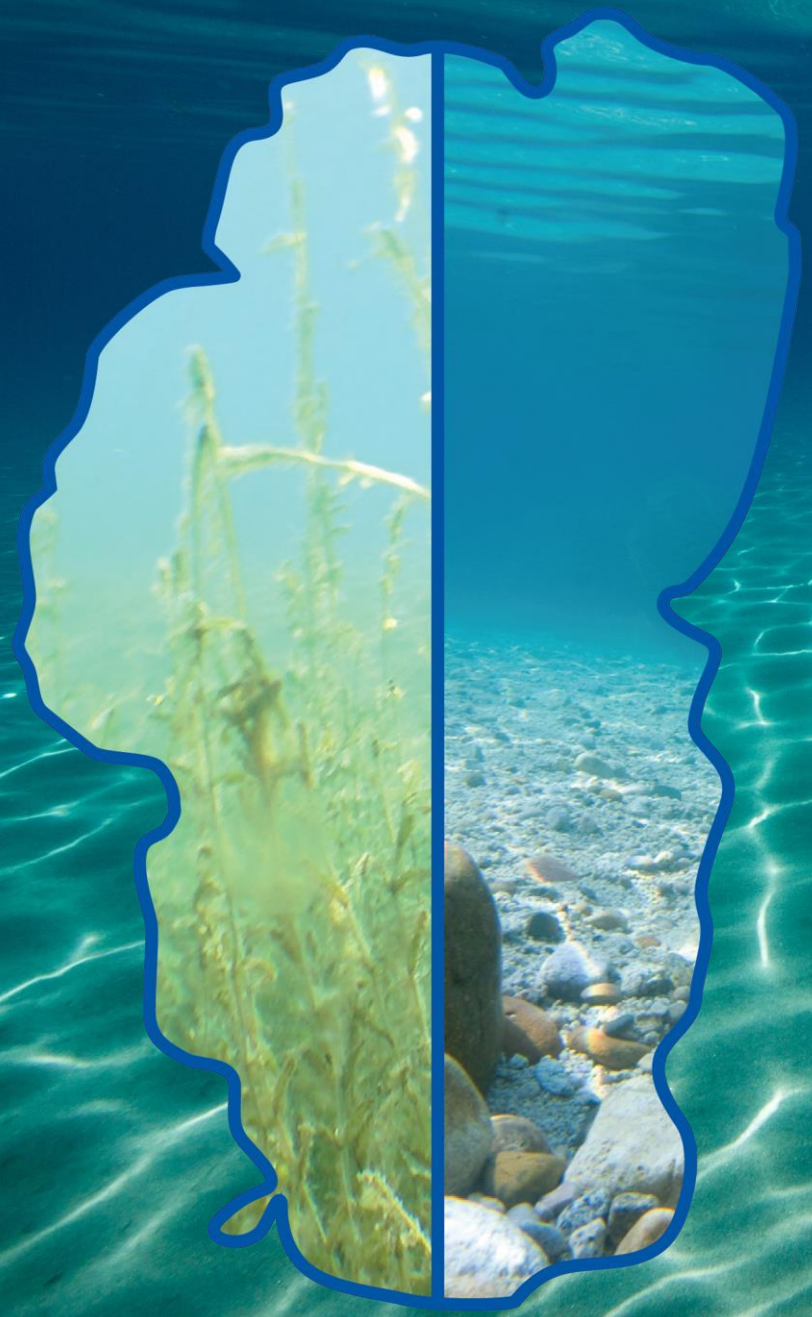


Legend

- Bottom Barriers / Hand-pulling
- Bubble Curtain
- CollecThor
- Pixie Drone
- Suction / Hand-pulling
- UV-C Treatment

N

500 ft



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LAKE TAHOE
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Summary

TAHOE
REGIONAL
PLANNING
AGENCY

- Urgency
- Epic collaboration & coordination
- Comprehensive monitoring and protections
- Encouraging results from the first year
- Next steps
- Complementing efforts
- Finding a solution is critical

Thank you

www.TahoeKeysWeeds.org

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TAHOE REGIONAL PLANNING AGENCY

Tahoe Keys PROPERTY OWNERS ASSOCIATION

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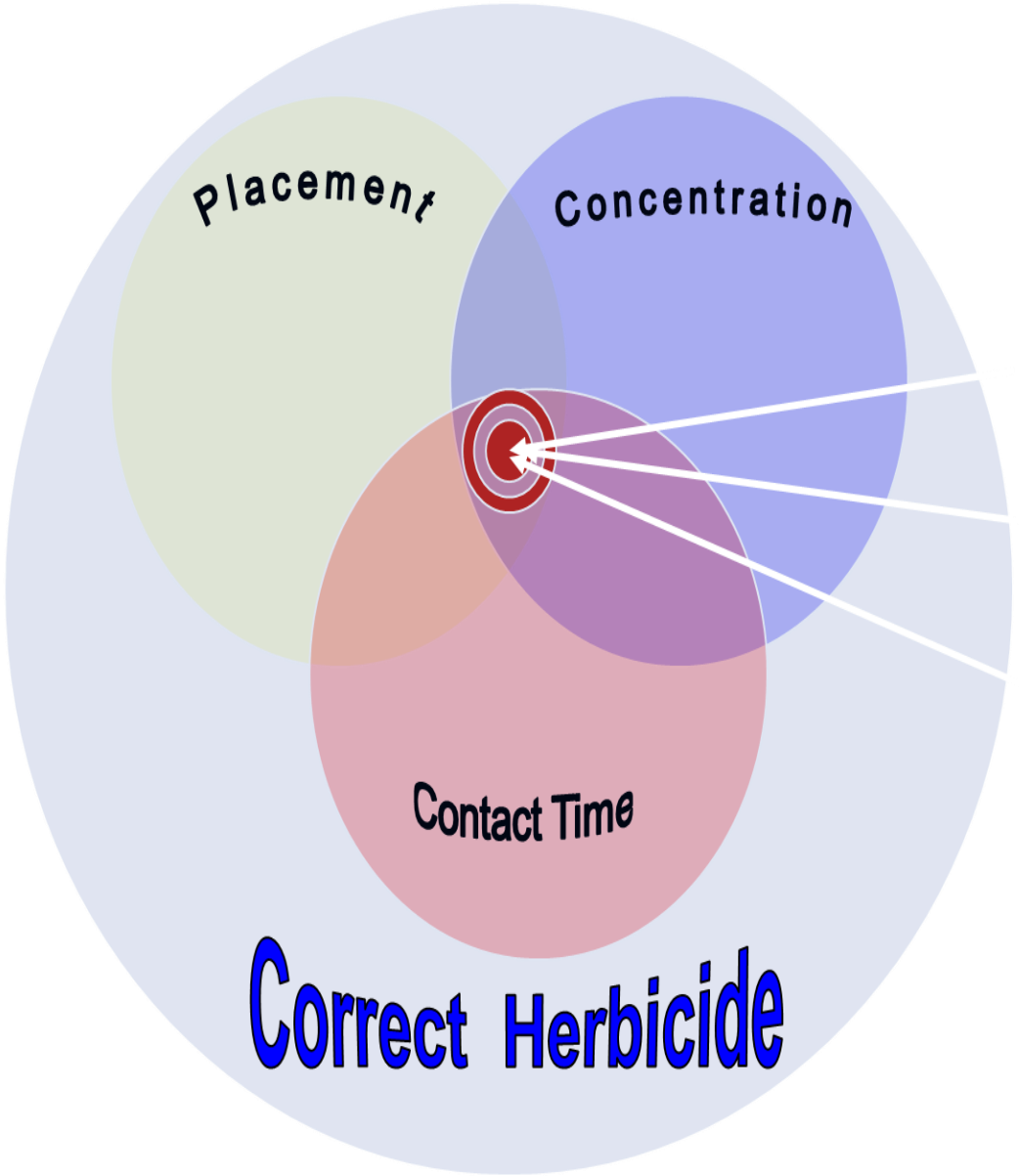
Extra Slides/ follow up if needed

Obtaining Optimal Effectiveness of Aquatic Herbicides



Eurasion watermilfoil

Curlyleaf pondweed

Coontail (Hornwort)

CMT Used ”Selective” Aquatic Herbicides:

>They do not harm desirable native plant *Elodea canadensis*

Endothall (2 ppm): Controls All three target plants

(“Mainly Contact”= shorter control)

Triclopyr (1 ppm): Controls Eurasian watermilfoil

(“Systemic”=longer control)

Monitoring: Nutrient Results Summary

- Nutrients (nitrogen and phosphorous) in all CMT sites and Un-treated Control sites were above regulatory levels
- Some nutrients were elevated in Endothall-only sites and Triclopyr-only sites
- Nutrients were lower in LFA site compared to controls
- UV treatments had less effects on nutrient levels

Monitoring: Quality Results Summary

- pH was above regulatory ranges in Controls
- Herbicide treatments brought pH into regulatory range in many sites.
- Dissolved oxygen was depressed in all sites near the bottom and in mid-depth in Endothall and some Triclopyr sites
- Turbidity was very high in Endothall only sites
  (generally in all of ”Area A”)
  >This probably slowed degradation of Triclopyr
- Temperature was not affected by UV treatments.

Triclopyr Degradation in Area A

(Different lines are from separate monitoring stations in Area A)