

August 27, 2025 Testimony to TRPA Governing Board and TERC Director Stephanie Hampton

Concerning the 2024 and 2025 State of the Lake Reports

Alan Miller, Civil and Environmental Engineer

Last week when your agenda came out about the presentation planned for the State of the Lake report with last year's data, I dove in to follow up some comments I sent you last month on the Johannesson pier related to water quality, microplastics and the Total Maximum Daily Load regulations here in the basin. You have my written comments in the form of an updated independent water quality report with my engineering perspectives on the data from the last several years of reports and TMDL program. I suggest you read it.

It shows Lake Tahoe is in a crisis and what it points to is a need for change. Change the approaches to regional management, change the regulations to accord with the laws, both at TRPA and the Lahontan Water Board, and implement the existing laws in place to protect the environment. You need to stop ignoring the waste discharge prohibitions in your own regional plan and cease approving of plastic shorezone structures that have contaminated the lake with microplastics. You need to clean up the toxic mess you have caused and created. You need to do a much better job of evaluating environmental impacts and stop being the Tahoe Regional Piecemealing Agency.

My analysis concludes that the TMDL for Lake Tahoe with your partners in CA and NV has not halted and will not halt the continued decline of clarity and overall lake health. If I am correct, and I challenge anyone to refute my findings based on scientific evidence, it means that

restoration promises under it are not possible, if they ever were. While some valuable restoration work has been accomplished I think in other ways it was perceived as a license for business as usual as long as the municipalities meet their load reduction targets, and that isn't working.

The State of the Lake Reports are the annual "report cards" for the agency actions basin-wide and it's another "F" this last year. They are the most important monitoring reports because that is all TRPA has to track the effects of its activities on the most-important threshold, water quality. The inactions to change and cumulative project effects TRPA has ignored for so long are now evident with the ongoing declines in water quality, a situation that will not reverse with status-quo management.

My report points out that TERC, the Lahontan Water Board, and to some extent TRPA, is under new executive management. Time will tell if any these people are leaders with followers. They are limited by those they serve, the boards, and that's what's led to this moment. Lake Tahoe is at a tipping point, so they need empowerment and help to make wise changes. Unless some large initiatives are started now, it looks like its 60 feet of clarity or less from here on out, and that Lake Tahoe will become a toxic pit filled with microplastics while the cash cow is milked to death. It's like asking TRPA to grow new eyes, a brain, a heart and hands to change course. That's what's needed. You have my recommendations.

**An Independent Report on Lake Tahoe Water Quality**  
**Based on a Review of Available Public Information**  
**Part 1: A Conceptual Model for Lake Tahoe**  
**with a Focus On Microplastics and the**  
**Total Maximum Daily Load Regulation for Lake Tahoe**

By

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South Lake Tahoe California

August 26, 2025

(Note to the reader: the information in Part 1 of this Report was first provided in Public Interest Comments to the Tahoe Regional Planning Agency Governing Board, meeting of July 23, 2025, Agenda item X.A. Remand of Appeal Stock/Johannessen Single-Parcel Pier Permit, and has been reformatted here without substantial revision other than removal of project-specific comments and findings.)

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*Keep Tahoe Pure; Microplastics Endure*  
*Use Wood, Metal and Stone in the Shorezone*

## GENERAL COMMENTS WITH REGARD TO WATER QUALITY

### WATER QUALITY STANDARDS

The USEPA implements water quality “standards” pursuant to the federal Clean Water Act, and has formally (and legally) delegated most program implementation to the states, with certain exceptions. The CA Water Boards implement the CWA under the California Water Code which preceded the CWA. TRPA has a role in federal CWA water quality planning. I am not familiar with NV water quality laws, which likely do not exceed CA’s.

CA doesn’t have water quality “standards” per se for Lake Tahoe as in the CWA; you won’t find that term in the CA regulations. CA has designated “beneficial uses” for the surface and ground “waters of the state” and narrative and/or numeric “water quality objectives” that support those beneficial uses, and may also prohibit disposal of wastes of certain types or in certain areas, i.e., sewage wastes are prohibited in the Tahoe basin. It also has a “non-degradation” objective for high-quality waters such as Lake Tahoe that are generally expected to support all beneficial uses, though it has not been very skillfully or effectively employed, as in the case of Lake Tahoe which has been allowed to degrade for decades, impermissibly in my view, to this day.

### CALIFORNIA’S WATER QUALITY CONTROL PLAN FOR LAKE TAHOE

Lahontan Water Board has its Water Quality Control Plan for the Lahontan Region, or “Basin Plan” which contains regulations implemented in permits called “waste discharge requirements,” which are Board orders, and other regulatory actions. The principal charge on the Lahontan Water Quality Board is to control the discharge of “wastes,” broadly defined, that may adversely affect water quality to the detriment of beneficial uses using the narrative and numeric water quality objectives and prohibitions when allowing waste discharges. See the Lahontan Basin Plan at [https://waterboards.ca.gov/lahontan/water\\_issues/programs/basin\\_plan/](https://waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/) for details.

### PROHIBITIONS ON WASTE DISCHARGES

Probably the first things to understand are general prohibitions (Basin Plan, p 4.1-1). Violation of these prohibitions may result in fines or other sanctions from the Water Board, or it may simply look away and take no action in its discretion. Sometimes prohibition is the best means of control. Applicable Basin Plan prohibitions include, and are not limited to, the following:

#### Regionwide Prohibitions

1. The discharge of waste that causes violation of any narrative or numeric water quality objective contained in this Plan is prohibited.

2. Where any numeric or narrative water quality objective contained in this Plan is already being violated, the discharge of waste that causes further degradation or pollution is prohibited.

3. The discharge of waste that could affect the quality of waters of the state that is not authorized by the State or Regional Board through waste discharge requirements, waiver of waste discharge requirements, NPDES permit, cease and desist order, certification of water quality compliance pursuant to Clean Water Act section 401, or other appropriate regulatory mechanism is prohibited.

If a waste-generating activity is not “exempt” it’s supposed to be regulated in some way. Prohibitions specific to Lake Tahoe are in Chapter 5, for example:

1. The discharge attributable to human activities of any waste or deleterious material to surface waters of the Lake Tahoe HU is prohibited. An exemption to this prohibition may be granted whenever the Regional Board finds all of the following:

- a. The discharge of waste will not, individually or collectively, directly or indirectly, adversely affect beneficial uses, and
- b. There is no reasonable alternative to the waste discharge, and
- c. All applicable and practicable control and mitigation measures have been incorporated to minimize potential adverse impacts to water quality and beneficial uses.

2. The discharge attributable to human activities of any waste or deleterious material to land below the highwater rim of Lake Tahoe or within the 100-year floodplain of any tributary to Lake Tahoe is prohibited.

## BENEFICIAL USES OF WATER

Beneficial uses may be adversely affected (discussed blow) by plastic structures in the Lake Tahoe shorezone and there are reasonable alternatives for such plastics use to mitigate this source for new or replacement structures; wood, metal and stone/concrete. It all ties back to the beneficial uses and objectives. What are the beneficial uses of the waters of Lake Tahoe that may be adversely affected by microplastics, and cumulatively with all the other project-sources of microplastics? Definitions of Beneficial Uses are listed and described in Chapter 2. I’ve left some descriptions in below while leaving most out as self-evident and included only those I assert may be adversely affected by microplastics:

Agricultural Supply. Aquaculture. Preservation of Biological Habitats of Special Significance (refuges, parks, sanctuaries, ecological reserves, etc.). Cold Freshwater Habitat. Commercial

and Sportfishing. Tribal Tradition and Culture (uses that support the rights or lifeways of California Native American tribes). Freshwater Replenishment. Ground Water Recharge. Industrial Service Supply. Migration of Aquatic Organisms. Municipal and Domestic Supply. Industrial Process Supply. Rare, Threatened, or Endangered Species (uses that support habitat necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened or endangered). Water Contact Recreation. Noncontact Water Recreation (uses not limited to, picnicking, beachcombing, aquatic life study, fishing, sightseeing, and aesthetic enjoyment). Spawning, Reproduction, and Development (uses of waters that support high quality aquatic habitat necessary for reproduction and early development of fish and wildlife. Subsistence Fishing. Tribal Subsistence Fishing. Wildlife Habitat (uses for preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl). Water Quality Enhancement.

#### Potential Significant Impacts to Beneficial Uses

Without going into detail on each, I assert legitimate arguments could be made that any or all of the above beneficial uses may be adversely affected by toxins in microplastics, or affected aesthetically such as by clarity loss from microplastics. There is plenty of info in the literature, with more coming every day, about the toxic effects of plastics on human health and the environment. There is very little encouraging news that way, with too many plastics of too many types to study, assess and manage, testing difficulties and lack of specific regulatory standards and/or regulations. There are no unaffected control sites; plastic contamination is global. Thus, the need for narrative objectives (i.e., no toxins in toxic amounts) and prohibition requirements (to prevent) come into the water quality control picture.

#### Global Microplastics

There has been blindness to the insidious and widespread contamination of the global environment with microplastics by regulatory agencies of all stripes, including *every agency* at Lake Tahoe with authority over pier approvals. They are following the failed USEPA policies on plastics that have resulted in contaminating air, water, soil and all biologic organisms with man-made toxins at detrimental levels. Evidence of the notorious contamination of Lake Tahoe with microplastics has not restored sight to the blind as yet, the idiotic abandonment of the precautionary principle by all with regard to approving new sources of microplastics in the shorezone. This has continued through my appeal in 2022 of a project involving microplastics (hear my recorded testimony at the September 2022 meeting of the Governing Board), my litigation over same, my public comments and petitions to TRPA, the Water Boards (State and Regional) and other agencies over marinas and piers as prime sources of microplastics in Lake Tahoe in 2022 through 2024, and my Petition and other writings to TRPA concerning

microplastics in 2025. They violate their charges routinely under blind, rote permitting policies, just as here; with TRPA it is done under fraudulent environmental review requirements.

### Controlling Impacts of Microplastics - Prevention

There is information to indicate that exposure to microplastics adversely affects growth and development of plants and wildlife, is generally “deleterious,” and that plastics and toxins in plastics concentrate up the food web to contaminate benthic organisms, algae, copepods, fish, waterfowl, birds, bears and other wildlife, even crossing the blood-brain barrier in humans. Plastics may contain “heavy metals” such as lead (Pb) and other additives which are also toxic. Particles of microplastics shed from the piers may tend to disperse in the water while heavier components may settle out and deposit on the bottom in a zone around them that has toxic elements in the sediment that can be taken up by people (swimmers), and aquatic and terrestrial organisms.

Prohibition and prevention therefore looms large as the primary cost-effective means for control of microplastics at Lake Tahoe—and elsewhere. I further assert microplastics from approved projects have already caused or contributed majorly to microplastic contamination in Lake Tahoe and recognition of the fate of such plastics in the Lake Tahoe environment is needed, for instances, when planning new proposed piers and conducting marina “master planning” at the Tahoe Keys Marina to redress toxic plastic discharges. Humans may be able to eventually treat the water they drink to make it safe, while wildlife and aquatic organisms must live with or within and survive amidst the toxins.

### WATER QUALITY OBJECTIVES

What are the relevant CA water quality objectives for microplastics? There are many, and again I will cite those I see as most threatened by microplastics (Basin Plan Chapter 3).

Toxicity: All waters shall 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. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration and/or other appropriate methods as specified by the Regional Board. The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge. . . .” (Basin Plan, p 3.7).

Numerical objectives are not available for all plastics in use but there are objectives for certain chemicals in plastics and the regulations include a “catch-all” phrase under “Chemical Constituents” (the last part):

Waters designated (for municipal supply) shall not contain concentrations of chemical constituents in excess of the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in the following provisions of Title 22 of the California Code of Regulations, which are incorporated by reference into this plan . . . . Waters shall not contain concentrations of chemical constituents in amounts that adversely affect the water for beneficial uses.”

The above are just some of the relevant water quality “standards” pertaining to microplastics. Lake Tahoe Clarity is a separate distinct objective that is not being met while further “consistent degradation” (per TERC) is allowed to continue. Read Basin Plan Chapter 5 for details.

## **ANALYSIS OF TAHOE ENVIRONMENTAL RESEARCH CENTER REPORTS**

### **INTRODUCTORY GENERAL COMMENTS**

The comments in this section provide my independent review of the 2024 State of the Lake Report for Lake Tahoe published by Tahoe Environmental Research Center (TERC), with a focus on the Clarity Appendix and microplastics for purposes here. TERC has issued their reports annually for many years reportedly, among other reasons, to guide restoration efforts at Lake Tahoe. They don’t really say how that happens, how data and research is used to inform and guide policies, say of the TRPA or the CA Regional Water Quality Control Board, Lahontan Region, or the U.S Army Corps of Engineers or USEPA, which has a Tahoe office. They put certain information like the State of the Lake Reports out for the general public and lay agency decision-maker, while presumably working “behind-the scenes” with the agencies, and agencies can do what they want with them. From what I can tell, the agencies don’t do anything with the reports, beyond perhaps reading them.

My challenge to TRPA and the others is to point to one thing, just one, in their policies over the last decade that have changed as a direct result of “following the science.” TRPA may add their *spin* to the reports; I don’t presume the researchers are free of influence from their funders. Even if that is untrue, there are compelling trends showing consistent degradation of Lake clarity and water quality, and other plagues. TERC presents their data and the merest discussions providing their interpretations, reasons unknown. These comments therefore augment the limited discussions provided by TERC and others (TRPA).

### **A BATHTUB MODEL FOR LAKE TAHOE**

First I want to present a conceptual model for Lake Tahoe, an analogy that ought to help clarify for all what is going on with Lake Tahoe clarity and the overall water quality for which it is an indicator. I call it LAKE BATHTUB.

(For an informative video depicting the sides and bathymetry of the bathtub along with a brief historical perspective/facts see this link from UC Davis Tahoe

<https://www.youtube.com/watch?v=1kxySVKiWfU>.)

See below the screen shot from a U.S. Geological Survey public report showing Lake Tahoe with the rim shaded by rock type. Visualize Lake Tahoe as a bathtub, but a very, very cold, deep one that holds an extraordinary amount of what was once ultra-pure water since the last glaciers retreated over 11,000 years ago. The Washoe people occupied the Lake Tahoe region since then, until they were booted out 100-150 years ago.

### The Rim

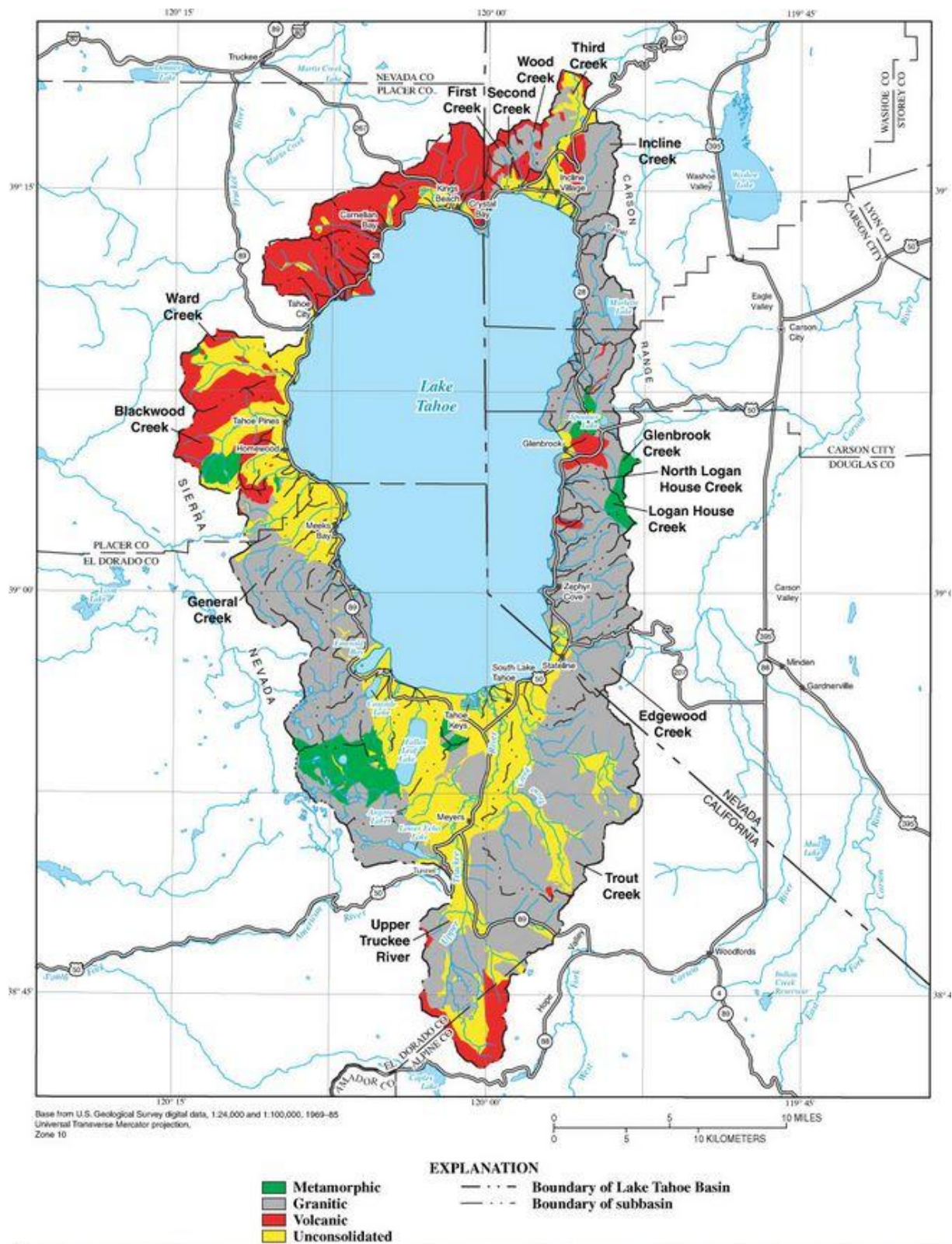
Lake Tahoe is sort of oval like a bathtub with a rim that slopes in from almost no width at the single outlet, the Truckee River in Tahoe City, to many miles wide from the headwaters of the largest tributary input, the upper Truckee River in S. Lake Tahoe. But our bathtub is not smooth-sided and the bottom is irregular, plunging to depths more than 1600 feet. It's more like one of those *plastic* bathtub spas that have the water jets built into the sides and a couple of arm rests and benches, the south shore being the shallower end of the tub. We have to include these jets in the model because Lake Tahoe has internal currents that slowly circulate waters in response to winds, thermal changes and input currents from 63 named streams that flow into Lake Tahoe. Every so often, it's like the winds or jets turn on high (or medium) and the bathtub is mixed either partly or completely from top to bottom, oxygenating the deeper waters in the process. It's very cold and dark at the bottom with tremendous hydraulic pressures and not much going on biologically.

We have the bathtub with its "rim" and its biggest inputs (> one-third) flowing in on the south shore, with Trout Creek the second largest stream input, with a discharge point in the general vicinity of the UTR. The top six feet of Lake Tahoe is literally operated to keep the bathtub from overflowing the top drain, the Lake Tahoe Dam outlet, and to provide water below Lake Tahoe in accordance with federal requirements and the complex "Truckee River Operating Agreement." All of the sediment particles that flow in are basically retained, trapped in the bathtub where they settle out or swirl about in the currents, and seldom reach the outlet except with extreme regional flooding, when the bathtub has overflowed and made quite a mess, as one might expect (e.g., 1997).

### The Showers

The bathtub sits outdoors year-round and has an omni-directional shower with twice as many showerheads on the west shore. In late-fall to early spring it receives rain and snow, the lands

to the rim get a series of “showers” that rinse all the watershed surfaces down and toward the receiving waters (streams, ground water) and storm drain outfalls to the bathtub, and carry that “annual load” or mass of substances into the tub. Sunny days are many, with the strongest sunlight in summer. That sunlight, together with wind, evaporates *tremendous* volumes of water from the surface of the bathtub—it doesn’t all go out the single river drain. That evaporation concentrates the pollutants in the remaining water over time, as salt concentrations increase from boiling water. Concentrations shall rise from evaporation effects absent dilution or other attenuation (e.g., chemical-precipitation reaction or off-gassing).



## Aerial Loading of Carbon and Particulates

The sun also heats the water and provides energy to drive photosynthesis and *primary productivity* in the upper parts where the sunlight reaches. That allows plant cells to pull carbon into the lake from the atmosphere to build their cells, whether diatoms, algae or rooted plants, another increasing “mass input” of carbon into the tub from the air that did not exist historically, before the algae now present. There never used to be significant algae; it is abnormal, let alone the toxic algae blooms in the Tahoe Keys I first reported to the Water Board in 2018. Some algae add their own toxins to water. Other air inputs are dust, ash, soot, Central Valley pesticides in wind drift from the Great Central Valley, and particulates from geoengineering, such as Desert Research Institute has conducted for six decades (without environmental impact reports) and they do not act alone as geoengineers; spraying or seeding the skies over the tub with very fine particles and soot to control the weather or get rid of toxic waste coal fly-ash has been routine for decades, globally and at Lake Tahoe. If you haven’t noticed these quite frequently in the last decade at Lake Tahoe you aren’t paying attention. (From DRI’s website:



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### Program Description

During the early 1960s, scientists from the Desert Research Institute (DRI) helped to pioneer the science of wintertime cloud seeding, developing research-based methods for increasing winter snowpack and subsequent snowmelt runoff across mountainous regions of the Western US. Since the DRI Cloud Seeding Research Program’s early days, our team of experts has conducted continuous research and development to create time-tested cloud seeding methods that are proven to enhance snowfall from winter storms. DRI’s cloud seeding projects are conducted in an environmentally safe manner, increasing the precipitation formation efficiencies of passing clouds to support the water needs of local communities and ecosystems.

DRI’s team of scientists and technicians work year-round to design, maintain, and operate successful cloud seeding projects for state, local, and federal partner agencies. During the 2022-2023 winter season (November – May), DRI will conduct cloud seeding research and operations in six mountain ranges including the Lake Tahoe Basin (CA/NV), Spring Mountains (NV), Ruby Mountains (NV), Santa Rosa Mountains (NV), the San Juan Mountains (CO), and in the Upper Colorado River Headwaters region along the Continental Divide in northern Colorado. DRI cloud seeding generators will also be operated over the Grand Mesa in western Colorado.

In addition to designing and conducting cloud seeding projects for specific partner agencies, DRI’s team monitors the results of cloud seeding operations via a network of precipitation stations. The team is also actively involved in subfreezing cloud physics research, including studies of clouds that cause icing on aircraft, and the effects of air pollution on clouds structures and storms. The cloud seeding research program is operated by DRI’s [Division of Atmospheric Sciences](#), and based out of DRI’s Northern Nevada Science Center in Reno, Nev.

[Cloud Seeding Program](#)

[What is Cloud Seeding?](#)

[Current Operations](#)

[Operating Criteria](#)

[Safety Guidelines](#)

[Equipment and Services](#)

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[NAWMC FAQs](#)

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## What Goes In, Stays In; Retention Time

Beginning to get the picture? More details follow below but basically what we have is erosion products being washed off the rim and into the tub every year, natural soils and vegetation, and products from the built environment, with some fraction being captured by upland control measures called “Best Management Practices.” Plus, substances are coming in from the air. When I was a child I often bathed in the same bath water as my three siblings. Every time one

of us, especially me, took a bath the water got a bit more clouded with the soils from our play, and then it was “down the drain” for the dirty water. Lake Tahoe is essentially the same as my childhood bathtub—with one major difference: there is essentially no drain, only a very, very slow drain, mainly for water—not pollutants. Not in our human life-span for practical purposes will the bathtub be drained of its inputs. Whatever water and other substances in the water column of Lake Tahoe are cycling there may have been there for 600 years or longer. That’s how long it takes to change all the water in the tub “on average” without overflowing the outlet drain too rapidly, *six centuries*.

### Microplastics in the Bathtub

Before leaving the “Lake Bathtub” model recall that my imaginary bathtub is made of plastic. Imagine if you will then, that you had an actual plastic bathtub that you left out in the sun and weather for 30 years or more in the Lake Tahoe weather extremes and floated about in occasionally on Lake Tahoe. What do you think its condition would be? Like new, or slowly wasting and eroding away, brittle, broken, essentially waste that is unusable? That is the fate of plastics in time. The bulk plastics shed microplastics or nanoplastics from their surfaces at that point and the plastic wastes from the boating community go into the bathtub. There are regulations against such “discharges” of toxic waste plastic, at least in CA, and they have never been enforced at Lake Tahoe or elsewhere to my knowledge, potential impacts considered “*de minimus*” by the policy-makers, not worth considering in other words.

Plastic structures *in and over waters* have been and are thus treated as “*de minimus*” sources of plastic contamination wherever they are, among many sources of plastics. So they have not been considered—until recently, and it is now being “discovered” that waters globally are contaminated with micro and nanoplastics. It’s plastic trash break-up products—but not trash only that is contaminating the waters. It is the “bathtub effect” of long hydraulic residence time that makes the accumulated contamination greater and therefore more detectable and critical at Lake Tahoe, plus the harsh sunlight and weather extremes aging the plastics rapidly. See photos of plastic-composite docks at the Tahoe Keys Marina below, pitted and flaking apart into the water, termed “friable.” The many docks there are (finally) slated for replacement. “Popcorn” is styrofoam plastic from float ballasts.

A note on trash is that many persons and organizations have removed gross tonnage of trash from the Lake Tahoe shorelines and near-shore areas in recent years, including plastics. That’s great, as these have potential to become microplastics over time. There is also work to examine microplastics in bottom sediment based on a recent news report (Lake Tahoe Tribune). The latter may be important to inform dredging activities, which could re-suspend and release plastics deposited in the sediment. Importantly, macro-plastic trash which has not disintegrated

can't account for the high levels of microplastics suspended and/or dissolved in the water column.



## The Bathtub Ring

Like any bathtub, Lake Tahoe gets dirtier and dirtier with every rinse of the watershed, and it has been doing that since the early 1960s, out of balance. The noticeable effects along the shorelines are just like a “bathtub ring”—some litter and other pollutants in runoff from the settled areas settle out or cling to the shoreline where the waters are shallow and sunlight penetrates, plants take hold, slimy rocks appear. Year after year the “ring” grows, but that has only recently been monitored and inadequately. Only the transparency in the deep waters of the open lake have a long term secchi-disc clarity record, begun by U.C. Davis professor Dr. Charles Goldman, and from these data comes the familiar “annual average” clarity graphs.

### SAVING LAKE TAHOE – HOW IT BEGAN; DR. GOLDMAN, PHD

The way I see it, Dr. Goldman came in the late 1960s (with Laurel Ames and a few others) and said (paraphrase), speaking for Lake Tahoe, “It is too much! All the sewage, all the erosion from urban development and cars driving on everything, all the meadows filled and built on, the Tahoe Keys! And all the highways with their sand and salt and cut slopes and eroding shoulders, the skiers, tourists and boaters . . . Lake Tahoe will only decline until such inputs are brought into balance with what can be absorbed and attenuated within the native threshold carrying capacity. And that capacity is being *way, way* exceeded, with plans for even more. It will be destroyed!”

Dr. Goldman was hated, threatened, and vilified in the press and elsewhere by the exploiters for his anti-development views. Most people don’t know that now that he is the revered emeritus professor in his old age. Nonetheless, he persisted and was able to get legislation passed to require sanitary sewers and export sewage basin-wide, thus buying a little time by *majorly* reducing nutrient loads to Lake Tahoe. That was absolutely critical. There were some lawsuits by the League to Save Lake Tahoe that stemmed some development, e.g., at Emerald Bay. The Tahoe Regional Planning Agency was born out of the perceived crisis in the bathtub, and the Lahontan Water Board established a primary office in the Tahoe basin, with a focus on reducing storm runoff and erosion from development. Another notable Goldman was Steve at the CA Tahoe Conservancy, a close associate, an erosion control expert and watershed restoration leader for two decades.

### The Contentious TRPA Shoreline Plan and Boating

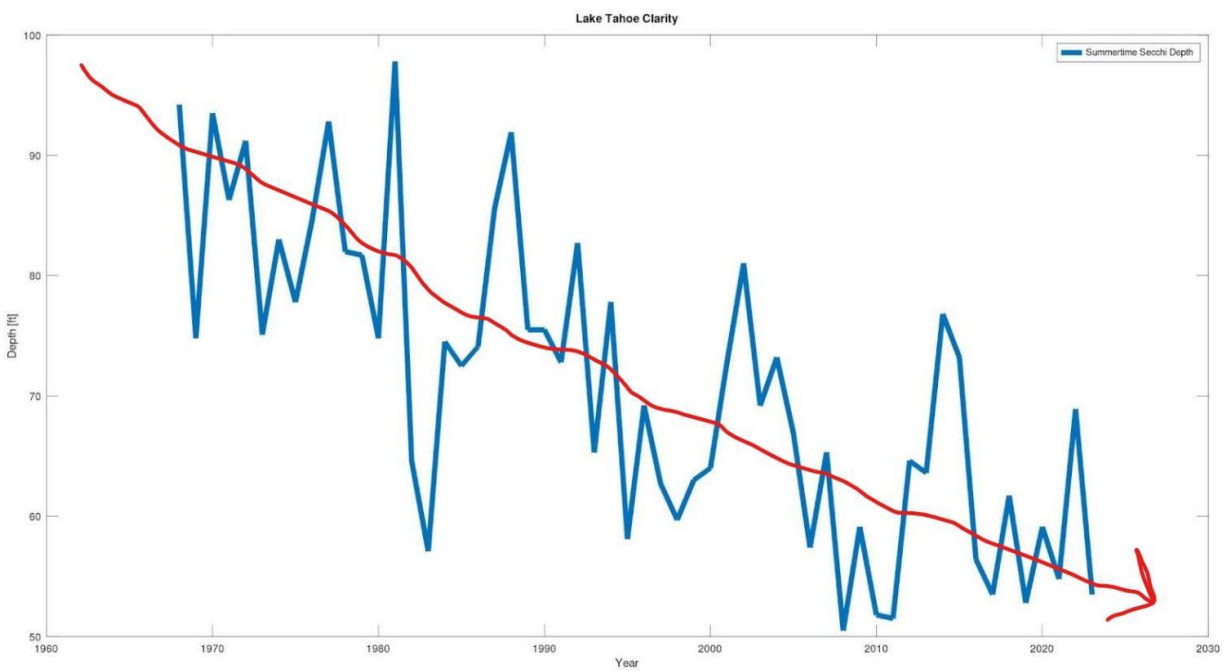
There was a multi-decade wresting match with TRPA over their plans and regulations, not including the many illegal regulations I have pointed out and will again here with Enclosures, particularly for the “shorezone.” The latter has always been contentious with shoreline or “littoral” property owners. Large boats had to stop putting sewage and bilge water into the bathtub. Other than that, boating activities got no attention other than the marinas and piers,

which *installations* came under the permitting thumbs of the TRPA and the Lahontan Water Board (where I worked first-hand with permits for them for over two decades) and other agencies. There was evidence that boat fuel-oil from two-stroke marine engines was fouling the waters and, to TRPA's credit, it enacted a controversial two-stroke engine "ban" that had nationwide ripples in the industry.

#### The Total Maximum Daily Load Regulation

The next major regulatory development at Lake Tahoe involved a substantial "makeover" to put a new face on an old regulatory program—namely, controlling erosion. This was called the "Total Maximum Daily Load" and is not actually Total, Maximum, or Daily. This regulation, developed by the states of CA and NV and adopted by the U.S. Environmental Protection Agency, was intended to describe the mentioned carrying capacity for *annual* pollutant inputs, namely particles, and dissolved nitrogen and phosphorus ("nutrients" N and P that feed algal growth). Pursuant to federal Clean Water Act requirements and designations of Lake Tahoe as "Outstanding National Resource Waters" for which no long-term degradation is permissible, the TMDL was focused on reversing decades-long clarity declines to restore historic clarity. I will comment more on the TMDL further below, and mention here that it shifted the restoration focus to eroded and other particles that were tiny, tiny *nanoparticles*, 20 micrometers ( $\mu\text{m}$ ) or less, due to the way they affect light and thus "clarity" – a measure of how far light penetrates. The TMDL was born in 2011 and was loosely joined with the prior Environmental Improvement Program (EIP), a TRPA program to track projects toward restoration goals, projects by others (mostly). Status *quo* is implementing these failing programs. We have to get into the details of the clarity reports for the information to support that last statement.

## COMMENTS ON THE 2024 STATE OF THE LAKE REPORT



### Observations on Clarity and Upwelling in 2023

The graph above shows average summer water clarity using TERC data (the spikes). I drew the red line. See Enclosure 1, also. There is an admission the summer averages are trending badly, "consistent degradation." The first graph has the annual averages of clarity measurements and the text is: "The greatest individual value recorded in 2023 was 123 feet (37.5 m) on March 2. This was the result of an ephemeral lake 'upwelling.' Upwellings are episodic events produced by strong winds and are not reflective of the overall lake clarity and health. The lowest clarity reading was 26.2 feet (8 m) on May 24." The greatest individual clarity value in 2023 is 123 feet, and is among the 12 highest values in the 55-year record. Before that event, in 2023 the clarity was likely closer to the winter averages, say 70 feet.

This post-upwelling water clarity was an anomaly per the report, something that happens randomly at varying intervals and extents: the Lake mixed from top to bottom due to strong winds, bringing clear water up from the great depths to dilute the surface-layer contaminants versus more usual conditions when the Lake is temperature-stratified. In the "overturn" the surface-layer pollutants may have been sent to the bottom or settled more quickly, or some combination of these things may have occurred. In addition, in the months prior to March 2, 2023, the Tahoe region was generally in a deep freeze, with a record snowpack building and limited runoff, which runoff continued through April and into May when things really began to melt and move.

As noted in TERC's 2023 State of the Lake Report (p 5):

The minimum reading of 8 m (May 24, 2023) is the lowest ever recorded in the history of continuous Tahoe monitoring (since 1968). On this day, the field team remarked on how much greener the water appeared and that the zooplankton tows collected significant amounts of algae. A 'live' phytoplankton sample (an equal composite of water samples collected at 5 and 10 m water depth) was collected and analyzed by TERC using a light microscope 72h later. Observations of Asterionella, Dinobryon, Staurastrum and Cosmarium were recorded with these latter two species potentially contributing to the green color observed.

Nice observations, but lacking any explanations. As noted, the lowest reading, 8 meters or 26.2 feet, was on May 24. That's 97 feet of clarity drop in two months. Apparently there was significant algae growth *on and before* May 24, 2023 based on the report; it didn't all grow on May 24. That observation may be attributable to the increased water clarity (during winter 2022-2023, especially March) increasing the depths to which sunlight could penetrate and stimulate algae growth, combined with the influx of nutrients from the depths that accompanies upwelling. After that upwelling Lake Tahoe set a new record-low for being clouded with sediments and algae.

#### Dilution Masks Pollution

Since water clarity was at an anomalous high when the massive 2023 runoff year began all that clear water near the surface received the load of sediments and other pollutants in the runoff. If that complete mixing hadn't occurred right before the big runoff, clarity would have dropped, not from 123 feet, but more like from 70 feet. In other words, all that clear water was there to absorb and attenuate the surface impacts. Had that not been the case, clarity would have likely dropped to even far less than the 26.2-foot minimum value observed. The average of these extreme winter values is  $(123 \text{ feet} + 26.2 \text{ feet})/2 = 74.6 \text{ feet}$ . That's a bit higher than the annual average clarity of 71.9 feet in 2022. That average of the extreme values is even clearer than the winter averages of recent years and makes *the annual average* of 68.2 feet in 2023 look *fantastic* based on the spring sediment load delivered—but it is actually just the opposite because the upwelling was an anomaly. It was pure luck that it *occurred right before* the most heavily-loaded runoff season in decades began, delivering way more particulates and dissolved nutrients than any "annual average" years. The *fantastic* is misleading with regard to what really occurred, more like *fantasy*.

Even so, that anomalous clarity event can't realistically be taken out of the record; it affected not only the March 2, 2023 measurement with an extraordinary "boost" in clarity, but elevated ALL the subsequent measurements in 2023, if not beyond that time. That's why 27 secchi disc

measurements, including the extremes, produced an average annual value of 68.2 feet. What we could do for estimation purposes is assume some winter value closer to the average, say 70 feet, and that the upwelling didn't occur in 2023. Then the "average" with the extreme loading would be LESS THAN  $(70 \text{ feet} + 26.2 \text{ feet})/2 = 48.1 \text{ feet}$ . It would be less than that because the minimum value 26.2 feet would have likely been much less without the attenuating effects of the upwelling event. Say minimum clarity went to 20 feet instead of 26.2 feet: in that case the average would be  $(70 \text{ feet} + 20 \text{ feet})/2 = 45 \text{ feet}$  as an estimate, etc., *way below the average*.

### Consistent Degradation Reflects Overall Lake Clarity and Health

The effect of including the anomalous high clarity readings on the time-series graph of annual averages over the years is to make the "best fit" curve show greater clarity values, possibly even showing the rate of clarity loss is slower, when the long-term graph of annual averages appears to be approximately parabolic (exponential) with a substantial decreasing trend until very recently. Average annual clarity is decreasing monotonically over time, "consistent degradation" in the words of the TERC report. The main point with the mixing is that it sort of saved the 2024 annual average clarity graph from showing much steeper declines than would otherwise be evident, and the second point is no one can predict when or if the next turnover event will occur and so it is ". . . not reflective of the overall lake clarity and health," as stated in the report. The clarity measurements are real, but they have to be analyzed in terms of the statistically "lucky break" that was the timing and duration of the upwelling.

### UPPER TRUCKEE RIVER MARSH RESTORATION

Another thing to consider is the UTR is the largest urban stream and the largest tributary to Lake Tahoe in the basin, and together with Trout Creek, another substantial urban tributary, passes through the now somewhat-restored Upper Truckee River (UTR) marsh. The UTR/marsh restoration project may therefore provide the largest and most important sediment trap in the basin. I say somewhat-restored because the Tahoe Keys subdivision and marina still occupies a large part of the UTR marsh, formerly the largest wetland complex in the Sierra-Nevada mountain range. The restoration by California Tahoe Conservancy has so far not eliminated the straightened reach of the UTR adjacent the marina harbor, a major conduit for sediment delivery to Lake Tahoe at times of extreme runoff and flooding, though flow pressures on it have been eased by other restoration activities to an extent. The restoration in the lower reach between US 50 and Lake Tahoe was largely functional in 2022-2023, starting before 2018 if memory serves (it was a staged affair). If it hadn't been functional, May clarity in 2023 would likely have been worse, no doubt, so "yay" for that project! Nonetheless the effects of UTR restoration still don't really "show up" markedly as an attenuator in the graphs of seasonal or annual clarity averages since 2018.

## THE TMDL HAS NOT ALTERED CONSISTENT DEGRADATION

The foregoing analysis points to a much more critical water quality condition with regard to clarity in Lake Tahoe than a mere reflection on the “average” graphs provides. The averages only tell part of the story with regard to the extremes, and with important implications for the Total Maximum Daily Load (TMDL) regulation enacted in 2011. The TMDL was the product of a multi-year state-led computer modeling estimation tool, The Clarity Model, developed by the CA Water Boards and NV Department of Environmental Protection under both encouragement and duress from US Environmental Protection Agency to meet federal Clean Water Act requirements. This modeling was accomplished with the aid of researchers and others, including TRPA, USFS\_LTBMU, UC Davis and UC Reno, Desert Research Institute, local governments, etc. Since late 2011, despite meeting annual TMDL pollutant reduction targets for runoff from the urban areas the clarity graphs have continued to show only “continued degradation.” Claims that winter clarity averages “are steady” and have ceased declining may be largely attributable to the “average winter clarity” of Lake Tahoe in 2022-2023 (91.9 feet) compared to the prior year as affected by the extreme measurement of 123 feet on March 2, 2023, late winter. Pollutants continue to accumulate more rapidly than they can be attenuated, even with the latest “upwelling” and thus average annual clarity continues its decline, albeit more slowly graphically thanks to the luck of the high winds that caused the turnover/upwelling.

Looking at the graph of individual secchi depths for 2021, 2022, and 2023, you can see there was another extremely clear winter reading at that index station in early January 2022, approximately 138 feet! One would postulate that this would improve the readings for at least a time if not the whole year. However, just days later readings returned to around 75 feet, declined thereafter to around 55 feet in June and subsequently improved somewhat thereafter. That was apparently a shorter-lived anomaly and, like the other, is also probably “. . . not reflective of the overall lake clarity and health.” Looking at the dark “2023” line with the dip to 123, observe that the clarity remained relatively high until early May, when it thereafter fell from well over 85 feet to 26.2, almost a 60-foot drop within one month! That is the effect of the tremendous load delivered in May 2023, a part of the total load not accounted for by the TMDL load-reduction estimation tools; these tools only estimate pollutants (sediments) removed from municipal stormwater drainage systems by human actions. Many of these drainage systems were overwhelmed, damaged, eroded, etc., during 2023 and functioning sub-optimally. The graph shows clarity limped back slowly from that 26.2-foot low over the next several months, most likely attributable to sediments settling from the surface zone. Clarity then hovered in the 50 to 60 foot range at this index station going from fall into winter 2023-2024.

## UPDATES FROM THE 2024 LAKE TAHOE CLARITY REPORT

2024 data is discussed in the 2025 TERC reports and so forth, a year in arrears. The following screenshot is Figure 1 from the 2024 Lake Tahoe Clarity Report dated 13 June 2025.



2024 Lake Tahoe  
Clarity Report

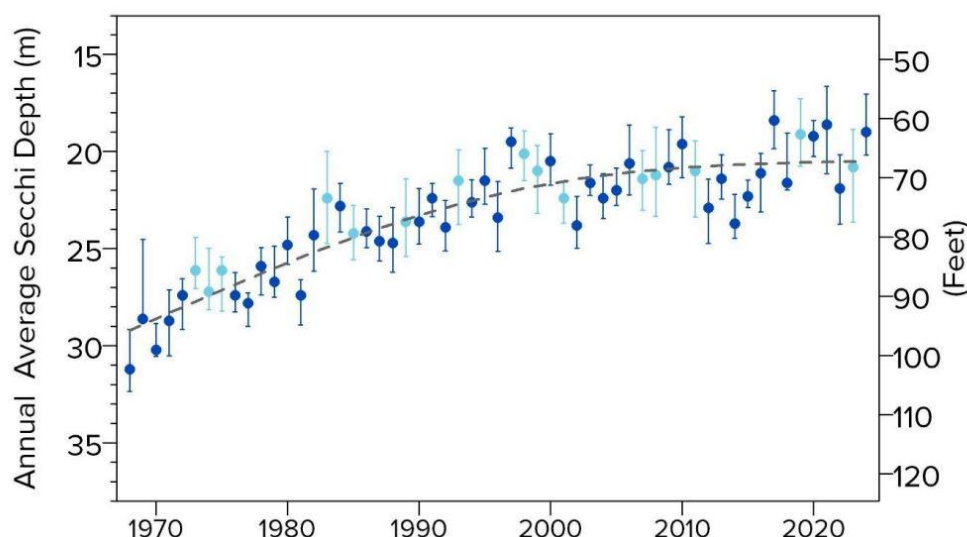


**Figure 1:** Annual average (January - December) Secchi disk measurements at the LTP Station 1968-2024. The whiskers on each point represent 95% bootstrapped confidence intervals. Trend line is derived from a Generalized Additive Model (GAM). The value for 2024 was 19.0 m with CI of 17.0 – 20.2 m. Light blue circles are years in which the lake fully mixed during winter, a process that typically enhances winter water clarity for a short time.

### Complete Mixing Effects?

Again we have the inverted graph, with clarity *decreasing* on the vertical axes. This graph includes (in light blue) the years when full mixing occurred, a winter phenomenon. What can be gleaned from that and what is the significance, if any? One result that seems counter-intuitive is that annual average clarity values for most years in which full mixing occurred resulted in annual averages near to or less than the trend line of the annual averages. In other words, full mixing generally doesn't improve average water quality—it often makes it worse than average (or average).

This effect could be attributable to mixing nutrients (mainly P) from the deeps into the upper zones where sunlight can fuel algae growth in spring through fall. There is often some modest improvement in clarity in the year(s) following complete mixing based on the graph, but not always; mixing doesn't often make water quality markedly *worse* the following year given the

statistical variability. Figure 2 shows there is a tendency for clarity to increase for a short period after the mixing during the winter season (when mixing often occurs). Notice that winter average clarity *the year following* a mixing event is accompanied by a loss in winter average clarity, with only two exceptions in the record except when deep mixing occurs in consecutive years. The graph of average winter clarity shows more dark-blue values (23 versus 18) are below the average curve and these generally follow mixing events.

There seems to be no discernible pattern to when complete mixing occurs in terms of years. It seems to occur fairly often over the years, perhaps driven by weather events as in 2023. Whether complete mixing occurs or not doesn't seem to make much of a difference in the annual average clarity measurements over time based on this graph, they are in the same range as non-mixed years, and only tends to drag the averages *lower* in years when full mixing occurs. Data shows the mixing events are occurring earlier in the year than historically. No planning can be done around mixing, it is just something that happens with random regularity, and is often accompanied by annual average clarity reductions. However, there are a couple more pieces of information to connect here. I noted mixing events appear to occur randomly based on the statistical chart above and tend to adversely affect water quality. We are told mixing brings nutrients to the surface. Where do they come from? Are they just dissolved or suspended in the deep waters that are brought to the surface? That goes against natural tendencies for suspensions and solutions of materials to disperse to homogeneous concentrations absent some other force or influence (say, cold).

#### Nutrients from Deep Mixing

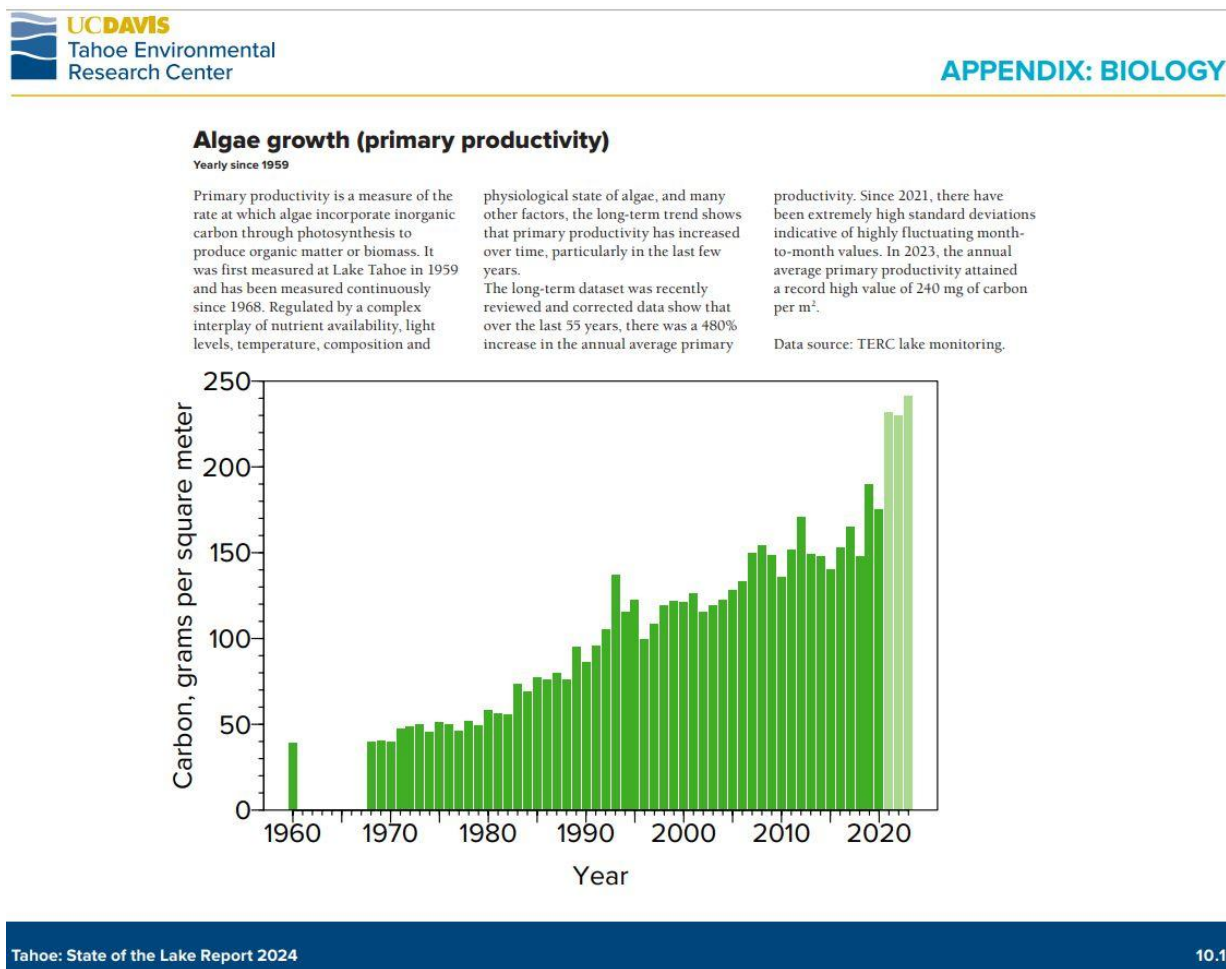
TERC research published in 2023 (Reference 3) provides some explanations for where some of these "nutrients" are coming from with deep mixing: they are being dissolved from bottom sediments when/after the mixing occurs and fluxed into the waters above. The research is rather technical so I will attempt a summary outline of the findings. As I understand it, during times when the bathtub is not mixed there is very little oxygen at the bottom, a condition called "anoxic," and iron (Fe) and P are chemically "reduced" and bound to minerals in the sediment to a depth of 4.5 centimeters (cm) or more below the sediment-water interface. If there was no oxygen at bottom (zero), experiments suggest minerals in the sediment would be locked in at a depth of 1.5 centimeters (cm) or more below the sediment-water interface. With deep mixing more oxygen reaches the bottom creating conditions for chemical reactions that reach deeper to dissolve and release Fe and P locked in the sediments into the water column above.

The research concludes that Fe species from the bottom are not of much concern, especially relative to releases of P, which are estimated to increase P in the water following mixing. Quoting the final part:

If we assume that 10% of Fe in the top 1.5 cm of sediment is reductively dissolved and phosphorus was homogeneously mixed into the entire lake water body, phosphorus concentrations in the water column would increase by around  $1.2 \mu\text{g L}^{-1}$  (using a total lake volume<sup>12</sup> of  $152 \text{ km}^3$ ) in line with previous findings by Beutel and Horne.<sup>12</sup> While this amount would not change the trophic status of Lake Tahoe, Beutel and Horne<sup>12</sup> suggested that it would result in a 40% increase in phytoplankton productivity. Therefore, there is a need for continuous monitoring of oxygen saturation in lake-bottom waters for early detection of internal nutrient loading in oligotrophic lakes.

## Primary Productivity

A  $1.2 \mu\text{g L}^{-1}$  (micrograms per liter) increase lakewide is only around 1 part in a billion but look at what is predicted to result: a 40% increase in primary productivity based on the stated assumptions. The screenshot below is from TERC's 2024 report.



“The long-term dataset was recently reviewed and corrected data show that over the last 55 years, there was a 480% increase in the annual average primary productivity. . . In 2023, the

annual average primary productivity attained a record high value of 240 mg of carbon per m<sup>2</sup>.” Some of the notable increases in primary productivity in recent years may be attributable in part to the chemical processes resulting from deep mixing and algae growth stimulation by P flux from bottom sediments. Whatever the causes are the trend is for more and more algae at increasing rates, a classic signature for “cultural eutrophication” of Lake Tahoe now well underway. This is more prime evidence of consistent degradation, algal biomass having increased 480% since 1955, from about 40 grams of carbon per square meter to 240, with most increases coming after 1980. That record accords with an average 8.7% increase annually over 55 years, and an eight-fold increase in biomass. The rate of increase appears approximately linear from 1970 to 2020, with rates apparently increasing exponentially since 2020.

Along with the concerns above the same research indicates that Lake temperature profiles data suggests complete mixing events may decrease in the future due to increases in thermal stratification that add resistance to complete mixing, i.e., by wind or other factors. If that occurs, it will probably bring the “annual averages” of clarity lower, much as I have described for 2023. There won’t be the periodic dilution of particle inputs from the clear deep waters rising. If that research proves true it may further accelerate rates of primary productivity (algae cells).

#### Averages; Effects and Limitations

Averages are a statistical measure, one of many. They tend to *smooth* the variable data, as do the GAM curve-fitting programs used by TERC to make that “average” line, with certain parameters set by the programmer-user. That makes a nice curve or line. But note the graph of annual average clarity is not linear—not a straight line—it curves. Discrete annual values rise then fall in a series of progressive steps that show clarity loss over time. The smooth curve sort of looks like it might be semi-linear piecewise, with one slope prior to 2000, where there is a “knee,” and another (lesser) slope after 2000. That could be an indication of a reduction in the *rate* of clarity loss but the slope is still negative or zero in recent years, meaning at best things are not getting worse as rapidly—despite overall health and clarity only decreasing, getting worse since 1969. Another graph could be produced from the *medians* of the values of the measurements for each year, which is not the average, but the middle value, with equal number of measurements higher and lower. That might tend to damp out some of the extremes and show a different picture. Why are the graphs of such measures not presented? Why not put medians in Table 1 of the report, for example?

## MICROPLASTICS

Given that controlling “loadings” under the TMDL will not address clarity loss based on the foregoing, the next urgent question in my mind is whether Lake Tahoe can escape being further contaminated with toxic, long-lived microplastics? That will only add injury to insult. However clouded Lake Tahoe is by natural sediment it has *previously* served all designated beneficial uses (drinking, aquatic life support, etc.). That could be ending. The following screenshots are from the 2023 Lake Tahoe Clarity Report.



2023 Lake Tahoe  
Clarity Report

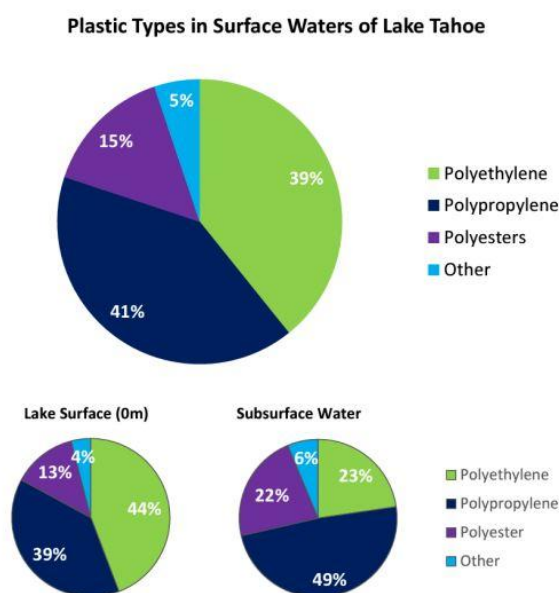


**Fig. 17:** Synthetic polymer (plastic) types of confirmed microplastic particles collected from surface and subsurface waters of Lake Tahoe (Gjeltema et al., 2023).

## POLYETHYLENE AND POLYPROPYLENE

Polyethylene (PE) and polypropylene (PP) together comprise 80% of the plastics identified in this study (large pie chart). That chart is presumably some “average” of those smaller charts below it, with the Lake Tahoe surface containing more of these types of PE and PP plastic “floaters” (83%) than the subsurface (72%). I have stated elsewhere in the public record that plastic particles vary in density and may float, stay suspended in the water column (i.e., if neutrally buoyant or having poor settling characteristics), or may sink and contaminate the Lake bottom sediments. Here we have evidence that particles are accumulating on the surface of Lake Tahoe and in the water column, with potentially significant implications for clarity. Researchers will be taking secchi disc measurements through an increasing lens of plastic in the

future. (Bottom sediments should be examined as well for toxicity, as a lesser priority.) Sources of PE and PP are not identified. Without that, what management adaptations are possible?

#### Marinas and Piers are the Largest Sources of Plastics in the Shorezone

My working hypothesis is that structures along the shorelines such as marinas, piers and docks built from plastics “composited” with wood are among the largest sources of PP and PE in and over the waters of Lake Tahoe, if not the largest sources. There is currently no data to contradict this hypothesis, and information to support the hypothesis from merchants of plastic composites. Also, TRPA could not identify which specific shoreline parcels had plastic shoreline structures in reply to a public records request I made: they basically replied “all parcels” with their lack of specificity. TRPA doesn’t really know what structures it has approved that are plastic in the shorezone, but they have records, lots and lots of records THEY could (and should) go through to abate the oldest and worst deteriorating (first). Of course TRPA has done little to address the legacy problem other than attempt to ignore it (and me) which is why I refer to it also as the Tahoe Regional *Plastics* Agency; they’ve really *earned* it. I think the only way to live that down is to act, now, and boldly, like with the two-stroke ban. It’s a different TRPA Board nowadays, with none that impress me at all. They are running a criminal organization as I have explained many times, so I don’t expect anything but the typical “slow walk” to figuring out half-way solutions.

#### Polyester Sources in the Shorezone

Beneath the lake surface there is a large proportion of polyester (22%). That is more than one fifth of the total plastic reported, so a relatively large quantity. As I have stated before, it is not easy to contaminate a body of water the size of Lake Tahoe with polyesters fibers. What are the largest sources, in the Lake? Clothing can be made from polyester, such as bathing suits, towels and outerwear. I doubt these provide substantial contributions, along with lint from terrestrial clothes dryers in the watershed. Many of the boats on Lake Tahoe, some quite large, have cloth awnings and covers, with carpeted interiors (another use of polyesters). These fiber materials would be discharged to the air over Lake Tahoe and directly in the water and may be among the largest sources of this polyester contaminant affecting Lake Tahoe.

#### Other Plastics in the Shorezone

Other plastics are associated with boating: Plastic fabrics (non-polyester) or solid plastics like “vinyl” boat interiors are examples (more PE and PP). Turbidity curtains and bottom barriers used on certain projects may be vinyl. “Fiberglass” boats may contain a variety of plastic resins. Many boats are structured with these plastics, which are strong for their weight, and nonetheless represent a very large mass-quantity of plastic in direct contact with the water, or directly above the water where it is exposed to the elements of erosion: wind, water, ice and

sunlight. Some docks and support structures are painted, with the paints wearing away and ultimately ending up in the water; some may contain nanoplastics. Sunlight degrades most plastics, especially older plastics. Shoreline structures and many sailboats are left on the water year-round. Some are decades old with deteriorating surfaces from erosion of dust-like particles of plastic. To stem this erosion a variety of surface treatments may be applied to boats from sanding to chemical treatments and paints, waxes and polishes that, in this age, may contain plastics. While dry-dock boat maintenance may be practiced for sanding (one would hope) that is likely frequently not actual practice, such as cleaning or waxing one's boat in the harbor slip.



I have written that among the “other” unidentified or collectively-considered plastics is polyvinyl chloride (PVC), one of the most toxic of seven common types of plastics, and that this was known to be a component of plastic decking used in many of the marinas and piers and marinas and piers in past decades. Over time PVC use for such applications reportedly has lessened in favor of other plastics such as PE and PP, but is still commercially available.

## Quantities of Microplastics in Lake Tahoe are Likely Much Greater than Testing Shows

The following screenshot from the 2024 Report discusses microplastic particles. Or does it? The title above the graph says that but the casual reader may not notice that the graph shows ALL particles greater than 335  $\mu\text{m}$ , not plastic particles only, based on the text. That requires further research. In other words, this research did not “partition” the samples into natural substances or man-made substances (plastics); in this graph a particle is a particle, and it is 335  $\mu\text{m}$  or larger.

Collected samples were sieved to only yield particles greater than 335  $\mu\text{m}$ , which is much larger than the size classes known to affect clarity (1 – 6  $\mu\text{m}$ ); however, observed concentrations of these larger size classes followed a similar seasonal trend (**Fig. 18**) as the particles being measured using the Liquilaz. Partitioning the relative contribution from natural and anthropogenic (e.g. microplastics) sources is necessary for future work.

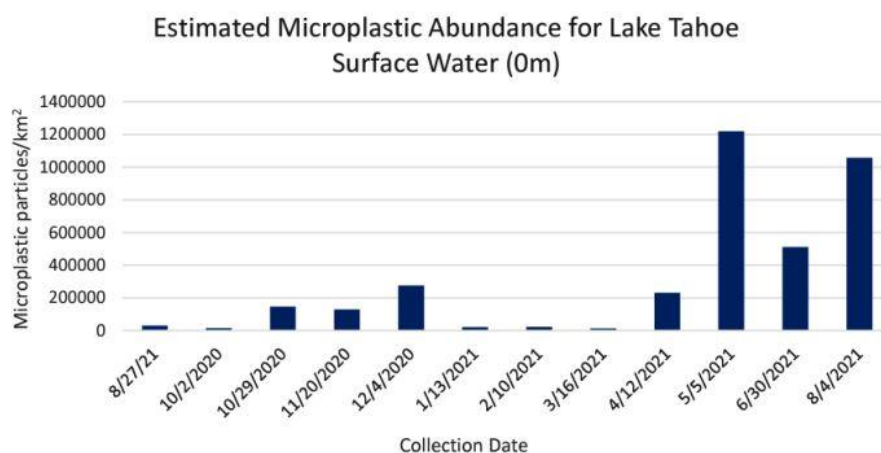


**Fig. 18:** Estimated microplastic particle abundance (> 335  $\mu\text{m}$ ) in the surface water of Lake Tahoe during the period of August 27, 2020, to August 4, 2021 (Gjeltema et al., 2023).

14

Said another way, everything smaller 335  $\mu\text{m}$  escaped the sieve, with openings at least 56 times larger than the 6  $\mu\text{m}$  particle, with particles that size and below affecting clarity the most according to the researchers here. The then-Director, author of this report, told TRPA’s governing board in a July 2024 presentation that they haven’t measured plastics below that 335  $\mu\text{m}$  size because they can’t. The Tahoe researchers literally don’t know what plastic is out there below the 335  $\mu\text{m}$  particle size, though that plastic amount could be less than, the same, or much greater than what has been measured. I suspect the latter, because the bulk of the particles from in-lake sources as discussed here, and probably the grindings from tires and paint in runoff, and particles deposited from the air, are likely in the size range less than 335  $\mu\text{m}$ , though some will be larger. There is thus NO CREDIBLE RESEARCH HANDLE on the microplastics

problems at Lake Tahoe, which are extraordinary to contaminate so large a water body so greatly.

### Microplastics and Clarity

Stating what should be obvious here, but isn't reported as such: Maybe particles less than 6  $\mu\text{m}$  affect clarity in a particular way, as stated in the report, by how they scatter light. There could be lots of plastics that size in Lake Tahoe; that can't be discounted in the absence of any data. But besides that, all the MUCH LARGER particles measured and observed must also have a large effect on clarity, larger than the smaller particles. Rather than scatter light they could shadow and block it completely. Certain human hairs may have diameters less than 20  $\mu\text{m}$ , and thus we can see objects that size when strung in a hair-line. A particle of 335  $\mu\text{m}$  is more than 16 times larger, and still the researchers reportedly can't measure those—only particles larger than that, as reported, and they have not separated the plastic from the native sediments in their samples. My working hypothesis includes that plastic particles also affect clarity, including microplastics larger than 6  $\mu\text{m}$ , and these may affect clarity equally or more than the fine sediments of native minerals and algae. They may combine with the smaller particles to decrease clarity even more, especially if the plastics are buoyant or the same density as water, as they will remain in the water column, or float on the surface of the "bathwater."

When a plastic surface such as a plastic pier or sailboat is exposed long-term to the elements the microplastics are emitted as dust, coarse at best but often very fine dust. Apart from that there is breakage, i.e., of boards and ballasts. Cutting wastes to install structures. Abrasion from foot and "freight" traffic (plastic coolers dragged, etc.). Styrofoam in floats or ballasts has been an issue, mainly as unsightly floating litter from broken floats. Styrofoam is 98% air but comes with a host of environmental issues. From Wikipedia, "Extruded polystyrene is usually made with hydrofluorocarbons . . . which have global warming potentials of approximately 1000–1300 times that of carbon dioxide." Styrofoam and virgin-plastic beads, called "nurdles," can also escape these thin-walled-plastic float structures and litter beaches before breaking down to sizes invisible to the naked eye. All of these represent potential sources of microplastics in or on the Lake itself, other than in runoff or air deposits.

### Composite Plastic Materials; Outdoor Decking

PP and PE, the latter often as high-density PE (HDPE) or low-density PE (LDPE), are the two most common plastics in Lake Tahoe based on research to date. (See charts above.) They may come from litter such as has been recovered by in-lake and beach collection efforts, pending further research. Bottom barriers for aquatic invasive species control may be comprised of PP and/or PE. But the information presented below indicates PP and PE are among the principle materials currently in marketed uses such as plastic and plastic-wood composite decking materials for

marine uses. The information below provides an overview, with the caveat that trade formulations and materials are guarded “secrets” of the trade and are not generally disclosed to the public.

Hard-fact info is thus intentionally hard to come by for these toxin-producing products, often touted as the safe “environmental” alternative to wood. Wood has supported the environment since the early days of the earth; trees give life to all life. The indigenous call trees “the standing people.” Meanwhile plastic manufacturers have coated the world and all human blood with toxins with extraordinary longevity in less than 100 years, their “environmental” alternative. The industrialists and their market reps and the USEPA and other enablers need to be hit over the head with a wooden 2 by 4 and “wake up.” To bring it home, none of this in-lake plastic particulate loading was accounted for by the Lake Clarity Model or the TMDL. Implications for Lake Tahoe are huge.

I will note a few important things from the screenshots below. One claim is that composite materials last longer than wood. That is probably true for some woods. Wood breaks down in the environment. So do plastics, it just takes more time—and they do not say what that the time period for plastics to break down is. It varies widely by plastic and exposure. Wood breaks down into natural elements and substances. Macro-plastic only breaks down into smaller versions of the same toxic, long-lived man-made microplastic and nanoplastic polymers. Plastics begin to weather and shed particles within a short time and shedding rates thereafter likely increase with time of exposure until the composites are deemed unserviceable and discarded to landfill or left to rot. Plastic recycling is largely a myth and such uses as putting recycled plastics into composite decking or other engineering uses (such as pavement formulations) may have long-term adverse environmental consequences as pavements wear away sub-visibly like the composite docks until the erosion becomes apparent.

#### Changes in Plastic Composites Will Not Solve the Microplastics Problem at Lake Tahoe

The comparison below of “Today’s Composite Decking vs. Early-Generation Composite” tells us about the existing legacy at Lake Tahoe, because many of the piers and marinas are this “early generation” of plastics and are still in service. The new products are: “Now resistant to: wear and tear . . . mold.” It is touted as “better” than older products at resisting degradation by ultraviolet (UV) sunlight. Read another way, the early products (often PVC) were much less durable to wear and subject to UV and fungal attack, and that is mostly what is in and over Lake Tahoe. The new products only come with a longer warranty; I expect these will extend several decades only for the “premium” products, a very short time relative to the lifespan of microplastics in the environment which may be centuries or longer. The warranty does not include for damage to the environment. I presume some toxic additive, proprietary (meaning

“not disclosed”), is now used to control mold or slow UV degradation, “a blend of chemical additives.”

The environmental implications of installing a “generation” (dating from the mid-1990s) of semi-durable plastics touted as “environmentally friendly” (bogus sales-hype) in and over waters and to otherwise rot in the environment is not for plastic sales pitches. It’s a growth industry. Use of composite decking is nonetheless contributing to microplastic contamination wherever these plastics have been used as an unrecognized and/or unregulated source, just as at Lake Tahoe. Plastics manufacturers are culpable but have not been held accountable for the effects of their products on the global environment, now toxic with microplastics for the foreseeable future of humanity, which may be cut short by illness if we don’t act against these poisons in the water supply, soil, food, wildlife, vegetation and air. Agencies have been negligently approving these products in aquatic and marine environments for years with never “a hard look” at environmental consequences and are slowly waking up the fact that waters globally are polluted with plastic from numerous sources. But LAKE TAHOE IS CONTAMINATED WITH MICROPLASTICS—the 3<sup>rd</sup> worst of 38 large water bodies examined globally. How did that happen?

#### Marketed Composite Plastic Products Available Now - Screenshots

Trex and TimberTech are cited as leading manufacturers, the latter of PVC products, which is apparently still in widespread use despite being among the most toxic types of microplastics. “Lower cost” composites basically come with less warranty-covered durability, thus “externalizing” the buyer’s cost with discards onto the environment and general public, hardly a model of “environmental” industry to emulate or reward. Because wood compromises the integrity of the composite decking these are typically now coated or “capped” with a layer of “virgin” or newly-manufactured PP—one of the two predominant materials contaminating Lake Tahoe based on the research above, the other being PE. Those report findings may largely be attributable to *litter* collected, being greater than 335 µm dimensionally, and may not account for microplastics from weathered composite decking (dust) and fiberglass boats, etc.

The following screenshots are from: <https://www.decks.com/how-to/articles/best-composite-decking-materials-options>



The most common question we get at Decks.com is, "What's the best composite decking material?" Unfortunately, there isn't a simple answer. There are multiple [brands](#) to choose from, that range in price and quality. You should also take into account [composite decking reviews](#) to see which brand is the best option for your home, budget and taste.

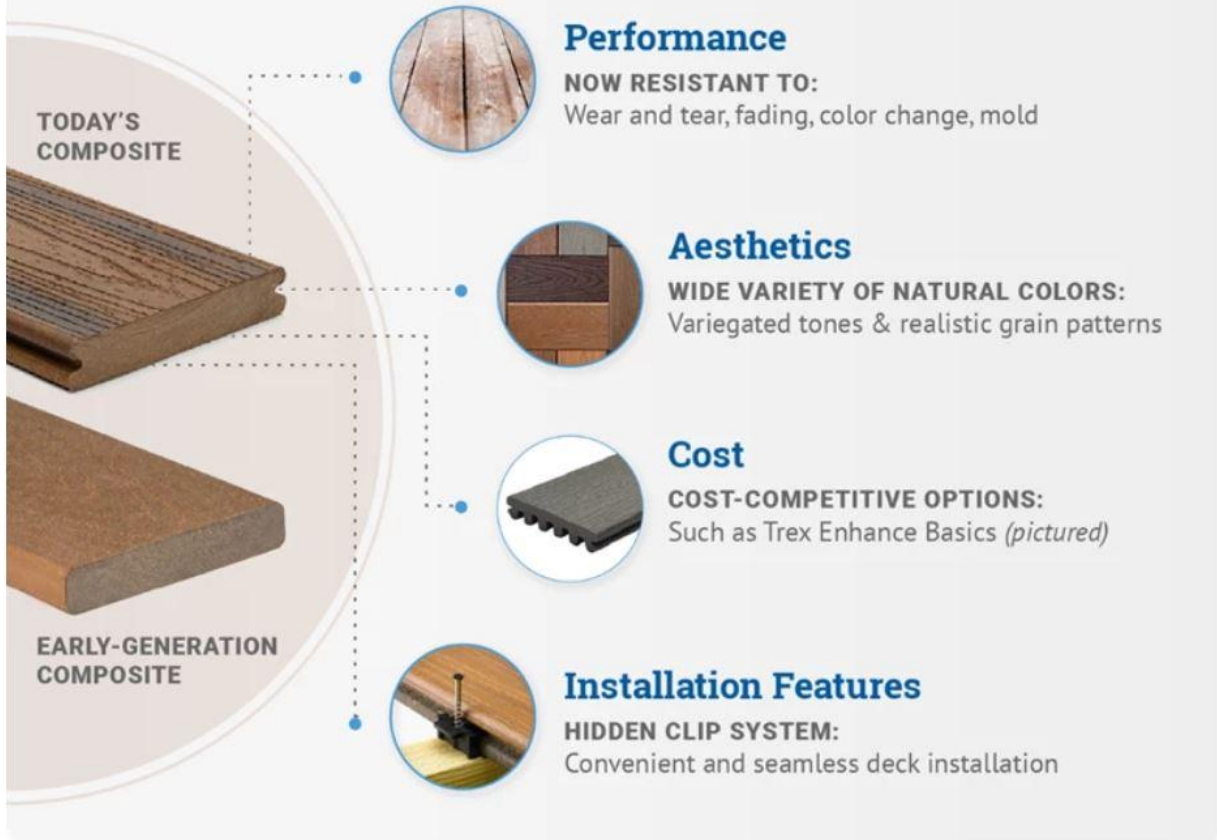
## What is Composite Decking?

Composite decking boards combine two or more materials—typically wood fibers and one or more forms of plastic—to improve the appearance and durability of decks. Composite decking cuts and fastens like wood but performs better because it eliminates the imperfections of natural materials. As a result, composite decking lasts longer and reduces the need for maintenance, including power-washing, sanding, and staining.

## What is Composite Decking Made of?

Composite decking boards are often made from recycled or reclaimed materials, mainly polyethylene (HDPE or LDPE) or PVC (polyvinyl chloride) mixed with wood fiber, rice hulls or other fillers, as well as a blend of chemical additives. Some composite products contain no recycled materials, while others are made with as much as 95% recycled content. The difference in recycled content, however, is more of an environmental consideration than a performance concern since most manufacturers have perfected their processing techniques.

# Today's Composite Decking vs. Early-Generation Composite



First-generation composite decking boards were a uniform mixture of wood fiber and plastic. Later, manufacturers added a synthetic cap that covers three or four sides of the boards, improving performance and appearance. The core of these capped boards differs among manufacturers and product lines. It is either a composite of wood fibers and plastic or fully synthetic.

- First-generation boards. Made from reclaimed wood and plastic, the first composite deck boards were appealing because they were environmentally friendly, lasted longer than wood, were splinter free, and didn't need much maintenance. Without a synthetic cap, however, the boards would eventually show the effects of moisture and exposure to the sun.
- Capped boards with a composite core. The cores of these boards often include materials similar to those found in first-generation composite decking. Around the core is a wrap, or cap, which prolongs the service life of the boards and enables manufacturers to offer a richer variety of colors. The cap also makes the boards easier to clean.
- Capped boards with a synthetic core. These composite boards have synthetic (plastic) cores and synthetic caps. As a result, they withstand the elements better than boards that have wood fiber in their core and come with a longer warranty. Depending on the manufacturer and product line, the core contains either a blend of recycled and new material or all-new material.

## Composite Decking in 2022: How Have Materials Evolved Over Time?

### Performance

Today's composite decking materials perform better than earlier versions. They're less prone to damage from exposure to elements and deliver impressive resistance to scratches and scuffs. This is largely due to the resilient caps most manufacturers added to their decking, as well as new formulations and additives. The newest generation of composite decking is more resistant to general wear and tear, fading, color change and damage from elements, especially UV from the sun. When comparing composite decking beware of outdated information. Base your buying decision on reviews of the latest products and technology.

### Aesthetics

Another improvement is the tremendous variety of natural-looking [colors to choose from](#), including many variegated tones that realistically imitate exotic hardwood grain patterns. New lines of colors are added so often that many deck builders now refer to the ever-expanding design choices as "deck fashion."

### Cost

Composite decking manufacturers have also found ways to offer more cost-competitive options, such as [Trex's lower-cost board](#), to fit a wider range of budgets. Now, it's possible for a homeowner or contractor to build with composite decking materials and get the same long-term benefits without breaking the bank. When [comparing the prices](#) from various manufacturers, also compare attributes, such as board thickness, board profile (solid or scalloped), aesthetics, and scratch resistance. These are what typically separate lower-cost boards from the more premium offerings.

## Composite Decking Brands to Know

Invented by Trex in the mid-1990s, composite decking is widely recognized as a high-value alternative to wood. Many manufacturers have since entered the market, and several brands offer unique features, including proprietary materials, realistic grain patterns, and a variety of color options.

**Trex(r)** – Trex was the first company to combine plastic and wood flour in an extrusion process to make non-wood deck boards. Since launching approximately 30 years ago, Trex has remained the #1 brand leader. The company is best known today for its industry-leading Transcend product line, which is durable, beautiful, and easy to source locally.

Additionally, Trex offers boards at multiple price points to fit every buyer's budget. Trex also offers a full complement of fascia, railing and deck lighting.

**TimberTech(r)** – Several years ago, Azek Building Products—the leading manufacturer of PVC (polymer) decking—acquired TimberTech. Azek was a very strong composite decking brand, and the acquisition put the two most popular decking technologies under one roof.

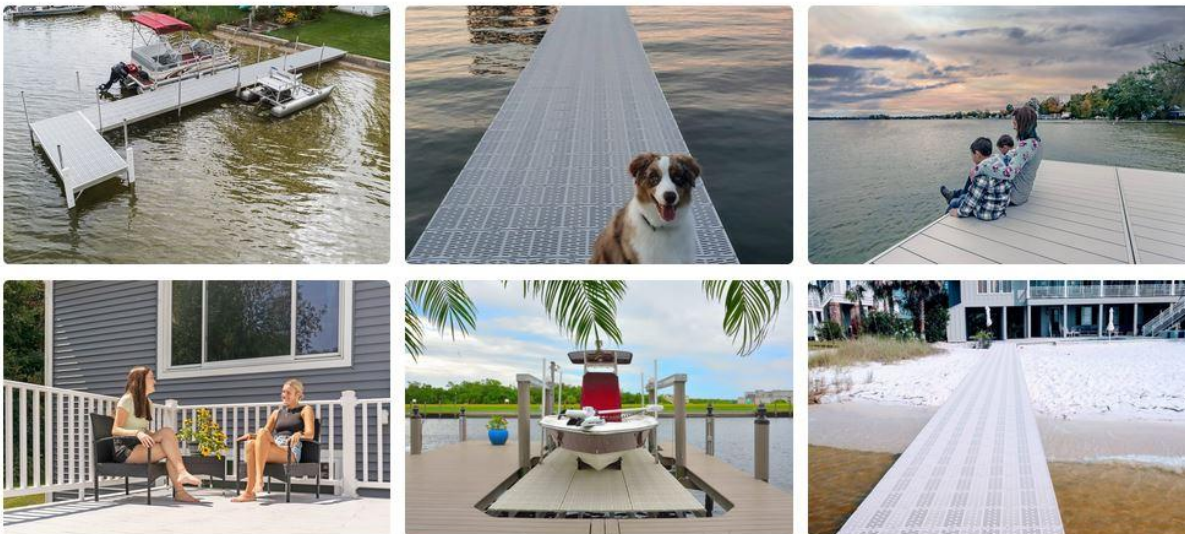
**Fiberon(r)**- Fiberon is another strong composite decking brand with a long history. Known for offering unique grain patterns and streaking aesthetics, Fiberon composite decking is easy to find in key markets.

## Which Composite Decking Material is Best?

Few manufacturers will tell you exactly what their composite decking contains or how it's made, so precise comparisons are difficult. Nonetheless, [capped composite decking boards](#) have several advantages, most of them stemming from the synthetic shell that protects the board's core from mold, mildew, rot, and the elements.

Capped composite decking is certainly more durable than its uncapped counterparts. Even so, it's up to

From: <https://www.perspectiveproducts.com/polypropylene-vs-composite/>



Composite deck solutions offer a similar maintenance free option to traditional wooden decks, but there are some key differences compared to polypropylene. Our **Sure-Step** and **TREDZ** products use 100% virgin materials, whereas composite decks are made from a mixture of wood fibers and plastic. The wood fibers can compromise the quality of material, reducing the lifespan of the product. A solution composite deck manufacturers use is to wrap the material in polypropylene. Sure-Step and TREDZ are already polypropylene decking systems.

Our 100% virgin products offer a durable solution which is slip-resistant and barefoot friendly.

## CONCLUDING REMARKS – WITNESSING A TRAGEDY OF THE COMMONS

The TMDL was a cause for celebration for many when it was adopted. While I was hopeful, I was also skeptical that it would lead to recovery of Lake Tahoe's historic clarity, especially over a 65-year timeframe. My contrary views put me on the "outs" with certain managers and peers at the time when they became known, because the TMDL was the perceived answer to restoring clarity, reducing loads over time. Fifteen years in, it appears the TMDL underestimated the needed load reductions and/or Lake Tahoe has not responded to the load reductions as predicted by the Clarity Model. That is bad news for all concerned because the implications are the TMDL regulations will need to be revised by the states under USEPA direction to address the shortcomings before water quality worsens further.

Recreational boating has caused outsized impacts on Lake Tahoe, impacts that are unaddressed by the TMDL. In addition to microplastics, aquatic invasive species came in on the recreational boats, with the Tahoe Keys the prime example of the harm that can come from such

developments. It is unfortunate that the invasions occurred and that there were no clear regulatory structures to control that at the time, other than permits required to apply herbicides to the waters of Lake Tahoe. I believe more AIS invaders will eventually get past boat inspectors, if they have not already. That harm continues to unfold and will so long as the impacts of recreational boating on Lake Tahoe are allowed to continue unabated.

More of the same will bring more of the same and worse. Time is running out for Lake Tahoe unless the impacts of in-lake activities are also addressed by all agencies with jurisdiction in the matters, as they never have been, with TRPA and other agencies both causing additional impacts under its deficient policies and failing to mitigate existing impacts. Lake Tahoe is a resource held in common by multiple jurisdictions, each with a role to play. Under current policies the tragedy will continue to unfold. I am not suggesting the current trajectory can't be altered, and it will not change unless TRPA and the other "partners" begin the difficult steps necessary to address the issues plaguing Lake Tahoe. That must include addressing the impacts of recreational boating, or Lake Tahoe will become toxic and will be sacrificed for all, future generations, for the benefit of the few.

Keep Tahoe Pure; Microplastics Endure

Use Wood, Metal and Stone in the Shorezone

TRPA can continue the failed programs discussed in my Petition or begin to address the unaddressed impacts and shortcomings of the TMDL restoration goals and permit programs for shoreline structures with your partners. If TRPA won't approve permits for these plastic shorezone structures the other agency permits do not matter.

Alan Miller, Professional Engineer

S. Lake Tahoe CA

REFERENCES (all can be found at <https://tahoe.ucdavis.edu/> except no. 3)

1. 2023 Lake Tahoe Clarity Report, Alexander L. Forrest and Shohei Watanabe, UC Davis Tahoe Environmental Research Center, Prepared for the Tahoe Regional Planning Agency (7/12/24)

2. 2024 Lake Tahoe Clarity Report, Stephanie E. Hampton, Alexander L. Forrest, Shohei Watanabe, and Lidia Tanaka, UC Davis Tahoe Environmental Research Center, Prepared for the Tahoe Regional Planning Agency (6/13/25)
3. Iron Reduction in Profundal Sediments of Ultraoligotrophic Lake Tahoe under Oxygen-Limited Conditions, Meret Aeppli, Geoffrey Schladow, Juan S. Lezama Pacheco, and Scott Fendorf, *Environmental Science & Technology* 2023 57 (3), 1529-1537 DOI: 10.1021/acs.est.2c05714
4. Naranjo, R., Work, P., Heyvaert, A., Schladow, G., Cortes, A., Watanabe, S., Tanaka, L., and Elci, S., 2022, Seasonal and long-term clarity trend assessment of Lake Tahoe, California–Nevada: U.S. Geological Survey Scientific Investigations Report 2022–5070, 86 p., <https://doi.org/10.3133/sir20225070>.

**An Independent Report on Lake Tahoe Water Quality**  
**Based on a Review of Available Public Information**  
**Part 2: Focusing on Review of the**  
**Tahoe Environmental Research Center's**  
**2025 State of the Lake Report**  
**and**  
**Recommended Actions to Aid the Restoration of Lake Tahoe**

By

Alan Miller, Civil and Environmental Engineer

South Lake Tahoe California

August 26, 2025

(Note to the reader: The information in Part 2 of this Report was first provided in Public Interest Comments to the Tahoe Regional Planning Agency Governing Board, meeting of August 27, 2025, Agenda item VII.B., State of the Lake Report 2025 with Director Stephanie Hampton, U.C. Davis Tahoe Environmental Research Center. The information in Part 1 of this Report was first provided in Public Interest Comments to the Tahoe Regional Planning Agency Governing Board, meeting of July 23, 2025, Agenda item X.A. Remand of Appeal Stock/Johannessen Single-Parcel Pier Permit, and has been reformatted here without substantial revision other than removal of project-specific comments and findings.)

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*Keep Tahoe Pure; Microplastics Endure*  
*Use Wood, Metal and Stone in the Shorezone*

## INTRODUCTORY COMMENTS

This independent analysis of the State of the Lake Report (SOTLR) for 2025 cited herein, with data current through 2024, both precedes and follows the publication of the SOTLR in 2025. I searched the document to see if it had undergone peer review. If so, it is not mentioned in the SOTLR. Similar to the SOTLR the analysis herein is written for the non-scientific public and has not been peer-reviewed. Unlike Tahoe Environmental Research Center (TERC), I have no one to thank for its preparation beyond those who contributed to the public reports I cite. I am appreciative of the work by Tahoe Environmental Research Center (TERC) and Desert Research Institute (DRI) to provide the public reports and the work to develop the data behind them.

This report is my review of the work of my peers and others with far-stronger research backgrounds and institutional credentials. It is also their opportunity to consider and critique my writings and scientific hypotheses, opportunities which have so far been declined without the slightest peep by the great scientists and researchers in the Tahoe science community. That's okay. I am not supposed to have a seat at the table, as I have been the "opposition" to the Tahoe Regional Planning Agency (TRPA) (and others in their partnerships) on many policies and projects. I have been an alternative voice not by choice so much as necessity, the mother of invention. I am a civil and environmental engineer and a generalist with a practical bent by nature, well-known to the TRPA with a long regulatory background at Lake Tahoe.

From <https://pmc.ncbi.nlm.nih.gov/articles/PMC11797007/>:

"The peer review process is a critical component of scientific research and publishing, designed to validate and improve manuscripts before their public release. . . .

The effectiveness of peer review rests on at least three foundational principles which include (i) disclosure of conflicts of interest: to maintain transparency, reviewers must disclose any potential conflicts of interest, including financial, professional, or personal biases that could affect their impartiality. Disclosing these conflicts protects the integrity of the peer review process and maintains trust among authors, editors, and readers; (ii) scientific expertise: reviewers must have sufficient knowledge in the manuscript's subject area to provide a useful assessment of its content. This expertise ensures that reviewers can evaluate the scientific rigor, relevance, and quality of the research appropriately; and (iii) constructive feedback: feedback should not only highlight strengths and weaknesses, but also provide actionable recommendations for improvement. Constructive feedback allows authors to refine their work, and often strengthens the study's contribution to its field (Table 1).

I don't participate in the "research" world of the academics and scholars. I don't have any "research" credentials beyond my bachelor's degree in environmental resources engineering, where I did assist professors with their water research. My comments are based on my 30-some years of background in the field and my registration as a CA professional engineer. Credentials help understand qualifications to a degree. However, science is not concerned with credentials, but the quality of information. One right equation makes all others wrong, as in  $E = mc^2$ , thinking conducted by one individual in that case. That's real science. And, of course, lowly Dr. Einstein was opposed by his institutionalized peers, but his voice of truth overcame the throng, just as did Dr. Charles Goldman in his day. I therefore rest on the quality of my analyses.

## **GENERAL COMMENTS ON THE 2025 STATE OF THE LAKE REPORT**

Before I present comments, TERC states that the SOTLRs are intended for non-scientists, so we may assume the SOTLRs are not peer-reviewed while presenting certain information that has, in some cases, undergone peer review. I quoted the above because it is in that spirit that I approach the critique here, based on what has been presented in the SOTLR to the public and decision-makers in regulatory authority over the Lake Tahoe basin, and to a certain extent, public news reports and responses to the SOTLR which are "concerning" to me.

Regarding the above quote on peer review: I have no potential conflicts of interest, as stated, no inherent biases. My insights are from training and experience. I believe I have enough expertise in the subject matter to provide a useful, independent, assessment of the contents of the reports and other information, and I seek to provide constructive feedback while not sugar-coating important deficiencies with subtleties. I am a volunteer in service to the mother of us all. Now is a time to review what has gone before and put forward and test new hypotheses.

Prior Reporting, July 2025

This water quality report augments and follows a prior report I submitted for the public record of TRPA in July 2025 (as noted on the title page) in connection with a private pier approval. Because I'm not being paid for any of my engineering-activist work, to save time I have simply stripped out the portions applicable to the specific project (in the public record) before reformatting and republication here in Public Interest Comments, with other minor edits and changes. You'll find it after Part 2, titled *An Independent Report on Lake Tahoe Water Quality Based on a Review of Available Public Information; Part 1: A Conceptual Model for Lake Tahoe with a Focus On Microplastics and the Total Maximum Daily Load Regulation for Lake Tahoe*. Those who have not read it may wish to start there then come back to here. These comments

are related but separate, and augment the prior report in certain respects based on the new information in the 2025 SOTLR, and I provide a short lead-in to Part 1 at the end of Part 2.

### **With Specific Reference to the 2025 SOTLR**

In this section I provide a summary of comments on topics of interest to me, going through the report from top to bottom, a sort of “first cut.” Discussion of many these of topics and the quoted information appears again in later comments where they are woven as reminders into the context I have explained. Therefore I am not being mindlessly repetitive, but methodically examining new angles and potential dots to connect.

I agree completely with the statement of p 2.1 – “people transforming data into knowledge.” That is what I’m attempting here as well and I understand it takes partners to bring “knowledge to action.” I likewise wish to foster a more “holistic understanding,” as in my Bathtub Model in Part 1.

P 2.2 mentions a number of monitored parameters. Among them are many things no one can control: Air and water temperatures, rain as snow, precipitation, lake mixing, stratification, stream temperatures, mixing, plankton species, periphyton, chlorophyll, turbidity, dissolved oxygen, internal wave structures, materials movement, and others. There may be very good reasons I don’t understand for monitoring all of these things that can’t be managed, for instance, scholarship and pure research. I don’t mean to impugn any of that, especially to the extent it may be funded solely by U.C. Davis (or DRI). There are big management problems at Lake Tahoe with a need for greater science-research integration. If the science is understood, that isn’t clear to me and, by extension, the public based on the SOTLRs. So I appreciate the Director’s desire to bring more accessibility to the reports for non-scientists, while maintaining high quality, to “transform that knowledge to action.”

Part 1 included discussions of primary productivity and I note that p 2.3 indicates “primary productivity increased” with the data for the last several years withdrawn from the chart pending some reassessments underway. The comments in Part 1 need to be considered in that light, as they were prepared before this was known.

P 2.4 discusses,

. . . annual average clarity (62.3 feet in 2024) appears to have plateaued. Winter trends have stabilized or improved, but summer trends remain concerning. We have monitored particles since 2009, with attention to those most strongly affecting water clarity in the 1–6.73 micron size class, and we saw a sudden increase after 2015. This past year we

recorded the highest number of particles since monitoring began, with over 6 million particles per liter in the 1–6 micron size class . . . The specific identity of these particles remains unknown . . . targeted research is needed into the nature of the clarity-reducing particles . . . collecting data on characteristics of the light that enters the water.”

Subsequent parts of this report and Part 1 may help to inform, in detail, the incomplete picture here. The increase is of course directly attributable in large part to particles in terrestrial storm runoff, and I suggest also cumulative increasing inputs of microplastics from plastic structures on the shoreline—the weather in 2022-2023 was also hard on in-lake plastic structures. In addition I suggest the effects of geoengineering must be considered.

I echo what was written about the importance of educating the public: “Education about the Lake Tahoe environment remains a cornerstone of TERC’s engagement with the Tahoe community” (P2.5) I too “. . . celebrate stewardship successes that have protected the lake from the degradation while also recognizing the need to make additional progress in restoring the lake and building resilience to face current and future environmental challenges.” With regard to “. . . novel pollutants all pose challenges that threaten health of the lake,” I again suggest microplastics from in-lake structures may be chief among them until more is known to quantify this contribution, and that any such contribution is illicit and should not have been allowed.

The Wirewalker device (p 6.5) for continuous data collection to 150 m is pretty amazing to me, and it would be great if it could help correlate its data with other parameters like clarity and particle counts, etc. I comment further below from p 6.8, “One of the buoys holds a microplastic deposition bucket for our partners at Desert Research Institute, to help further their microplastic research.” I comment below regarding deposition of particulates from geochemical engineering, which DRI also conducts, and the need for testing. For example, has there been any change in concentrations of aluminum over the decades? If so, the likely and perhaps only source is atmospheric pollutants known to be associated with geoengineering.

#### Finding the Answers Needed and Cumulative Impacts

P 6.16, cites some TERC Goals: “Interdisciplinary teams must work together to collect and share data, ask the right questions, and find the answers needed to keep Lake Tahoe a healthy and clean source of fresh water that sustains life in the Basin, and help to future-proof the lake for inevitable changes.” Yes, but unless TERC is also monitoring what TRPA is approving and allowing they will be working at cross purposes and TRPA will continue using TERC to provide cover for their thousands of project approvals. That is because of false claims that nothing TRPA allows ever has any adverse impact: their regulations don’t really allow projects with significant

adverse impacts absent findings of overriding considerations. Therefore every plan and project since the 2012 adoption of the Regional Plan has been approved under a “Finding of No Significant Effect” or FONSE, and before that as well. TRPA has come to stand before the public as the “Tahoe Regional Piecemealing Agency,” as well as the “Tahoe Regional Plastics Agency,” in my view, and has been recalcitrant as such. While TRPA is not TERC’s problem, it affects the research. TRPA doesn’t do project monitoring, so the research is all it has, and the research is showing ongoing cumulative effects in Lake Tahoe, no question.

The public is told to believe their findings when TRPA staff opines it has completely eliminated significant adverse project effects, and all that remains are “legacy” impacts. It’s not credible. There are a lot of those legacies and some have been reversed, but others, like the Tahoe Keys, will remain. None of the “minor impacts” of its approvals are cumulatively considerable in TRPA’s view so there is no reason to do anything any differently than it has done in the last two decades and more. The FONSEs require little analysis and are “efficient.” The cumulative impacts are writ large in declining Lake Tahoe water quality. The more-recent evidence is that all those FONSE’s are not leading to restoration of Lake Tahoe clarity or ecology, and that TRPA needs a lot more help from scientific managers. Is that a reason for TRPA to pause or do anything different? They must or it will be “game over” at Lake Tahoe as the downslide continues and accelerates with negative feedbacks.

#### Not a Solution

If they are told of their shortcomings, TRPA and the other partners clam up, throw their backs up, circle the wagons, and yield only to legal actions . . . because they are the planning and regulatory experts and they’ve got their agency partners at TERC/DRI and elsewhere to defend their ignorance. They seldom if ever admit to any shortcoming. TRPA is not a scientific organization; it is a planning and political body acting under color of state law, appointed by the legislators of the states, and little more. The legislatures no more understand TRPA than anyone else; their job is to provide funding, not oversight . . . leading to the present situation. There is lots of funding with little accountability for results.

On p 9.1 Sources of clarity-reducing and blueness-reducing pollutants are charted, but if I recall correctly the charts shown are from TMDL development prior to 2011, and have never been verified or updated. They may have been peer-reviewed at the time? The characterization was done to help identify the three main pollutants affecting lake health, and their sources at the time. Suggestions are to provide references and frame this in a “historic” context beyond the mention of the TMDL in the last sentence, which says it formed the strategy for Lake Tahoe restoration. Is the strategy working? It doesn’t seem to be, based on the SOTLRs over the years,

but you can't glean anything like that from them. Such information has to be ferreted out the dense data collections and all the different research efforts and silos, a challenge.

On p 9.5 Suspended sediment contribution by Upper Truckee River is discussed and this is more of a questioning than a critique: It says, "In 2024, the estimated suspended sediment load from the Upper Truckee River was 879 MT. The highest load ever recorded was 6,100 MT in 2006. The average annual load is 1,909 MT. (One metric ton (MT) = 2,205 pounds.)." This begs for more explanation: How did we get from 6,100 MT in 2016 to 879 MT in 2024, a year with among the highest precipitation/runoff in many decades? Is it channel restorations, the UTR marsh restoration, or some other factor? There must be data to help inform this picture, which seems very positive. I would suggest examining more of the peaks to see whether there are management tools to reduce them further, as the floods are when materials move, with snowmelt most-often entering the ground before discharging as overland runoff or stream flows. For example, if rain on snow accounts for 2006 loads (I seem to recall) then perhaps slower snowmelt accounts for load reductions in 2024? What is the correlation with precipitation, stream flow and the sediment rating curve? (My guided undergraduate research clearly showed a non-linear rating curve for UTR based on flow and suspended sediment data to about 1990; what is it now?) What is the contribution of fine sediment from UTR?

The discussion on p 9.8 of Lake fine particle concentration shows a "concerning" to me exponentially-increasing trend from around 1 particle per liter in 2012-2015 to 6 in 2024, with five years since 2016 above 4 particles per liter. Explanations are lacking as noted, and there have been some big fires and smoke events in that timeframe. I also offer observations on microplastics in what follows that may in part account for this unexplained increase. I have identified plastics from marinas and piers as an ongoing slow-release microplastics time-bomb, with a lot of big explosions coming in time, not long now.

P 9.12 Fine particle distribution "The entry of particles in the upper part of the lake (above 300 ft) associated with spring snowmelt is evident in late May through August." That is conjectural and incomplete as this discussion omits consideration of microplastics, an in-lake particle source, as discussed in Part 1 and more in sections below.

#### About "Stability"

The discussion on p 11.1 Annual average Secchi depth indicates: ". . . due to natural variability, the long-term trend over the past two decades suggests that lake clarity is neither significantly improving nor declining. The system appears to be in a relatively stable state." While rates of clarity loss have decreased based on the statistics, the finding in the latter sentence requires

greater support in light of other factors and trends adverse to ecological restoration. “Stability” is used elsewhere to say both that temperature stability is a great concern (to overall “system” stability) and that the “system” has reached a stable state with regard to clarity. The system “appears to be” statistically stable unless its stability is upset by increasing temperature stability. This is confusing and contradictory and I question whether or how both together are correct? That is also where I believe the public thinks something is amiss with the “stability” announcements and that total facts don’t add up to this claim.

In 2024, Lake Tahoe’s annual average Secchi depth was 62.3 feet, a decline from 68.2 feet in 2023 (see comments on 2023 annual average clarity in Part 1). P 11.3 Summer Secchi depth states, “The summer average Secchi depth dropped to 53.4 feet (16.3 m), making it the fifth poorest summer average recorded, with 2019 being 53 feet, 2008 being 51 feet, 2010 and 2011 being 52 feet.” Part 1 showed 68.2 feet in 2023 was following upwelling. P 11.1 says 103 feet on 2/1/24 and p 11.2 says on 3/7/24 (?); a clear-water dissolved-nutrient upwelling combined with later/other inputs to drive summer clarity lower, much like 2023. I dare say few were expecting or prepared for 2022 into 2023. Nonetheless, these things do not bode well for the “goal that agencies and the Tahoe Basin community continue to work toward” because wet years will come and go, and we’ve seen nothing of what is potential with a significant “atmospheric river” continental runoff event, as occurred with random regularity in the CA/OR/WA geologic record of the last two millennia. 2022-2023 gave an indication of how to prepare for that and worse, and what will result lacking that preparation. Call it a safety factor to plan for the worst.

#### Research Suggestions Not in the SOTLRs

Some things I’d like to see more of from the regional research community include: municipal storm runoff characterization, development of treatments for runoff and effectiveness testing. Also, examinations of ground water conditions, and contributions of N/P/FSP (esp. urban), to the totals—which may be changing. Because it is far better than direct discharge, stormwater infiltration is both one of the most cost-effective management measures and a perceived panacea for development impacts, past and present. Such waste disposal practices are not without potentially significant cumulative impacts as assumed in planning and regulatory circles. Now that agencies and individuals have been shoving as much pollution as possible into the ground and thence to groundwater for 50 years through the basin’s shallow, porous soils, examinations of potential changes to groundwater are needed: what is going on down there since the last examination (by USACOE/BLM?) in years prior to the TMDL adoption? What are travel times for pollutants in groundwater at Lake Tahoe and what are the contributions and long-term implications for the Lake from ongoing and increasing pollutant discharges to groundwater?

## Suggestions for Additional Applied Research

With regard to the SOTLR and constructive feedback one overarching comment is that the various research efforts, public reports and publications seem largely in the domain of “pure research” versus “applied research” or “applied science” directed to solve Lake management problems, with notable exceptions such as aquatic invasive species monitoring and runoff monitoring. I find much of the report is concerned with collecting data to analyze and understand factors that may affect Lake water quality which are entirely beyond the ability of any manager over the region to do anything about. More management guidance is needed or more explanation of the implications of changes in monitored conditions would be helpful.

I suggest a greater emphasis on how pure research into factors that are not predictable or controllable in any real sense can be applied by basin managers, with numerous variables and unknowns like the weather. For instance, more precipitation is notably falling as rain than snow. For this single concept: What are the implications of that on erosion rates and runoff rates? What are the implications for stream morphology, particularly with regard to large-scale “restoration” interventions? What are the implications for storm water managers and project developers? What can be done to provide more robust and resilient treatments? How can we test these management implications and adjust policies? The agency staff and public would like to know your research perspectives, and need to understand them; not the minutia, the big picture as I attempt to sketch.

## Future Research

Future research and monitoring (p 2.5) augments what has gone before with new and better methods. I was challenged to pull concrete recommendations from the SOTLR Report for “actionable recommendations for improvement” other than for AIS. This critique will provide many such management recommendations, and my main recommendation as a reviewer is to focus future efforts more on applied research needed to assist land managers with actionable recommendations. As discussed further below, the runoff to be examined in the study begun (p 6.21) should also be examined for microplastics, in urban runoff, and geoengineering chemicals deposited on the land and vegetation, as well.

## **Additional Comments on the Clarity and the Total Maximum Daily Load Regulation**

Part 1 comments extensively on the TMDL for Lake Tahoe. The SOTLR comments on the perhaps-slower pace of adverse changes to annual average water clarity, the ongoing declines in “summer average clarity” and increases in fine particles the researchers reportedly do not understand based on insufficient data. They note that current regulatory (and research) efforts

are designed to restore lost annual average clarity to nearly 100 feet by the latter decades of the century, and that the ongoing regulatory efforts are directed at attaining long-term clarity targets the agencies are diligently working on. Those targets are pie-in-the-sky goals adopted for policy and legal purposes. They weren't believable on adoption and are far less believable now.

### The BIG Question

TERC originated in Dr. Goldman's efforts to show decision-makers what was scientifically predictable if sewage and other wastes discharges to Lake Tahoe were not rapidly reduced; environmental disaster. These public science reports no longer perform that role. They tend to downplay the adverse changes to Lake Tahoe year after year. I would prefer to see talents redirected to answer management questions, big ones like Dr. Goldman once asked, "Is the Total Maximum Daily Load (TMDL) regulation correct and, if so, why has clarity responded negatively for the past 14 years?"

### Consider Expanding Secchi Disk Sampling

While "annual average clarity" is reportedly without a clear trend, a "plateau" is asserted based on the wide variability of Lake Tahoe and the statistical limitations of the long-term data set. That data set is based on one location in the middle of Lake Tahoe and two locations on the west shore where secchi disk readings are taken methodically throughout the year. From p 11.1, "27 readings at Lake Tahoe's long-term index station and 12 readings from the mid-lake index station taken throughout the year." There is very little statistical power with so few measurement locations. All the secchi disk clarity statistics are from those three surface locations with no data to show those clarity readings are representative of the entirety of Lake Tahoe, while spatial clarity may vary considerably.

One suggestion therefore is to increase the number of secchi disk monitoring locations to compare against the long-term data set(s) to reduce the statistical error bars and provide a more robust statistical picture at reasonable cost. Secchi disk reading is reported to be highly reproducible and could be accomplished with volunteers from the boating community with researcher oversight, watching a plate disappear underwater and recording the observations. Volunteers and scholars would enjoy that. Lake Tahoe is a very large water body to represent clarity in the upper 140 feet based on one to three monitoring locations. Why weren't more long-term data collection efforts started to expand the secchi disk knowledge long ago, with so much riding on clarity? Perhaps it is because secchi disk measurements can't inform of the

reasons for particular readings, as secchi disk clarity is a combined surrogate parameter for the combined effects of all influences on clarity, without regard to cause.

### Consider the Effects of Geoengineering on Clarity Measurements

TERC collects dust on buoys in the Lake. The dust from the buoys, especially if past dust is available, should be examined for aluminum, barium, strontium, carbon and heavy metals, likely signature chemicals from geoengineering carried out within the region for the last several decades or longer. Since the latter part of the last century and increasingly in recent decades these particles have been intentionally sprayed into the atmosphere from aircraft to dim solar radiation reaching the planet surface, to control weather, and for other illicit and secret military purposes. (You needn't accredit me. See the film UnConventional Grey <https://rumble.com/v39uii8-un-conventional.html> and many other info sources such as Dane Wigington's website <https://geoengineeringwatch.org/category/geoengineering/top-story/> and be among more than 50 million other website visitors.) The institutionalized academic researchers and governments they support and are supported by do not acknowledge the existence of the ongoing global geoengineering despite credible, widespread and growing evidence in the public sphere. Thus has "science" been corrupted and is not to be believed if geoengineering is omitted from discussions. The researchers in denial sully their own work—and worse.

My conclusion is that by their silence, which has been bought, institutionalized academic and science researchers are assisting in geoengineering efforts to contaminate and destroy the air we breathe, the food and water we ingest, all plant and animal life and, of course, to sicken and kill humans in a secret war on them before they get informed, out of control, angry. Those behind it, the trillionaires and governments of the world they control, use geoengineering as a means to manipulate the weather and climate, changes they are causing to manipulate the people into believing claims that the climate is changing in response to carbon dioxide from human activity for their own, secret reasons. (Following his recent assumption of office President Trump provided a notice to the perpetrators and flyboys of geoengineering that further activity will not be without severe consequences and it seems to be abating, but we shall see, literally.)

There can be no credible or informed scientific debate about anything having to do with so-called "climate changes caused by human CO2 emissions" until the past and ongoing geoengineering is acknowledged and the effects are quantified. The point is: Lake Tahoe is affected by the ongoing geoengineering with never a word from TERC—or its "partners" at DRI

undeniably involved in geoengineering. They are two-bit actors, “extras” on the set in a global tragedy being enacted, not connecting the facts for the decision-makers.

Don’t forget public, these research specialists are supposed to be the smartest people, the trained experts with science backgrounds, so the blindness is either real, or feigned for reasons unknown. Maybe they secretly believe the global climate manipulation experiment is needed to combat climate change? DRI wants to be a rainmaker. The others nonetheless tacitly support ongoing undisclosed government efforts to change the weather and/or climate while poisoning the planet, something I will never understand that seems to be tied to economics and “service to self.”

Such geoengineering, for instance by DRI (see Part 1), is well known by hydrologists and others, but they at DRI are not military contractors so far as I know. Decreases in incoming solar radiation have been documented by decreases in energy outputs from solar arrays, for example by Dane Wigington, and may also be an unexamined factor affecting clarity in a variety of ways, just as does weather affect UV light penetration, per the SOTLR. Therefore, a suggestion is to research the ongoing changes to solar influx, “the dimming,” the number of cloudy days in past decades vs. more recent times, etc., particularly those attributable to geoengineering, with jet “chemtrails” criss-crossing over Lake Tahoe as frequently observed in the past before the overcast sets in.

Changes in incoming solar radiation since 1969 are likely not accounted for in the TERC research. Decreases in sunlight intensity over time would likely reduce depths at which a secchi disk can be observed but this is done by dispersing aerosol particles in the upper and lower atmosphere to rain down on the land and waters. So combined effects are likely going to show up in Lake clarity data as decreases in clarity from particles, even if particle numbers were, say, reduced by runoff controls. The geoengineering may also affect the sun-energy inputs driving primary production and biological responses. Who knows how these unacknowledged, unaccounted for, geoengineering factors are affecting Lake Tahoe? I don’t, nor do the researchers at TERC/DRI who remain silent behind climate-change-driven agendas and funding.

#### No Apparent Trends?

Few are interested in simply tracking the ongoing declines in clarity, even if rates are slower. I assert declines have not been arrested based on rising fine particle counts, increasing primary productivity (PP), increasing nitrogen and phosphorus, and other data in the reports, statistical “noise” aside. The complete record shows ongoing declines, and a statistical plateau is not an improvement, just a lessening or ceasing of the rate of decline. With no clear trend upward and

many factors tending toward forcing ongoing declines, clarity could resume declining from its “apparently” unchanging statistical plateau just as PP appears to be accelerating exponentially based on prior reports. (TERC is refiguring the PP baseline to accord with current measurement methods, so data from recent years is missing from the 2025 SOTLR. Any such changes to PP values are suspect and only justifiable with robust peer review in my opinion, due to the conflicts cited. See Part 1.)

### **Tahoe Environmental Research Center Welcomes a New Director**

Like many others, I respectfully welcome the new TERC Director, Stephanie Hampton, with her impressive background and credentials. I think Lake Tahoe is fortunate to gain her. However, I didn’t see any “Super-Hero” superpowers listed, though maybe she has them? I hope so. I think it is going to take more than superpowers to reverse the ongoing degradation of Lake Tahoe and not reasonable to expect. That is especially true if the role she assumes is to put the seal of approval on all that has gone before; if so, her presence will make no real difference in the fate of Lake Tahoe. On the other hand, perhaps god has sent her to assist to abate this mess?

### **TERC and the TMDL**

Director Hampton obviously has broad experience with institutional research. However, I’ve been at the Wild West Rodeo at Lake Tahoe for over three decades, and witness to the Total Maximum Daily Load modeling and regulatory actions by the two states and others, largely under the direction of former TERC Director Schladow. His recent departure, following most of the others then involved, comes at a time when the TMDL appears to be deficient in all significant respects. There have been no actual improvements in Lake clarity since the TMDL was adopted in 2011, following nearly a decade in development. The TMDL adoption was driven not only by USEPA regulations but in response to public ire over obvious continued degradation. Despite Lahontan Water Board assurances, the TMDL adoption was opposed by local government leaders in CA at the time as sediment reductions required were perceived as unrealistic and potentially too costly and difficult to achieve.

That has proven not to be the case. The TMDL pollutant reduction targets have reportedly been met with great consistency in general. Wouldn’t water quality be worse without the TMDL? That is my working assumption, and also that the TMDL has not resolved the clarity dilemma. It has brought us to now. So unless some very basic assumptions are questioned and resolved, the TMDL is not the answer. Perhaps the reduction targets should have been more stringent and tied to short-term clarity improvements?

TERC's role since the TMDL was developed seems to be to forget about any details of that past effort, laud the "partner" agencies and their staff for their role in "restoring Lake Tahoe" and give the public a microscopic view of the ongoing degradation playing out macroscopically for those like me who have lived and worked here for decades. That includes never calling the assumptions of the TMDL into question, at least not in public, or doing any research into potential shortcomings and blind spots. Perhaps that will change with Dr. Schladow's departure? Research of factors that can't be controlled (even if understood) will not cure what ails Lake Tahoe in any event; while it may aid in understanding limnology it is nest-feathering at public expense with regard to Lake Tahoe. Let's hope for more than that going forward while understanding that TERC and its research partners are in large part financially-dependent on the largesse of the agencies funding the TMDL implementation, and thus inherently in appearance of conflict of interest. It is the Lake of the States, the TMDL research funders.

### Making Waves at Lake Tahoe

Top researchers don't often get where they are by going against the powers that be, being controversial, nor do their minions. While all are interested in improving Lake Tahoe water quality, the regulatory agencies and legislative funders have a tremendous vested interest in maintaining the illusion that the problems will be resolved given enough money, staff and time . . . perhaps for them to retire, like Dr. Schladow and the others who helped develop the TMDL regulations, before the illusions break down completely.

Likewise, the research institutions have a vested interest in maintaining their government funding, and risk losing it by research into issues that would put their funders in a bad light. That's why I'm here, to point out and pursue the issues they haven't addressed, that they may be addressed in the future. If the agents continue to sideline me, I'll do what I can. Answering the TMDL question would be good research work worth doing. With that, I wish Director Hampton all the best and state that only time and her actions will tell what her contributions will be at Lake Tahoe.

### IN RECENT NEWS REPORTS . . . AND NOT

The annual release of the SOTLR comes in advance of the annual meeting of the politicians and agency heads that is either The Grandstand on the Sand (at Sand Harbor) or The Rally at Valhalla; this year it was the latter. This is an excerpt from TRPA's report of it at <https://www.trpa.gov/tahoe-summit-progress-and-legacy/>:

While progress is coming from many directions, the lake's health and clarity remain the cornerstone of TRPA's work. Recent reports show that thousands of public and private

water quality projects are now preventing more than 700,000 pounds of fine sediment from reaching the lake each year. Encouraging progress, but clarity has yet to improve during the summer months. This underscores the importance of continued action. From restoring streams and wetlands to improving transportation and expanding affordable housing to reduce commutes, today's work is laying the foundation for long-term improvements in lake clarity.

Like I wrote, an implied reference to meeting TMDL removal targets that won't achieve restoration goals and no clarity improvements, period. Half-truths are lies for agency-preservation, "weasel-words" as transparent as Lake Tahoe in early winter. The Lake Tahoe Daily Tribune (August 15, 2025) also carried a report of the Rally at Valhalla and I find nothing worth quoting from that article for purposes here, just mutual back-patting about transportation improvements, development projects and "restoration" that has yet to arrive.

#### Keeping It Real

Peggy Bourland writes a monthly editorial column in the Tahoe Mountain News called "Keeping It Real" and frequently comments on regional government and agency follies. She is widely read and seems to perceive what others without, say, my technical background, perceive with the SOTLR and agency "spin." Despite heavy propagandizing by TRPA (at all times) she knows the history and trend and isn't buying it, like the tens of thousands of readers she writes for. See <https://tahoemountainnews.net/> with the salient points reproduced below:

# Is saving Lake Tahoe a “Kobayashi Maru”?

In the Star Trek universe, a fictional training simulation designed to be a no-win scenario for Starfleet Academy cadets poses a rescue mission into Klingon territory that requires cadets to decide whether to attempt a rescue of a disabled freighter (the Kobayashi Maru) or retreat. Both options lead to certain death.

The Basin’s overlord (TRPA) has led a 60-year, \$3 billion rescue mission to save and restore Lake Tahoe that looks more and more like a no-win situation. Lake clarity has dropped forty feet in the last fifty years and scientists remain baffled by the lake’s decline in clarity (UC Davis, 2025 report). The TRPA’s current executive director, Julie Regan, claims lake clarity has stabilized and is a sign that “we” are making progress. She calls the lack of improved clarity “concerning.” The lake’s summer average of 62.3 feet of clarity and algae-tinged waters are way more than concerning.

The scientific and water clarity reports call for a return to serious environmental efforts that don’t yield to economic expansion. Yet the TRPA supported the now-defunct, five-lane Loop Road that would have paved over acres of land to make way for large economic development while displacing hundreds of workers, routinely approves luxury condominium

projects, authorized 1,800 additional buoys, and refuses to address the estimated 7,000 VHRs in the basin that contribute to the housing crisis in favor of more tourists.

In the end, Captain Kirk famously triumphs over the Kobayashi Maru simulation test by reprogramming the simulation. Tahoe’s no-win simulation test needs to be reprogrammed, but first the hucksters, TRPA, and lawmakers need to stop selling the lake out to more tourism and high-rise development and focus on preservation instead of the almighty dollar.

## UPDATES

**Measure T Appeal:** On July 25, Judge Gary Slossberg (EDC Superior Court) ruled that the request for nearly \$1.3M in legal fees by the attorney for the plaintiffs (SLT Property Owners Group/Bob McIntyre, Mark Salmon, Duggan Smith and others) in the Measure T case will be postponed for one year pending the outcome of the appeal by the Tahoe Neighborhoods Group on behalf of SLT’s voting majority. This provides temporary cover for the city and acknowledges that there is an appeal to restore Measure T. City attorneys had



**Keeping It Real**  
by  
Peggy Bourland

taxpayers to pay the meantime, if issuing permits businesses (VI neighborhoods passed by the city Google “cityofsf” VHR Buffer App

**Digital C** industry’s plan is by advertising creating a digital involves tech grocery stores the City of San coupons at grocery to offer paper discounts. San Transparency that all shop smartphone from disco

The Tahoe Daily Tribune’s August 15, 2025 issue also had a report headlined, “Joint State Effort Shields Lake Tahoe from a Record Amount of Polluted Runoff.” The article was actually a press release from the CA State Water Resources Control Board. Here is an excerpt:

Results from the bi-state report found that each of the program’s urban implementing partners, the California Department of Transportation, Nevada Department of Transportation, El Dorado County, Placer County, Douglas County, Washoe County and the City of South Lake Tahoe, exceeded their pollutant reduction targets. Results are estimated using the Pollutant Load Reduction Model, therefore actual load reductions may differ. . . .

On the research front, program partners are accelerating efforts to understand the full range of complex interactions and processes that harm lake clarity, such as wildfires, warming air and water temperatures, extreme weather and invasive species. While there is uncertainty surrounding in-lake processes, scientists and agencies agree that the TMDL Program and associated pollutant reductions are fundamental to protecting the lake.

The press release also states “an estimated 727,000 pounds of fine sediment, more than 5,800 pounds of nitrogen and nearly 2,100 pounds of phosphorus were prevented from reaching the lake in 2024, all annual record highs since the program began tracking these statistics in 2016.” That’s all well and good, they made their targets in 2024, and the fractions of the maximal “total load” are unstated. The recent appointee to Lahontan Water Board Executive Officer, Ben Letton, is quoted: “. . . Building resilience into our pollutant control efforts is essential.” My reading of the above based on my experience is that, due to the heavy runoff in 2023, the runoff control systems were most likely silted up and overwhelmed long before the major runoff period ended. They are reporting only what was caught in 2024, not what was bypassed, which was major in 2023. I also question whether that was all “fine sediment” as stated, as defined by TERC and the TMDL, and how that was determined, details of the tracking models I have no time for in advance of the TRPA meeting this was prepared for.

#### Staff Changes and Promotions at Lahontan Water Board, New Executive Officer

If you didn’t notice above, the California Regional Water Quality Control Board—Lahontan Region has a new Executive Officer appointee, elevated from his position as second in command. My former colleague from Victorville, Mike Plaziak (MP) has been replaced, I know not why, but not before issuing a General Order titled: “Board Order No. R6-2025-0008, Granting Clean Water Act Section 401 Water Quality Certification and Exemption to Waste Discharge Prohibitions for Regional General Permit 4 for Lake Tahoe Minimal Impact Activities and Structures, Placer and El Dorado Counties.” This lame document sets the stage for more exempt approvals of plastic shorezone structures at Lake Tahoe, all new piers and pier replacements, with no findings to support that they will not shed prohibited microplastics and other toxic wastes. Good riddance to “MP” Mike and his misleadership of the Lahontan Water Board and staff concerning microplastics control at Lake Tahoe since my retirement.

Also gone, earlier this year, is a long-time associate Senior Scientist at the Lahontan Water Board, former supervisor of the Non-Point Source Unit with Lake Tahoe TMDL oversight responsibilities and one person who read at least some of my petitions and writings to the Lahontan Water Board and TRPA. One more institutional memory lost, I know not why. The

replacement supervisor is Senior Environmental Scientist Laurie Scribe, whom I hired decades ago. The departures are significant and I wish Laurie well in the years ahead with the deficient TMDL she inherits, and likewise for Mr. Letton, who I barely know but who knows of me.

#### Pollutant Reduction Targets and Total Loads

The State Water Board press report concludes,

These measures, such as street sweeping and stormwater infiltration, are important steps toward achieving water clarity of at least 78 feet visibility by the end of 2031. In time, the goal is for people to once again be able to see to depths of 100 feet.

Despite the record amount of pollution reduction recorded last year, the lake's annual average clarity in 2024 was only 62 feet deep, shallower than clarity levels in 2023 and 2022 of 72 and 68 feet deep, respectively. However, long-term trends in clarity are regarded as a more representative metric of lake health than year-to-year variation.

Recent data show that the lake's long-term clarity is not trending worse or improving.

Only 62 feet annual average clarity in 2024, from the new SOTLR, the new data point I was awaiting from my earlier report (Part 1) that provided extensive analysis of early 2023 impacts; I refer the reader there. Since this was another statistical low following the winter upwelling that brought clear nutrient-rich winter waters from below, similarly to 2023, this may be a pattern. We can see the reliance on TERC interpretations from the SOTLR in the last sentences. That is the *best* thing that can be said, no worsening, if that it is correct based on the limited statistics.

#### TMDL Clarity Targets Will Not Be Met, Never Have Been Met

There is no realistic chance as stated of hitting 78 feet as an annual average in six years by following the current TMDL programs in my view, clarity values last seen circa the latter 1980s. That is just a targeted clarity objective of the TMDL that won't be met, a paper TMDL. Streams move sediment all the time, but much more in response to extreme runoff and erosion events such as in 2024. A lot of soil movement occurred in 2024. Most likely much of that soil material is still working its way down to Lake Tahoe, conveyed on the stream flows, which could take a number of years or longer absent more large-scale runoff events which, of course, would move more eroded soil and sediment. The SOTLR and Water Boards don't seem to consider that and the state can seldom admit an error, makes the governors look bad. On the other hand, the latter don't understand or care as we do.

While clarity was supposed to increase following implementation of the TMDL in 2011, it has only declined overall in the last 14 years. That is more than unfortunate. It goes against the

regulation, the premise of the TMDL sold to all. The implication is that the Lahontan and State Water Boards will wait and see what the clarity conditions are in 2031 and then determine a course of action when the clarity is further diminished, and shout “Rah-rah!” for the current program in the meantime. Given the timelines to correct *anything* TMDL, the implication is the states need to begin work on revising the TMDL to be more protective now, not in six years.

#### **SPECIFIC COMMENTS BASED ON THE 2025 STATE OF THE LAKE REPORT**

The 2025 SOTLR presents data from July 2024 for certain monitored parameters. The hypothesis that increased concentrations of fine particles in the springtime may be correlated to storm runoff from the surrounding landscape needs further support based on sampling of the incoming streams that has begun. While there probably is a strong correlation, testing would need to show whether any correlation with the in-lake increase cited corresponds also to the types and amounts of particles found in runoff. Source assessments would then be needed if the types and amounts of particles do in fact account for the increase in particles.

##### **Microplastics Not Considered with Fine Particles**

Much of the prior report (Part 1) is concerned with in-lake sources of microplastics and the data TERC reported on them. Urban landscapes and roads are where microplastics from tire wear and other significant terrestrial sources of microplastics, including those deposited by air, may be found; in forests, not so much beyond air deposits. Urban runoff control systems may help collect microplastics. That is widely assumed and should be verified. Testing of storm runoff and stream waters should be conducted for microplastics to determine the contributions and species of plastic chemicals most prevalent to assist in source identifications.

While past SOTLRs and other reports have included information on microplastics, the 2025 SOTLR includes only two references to that word on page 6.8 about collection of atmospheric microplastic dust deposits on buoys in Lake Tahoe, and another mention on page 12.1 concerning their education of visitors. That dust data is needed to help fill in data gaps, and dust inputs are nonetheless largely uncontrollable unless produced regionally and are thereby manageable.

Despite the prior reporting on microplastics by TERC discussed in Part 1, the 2025 SOTLR (including the Executive Summary) omits the existence of microplastics with regard to its discussions of “Lake fine particle concentration,” stating on page 9.8 and again on 9.9, “Fine particles in the size range of approximately 1–6 microns in the upper 50 m are principally responsible for the attenuation of visible light and the consequent loss of lake clarity. **These particles can be inorganic (clay and silt) or organic (phytoplankton) . . .**” (emphasis added),

leaving out “microplastics” and repeats this again on page 9.12 with the chart for Fine Particle Distribution.

The researchers know, or should, that no testing for microplastics has been done below a level of 250 micrometers. Above that level, Lake Tahoe is among the most contaminated large water bodies in the world. There is no reasonable basis to expect that microplastics do not exist below 250 micrometers in size, right down to 6 or less, based on no testing (as reported last year by interim TERC Director Forrest). While the text is likely a carryover from prior reports, given that that plastics could also be included in and thereby affect fine particle samples the researchers collect, the omissions of microplastics in these sections is “concerning” to me. In a sense, a particle is a particle, and I am nonetheless concerned with sources of particulates not included in the models and measurements, particularly in-lake sources. The effects of microplastics on clarity readings are unknown and are apparently included with the natural substances. I don’t know that differentiation is needed, but microplastics are likely a part of the total particle counts, and could perhaps help to understand unexplained cumulative increases in the “fine particles” in recent years.

#### Microplastics Contributions from In-Lake Plastic Sources Not Considered

Another potential source of microplastics to consider and so far not discussed in any detail within public reports I am aware of is within the Lake Tahoe shoreline boundary, the marinas and piers along the Lake Tahoe shoreline comprised of polymer materials and, perhaps to a lesser extent, the plastic polymer recreational boats that the former support. Collectively I estimate these shoreline structures must amount to millions of pounds but, more specifically, each discrete piece of plastic has one or more surface areas exposed to the Lake Tahoe elements. Apart from styrofoam- or nurdle-filled ballasts for floating piers that break apart (a significant concern), the plastic surfaces exposed to sun, heat, foot traffic, cold, wind, water and ice abrasion are the areas from which microplastics are shed.

#### An Estimate of Plastic Surfaces in the Shorezone of Lake Tahoe

The total surface areas of these materials can scarcely be accurately estimated, total quantities being enormous and structures variable. For example, each “two by four” composite board has four sides, excluding the ends. Though lumber dimensions are less than names imply, let the composite board be 2 inches thick by 4 inches wide and 96 inches long (or 8 feet) for estimation purposes. The surface area then equates to 1152 square inches or 8 square feet. A moderate-sized pier 80 feet long by 4 feet wide would then have 12 boards across and 10 lengths, or 120 in total number. The surface area of the pier potentially subject to surface deterioration from

our one-pier estimate is thus 960 square feet, with some surfaces being more subject to wear and higher particle emission rates than others, but all surfaces potentially shedding year in and year out.

The 2018 Shoreline Plan of TRPA indicates at that time there were 662 piers (24 public, 638 private) and 14 marinas on Lake Tahoe, 12 in California and two in Nevada. Buoys for additional boats number over 4000. Floating platforms may also contain plastics. More piers have been approved since 2018. The Shoreline Plan has no development standards for materials in the shorezone of Lake Tahoe and no discussion of potential adverse impacts of plastics in its Environmental Impact Statement or anywhere else. Not all piers are plastic but most marinas are primarily plastic, and those that are wood will likely be replaced in time with plastic under existing deficient policies.

Therefore I will examine a potential “worst-case” scenario, an order-of-magnitude estimation for the surfaces rather than a “conservative” estimate of what the least discharges might be to estimate the potentials for decay. That is appropriate for Lake Tahoe, where the consequences of maximum releases should be considered. Since discharges of industrial microplastics from the recreational boating industry are prohibited, all discharges must be considered significant and posing a significant public nuisance condition with regard to Lake Tahoe water quality (adding toxins) and aesthetics. Even so, I’m not going to include microplastics from boats, buoys and the boats they support, which are also sources of microplastics, as are the plastic ballasts filled with styrofoam or plastic nurdles omitted from the estimate.

I’ll assume 1280 square feet of surface substantially contributing microplastics from each pier and that each marina has 20 times that amount of surface on average for its collective piers and accessways (though all are different). The estimate of eroding plastic surface area is then on the order of  $14 \times 20 \times 960 + 662 \times 960 = 942 \times 960 = 904,320$  square feet of total plastic surface area, or about 20.8 acres. One acre is a bit less than a regulation football field, and we don’t know anything about the rates or mass of materials that may be emitted year in and out, with visual evidence that it can be quite substantial. Whether the actual amount of surface is one or 100 acres, the discharges bulk or dust, is beside the point: none of this plastic belongs in Lake Tahoe. It was introduced by reversible error.

#### Toxics and Cumulative Effects of Plastics in the Shorezone

Considering the many hundreds of piers and marinas containing multiple piers around the Lake, the thousands of boats, one can begin to get a sense of the magnitude of the potential in-lake sources of plastic. Every amount added to the Lake has potential significant immediate and

cumulative impacts to water quality, biology and ecology, established beneficial uses of the waters and aesthetic qualities such as clarity. I remind that microplastics contain long-lived man-made toxins by their very chemical nature, and may contain additional toxic additives such as lead and other heavy metals. That is particularly so for the plastics of a decade or more ago, what the composite-plastics industry marketing calls “early generation” materials, with many such applications still in use around, over and in the Lake. See Part 1 for more details.

The plastic monomers have a variety of densities compared to water, defined as  $1 \text{ g/cm}^3$  at standard temperatures and air pressure, as shown in the following listing for virgin materials without additives. Those materials less dense than  $1 \text{ g/cm}^3$  would tend to have poor settling characteristics and include plastics used in plastic composite decking used in piers, old and new. (See part 1.) While many plastics, not all, have densities greater than water and would therefore tend to sink, note that may not be true for composites of polymers with wood. Since wood floats and would be bound to the plastics prior to wood decay, the bound combination may be subject to buoyant forces that would tend to maintain composite particles in suspension, where they may accumulate and cloud the water.

# DENSITY OF PLASTICS AND POLYMERS

Density of some plastics materials and polymers are given in the following table.

| Room Temperature Density Values for Polymers |                   |                                   |
|----------------------------------------------|-------------------|-----------------------------------|
| Material                                     | Density           |                                   |
|                                              | g/cm <sup>3</sup> | lb <sub>m</sub> / in <sup>3</sup> |
| ABS, Extrusion Grade                         | 1.052             | 0.038                             |
| ABS, High Impact                             | 1.024             | 0.037                             |
| Acetal, 20% Glass                            | 1.550             | 0.056                             |
| Acetal, Copolymer                            | 1.412             | 0.051                             |
| Acetal, Homopolymer                          | 1.412             | 0.051                             |
| Acrylic                                      | 1.190             | 0.043                             |
| Butadiene - acrylonitrile (nitrile)          | 0.98              | 0.0354                            |
| CPVC                                         | 1.550             | 0.056                             |

## AmesWeb

|                                                  |             |               |
|--------------------------------------------------|-------------|---------------|
| Polybutylene terephthalate (PBT)                 | 1.34        | 0.0484        |
| Polycarbonate (PC)                               | 1.20        | 0.0433        |
| Polyester (thermoset)                            | 1.04 - 1.46 | 0.038 - 0.053 |
| Polyetheretherketone (PEEK)                      | 1.31        | 0.0473        |
| Low density Polyethylene (LDPE)                  | 0.925       | 0.0334        |
| High density Polyethylene (HDPE)                 | 0.959       | 0.0346        |
| Ultrahigh molecular weight Polyethylene (UHMWPE) | 0.94        | 0.0339        |
| Polypropylene (PP)                               | 0.905       | 0.0327        |
| Polytetrafluoroethylene (PTFE)                   | 2.17        | 0.0783        |
| Polyurethane                                     | 1.052       | 0.038         |

## Reference:

- Oberg, E. , Jones ,F.D. , Horton H.L. , Ryffel H.H., (2016) . [Machinery's Handbook](#) . 30th edition. Industrial Press Inc.

### Plastic Weathering and Break-up Processes

It has been said that macroplastics “break up” into smaller pieces to become microplastics but do not “break down” in chemical composition. The composite plastic weathering and erosion processes ensue each summer with increased ultraviolet sun exposure (hard on plastics), shrinking and contracting with daily temperature changes, and with the season of use, breakage, people and dogs walking and scuffing the pier surfaces (e.g., with sandy feet), dragging skis, kayaks, paddle boards, water toys, sails, coolers, monitoring equipment and other belongings, many plastic. When the boaters retire for the season, storms set in and further dislodge and rinse the fine particles from abrasion and sun-exposure into the waters. The season of wind, snow and ice (and sun) then comes to further abrade and degrade the exposed

plastic surfaces through multiple snowstorms and freeze-thaw cycles. Finally, the warm storms of spring come to scour and rinse the surfaces abraded by wind and ice. This seasonal discharge of microplastics largely coincides with the period of greatest storm runoff and increases fine particles in the Lake, together with materials from spring runoff. When the last rainstorms of spring end the annual cycle begins anew, with occasional rinses from summer thundershowers. That is why I wrote earlier that terrestrial particles have not been partitioned from in-lake particulate sources, calling assumed correlations with particles in runoff into question.

#### **Cumulative Impact and Other Assessments Lacking**

These shoreline structures, in-lake sources of fine microplastics and very-fine nanoplastics, may plausibly be at least as significant as the terrestrial and airborne sources of fine particulates. Perhaps it is a combination of airborne, terrestrial and in-lake sources that accounts for the reported spring increase in particles? That is common sense and only further research and investigations could determine that. The order of magnitude estimate above shows that in-lake sources can't simply be discounted and dismissed out of hand without further examination and study, with relatively little known at testing-levels for microplastics below 250 micrometers. While the surface erosion products may be barely visible there is widespread evidence of significant visible mass wasting of many of the composite structures in the Lake Tahoe shorezone. With essentially very little plastic escaping the lake and tremendous amounts of water lost to evaporation each year, contamination by microplastics from these sources will only grow over time unless the existing sources are abated by removal, especially of the older and deteriorated materials still in use, and new sources are eliminated.

#### **Recreational Boating and Plastics**

Beyond the plastic piers, likewise, boats that are exposed to the weather may be a significant contributor of microplastics, from both visible and invisible deterioration. The problems are exacerbated by accumulation over time, with erosion rates of the plastic surfaces generally increasing with time and age. "Fiberglass" is a composite of polymer plastics and glass often used for boat exteriors. As fiberglass ages in the Tahoe environment it can develop surface cracks and other signs of visible deterioration, with surface emissions of particulate dust that can be discerned by wiping with a soft cloth of unlike color. Plastics shed as particulates from boat interiors (carpets, polyester, vinyl, etc) can also be discharged through bilge pumps and on the wind. Boats in deteriorated conditions must be observed and overlooked in aquatic invasive species inspections, since TRPA has inspected every boat at least once?

## Apply Common Sense to Save Money, Time and Lake Tahoe

All this could take a lot of study and expense to figure out just exactly what the specific contribution may be to the microplastics problem from the in-lake plastics and shorezone structures, and the boats, but that is ALL unnecessary and a waste of public money that could be used for abatement or other research. That is because naked-eye visual inspections are sufficient in many cases to discern surface erosion of the macroplastics and thus verify the microplastics are being discharged as wastes (as legally defined) in violation of unenforced prohibitions in federal and state law, in TRPA's Regional Plan. The erosion occurs as sub-visible discharges of plastic dust but the cumulative erosion is readily discernible with time. Focus on that with fine particulate monitoring if necessary, for instance to show effects of control efforts if developed (with none currently in the regulations).

This Idea is Taboo and Can't Be Discussed!

**The obvious answer to the microplastics discharges from plastic shoreline structures is one no one wants to hear: Remove the plastics from Lake Tahoe.** They never should have been allowed in the first place! This composite-decking came into use in the 1980s and is now common. While many sources of microplastics may not be controllable, i.e., from the landscape or sky,

THESE IN-LAKE SOURCES ARE CONTROLLABLE. THEY ARE DISCHARGING PROHIBITED TOXIC WASTES. WHILE THEY ARE MANY THEY ARE FINITE IN NUMBER.

Therefore, the only questions worth researching concerning microplastics in my mind are:

1. When will any one or all of the agencies listed below and their research "partners" do anything about the toxic microplastics in Lake Tahoe to address the errors of the past?
2. When will they stop approving of more and more plastics in the Lake Tahoe shorezone?
3. If they will not stop their approvals, what is the justification given the magnitude of the problems, the lack of appropriate implementation of existing regulations, the current unknowns concerning toxic microplastics, and the facts that Lake Tahoe is a drinking water source for Reno and others and a designated Outstanding National Resource Water for which no long-term degradation is supposedly legally allowable?

## The Exempt Industry

Activities leading to degradation by controllable but uncontrolled microplastic waste discharges in the shorezone from the recreational boating industry are not exempt from regulation. However, it has been given a tacit "free pass" by all agencies nonetheless in support of historic

recreation uses and recreation goals. Now the water is contaminated. And policies can't even be examined? Nonetheless, recreation goals can be met using wooden and metal piers and boats, like the John LeConte. The ongoing contamination of Lake Tahoe with microplastics is completely unnecessary and further approvals of plastic uses in the shorezone are inexcusable.

I note the Lake Tahoe Marina Association is a co-funder of the SOTLR, again raising the potential "appearance," at least, of a financial conflict of interest (on the part of researchers) to investigate the marinas for microplastics, which indeed has not been done to my knowledge. I presume the Marina Assn is acting entirely in good faith in doing so, to provide management information for AIS and otherwise "do their part" with limited or no awareness of the impacts of plastic shoreline structures on Lake Tahoe. Surely there is hesitation to accuse marina owners of impacts from approved structures—negligent dereliction of duty by the regulators in light of the evidence in the public records.

#### Final Thoughts on Microplastics

It is a multiple-agency conspiracy to ignore the problems: TRPA sits on the Shoreline Review Committee, as I once did, and has been repeatedly informed over several years (by me) of their responsibility for this unfolding microplastics water quality disaster, as has the Lahontan Water Board, the State Water Resources Control Board, the U.S. Army Corps of Engineers and others *approving of these plastic structures to this day*, without any thought given to microplastics. I would add the U.S. Environmental Protection Agency to the list. It is up to each agency to stop waiting and do all that is within its jurisdiction and authority to:

**KEEP TAHOE PURE, MICROPLASTICS ENDURE;**

**USE WOOD, METAL AND STONE IN THE SHOREZONE.**

# Shoreline Review Committee



- Nevada Division of State Lands
- California State Lands Commission
- Nevada Division of Wildlife
- California Department of Fish and Wildlife
- Nevada Division of Environmental Protection
- Lahontan Water Quality Control Board
- Army Corps of Engineers
- Coast Guard
- Local Jurisdictions
- Water Purveyors
- Tahoe Regional Planning Agency



## NOW IS THE TIME FOR CHANGE

The world as we know it is changing. For the Tahoe region, with the staff changes at Lahontan Water Board and TERC, and TRPA in recent years, there is an opportunity to reconsider the past approaches. It has to happen or the clarity battle is a stalemate at best and bound to be lost in time. They are, in essence, the new crew and we'll see what they do. Director Hampton seeks to "have the opportunity to see our work through fresh eyes." May it be so, and god speed.

That is my petition and charge to TRPA, specifically. If TRPA stops approving these plastic shoreline structures, there will be no more new shoreline structures approved by any other agency. There are reasonable alternatives. Be a planner, TRPA. No chemical testing is needed for TRPA and Lahontan Water Board to begin to follow the law and fulfill your public trust under the Compact to keep Lake Tahoe pure with regard to shoreline structures. TRPA and others must stop polluting Lake Tahoe with toxic microplastics for the long term by care-less piecemeal approvals and unjustified prohibition exemptions for plastic shoreline structures solely for Lake Tahoe joy-rides. Wood, metal and stone are alternatives.

Likewise the Water Boards must not wait to address the TMDL shortcomings—with the aid of the research community, honestly invested—no ignoring known sources of pollutants. To further delay these matters is criminal in my opinion and no good will come from it.

I'm not a know-it-all and I don't have all the answers, far from it. I am seeking to ask the right questions and present my honest views without intent to deceive. I assert the reasoning is defensible behind my hypotheses. I have limited means of testing for confirmation. I have no animosity towards the new TERC Director and assume the best of intentions. Others have earned a certain amount. I have welcomed scientific and policy debate but no one seems to want that so I snipe from the sidelines to promote change.

I am writing the story for the public of how the demise of Lake Tahoe occurred at agency and legislative hands, unless and until that scenario changes. I welcome free debate where all are encouraged to speak or write their views under the First Amendment openly without fear of reprisal and retribution. Critique me if I am misinformed and we will engage. All hands are needed, doing their utmost to fulfill the law and thereby aid in the true restoration of Lake Tahoe. Let's do this work, each doing their best, together or apart.

Alan Miller, Professional Engineer

S. Lake Tahoe CA

Reference: TAHOE: STATE OF THE LAKE REPORT 2025, University of California, Tahoe Environmental Research Center, July 2025, <https://tahoe.ucdavis.edu/stateofthelake>.

#### Addendum: Author's Note Concerning Part 1

Part 1 has a Table of Contents like Part 2 as a guide. In part 1 is information on water quality standards and regulatory frameworks for the Tahoe basin including from my background and experience with the Total Maximum Daily Load Regulation for the Lake Tahoe clarity objective. There is presentation of a conceptual model for Lake Tahoe water quality followed by detailed discussions of factors not considered by the TMDL that are adversely affecting water quality. Chief among these are microplastics from approved shoreline structures, so I briefly discuss TRPA's shoreline plan, with policy recommendations, then dive into analyses and information related to the 2024 State of the Lake Report and two other reports, providing my own interpretations. Information on plastics in the shorezone concludes the report.

Rationale for Repetition: While Part 2 substantially augments Part 1, there are some redundancies and overlaps with Part 1 in Part 2 that are somewhat unavoidable, and it is nonetheless useful to circle back on topics and thereby gain new perspectives and insights. That is a part of my analytical process. I'm not seeking a license to ramble just to be wordy, tedious or bash with my reminders. I therefore suggest reading Part 1 first, as it provides additional analyses and context relevant to Part 2.