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Lahontan Water Board

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Lahontan Water Board Executive Officer, Mike Plaziak

c/o Board Clerk

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(sent via email)

Subject: Tahoe Keys Lagoons Aquatic Weed Control Methods Test Draft NPDES Permit, Exemption and Mitigation and Monitoring Reporting Program

Dear Members of the Lahontan Water Board, Executive Officer Plaziak:

Lake Tahoe is a national treasure and Tier III Outstanding National Resource Water (ONRW), renowned for the purity and clarity of its waters and its scenic beauty. All decisions affecting the long-term ecological health of Lake Tahoe require your utmost attention and concern. The Proposed Orders permitting the Tahoe Keys Property Owner's Association (TKPOA) Control Methods Test (CMT) on the January Board meeting agenda would authorize the first-ever use of aquatic herbicides in Tahoe Keys waters connected to Lake Tahoe. This will set a very dangerous precedent for the long-term use of herbicides throughout Lake Tahoe.

Herbicides are viewed as a quick fix for a rapidly worsening problem of the weeds spreading throughout the Lake. The Sierra Club contends that other alternatives and non-chemical control methods have not been sufficiently considered to warrant this unprecedented project. Herbicides will not reduce the underlying source of the invasive weed growth in the Tahoe Keys lagoons: the unnatural, stagnant, increasingly warmer waters, and decades of nutrient loading to the waters and sediments by stormwater from the Keys and South Lake Tahoe. TKPOA

acknowledges this source of the problem, stating that “The general conditions of the lagoons provide ideal habitat for prolific plant growth with abundant light, nutrients in the sediment, and near optimal water temperatures for most of the summer months.” Until the lagoon design with its stagnant, warm waters and nutrient problems are effectively addressed, the weeds will continue to plague the lagoons, whether or not herbicides are used.

Like every other invasive weed-infested lake in the US, the Keys’ lagoons would require annual, perpetual herbicide treatment (see Exhibits). Indeed, the documents provided to the Lahontan Water Board by TKPOA plans to submit future applications for multiple years of herbicide treatments. TKPOA has previously submitted permit applications for up to 12 years of herbicide treatments. Future annual, perpetual herbicide treatments in the Tahoe Keys and elsewhere in Lake Tahoe, a national treasure and Tier III ONRW, would grossly violate non-degradation regulations and threaten the Lake’s priceless water quality.

Lahontan Basin Plan Pesticide Prohibition Exemption Criteria

Adopting this precedent-setting permit to discharge herbicides before available non-chemical methods have been thoroughly evaluated and determined to be ineffective will violate the Lahontan Basin Plan. Two available non-chemical methods, UV light and laminar flow aeration, have shown promising results at Lake Tahoe, yet they have not been proven infeasible for the Keys, based on the trials in the Tahoe Keys and elsewhere, to date. The proponents of the CMT assert that the Tahoe Keys infestation cannot possibly be controlled by non-chemical methods because the infested area is so large and the infestation is so severe. However, the proponents have not provided any quantitative analyses supporting this conclusion.

The Pesticide Exemption Staff Report claims that CMT use of herbicides is justified by the CMT’s simultaneous testing of chemical and non-chemical methods. This argument is not consistent with or relevant to the criterion that non-chemical methods must first be shown to be infeasible. If this justification is accepted, simultaneous use of chemical and non-chemical methods could justify any project and effectively nullify the Basin Plan exemption criteria. When the Basin Plan was amended in 2011, the exemption criteria were included to ensure that no pesticides would be used in the Lake without adequate justification and demonstration that all other less toxic approaches had been shown to be ineffective. The Proposed Project is essentially an attempt to circumvent both the intent and the regulatory standard of the Basin Plan.

Antidegradation Regulations

The State Water Board’s “Statement of Policy With Respect to Maintaining High Quality of Waters in California” states; “... discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with the maximum benefit to the people of the State will be maintained.” The antidegradation analysis in the draft NPDES permit claims that the

water quality degradation from herbicide discharges will be to the maximum benefit of the people of the state because the discharges of herbicides will improve water quality by reduction of the invasive weed infestations at the Keys and preserve the outstanding features of the Lake which are essential to the \$5 billion recreation-based economy. However, boating is a subset of a multitude of recreational activities at Lake Tahoe, and therefore a subset of the entire recreation economy. Boating by Keys homeowners, who are the primary beneficiaries of the discharge of herbicides, is an even smaller portion of that subset. Furthermore, no information is provided about the alleged decrease in economic value of recreation attributable to existing aquatic weed infestations in the Tahoe Keys and at shoreline sites elsewhere around the Lake, or whether herbicides are necessary to protect this economic value. The antidegradation analysis fails to support its claim that discharges of herbicides would be consistent with the maximum benefit to the people of the State because they preserve the outstanding features of the Lake. Sierra Club asserts that the maximum benefit to the people would result from fixing the source of the weeds in the first place: the stagnant, warming waters and nutrient load in the Keys.

The antidegradation analysis also cites EPA's policy interpreting "short-term" to mean "weeks to months, not years." Annual, perpetual herbicide treatment, at the Keys or anywhere else in the Lake¹ would violate this policy. Surely, it's logical to conclude that this inevitable violation of antidegradation policy is a sufficient reason to deny a permit for the use of herbicides. Yet, the CMT is clearly designed to set a precedent for routinely permitting herbicide use (otherwise why include it in the test). Indeed, it is difficult to imagine what different conditions could justify denying permits for herbicide use elsewhere if herbicides are permitted in the Tahoe Keys. Thus, future permits will be routinely granted despite antidegradation regulations, thereby clandestinely circumventing those regulations.

The Real Quick-Fix: A Barrier

A reasonable and feasible quick fix, which could have been implemented years ago, is installing a barrier separating the West Channel from the Lake. Boats entering the Channel from the lagoons could be inspected for weed fragments while they are being hoisted up and over the barrier. The Sierra Club requested that a barrier alternative be analyzed during the 2019 scoping phase of the environmental review process. Our request was ignored. All of the Sierra Club comment letters on the CMT (scoping, DEIR/DEIS comments, and draft permit comments) have emphasized the absolute necessity of formulating and ordering the implementation of a long-term plan to, as completely as possible, eliminate the source of the Tahoe Keys weed infestation – the stagnant, shallow, warming, nutrient-filled waters and sediments in the

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https://www.fws.gov/anstaskforce/Meetings/2009_November/Lake%20Tahoe%20Region%20AIS%20Management%20Plan.pdf, "E1f. Continue efforts to provide for all available control technologies, including the use of aquatic herbicides to control Eurasian watermilfoil and curlyleaf pondweed (Strategy G3) by working closely with the LRWQCB." Page 59

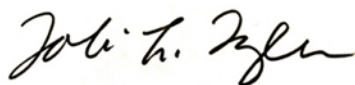
lagoons – using only non-chemical methods. We also emphasized that the long-term plan must eliminate transport of weed fragments into the Lake by boating from the Tahoe Keys during the lengthy implementation of the plan. We have received no substantive responses to these comments.

We urge you not to set a dangerous precedent by permitting the first-ever use of herbicides, to approve testing only non-chemical methods, and to order that work on devising a long-term plan addressing the source of the problem – stagnant waters and nutrients from years of stormwater inputs – be initiated. Should the Water Board have done more in the past to prevent this situation from getting so bad? Absolutely. The public needs to know why Lahontan staff allowed the water treatment and circulation systems to be discontinued in the late 1990's and 2000's, respectively, without any public input, and at the same time began laying the groundwork for herbicide discharges to the Lake. The public would also like to know if the \$4,000 per lot mitigation fees required by Resolution 82-10, which TKPOA filed a legal action against (see Exhibits), were ever used “to accomplish projects designed to achieve a net reduction of nutrients entering Lake Tahoe equivalent to that generated by the Tahoe Keys development.” [TAHOE KEYS PROPERTY OWNERS ASSOCIATION v. STATE WATER RESOURCES CONTROL BOARD | FindLaw](https://caselaw.findlaw.com/ca-court-of-appeal/1760635.html) (<https://caselaw.findlaw.com/ca-court-of-appeal/1760635.html>)

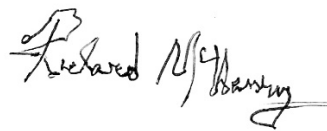
TKPOA and TKPOA's allies – the LWB staff, TRPA, and the League to Save Lake Tahoe – may have concluded that pouring herbicides into Lake Tahoe is a good idea simply because herbicides have been sold to them as the cheapest and easiest solution. TKPOA and its allies are trying to avoid the hard choices required to save Lake Tahoe from the disastrous construction of the Tahoe Keys 60 years ago. Many people inside and outside the Tahoe Basin think that pouring herbicides into Lake Tahoe is an appalling approach that will not address the source of the weed problem: the lagoons' stagnant, warm, nutrient-rich waters and nutrient-rich sediments.

The inevitable outcome of applying herbicides will be more weeds and perpetual use of herbicides. It's time to require real solutions, not toxic chemical Band-Aids. After the devastation from the Caldor, all efforts at Lake Tahoe must be made to restore the ecological health of the Tahoe Basin, restoring the natural function of watersheds and wetlands in the basin, not opening the door to continued use of unnatural, toxic chemicals.

Please deny these Orders and direct staff to draft permits for use of non-chemical methods.



Tobi Tyler, Tahoe Area Group Vice Chair



Richard McHenry, PE
California Sportfishing Protection Alliance
Director of Compliance, Board Member



Judith Tornese, President
Friends of the West Shore

/s/ Fredric Evenson
Fredric Evenson, Director
Ecological Rights Foundation



Jason Flanders
Aqua Terra Aeris Law Group

Exhibits

Evidence of Perpetual Treatment in Other US Lakes

The Michigan Riparian, Winter 2015, Hybrid Milfoil: Management Implications and Challenges, [Hybrid Milfoil Riparian 2015.pdf \(lakemissaukee.org\)](#) "Herbicide applications are the most commonly-used method to control Eurasian milfoil. However, in some lakes, herbicide treatments have become less effective. Dose rates that historically provided good control of milfoil are sometimes only partially effective, and plant die-back is incomplete and/or regrowth occurs more rapidly. Recent research indicates that hybrid milfoils may exhibit increased tolerance to some herbicides."

[Full article: Effects of repeated, early season, herbicide treatments of curlyleaf pondweed on native macrophyte assemblages in Minnesota lakes \(tandfonline.com\)](#) "Multiple years of treatment may be needed to see significant increases in overall native macrophyte abundance because significant changes in abundance were not observed within 4 years of treatment; however, consecutive early season, lakewide endotherm treatments of curlyleaf pondweed can control curlyleaf pondweed without substantial harm to native macrophytes."

Minnesota, Aquatic Invasive Species Curly-leaf pondweed: [Curly-leaf pondweed factsheet \(state.mn.us\)](#) "Past experience in Minnesota and elsewhere has shown that eradication or elimination of curly-leaf pondweed from lakes is not a realistic goal."

1994 TKPOA sued State Water Board over mitigation fees

[TAHOE KEYS PROPERTY OWNERS ASSOCIATION v. STATE WATER RESOURCES CONTROL BOARD | FindLaw](#), "In 1982, by resolution No. 82-8, Lahonton reclassified the Tahoe Keys as a man-modified stream environment zone. The resolution contains factual findings in support of the reclassification. Included among Lahonton's determinations were findings that the modification of the upper Truckee Marsh resulted in significant reduction of the natural water treatment capacity of the zone and that substantial deterioration of Lake Tahoe had resulted, and construction and continuing operation and maintenance of the Tahoe Keys lagoons and peninsulas contributes significant quantities of nutrients to the waters of Lake Tahoe. The resolution imposes requirements for the buildout of the area. The requirement with which we are concerned here is that a mitigation fee of \$4,000 be paid for each lot to be developed. The fees thus collected were to be used to establish a mitigation fund which would be used, with the participation of TKPOA, to accomplish projects designed to achieve a net reduction of nutrients entering Lake Tahoe equivalent to that generated by the Tahoe Keys development."

Comment Letters on 2011 Basin Plan Amendment

Don and Nancy Erman's Comments: [Microsoft Word - LRWQCB Basin Plan Changes/11 \(ca.gov\)](#).

Tahoe Area Sierra Club's Comments: [Microsoft Word - basin plan brief comments 4-2011.doc \(ca.gov\)](#)

Hybrid Milfoil: Management Implications and Challenges

By: Tony Groves, Paul Hausler, and Pam Tynning
Water Resources Group, Progressive AE

Background

Millions of dollars are spent annually on programs to combat invasive aquatic plants in Michigan. A primary focus of many of these programs is the control of Eurasian milfoil (*Myriophyllum spicatum*), an aggressive-growing exotic plant introduced into the United States from Europe and Asia.

Eurasian milfoil is not the only type of milfoil found in Michigan. There are several native milfoil species, such as northern milfoil (*Myriophyllum sibiricum*). Some native species closely resemble Eurasian milfoil and are commonly mistaken for it. However, the native milfoils rarely form dense, impenetrable plant beds like Eurasian milfoil often does. In some lakes, hybridization between exotic Eurasian milfoil (*M. spicatum*) and native northern milfoil (*M. sibiricum*) is occurring. Genetic testing has found milfoil hybrids to be widely dispersed across the northern portion of the United States and hybrid milfoil appears to be widespread in Michigan. The documentation of the presence of hybrid milfoil is important because hybridity in plants is often linked to invasive traits. In fact, hybrid milfoil may be more invasive than Eurasian milfoil. There is concern in the scientific community that hybrids could have a competitive advantage over, and ultimately displace both northern milfoil and Eurasian milfoil.

In terms of physical appearance, hybrid milfoil is difficult to distinguish from Eurasian milfoil. For positive identification, genetic testing is required. Further, not all hybrid milfoils are the same. There is considerable genetic variability within hybrids.

Herbicide Treatments

Herbicide applications are the most commonly-used method to control Eurasian milfoil. However, in some lakes, herbicide treatments have become less effective. Dose rates that historically provided good control of milfoil are sometimes only partially effective, and plant die-back is incomplete and/or regrowth occurs more rapidly.

Recent research indicates that hybrid milfoils may exhibit increased tolerance to some herbicides. On average, hybrid milfoil is less susceptible to control with the commonly-used aquatic herbicide 2,4-D in comparison with Eurasian milfoil. The decreased sensitivity to 2,4-D appears to be common across different hybrid lineages. Lakes that have been treated historically with 2,4-D have a higher incidence of hybrid milfoil than non-treated lakes. This research suggests that use of certain herbicides may inadvertently allow tolerant hybrid milfoil to gain dominance.

With the aquatic herbicide fluridone (Sonar®), hybrid tolerance appears to be limited to fewer hybrid lineages. While hybrid resistance to fluridone has been observed in a small percentage of lakes, hybridity does not necessarily infer fluridone tolerance.

Management Implications

Management of hybrid milfoil presents new challenges. Fortunately, there are some new tools available to document the presence of hybrid milfoil and to evaluate the potential for herbicide resistance.



Eurasian milfoil (*Myriophyllum spicatum*)



Hybrid milfoil (*Myriophyllum spicatum* x *Myriophyllum sibiricum*)

Genetic Testing: As discussed in an article in the Summer 2014 issue of the Michigan Riparian, genetic testing is now commercially available and can be used to determine the presence and distribution of Eurasian versus northern versus hybrid milfoil in a given lake. This data can, in turn, be used to inform management decisions.

Herbicide Susceptibility Screening: Another approach that is being used is herbicide susceptibility screening in which milfoil samples are collected from various locations in a lake and exposed to typical herbicide dose rates to evaluate plant response. If plant response is diminished, it may indicate the presence of hybrid milfoil and the need for reevaluation of a treatment approach, before substantial resources are committed to a treatment protocol that may not be very effective.

As with most invasive species, early detection and rapid response is key to effective control. Annual monitoring of the type and abundance of aquatic plants is an essential first step in this endeavor. In areas of the lake where milfoil is found, plant samples can be collected for further analysis.

In general, the use of herbicides with different modes of action, rather than using the same type of herbicide year after year, may help stem the spread of hybrids that are showing resistance to a particular herbicide or class of herbicides.

Given the potential management implications, genetic testing and herbicide susceptibility screening may soon become standard practices for lake managers. Additional research is ongoing to better evaluate the distribution of hybrid milfoil, its biological characteristics, herbicide treatment impacts, and its susceptibility to control measures.

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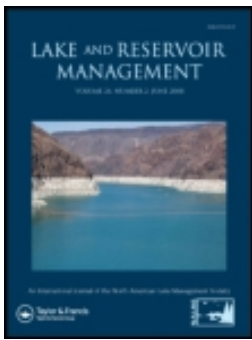
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Effects of repeated, early season, herbicide treatments of curlyleaf pondweed on native macrophyte assemblages in Minnesota lakes

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Effects of repeated, early season, herbicide treatments of curlyleaf pondweed on native macrophyte assemblages in Minnesota lakes

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Abstract

Jones AR, Johnson JA, Newman RM. 2012. Effects of repeated, early season, herbicide treatments of curlyleaf pondweed on native macrophyte assemblages in Minnesota lakes. *Lake Reserv Manage.* 28:364–374.

We examined the response of native aquatic macrophyte communities to spring herbicide treatments of curlyleaf pondweed (*Potamogeton crispus*) from 2006 through 2009. Eleven lakes were examined during our study; 8 were treated in May with endothall at 0.75–1.00 mg active ingredient per liter (ai/L) and 3 were used as untreated reference lakes. Macrophyte communities were assessed for frequency of occurrence in the littoral zone with the point intercept method in the summer after each treatment. During each survey, we collected biomass samples from 40 random locations in each lake. In the reference lakes, curlyleaf persisted at moderate to high frequencies over the 4 years, and no consistent changes in native macrophyte frequency of occurrence were seen. In most treated lakes, overall native macrophyte frequency of occurrence and species richness changed little over the 4 consecutive years of treatment, although shifts in the abundance of some species were observed. In untreated lakes, biomass varied between years, whereas in many treated lakes, biomass generally increased; however, these increases were usually not significant. The most substantial increases in biomass were attributed to single species in each treatment lake. Likewise, we observed substantial but insignificant increases of *Chara* sp. frequency and biomass in many treated lakes. Multiple years of treatment may be needed to see significant increases in overall native macrophyte abundance because significant changes in abundance were not observed within 4 years of treatment; however, consecutive early season, lakewide endothall treatments of curlyleaf pondweed can control curlyleaf pondweed without substantial harm to native macrophytes.

Key words: *Ceratophyllum demersum*, *Chara*, curlyleaf pondweed, *Elodea canadensis*, endothall, native macrophytes, *Potamogeton crispus*

Curlyleaf pondweed (*Potamogeton crispus*) is an aggressive invasive aquatic macrophyte found in Minnesota and the northern United States. The timing of curlyleaf's annual life cycle is a major factor that allows it to be a successful invader (Bolduan et al. 1994). In Minnesota and much of North America, curlyleaf sprouts in the fall as well as under ice cover during winter months (Bolduan et al. 1994). When the water starts to warm in early spring, curlyleaf exhibits rapid growth toward the water's surface (Sastroutomo 1981, Jian et al. 2003), where it begins to form a dense mat that

can block sunlight (Sastroutomo 1981). This early sprouting, rapid, cold-water growth and dense canopy formation all occur before native macrophytes begin actively growing and allow curlyleaf to out-compete and displace native macrophytes in Minnesota (Madsen and Crowell 2002). Biomass in monotypic curlyleaf stands is often much higher than in indigenous aquatic macrophyte stands (Kunii 1984, Bolduan et al. 1994). These dense monotypic stands of curlyleaf can impair recreational use of lakes (Bolduan et al. 1994) and have been shown to displace native submersed macrophytes (Catling and Dobson 1985). In addition, upon senescence in early summer, decaying curlyleaf releases nutrients into the water column that can perpetuate phytoplankton growth

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and degrade water quality (Rogers and Breen 1982, Bolduan et al. 1994).

As a result of these detrimental effects, there is considerable interest in improved approaches to control curlyleaf infestations. Previous mesocosm studies have suggested that herbicide treatment in the early spring can selectively target curlyleaf without harming native macrophytes (Getsinger et al. 1997, Netherland et al. 2000). Specifically, these past studies suggest that early season endothall treatments could benefit native macrophytes by reducing the formation of dense, surface-matted curlyleaf growth, thus increasing light availability. Although peak curlyleaf abundance occurs in mid to late spring in Minnesota, the peak abundance of most native macrophytes typically occurs later in the summer months (Crow and Hellquist 2000). Reducing curlyleaf abundance may also lead to reductions in phosphorus release and subsequent algal blooms after curlyleaf senescence (James et al. 2002), which could allow more native macrophyte growth in deeper water due to increases in water clarity. Recent research further suggests that early season, low-dose endothall treatments can be an effective method for control of curlyleaf pondweed in Minnesota lakes (Skogerboe et al. 2008, Johnson et al. 2012).

It is important that any control of curlyleaf pondweed not damage native macrophytes, but rather maintain or increase their abundance. Abundant and diverse native macrophytes communities host a variety of epiphytic organisms (Carpenter and Lodge 1986), increase macroinvertebrate abundance and diversity (Gilinsky 1984, van den Berg et al. 1997), and provide food and shelter for fishes (Smart et al. 1996, Shoup et al. 2003, Valley et al. 2004). In addition, a diverse macrophyte community can help sustain water clarity by providing a refuge for zooplankton, sequestering pelagic nutrients, reducing sediment resuspension, and decreasing phytoplankton abundance (Jeppesen et al. 1998).

Endothall, the herbicide used to control curlyleaf in our study, is a useful contact herbicide due to its short persistence time and potential to target only actively growing macrophytes during the time of application (Langeland and Warner 1986). Most native macrophyte species are dormant at the time of early spring treatments, and many emergent, floating-leaf species and charophytes are relatively tolerant of endothall, even when actively growing. However, certain submersed native macrophyte species have been shown to be sensitive to endothall if present during the time of treatment (Skogerboe and Getsinger 2001, 2002, Skogerboe et al. 2008). In particular, many macrophytes in the genus *Potamogeton* show high sensitivity to endothall, whereas coontail (*Ceratophyllum demersum*) shows only a moderate sensitivity. Despite the sensitivity of some native macrophytes to herbicide treatments, the positive effects resulting

from removal of curlyleaf pondweed may enhance the overall native macrophyte community composition and abundance. Although consecutive, annual, early season endothall treatments have been shown to be effective for controlling curlyleaf pondweed (Skogerboe et al. 2008, Johnson et al. 2012), the long-term effects of such treatments on native macrophytes have not been examined across multiple lakes.

The primary goal of this study was to assess the effects of consecutive, early season endothall treatments on native macrophyte communities. Specifically, our objective was to determine if the frequency, biomass, species richness, and diversity of native macrophytes were maintained or enhanced in lakes that received successive years of endothall treatment. A companion paper by Johnson et al. (2012, this issue) assessed the response of curlyleaf pondweed to the endothall treatments.

Methods

Study lakes

In cooperation with the Minnesota Department of Natural Resources (MNDNR), we selected 11 curlyleaf-infested lakes in Minnesota for this study (8 treated and 3 reference; Table 1). These lakes ranged in trophic status from mesotrophic to hypereutrophic, but most were eutrophic; mean Secchi depth ranged from 0.6 to 3.8 m (Table 1). The 3 reference lakes were chosen to represent levels of curlyleaf infestation, location, size and trophic status similar to the treated lakes. Study lakes varied in size from 60 to 290 ha, and all lakes were moderately shallow with maximum depth <10 m. All lakes were sampled by the University of Minnesota, although surveys prior to June 2008 for Clear, Blueberry, and Long lakes were conducted by the MNDNR. Study lake locations are provided in Johnson et al. (2012).

Herbicide treatments

Staff from the MNDNR delineated treatment areas and supervised all herbicide applications in 2006, 2007, 2008, and 2009 (Table 2). All treatment lakes were treated exclusively with endothall to achieve concentrations of 0.75–1.0 mg active ingredient per liter (ai/L) in the treated areas. In 2009, treatment was stopped on 2 of the study lakes (Crookneck and Fish), and 1 of the previously untreated reference lakes (Rebecca) was treated with endothall. Endothall applications were limited to areas of early spring curlyleaf growth; MNDNR staff delineated these areas and monitored herbicide applications. Endothall was applied by a boat-mounted tank injection system with 1 m drop hoses, allowing precise dosing and coverage. Endothall treatments were composed of a liquid formulation of the dipotassium salt of endothall and were applied when surface water

Table 1.-Characteristics of treated and untreated reference lakes, ecoregion within Minnesota and Division of Waters identifying number (DOW).

| Lake (DOW) | Trophic ^a Status | Mean Secchi (m) ^b | Ecoregion ^c | Size (ha) | % Littoral | Maximum Depth (m) | Mean Depth (m) | Survey Points (≤4.6m) |
|-------------------------|--------------------------------|------------------------------------|------------------------|--------------|---------------|-------------------------|----------------------|-----------------------------|
| Treated Lakes | | | | | | | | |
| Blueberry (80-0034) | E | 0.8 | NLF | 211 | 100 | 4.2 | 1.7 | 400 |
| Clear (47-0095) | H | 0.6 | WCBP | 201 | 83 | 5.5 | 2.8 | 225 |
| Crookneck (49-0133) | M | 2.9 | NLF | 74 | 80 | 6.7 | 3.3 | 166 |
| Fish (70-0069) | E | 1.6 | CHF | 70 | 40 | 8.5 | 4.6 | 128 |
| Julia (71-0145) | E | 0.6 | CHF | 62 | 100 | 4.6 | 2.1 | 106 |
| Long (30-0072) | H | 1.0 | CHF | 158 | 100 | 4.2 | 1.9 | 408 |
| Lower Mission (18-0243) | M | 3.8 | NLF | 292 | 60 | 8.5 | 3.9 | 220 |
| Rush (71-0147) | E | 0.6 | CHF | 65 | 100 | 3.4 | 1.3 | 112 |
| Untreated Lakes | | | | | | | | |
| Coal (77-0046) | M | 2.4 | NLF | 69 | 40 | 8.2 | 4.7 | 101 |
| Rebecca (27-0192) | E | 1.9 | CHF | 105 | 50 | 9.2 | 4.2 | 159 |
| Vails (73-0151) | E | 1.6 | CHF | 64 | 80 | 6.1 | 2.7 | 174 |

^aMesotrophic (M), Eutrophic (E), Hypereutrophic (H) (Minnesota Department of Natural Resources).

^bMay-September mean Secchi (Minnesota Pollution Control Agency).

^cCentral Hardwood Forests (CHF), Northern Lakes and Forests (NLF), Western Corn Belt Plains (WCBP).

temperatures were between 10 and 15 C. The rate of application was continuously adjusted based on the water depth to achieve target concentrations in the area of treatment.

The reference lakes did not receive lakewide herbicide treatments during the years of monitoring. In addition to the experimental treatments discussed above, several of the study lakes received herbicide treatments prior to 2006. The MNDNR supervised lakewide treatments on Fish Lake in 2005, but previous shoreline endothall treatments on Julia and Rush lakes from 2000 to 2005 and on Lower Mission in 2005 were not supervised by the MNDNR.

Table 2.-Number of consecutive years lakes were treated with endothall and years of treatments.

| Lake | Years Treated | Years of Treatments |
|---------------|---------------|------------------------|
| Blueberry | 1, 2, 3 | 2007, 2008, 2009 |
| Clear | 1, 2, 3 | 2007, 2008, 2009 |
| Crookneck | 1, 2, 3 | 2006, 2007, 2008 |
| Fish | 1, 2, 3, 4 | 2005, 2006, 2007, 2008 |
| Long | 1, 2, 3 | 2007, 2008, 2009 |
| Lower Mission | 1, 2, 3, 4 | 2006, 2007, 2008, 2009 |
| Julia | 1, 2, 3, 4 | 2006, 2007, 2008, 2009 |
| Rush | 1, 2, 3, 4 | 2006, 2007, 2008, 2009 |

Native macrophyte frequency

We employed the point intercept method (Madsen 1999) to survey aquatic vegetation in the study lakes. The sample sites (points) were located using the MNDNR Random Sample Generator extension for ArcView or the ArcMap GIS regularly spaced grid generating software extension. The distance between sample points ranged from 50 to 80 m depending on lake size. To determine the maximum depth of macrophyte colonization, we sampled beyond depths where macrophytes were found, although only depths of ≤4.6 m (littoral area defined by MNDNR) were analyzed for frequency and biomass to provide consistency across lakes and between years (Johnson et al. 2012). Due to the differences in the amount of littoral area among lakes, between 101 and 408 points were ≤4.6 m deep in each lake (Table 1). To examine native macrophyte response subsequent to spring endothall treatments, surveys for native macrophytes were conducted in August, the time of peak native macrophyte abundance. We also surveyed the plant communities in our study lakes in May and June of each year; results from these surveys are given in Jones (2010) and Johnson et al. (2012).

At each survey point, we measured water depth and sampled macrophytes with a weighted, double-headed, 0.33 m wide rake attached to a rope. The rake was tossed and then dragged for 3 m along the bottom before retrieving for analysis. Macrophytes retrieved on the rake at each point were identified and recorded as present. Floating and emergent macrophytes that were not easily sampled by the throw rake were rated based on their visible density within a 3 m radius of the boat. Rare taxa, or taxa that were not easily sampled

by the throw rake due to small size or firm rooting, were noted as present within the lake when observed submerged or floating anywhere within the water column. The littoral frequency of occurrence of macrophyte species was calculated as the number of sites with the species present divided by the total number of sampled sites ≤ 4.6 m deep.

Native macrophyte biomass

Macrophyte biomass was sampled in conjunction with each point intercept survey. Biomass was sampled at 40 sample sites randomly selected from the point intercept sites using the MNDNR Random Sample Generator extension for ArcView. Biomass was collected using a single-headed, 0.33 m wide, 14-tine rake (Johnson and Newman 2011). The rake had an extendable pole to facilitate sampling in depths of up to 4.6 m. Samples were acquired by placing the tines of the rake flush with the lake bed and rotating 3 times on the axis of the rake’s handle. The rake was rotated slowly as it was retrieved to keep macrophyte material on the rake. The collected macrophytes were then bagged and stored in an ice-filled cooler while in the field. Upon arrival to the lab, samples were stored at 5 C until they could be sorted.

Macrophytes from the biomass samples were separated by taxon and spun in a salad spinner to remove excess water. Individual taxa were placed into a preweighed paper bag, and fresh weight biomass was recorded. Bagged macrophytes were then dried for at least 48 h at 105 C and reweighed. Macrophyte biomass was converted to grams of dry mass (dm/m^2 ; rake sample area = 0.09 m^2). Mean biomass was determined as the mean mass of samples from ≤ 4.6 m depths

for all native macrophytes collectively as well as each individual taxon.

Statistical analysis

All statistical analyses were completed using R statistical software version 2.10.1 (R Development Core Team 2008). Unless stated otherwise, differences were considered significant if $P < 0.05$. Given the categorical nature of frequency data (presence or absence), we used a chi-squared analysis to test between-year differences in native macrophyte frequency (collectively and for select individual taxa) in each individual lake. Additionally, a Wilcoxon 2-sample rank sum test was used to test differences in native macrophyte biomass (collectively and for select individual taxa) between years in individual lakes.

Results

Native macrophytes (all taxa combined)

Overall, there was no clear pattern to changes in native macrophyte frequency in treated or untreated lakes during our study (Table 3). Looking at individual lake responses, native macrophyte frequency in treated lakes did not change significantly between consecutive years (chi-squared; $P > 0.05$) after 15 of the 18 lake treatments, with the remaining comparisons showing 2 cases of increased native macrophyte frequency and 1 case of decreased frequency after treatments. Similarly, native macrophyte frequency in the untreated lakes did not change significantly between consecutive years in 7 of the 8 cases, with the remaining 1 case

Table 3.-Frequency (% occurrence) of native macrophytes in each study lake for treated and untreated lakes. A dash (—) indicates that the data were unavailable either due to change in lake treatment or because the lake was added after 2005. “*” indicates the first year of endothall treatment. “◆” indicates significant change between years ($P < 0.05$, chi-squared).

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------|------|------|------|------|------|
| Treated Lakes | | | | | |
| Eutrophic | | | | | |
| Blueberry | — | — | —* | 38 | ◆ |
| Clear | — | — | 22* | 23 | — |
| Fish | —* | 76 | 69 | 76 | — |
| Julia | — | 48* | 51 | 50 | 42 |
| Long | — | — | 7* | 11 | 15 |
| Rush | — | 29* | ◆ | 50 | ◆ |
| Mesotrophic | | | | | |
| Crookneck | — | 99* | 98 | 100 | — |
| Lower Mission | — | 87* | 88 | 90 | 87 |
| Untreated Lakes | | | | | |
| Eutrophic | | | | | |
| Rebecca | — | 36 | 36 | ◆ | 46 |
| Vails | — | 40 | 30 | 21 | 23 |
| Mesotrophic | | | | | |
| Coal | — | 85 | 88 | 88 | 86 |

Table 4.—Mean August biomass (dry g/m²) ± 2 SE of native macrophytes in each study lake. A dash (—) indicates that the data were unavailable either due to change in lake treatment or because the lake was added after 2005. “*” indicates the first year of endothall treatment. There were no significant differences in biomass between years in any study lakes.

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------|------|------------|-----------|-----------|-----------|
| Treated Lakes | | | | | |
| Eutrophic | | | | | |
| Blueberry | — | — | —* | 150 ± 40 | 293 ± 318 |
| Clear | — | — | —* | 198 ± 60 | 98 ± 100 |
| Fish | —* | 370 ± 182 | 209 ± 114 | 645 ± 320 | — |
| Julia | — | 43 ± 26* | 101 ± 64 | 263 ± 182 | 794 ± 604 |
| Long | — | — | —* | 59 ± 40 | 33 ± 36 |
| Rush | — | 1 ± 2* | 60 ± 72 | 32 ± 34 | 21 ± 18 |
| Mesotrophic | | | | | |
| Crookneck | — | 371 ± 226* | 650 ± 228 | 630 ± 190 | — |
| Lower Mission | — | 111 ± 54* | 179 ± 102 | 185 ± 100 | 327 ± 250 |
| Untreated Lakes | | | | | |
| Eutrophic | | | | | |
| Rebecca | — | 44 ± 46 | 64 ± 36 | 128 ± 106 | — |
| Vails | — | 21 ± 18 | 1 ± 2 | 2 ± 2 | 57 ± 4 |
| Mesotrophic | | | | | |
| Coal | — | 336 ± 128 | 410 ± 104 | 266 ± 80 | 247 ± 98 |

showing increased frequency. Furthermore, we did not see changes in native macrophyte maximum depth of colonization in any lake.

Native macrophyte biomass varied substantially both within individual lakes (between years) and among lakes (Table 4). Mean native macrophyte biomass in many of our treated lakes was substantially higher in the final year of our study when compared to treatment year 1; however, this higher mean biomass coincided with greater variability. Consequently, the observed changes in mean treated lake biomass over the years of treatment were not significant ($P > 0.05$; Table 4). The most notable changes in native macrophyte biomass occurred in 2 of the study lakes between the last 2 years of treatment. In Lower Mission, mean native biomass increased by 75% ($P = 0.15$) while in Julia, biomass increased by 300% ($P = 0.33$) compared to the previous year (Table 4). Biomass also increased noticeably between years 1 and 2 of treatment in Crookneck (371 ± 226 to 650 ± 228 g/m², $P = 0.45$) and Rush (1 ± 2 to 60 ± 72 g/m², $P = 0.14$) and between years 2 and 3 in Blueberry (150 ± 40 to 293 ± 318 g/m², $P = 0.33$), but declined appreciably between years 2 and 3 in Clear Lake (198 ± 60 to 98 ± 100 g/m², $P = 0.15$; Table 4). Although some lakes experienced large biomass increases in the final year of treatment, most of these changes were due to a few species in each lake, and large increases in biomass were typically observed at a relatively small number of points as isolated patches of dense growth.

We observed no changes in native macrophyte species richness (number of taxa; Table 5) or the mean number of na-

tive taxa per point (Table 6) between consecutive years of treatment or between years 1 and 4 of treatment. Similarly, richness and taxa per point did not change between survey years in untreated lakes. Findings were similar when analyses were restricted to submersed taxa (floating and emergent taxa excluded).

Looking at lakes by trophic status (eutrophic and mesotrophic), there was no difference in the observed pattern of change in mean frequency (Table 3), biomass (Table 4), species richness (Table 5), or native macrophytes per point (Table 6) over time; however, mesotrophic lakes consistently had higher native macrophyte frequency, biomass, native species richness, and native taxa per point than eutrophic lakes.

Ceratophyllum demersum

C. demersum was present every year in all study lakes; however, its mean frequency and mean biomass varied greatly both within lakes (between years) and among lakes. Overall, there was no significant change of *C. demersum* frequency or biomass between years in any of the treated or untreated lakes, although biomass increased dramatically in several treated lakes (Table 7).

Elodea canadensis

Elodea canadensis was found in 7 of the 8 treatment lakes and 2 of the 3 untreated lakes. Overall, there was no pattern to changes in *E. canadensis* mean frequency or mean biomass

Native macrophyte response to herbicide control of *P. crispus*

Table 5.-Annual species richness in each study lake and list of all macrophyte taxa found in our study lakes. A dash (—) indicates that the data were unavailable either due to change in lake treatment or because the lake was added after the first treatment year. “*” indicates the first year of endothall treatment.

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------|------|------|------|------|------|
| Treated Lakes | | | | | |
| Eutrophic | | | | | |
| Blueberry | — | — | —* | 19 | 23 |
| Clear | — | — | 12* | 14 | 11 |
| Fish | —* | 16 | 19 | 16 | — |
| Julia | — | 14* | 8 | 12 | 10 |
| Long | — | — | 4* | 8 | 12 |
| Rush | — | 9* | 11 | 10 | 11 |
| Mesotrophic | | | | | |
| Crookneck | — | 21* | 22 | 26 | — |
| Lower Mission | — | 29* | 29 | 32 | 37 |
| Untreated Lakes | | | | | |
| Eutrophic | | | | | |
| Rebecca | — | 9 | 11 | 10 | — |
| Vails | — | 7 | 11 | 7 | 11 |
| Mesotrophic | | | | | |
| Coal | — | 30 | 31 | 33 | 33 |

Note. Macrophyte Taxa Found:

| | | |
|--------------------------------|----------------------------------|----------------------------------|
| <i>Bidens beckii</i> | <i>Nymphaea odorata</i> | <i>Potamogeton zosteriformis</i> |
| <i>Brasenia schreberi</i> | <i>Nuphar variegata</i> | <i>Ranunculus longirostris</i> |
| <i>Eleocharis acicularis</i> | <i>Potamogeton amplifolius</i> | <i>Scirpus acutus</i> |
| <i>Chara sp.</i> | <i>Phragmites australis</i> | <i>Sparganium eurycarpum</i> |
| <i>Ceratophyllum demersum</i> | <i>Potamogeton crispus</i> | <i>Sagittaria graminea</i> |
| <i>Elodea canadensis</i> | <i>Potamogeton foliosus</i> | <i>Stuckenia pectinata</i> |
| <i>Equisetum fluviatile</i> | <i>Potamogeton friesii</i> | <i>Spirodella polyrhiza</i> |
| <i>Fontinalis antipyretica</i> | <i>Potamogeton gramineus</i> | <i>Typha sp.</i> |
| <i>Hippuris vulgaris</i> | <i>Potamogeton illinoensis</i> | <i>Utricularia vulgaris</i> |
| <i>Lemna minor</i> | <i>Potamogeton spp.</i> | <i>Vallisneria americana</i> |
| <i>Lemna trisulca</i> | <i>Potamogeton nodosus</i> | <i>Wolffia columbiana</i> |
| <i>Myriophyllum sibiricum</i> | <i>Potamogeton praelongus</i> | <i>Zosterella dubia</i> |
| <i>Myriophyllum spicatum</i> | <i>Potamogeton pusillus</i> | <i>Zizania sp.</i> |
| <i>Najas flexilis</i> | <i>Potamogeton richardsonii</i> | <i>Zannichellia palustris</i> |
| <i>Najas guadalupensis</i> | <i>Potamogeton robbinsii</i> | |
| <i>Nitella sp.</i> | <i>Potamogeton strictifolius</i> | |

in treated lakes between treatment years (Table 8); however, 3 treated lakes showed significant changes in *E. canadensis* frequency between years. *E. canadensis* frequency tripled between years 1 and 2 of treatment in Rush Lake ($P < 0.001$) and between years 2 and 3 of treatment in Blueberry Lake ($P < 0.001$). By contrast, *E. canadensis* frequency in Julia Lake decreased by a factor of 4 between years 1 and 4 of treatment ($P < 0.001$).

Potamogeton spp.

Broadleaf *Potamogeton* spp. were found throughout a moderate number of lakes in the study at fairly low frequency and consisted of the following taxa: *P. amplifolius*, *P. gramineus*, *P. illinoensis*, *P. nodosus*, *P. praelongus*, and *P. richardsonii*. Due to the sparse distribution of these native *Potamogeton* species throughout the study lakes, the frequency and

Table 6.-Mean number of native macrophyte taxa per point in treated and untreated lakes. A dash (—) indicates that the data were unavailable either due to change in lake treatment or because the lake was added after the first treatment year. “*” indicates the first year of endothall treatment.

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------|------|------|------|------|------|
| Treated Lakes | | | | | |
| Eutrophic | | | | | |
| Blueberry | — | — | —* | 0.7 | 1.5 |
| Clear | — | — | 0.5* | 0.1 | 0.7 |
| Fish | —* | 1.3 | 1.3 | 1.5 | — |
| Julia | — | 0.9* | 1 | 1.1 | 0.8 |
| Long | — | — | 0.1* | 0.1 | 0.2 |
| Rush | — | 0.4* | 0.8 | 1 | 0.8 |
| Mesotrophic | | | | | |
| Crookneck | — | 2.5* | 2.4 | 2.5 | — |
| Lower Mission | — | 2.3* | 2.2 | 2.4 | 2.8 |
| Untreated Lakes | | | | | |
| Eutrophic | | | | | |
| Rebecca | — | 0.4 | 0.4 | 0.6 | — |
| Vails | — | 0.2 | 0.2 | 0.4 | 0.2 |
| Mesotrophic | | | | | |
| Coal | — | 3.8 | 2.9 | 3.6 | 3.7 |

biomass of a combination of these 6 broadleaf *Potamogeton* taxa were analyzed as if they were a single species (collectively referred to as *Potamogeton* spp. hereafter). Overall mean frequency of the native broadleaf *Potamogeton* species did not change significantly in any treated lakes between any of the years of treatment. Similarly, mean *Potamogeton* spp. biomass in most treated lakes was highly variable between years and showed no clear pattern of change after treatments. Untreated lakes also showed variability in mean *Potamogeton* spp. between years, but only 1 untreated lake (Coal) had considerable amounts of *Potamogeton* spp. present.

Chara sp.

The native macroalga *Chara* was found in all of our study lakes, with the exception of one untreated lake (Vails). In most treated lakes, the mean frequency of *Chara* sp. changed little over the treated years (Table 9). Mean biomass of *Chara* sp. in many treated lakes increased noticeably but insignificantly between years, however, particularly between the first and final year of treatment (Table 9). Similarly, overall *Chara* sp. biomass increased as a proportion of total native biomass from 7% in year 1 of treatment to 45% in year 4. Despite these increases between years 1 and 4 of treatment, we did not see significant increases between other years in individual lakes due to the high variability among biomass samples. In the 2 untreated lakes where *Chara* sp. occurred (Coal and Rebecca), its frequency and biomass ($\leq 1 \text{ g/m}^2$ in any given year) remained low throughout the study period and did not change between years.

Table 7.-Frequency and mean biomass (± 2) SE of *Ceratophyllum demersum* in treated and untreated lakes. A dash (—) indicates that the data were unavailable either due to change in lake treatment or because the lake was added after the first treatment year. There was no significant ($P > 0.05$) difference in frequency or biomass between years in individual lakes. “*” indicates the first year of endothall treatment.

| | Frequency | | | | | Biomass g/m ² | | | | |
|------------------------|-----------|------|------|------|------|--------------------------|---------------|---------------|---------------|-------------|
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Treated Lakes | | | | | | | | | | |
| Eutrophic | | | | | | | | | | |
| Blueberry | — | — | —* | 16 | 16 | — | — | —* | 60 \pm 13 | 46 \pm 13 |
| Clear | — | — | 24* | 17 | 19 | — | — | —* | 14 \pm 6 | 62 \pm 56 |
| Fish | —* | 76 | 67 | 73 | — | —* | 352 \pm 285 | 198 \pm 137 | 616 \pm 187 | — |
| Julia | — | 7* | 3 | 11 | 8 | — | 1 \pm 1* | 1 \pm 1 | 3 \pm 1 | 1 \pm 1 |
| Long | — | — | 0* | 0 | 2 | — | — | —* | 10 \pm 9 | 1 \pm 1 |
| Rush | — | 8* | 6 | 5 | 4 | — | 1 \pm 1* | 1 \pm 1 | 0 | 0 |
| Mesotrophic | | | | | | | | | | |
| Crookneck | — | 78* | 77 | 76 | — | — | 109 \pm 23* | 331 \pm 78 | 384 \pm 16 | — |
| Lower Mission | — | 78* | 64 | 64 | 40 | — | 39 \pm 9* | 36 \pm 9 | 35 \pm 11 | 63 \pm 15 |
| Untreated Lakes | | | | | | | | | | |
| Eutrophic | | | | | | | | | | |
| Rebecca | — | 35 | 33 | 40 | — | — | 87 \pm 56 | 62 \pm 34 | 87 \pm 54 | — |
| Vails | — | 36 | 24 | 20 | 4 | — | 48 \pm 23 | 2 \pm 2 | 4 \pm 2 | 41 \pm 13 |
| Mesotrophic | | | | | | | | | | |
| Coal | — | 52 | 40 | 49 | 44 | — | 19 \pm 5 | 19 \pm 13 | 28 \pm 12 | 31 \pm 16 |

Discussion

Johnson et al. (2012) found that curlyleaf pondweed was successfully controlled by early season endothall treatments. Our study found that repeated, early season endothall treatments in these same lakes did not have an overall negative

impact on native aquatic macrophytes. Other studies have similarly reported a lack of negative effects from endothall on nontarget native macrophytes (Skogerboe and Getsinger 2002, Skogerboe et al. 2008). Skogerboe et al. (2008) found that early season, low-dose endothall treatments reduced

Table 8.-Frequency and mean biomass (± 2) SE of *Elodea canadensis* in treated and untreated lakes. “♦” indicates significant change between years ($P < 0.05$, chi-squared). A dash (—) indicates that the data were unavailable either due to change in lake treatment or because the lake was added after the first treatment year. “*” indicates the first year of endothall treatment.

| | Frequency | | | | | Biomass g/m ² | | | | |
|------------------------|-----------|------|------|------|------|--------------------------|--------------|-------------|-------------|---------------|
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Treated Lakes | | | | | | | | | | |
| Eutrophic | | | | | | | | | | |
| Blueberry | — | — | —* | 13 | ♦ 38 | — | — | —* | 16 \pm 6 | 248 \pm 165 |
| Clear | — | — | 24* | 17 | 19 | — | — | —* | 6 \pm 1 | 22 \pm 14 |
| Fish | —* | — | — | — | — | —* | — | — | — | — |
| Julia | — | 40* | 42 | 22 | ♦ 9 | — | 45 \pm 12* | 43 \pm 14 | 7 \pm 1 | 4 \pm 1 |
| Long | — | — | 0* | 0 | 0 | — | — | —* | 1 \pm 1 | 0 |
| Rush | — | 16* | ♦ 46 | 56 | 36 | — | 0* | 77 \pm 17 | 39 \pm 12 | 6 \pm 3 |
| Mesotrophic | | | | | | | | | | |
| Crookneck | — | 3* | 2 | 5 | — | — | 1 \pm 1* | 1 \pm 1 | 1 \pm 1 | — |
| Lower Mission | — | 17* | 19 | 33 | 24 | — | 1 \pm 1* | 1 \pm 1 | 24 \pm 12 | 36 \pm 4 |
| Untreated Lakes | | | | | | | | | | |
| Eutrophic | | | | | | | | | | |
| Rebecca | — | — | — | — | — | — | — | — | — | — |
| Vails | — | 13 | 2 | 5 | 5 | — | 0 | 6 \pm 2 | 1 \pm 1 | 7 \pm 2 |
| Mesotrophic | | | | | | | | | | |
| Coal | — | 33 | 19 | 25 | 32 | — | 10 \pm 2 | 2 \pm 1 | 2 \pm 1 | 9 \pm 3 |

Native macrophyte response to herbicide control of *P. crispus*

Table 9.-Frequency and mean biomass (\pm 2 SE) of *Chara* sp. in treated and untreated lakes with means \pm 2 SE. A dash (—) indicates that the data were unavailable either due to change in lake treatment or because the lake was added after the first treatment year. There was no significant ($P > 0.05$) difference in frequency or biomass between years in individual lakes. “*” indicates the first year of endothall treatment.

| | Frequency | | | | | Biomass g/m ² | | | | |
|------------------------|-----------|------|------|------|------|--------------------------|------------|-------------|---------------|---------------|
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Treated Lakes | | | | | | | | | | |
| Eutrophic | | | | | | | | | | |
| Blueberry | — | — | —* | 6 | 14 | — | — | —* | 33 \pm 15 | 40 \pm 12 |
| Clear | — | — | 4* | 1 | 1 | — | — | —* | 4 \pm 3 | 13 \pm 12 |
| Fish | —* | 3 | 1 | 3 | | —* | 1 \pm 1 | 4 \pm 2 | 3 \pm 2 | — |
| Julia | — | 13* | 23 | 24 | 20 | — | 1 \pm 1* | 51 \pm 24 | 224 \pm 145 | 697 \pm 337 |
| Long | — | — | 1* | 7 | 9 | — | — | —* | 15 \pm 12 | 12 \pm 10 |
| Rush | — | 1* | 7 | 16 | 10 | — | 0* | 1 \pm 1 | 1 \pm 1 | 14 \pm 8 |
| Mesotrophic | | | | | | | | | | |
| Crookneck | — | 9* | 7 | 9 | — | — | 4* | 2 \pm 2 | 3 \pm 2 | — |
| Lower Mission | — | 27* | 26 | 25 | 37 | — | 44* | 52 \pm 16 | 44 \pm 11 | 157 \pm 26 |
| Untreated Lakes | | | | | | | | | | |
| Eutrophic | | | | | | | | | | |
| Rebecca | — | 0 | 0 | 6 | — | — | 0 | 0 | 0 | — |
| Vails | — | — | — | — | — | — | — | — | — | — |
| Mesotrophic | | | | | | | | | | |
| Coal | — | 5 | 4 | 2 | 0 | — | 0 | 0 | 0 | 0 |

curlyleaf frequency and biomass while not harming native macrophytes. They also reported that *E. canadensis* and *C. demersum* subsequently increased in some treated lakes. Although we did not see many significant increases in native macrophyte frequency or biomass over the 4 years of endothall treatment, biomass increased substantially in many of the treated lakes. By contrast, in the untreated lakes, native macrophyte biomass varied from year to year and did not show a clear pattern of change.

Throughout our study, lakewide native macrophyte species richness (Table 5) and the number of species per point (Table 6) did not change significantly in most treated or untreated lakes. This indicates that repeated early season endothall treatments generally did not result in an overall loss of the number of native macrophyte species or decreased diversity of the native plant community in treated lakes. The lack of an increase in the frequency of native macrophytes after curlyleaf control is also not unexpected, particularly for eutrophic lakes where phytoplankton were abundant and light availability was likely the main factor limiting macrophyte distribution (Barko and Smart 1981, Best et al. 2001). In these lakes, removing curlyleaf did not generally improve water clarity (Johnson et al. 2012; Table 10), and we did not see a change in the maximum depth of native macrophyte colonization. Similarly, mesotrophic lakes did not show increases in frequency or maximum depth of colonization. The most notable effects we observed in treated lakes were changes in the abundance (biomass) of macrophytes; however, frequency is based on macrophyte presence or absence

and is thus not particularly sensitive to changes in macrophyte abundance.

The lack of a significant decrease and the substantial but insignificant increase of overall native macrophyte biomass over 4 treatment years (Table 4) suggest that

Table 10.-Mean July/August Secchi depth in treated and untreated lakes from 2006 to 2009. Pretreatment data (PRE) include mean July/August Secchi depth 2 to 3 years prior to endothall treatment. Data provided by the Minnesota Pollution Control Agency. (<http://www.pca.state.mn.us>).

| | PRE | 2006 | 2007 | 2008 | 2009 |
|------------------------------|-----|------|------|------|------------------|
| Eutrophic Treated | | | | | |
| Blueberry | 0.5 | ^ | ^ | 0.8 | 0.7 |
| Clear | 0.5 | ^ | ^ | 0.4 | 0.3 |
| Fisha | 1.0 | 1.8 | 1.1 | 1.4 | 1.3 ^a |
| Julia | 0.4 | 0.6 | 0.4 | 0.5 | 0.5 |
| Long | 0.3 | ^ | ^ | 0.3 | 0.4 |
| Rush | 0.4 | 0.4 | 0.3 | 0.4 | 0.3 |
| Eutrophic Untreated | | | | | |
| Rebeccab | — | 0.6 | 0.6 | 0.8 | 0.6 ^b |
| Vails | — | 0.6 | 0.4 | 0.5 | 0.6 |
| Mesotrophic Treated | | | | | |
| Crookneckca | 2.9 | 2.4 | 2.7 | 2.2 | 2.6 ^a |
| Lower Mission | 1.1 | 1.3 | 1.6 | 2.6 | 2.5 |
| Mesotrophic Untreated | | | | | |
| Coal | — | 2.2 | 2.7 | 2.7 | 3.0 |

^aNot treated in 2009

^bTreated in 2009

^cIncluded in average pretreatment Secchi data

early season application of endothall did not hinder native macrophyte sprouting or growth and that the effective control of curlyleaf (Johnson et al. 2012) may have promoted increased abundance of some native macrophytes. Native macrophyte species that actively grow during the early spring or that persist throughout the year may be most susceptible to endothall treatments (Skogerboe et al. 2008). *E. canadensis* has the ability to grow quickly after ice cover recedes (Cook and Urmi-König 1984), and *C. demersum* persists year-round in Minnesota lakes (Spencer and Wetzel 1993); however, we did not see major decreases in mean frequency of *C. demersum* (Table 7) or *E. canadensis* (Table 8) in most treated lakes. Curlyleaf pondweed has low carbohydrate reserves during the time of endothall application (Woolf and Madsen 2003), making recovery after endothall treatments difficult, whereas native macrophytes like *E. canadensis* and *C. demersum* do not exhaust carbohydrate reserves during this time and have also been shown to recover after endothall treatments (Skogerboe and Getsinger 2002). Furthermore, endothall has been shown to target metabolically active macrophytes. Although curlyleaf pondweed actively grows immediately after ice-out, the majority of native macrophytes in our study are not thought to be metabolically active until water temperatures exceed 15 C (Westerdahl and Getsinger 1988).

Considering that both *C. demersum* and *E. canadensis* were present in many of our study lakes during early season endothall treatments, positive effects due to reduced competition with curlyleaf for light or nutrients may possibly have been masked by nonlethal damage from endothall contact. In untreated lakes, *C. demersum* and *E. canadensis* frequency showed no clear pattern of change; however, *C. demersum* biomass increased dramatically in several treated lakes between years 1 and 4 of treatment (Table 7). Similarly, *E. canadensis* biomass remained unchanged or increased slightly in every treated lake with the exception of Julia and Blueberry, and we observed a substantial increase of *E. canadensis* biomass in Blueberry Lake between year 2 ($15.5 \pm 12.4 \text{ g/m}^2$) and year 3 ($248.3 \pm 154.4 \text{ g/m}^2$) of treatment. In addition, large mats of *E. canadensis* were found in the same areas of Blueberry Lake where curlyleaf was abundant the previous year. This suggests that the increased biomass of *E. canadensis* in Blueberry was associated with reductions of curlyleaf. In Lake Julia, *E. canadensis* frequency decreased between year 1 and year 4, possibly due to competition with other native macrophytes, particularly *Chara* sp. and *Najas guadalupensis*. The biomass of *N. guadalupensis* in Julia increased each year from $7.6 \pm 8.8 \text{ g/m}^2$ in year 1, to $99.7 \pm 15.4 \text{ g/m}^2$ in year 4, while *E. canadensis* biomass decreased each year during the same time period (Table 8), although both these changes were insignificant.

We expected that various native *Potamogeton* spp. would be affected by endothall treatments because many *Potamogeton*

species are sensitive to endothall. Laboratory studies have shown that *P. praelongus*, *P. nodosus*, and *P. illinoensis* are highly sensitive to endothall treatments (Skogerboe and Getsinger 2001, 2002); however, many of these native *Potamogeton* species do not actively grow during the time of early season treatment in Minnesota. The abundance of native *Potamogeton* spp. was also very low in our study lakes, making it difficult to detect any effects. We did not see major decreases in any native *Potamogeton* species in our study lakes, suggesting that there were few nontarget effects of the endothall treatments. The untreated lake that contained abundant native *Potamogeton* species (Coal) also did not show any trends of declining biomass or frequency for *Potamogeton* spp., suggesting that the curlyleaf infestation in that lake was not causing continued declines in native *Potamogeton* taxa. Water clarity (Table 10) and native macrophyte growth in Coal Lake were high and not typical of lakes where large curlyleaf invasions occur, which may have allowed *Potamogeton* species to coexist with curlyleaf in this lake.

Endothall treatments did not have a negative effect on *Chara* sp. and may have been associated with enhanced growth. Extremely large increases of *Chara* sp. were observed in some of our treatment lakes; however, the rake method for biomass collection may possibly overestimate high densities of macrophytes (Johnson and Newman 2011), and the increases of *Chara* sp. biomass may have been magnified due to the collection methods. Despite possible overestimates of biomass, it is likely that our estimates accurately reflect relative changes in biomass.

Our finding that *Chara* sp. persisted or increased in our treated lakes is not unexpected. Charophytes are green macroalgae that differ greatly in physiology compared to aquatic angiosperms; thus, sensitivity to the same herbicides is not likely. Herbicide tolerance in charophytes may be due to a thick calcium and magnesium coating that may act as a barrier to chemicals (Wade 1990). Furthermore, charophytes produce spores (oospores) that are released in large numbers, sprout annually (Bonis and Grillas 2002), and may result in high recruitment. Wade (1990) found that in lakes where herbicides have been used, *Chara* sp. colonized areas previously inhabited by angiosperms. Similar results have been found in Minnesota where increases of *Chara* sp. were observed shortly after fluridone treatments in Lac Lavon (Crowell et al. 2006) and after treatment with 2,4-D, triclopyr, and endothall in Lake Minnetonka, where *Chara* sp. doubled in frequency within 2 years of treatment (Skogerboe and Netherland 2008).

In addition to herbicide tolerance and dormancy during application, there are other reasons why *Chara* sp. may have increased in our study lakes. Some charophytes are able to grow in areas of low light intensity due to a low

compensation point (Casanova and Brock 1999, Shilla and Dativa 2008). Charophytes are also rapid colonizers; Meijer et al. (1999) found that after the removal of fishes from 3 eutrophic lakes, charophytes had colonized 50% of the littoral area within 2 months. Although *Chara* sp. is a rapid colonizer that can grow quickly in disturbed habitats, charophytes have been known to be poor competitors with other established macrophytes (Wade 1990). High densities of other macrophytes limit the growth and germination of charophytes, whereas low densities of vegetation provide opportunities for *Chara* sp. to quickly establish thick mats (Bonis and Grillas 2002). In our study, *Chara* was able to inhabit areas where curlyleaf was controlled by herbicide over consecutive years.

Our finding of a lack of negative effects on native macrophytes is restricted to early season, low-dose endothall treatments; lakewide treatment with other herbicides may harm native macrophytes. Results from 2 other Minnesota lakes showed that consecutive years of early season treatment with fluridone resulted in dramatic declines in *C. demersum* in one lake, and in another lake, combined treatments with 2,4-D and endothall or triclopyr and endothall resulted in declines of *C. demersum* and *E. canadensis* (Jones 2010).

Although native species richness, taxa per point, and frequency of occurrence for native macrophytes were all substantially higher in mesotrophic lakes than in eutrophic lakes, there was no evidence of differential response to treatment. Thus early season control of curlyleaf with endothall seems suitable for both eutrophic and mesotrophic lakes, but such treatments will likely not result in rapid increases in native macrophytes in either lake type.

Increased native macrophyte biomass in some of our treated lakes may have been associated with the significant reductions of curlyleaf pondweed documented by Johnson et al. (2012). However, early season endothall treatments may have provided the most benefit for macrophyte species that do not actively grow during the time of herbicide application. Macrophytes, such as *Chara* sp., which germinate annually from seeds or propagules, are not likely to be harmed by early season herbicide treatments, whereas macrophytes that persist over the winter and actively grow in the early spring may be affected by early season endothall treatments. Overall, our results show that early season, low-dose endothall treatments do not cause substantial damage to native macrophyte communities and may promote increased abundance of some taxa after several years of treatment through effective control of curlyleaf.

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What is curly-leaf pondweed?

Curly-leaf pondweed is a non-native, invasive submersed aquatic plant that was first observed in Minnesota in about 1910.

Distribution in Minnesota

Curly-leaf pondweed is known to be present in more than 750 lakes in 70 of the 87 counties in Minnesota.

How to identify it

Curly-leaf is similar in appearance to many native pondweeds commonly found in Minnesota waters. It can be distinguished from other pondweeds by its unique life cycle. It is generally the first pondweed to come up in spring and dies in mid-summer. Leaves have undulating and finely serrated edges.



Why is it a problem?

In spring, curly-leaf pondweed can interfere with recreational and other uses of lakes and rivers by producing dense mats at the water's surface. Matted curly-leaf pondweed can displace native aquatic plants. In mid-summer, curly-leaf plants usually die, and dying plants accumulate on shorelines.

In a number of Minnesota lakes, low water clarity and algal blooms are found in mid-summer after the curly-leaf pondweed dies. Recent research suggests that the invasive plant does not cause these conditions. Lake-wide treatments of curly-leaf done in multiple, consecutive years did not

lead to significant increases in water clarity or native submersed plants.

Where is it a problem?

In Minnesota, Curly-leaf pondweed has caused problems in lakes by producing extensive mats in 3 to 10 feet of water. The plant is often a problem in lakes with low water clarity, mid-summer Secchi depths of three feet or less. Curly-leaf pondweed has not caused extensive problems in every body of water where it is established.

When is it a problem?

Curly-leaf may grow to problem levels in a lake one year, but not the next. This appears to be due to the weather, which can cause variations from year to year in environmental conditions in lakes.

What can be done?

Problems caused by curly-leaf can be managed by treatment with herbicides or mechanical removal of plants (see adjacent fact sheet on Best Management Practices).

How does it spread?

Curly-leaf is believed to spread from one body of water to another primarily by the unintentional transfer of plant fragments, primarily on trailered boats.

What can be done to prevent its spread?

The most important action is to remove all vegetation from your watercraft before you move it from one body of water to another.

Regulatory classification

Curly-leaf pondweed is classified as *prohibited invasive species* in Minnesota. It is illegal to possess, buy, sell, transport, and introduce a prohibited invasive species.



What can be done to manage curly-leaf pondweed?

Past experience in Minnesota and elsewhere has shown that eradication or elimination of curly-leaf pondweed from lakes is not a realistic goal. Problems caused by curly-leaf can be managed using available methods of control. Dense mats of curly-leaf that interfere with use of a lake can be reduced by mechanical harvesting or treatment with herbicide.

Can control of curly-leaf pondweed increase water clarity or native aquatic plants?

In the past, it was suspected that the plant was one cause of reduced clarity and algal blooms seen after the plant dies in midsummer. In attempts to increase water clarity and native plants in such lakes, the DNR and numerous partners used herbicides of curly-leaf pondweed in more than ten lakes from 2003 to 2012. Treatments reduced growth of the plant and disrupted reproduction, but water clarity was not consistently improved. Curly-leaf was reduced lake-wide, but a matching increase in native plants was not observed. In lakes with low water clarity, lake-wide control of curly-leaf pondweed in most cases appears more likely to reduce the amount of vegetation.

Mechanical control of curly-leaf

Mechanical control means to cut or pull by hand or with equipment such as rakes, cutting blades, and hand-operated or motorized trimmers. Mechanical control of large areas often uses floating, motorized harvesting machines that cut the plants and remove them from the water.

Use of herbicide to manage curly-leaf pondweed

Most treatments of curly-leaf pondweed are done with endothall herbicide. To selectively control the invasive plant, the goal is to have treatments done early in spring when water temperatures are between 50 and 60° F and are increasing.

Current BMP for curly-leaf pondweed

The most successful and cost-effective control projects involve partial-lake treatments. These treatments usually are focused on enhancement of recreational use.

Permits and technical assistance

If you would like more information on management of milfoil or other aquatic invasive species, contact the nearest Invasive Species Specialist. These staff can also help with permit applications to manage invasive aquatic plants.

Northwest MN

| | |
|--------------|-----------------------|
| Park Rapids | 218-699-7293 |
| Fergus Falls | 218-739-7576 ext. 254 |

Northeast MN

| | |
|--------------|--------------|
| Grand Rapids | 218-999-7805 |
| Brainerd | 218-833-8645 |

Central MN

| | |
|-------------|--------------|
| Sauk Rapids | 320-223-7847 |
| St. Paul | 651-259-5828 |

Southern MN

| | |
|------------|-----------------------|
| Hutchinson | 320-234-2550 ext. 238 |
| Waterville | 507-362-8786 |

Statewide

| | |
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| Saint Paul | 651-259-5100 |
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TAHOE KEYS PROPERTY OWNERS ASSOCIATION V. STATE WATER RESOURCES CONTROL BOARD

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Court of Appeal, Third District, California.

**TAHOE KEYS PROPERTY OWNERS' ASSOCIATION, Plaintiff and Appellant, v. STATE
WATER RESOURCES CONTROL BOARD et al., Defendants and Respondents.**

No. C012562.

Decided: March 30, 1994

Feldman, Shaw, DeVore, Lewis S. Feldman and Deborah A. Palmer, S. Lake Tahoe, for plaintiff and appellant. Daniel E. Lungren, Atty. Gen., Roderick E. Walston, Chief Asst. Atty. Gen., Jan S. Stevens, Walter Wunderlich, Asst. Attys. Gen., and Daniel L. Siegel, Deputy Atty. Gen., for defendants and respondents.

The plaintiff Tahoe Keys Property Owners' Association (TKPOA) brought an action against defendants State Water Resources Control Board, State of California Regional Water Quality Control Board—Lahonton Region (Lahonton), and State of California Resources Agency (Resources Agency),¹ seeking various forms of relief based upon its contention that a mitigation fee charged as a condition for obtaining building permits is unlawful. TKPOA unsuccessfully sought a preliminary injunction which would have precluded the defendants from collecting further mitigation fees and would have prevented them from making expenditures from the fund created by those fees which were previously collected. TKPOA appeals from the denial of its request for a preliminary injunction. We shall affirm.

FACTUAL AND PROCEDURAL BACKGROUND

In this appeal we do not have before us a fully developed factual record for two reasons. First, this is an appeal from the denial of a request for a preliminary injunction. A preliminary injunction is a provisional remedy and, except in unusual circumstances, a request for a preliminary injunction would not support a final determination on the merits. (See *Camp v. Board of Supervisors* (1981) 123 Cal.App.3d 334, 357, 176 Cal.Rptr. 620.) Accordingly, a request for a preliminary injunction does not contemplate a full trial on the merits. (Ibid.) Second, TKPOA is convinced that the decision of the United States Supreme Court in *Nollan v. California Coastal Comm'n* (1987) 483 U.S. 825, 107 S.Ct. 3141, 97 L.Ed.2d 677 compels a

decision in its favor and has thus approached this case as though it could be resolved as a question of law. As we shall explain, this case is not controlled by *Nollan* and on the record presented we find no error in the denial of TKPOA's request for preliminary injunctive relief.

Only a brief factual recitation drawn from the parties' submissions, including the verified complaint, is necessary. The area known as the Tahoe Keys consists of 26 subdivisions bordering on Lake Tahoe. The Tahoe Keys is a waterfront development which was created by extensive dredge and fill operations in what was formerly the Truckee Marsh. The development consists of individual lots on "arms of land" raised above the lake level by fill operations and surrounded by lagoons that meander through the development so as to give each lot owner access to the lagoons and through the lagoons to the lake. TKPOA is an owners association representing 1,594 members who own property within the Tahoe Keys and that holds title to the common areas in the Tahoe Keys.

The Tahoe Keys development commenced in the spring of 1959 and continued during the 1960's.

In 1970 the developer conveyed its interest in the common areas to TKPOA, and in a resolution Lahontan has stated that the modifications to the former stream environment zone (SEZ) were accomplished prior to 1972.

The Tahoe Basin is a unique natural environment.² "However, there is good reason to fear that the region's natural wealth contains the virus of its ultimate impoverishment." (*People ex rel. Younger v. County of El Dorado* (1971) 5 Cal.3d 480, 485, 96 Cal.Rptr. 553, 487 P.2d 1193.) By the late 1960's California, Nevada and the federal government were becoming increasingly aware of the degradation which was being and would be wrought by uncontrolled development of the region. In 1968 California and Nevada entered into the Tahoe Regional Planning Compact to regulate development. (See Gov.Code, §§ 66800–66801; Nev.Rev.Stat. (1973) §§ 277.190–277.220.) Congress gave its consent to the compact in 1969. (*Lake Country Estates v. Tahoe Planning Agcy.*, supra, 440 U.S. at p. 394, 99 S.Ct. at p. 1173, 59 L.Ed.2d at p. 406.) The Tahoe Regional Planning Compact created the Tahoe Regional Planning Agency (TRPA). (*Ibid.*) At the same time our Legislature created the California Tahoe Regional Planning Agency (CTRPA) to attempt to maintain an equilibrium between the region's natural endowment and its manmade environment. (Gov.Code, § 67002.) In creating CTRPA the Legislature provided for its deactivation upon the adoption by TRPA of ordinances, rules and regulations which met the requirements of the regional compact. (Gov.Code, § 67131; *California Tahoe Regional Planning Agency v. Day & Night Electric, Inc.* (1985) 163 Cal.App.3d 898, 906, 210 Cal.Rptr. 48.)

Virtually contemporaneous with rising concerns over the degradation of the Tahoe Basin and the creation of TRPA and CTRPA, our Legislature enacted a comprehensive revision of our water quality control laws in order to provide for a statewide program for the control of the quality of all of the waters of the state. (Stats.1969, ch. 482; see Water Code, § 13000.) The core of this new legislation was the Porter–Cologne Water Quality Control Act. (Wat.Code, § 13020 et seq.)

See generally Robie, *Water Pollution: An Affirmative Response by the California Legislature* (1970) 1 Pacific L.J. 2.) The new legislation retained from prior law the concept of enforcement of water quality objectives through nine regional boards, but gave the regional boards and the State Water Resources Control Board greater powers and duties to implement water quality policies. (See Robie, supra, 1 Pacific L.J. at p. 4.) Each regional board was required to formulate and adopt water quality control plans for all areas within its region, subject to approval by the state board. (Wat.Code, §§ 13240, 13245.) Lahontan is the regional board with jurisdiction over the Tahoe Basin. (Wat.Code, § 13200, subd. (h).)

In the early 1980's, at a time when structures had been built upon roughly two-thirds of the lots in the Tahoe Keys, both CTRPA and Lahonton classified the area as a stream environment zone under their respective regulations.³ Such a classification would effectively preclude owners from obtaining development permits to construct dwellings on their vacant lots. TKPOA, on behalf of its members, asked CTRPA and Lahonton to reclassify the Tahoe Keys to a classification which would enable individual lot owners to obtain building permits. The record on appeal does not include the records of the administrative proceedings which led up to the reclassification of the Tahoe Keys by CTRPA and Lahonton. It does appear, however, that there were extensive scientific studies, negotiations, and hearings conducted by and between CTRPA, Lahonton and TKPOA before reclassification of the Tahoe Keys in 1982.

In 1982, by resolution No. 82-8, Lahonton reclassified the Tahoe Keys as a man-modified stream environment zone. The resolution contains factual findings in support of the reclassification. Included among Lahonton's determinations were findings that the modification of the upper Truckee Marsh resulted in significant reduction of the natural water treatment capacity of the zone and that substantial deterioration of Lake Tahoe had resulted, and that the construction and continuing operation and maintenance of the Tahoe Keys lagoons and peninsulas contributes significant quantities of nutrients to the waters of Lake Tahoe. The resolution imposes requirements for the buildout of the area. The requirement with which we are concerned here is that a mitigation fee of \$4,000 be paid for each lot to be developed. The fees thus collected were to be used to establish a mitigation fund which would be used, with the participation of TKPOA, to accomplish projects designed to achieve a net reduction of nutrients entering Lake Tahoe equivalent to that generated by the Tahoe Keys development.

Also in 1982, by resolution No. 82-10, CTRPA reclassified the Tahoe Keys as a substantially altered stream environment zone. The CTRPA resolution included factual findings similar to the Lahonton resolution. CTRPA also imposed a \$4,000 per lot mitigation fee on further construction.⁴ The CTRPA resolution refers to a memorandum of understanding (MOU) that had been prepared to set forth the mitigation package proposed by TKPOA, which would include the requirement of a \$4,000 mitigation fee.⁵ It states that the mitigation fund thus established would be used to achieve a net reduction of nutrients equivalent to that generated by the Tahoe Keys and that priority would be given to on-site (within the Tahoe Keys) mitigation measures.

From the time of the Lahonton and CTRPA resolutions in 1982 until February 1991, TKPOA did not protest the imposition of mitigation fees and individual lot owners who obtained building permits paid their fees into the mitigation fund. During that time approximately 300 residences were constructed and, with interest, the mitigation fund grew to approximately \$1.5 million.

By letter dated February 15, 1991, TKPOA objected to the past and future imposition of the mitigation fee. It demanded that the mitigation fees which had been collected be refunded and that no such fee be imposed on future construction. Lahonton rejected TKPOA's demand by resolution No. 6-91-47. TKPOA commenced this action in June 1991.⁶ TKPOA seeks to preclude CTRPA and Lahonton from collecting further mitigation fees and to require them to pay over to TKPOA the mitigation fund established from the fees previously collected.

TKPOA sought preliminary injunctive relief to restrain CTRPA and Lahonton from collecting any further mitigation fees and from making any expenditures from the mitigation fund pending trial.⁷ The trial court denied the request for preliminary injunctive relief and TKPOA appeals.

DISCUSSION

“The law is well settled that the decision to grant a preliminary injunction rests in the sound discretion of the trial court.” (IT Corp. v. County of Imperial (1983) 35 Cal.3d 63, 69, 196 Cal.Rptr. 715, 672 P.2d 121.) The party challenging an order granting or denying a preliminary injunction has the burden of making a clear showing of an abuse of discretion. (Ibid.) An abuse of discretion will be found only where the trial court's decision exceeds the bounds of reason or contravenes the uncontradicted evidence. (Ibid.)

In determining whether or not to issue a preliminary injunction, a trial court must evaluate two interrelated factors. The first is the likelihood that the plaintiff will prevail on the merits at trial.

The second is the interim harm the plaintiff may suffer if the injunction is denied as compared to the harm that the defendant may suffer if the injunction is granted. (IT Corp. v. County of Imperial, supra, 35 Cal.3d at pp. 69–70, 196 Cal.Rptr. 715, 672 P.2d 121.) In thus balancing the respective equities of the parties, the court must determine whether, pending a trial on the merits, the defendant should or should not be restrained from exercising the right claimed by it. (Ibid.)

TKPOA sets forth several legal theories upon which it believes it is entitled to relief. While these legal theories require separate consideration with respect to the likelihood that TKPOA will prevail on the merits, the harm which TKPOA may suffer if provisional relief is denied is a factor which is common to the propriety of preliminary injunctive relief under every theory. Accordingly, before individually addressing the potential merits of TKPOA's theories, we will first address TKPOA's claim of interim harm by denial of preliminary injunctive relief.

The showing of potential harm that a plaintiff must make in support of a request for preliminary injunctive relief may be expressed in various linguistic formulations, such as the inadequacy of legal remedies or the threat of irreparable injury (compare Civ.Code, § 3422 with Code Civ.Proc., § 526),⁸ but whatever the choice of words it is clear that a plaintiff must make some showing which would support the exercise of the rather extraordinary power to restrain the defendant's actions prior to a trial on the merits. (See *Jessen v. Keystone Savings & Loan Assn.* (1983) 142 Cal.App.3d 454, 459, 191 Cal.Rptr. 104; *Voorhies v. Greene* (1983) 139 Cal.App.3d 989, 997, 189 Cal.Rptr. 132; *Schwartz v. Arata* (1920) 45 Cal.App. 596, 601, 188 P. 313.) In general, if the plaintiff may be fully compensated by the payment of damages in the event he prevails, then preliminary injunctive relief should be denied. (Ibid.) Where, as here, the defendants are public agencies and the plaintiff seeks to restrain them in the performance of their duties, public policy considerations also come into play. There is a general rule against enjoining public officers or agencies from performing their duties. (*Agricultural Labor Relations Bd. v. Superior Court* (1976) 16 Cal.3d 392, 401, 128 Cal.Rptr. 183, 546 P.2d 687; *Golden Gate S.T., Inc. v. San Francisco* (1937) 21 Cal.App.2d 582, 584–585, 69 P.2d 899.) This rule would not preclude a court from enjoining unconstitutional or void acts, but to support a request for such relief the plaintiff must make a significant showing of irreparable injury. (Ibid.)

TKPOA presented little evidence or argument that would support a claim of irreparable injury in the event of the denial of provisional relief. There was no evidence to suggest that if defendants continue to collect the mitigation fee individual lot owners would be precluded from building upon or otherwise utilizing their property.⁹ In the event TKPOA should prevail legal damages will be readily ascertainable and there was no evidence to suggest that if TKPOA prevails individual lot owners cannot be fully compensated by payment of those damages. In asserting the right to provisional relief TKPOA argued, essentially, that the fee is unconstitutional and if defendants are permitted to collect it pending trial then individual lot owners will be compelled to suffer, at least temporarily, the payment of an unconstitutional fee. To the extent

this assertion involves the likelihood that TKPOA will prevail on the merits we will discuss it in a subsequent portion of this opinion. At this point, we will not presume irreparable injury or the inadequacy of legal remedies based simply on assertion of a constitutional theory for relief.

With respect to expenditures from the mitigation fund, TKPOA's showing was even more scant. The mitigation fund was established by the payment of fees by individual lot owners who built on their lots in the nine years between defendants' reclassification of the Tahoe Keys and TKPOA's objection to the fees. Repayment through the assessment of damages, the legal remedy, is the only relief that can be accorded those persons and an order enjoining expenditures from the mitigation fund will neither ameliorate their damages nor hasten their recovery. TKPOA's attempt to establish the potential of harm from a denial of provisional relief was based upon the assertion that in light of the state's budget difficulties it would appear that the state could not respond in damages if TKPOA prevails. We, like the trial court, find that assertion to be entitled to short shrift. Although it is common knowledge that the state has suffered through budgetary difficulties in the last several years (see *Department of Personnel Administration v. Superior Court* (1992) 5 Cal.App.4th 155, 163, 6 Cal.Rptr.2d 714), the entire Tahoe Keys mitigation fund amounts to much less than .00003 percent of the state's annual general fund budget and there is no reason to believe that the state would be unable to reimburse any expenditures from the mitigation fund in the event it should be judicially determined that it must do so.

On the other side of the scale we consider the potential harm to defendants if a preliminary injunction is granted. Where, as here, the plaintiff seeks to enjoin public officers and agencies in the performance of their duties the public interest must be considered. (*Loma Portal Civic Club v. American Airlines, Inc.* (1964) 61 Cal.2d 582, 588, 39 Cal.Rptr. 708, 394 P.2d 548; *Cota v. County of Los Angeles* (1980) 105 Cal.App.3d 282, 292, 164 Cal.Rptr. 323.) In this instance the defendants are attempting to perform their legal duties to preserve or at least mitigate the degradation of Lake Tahoe and its environs caused by development. That is a matter of significant public concern and provisional injunctive relief which would deter or delay defendants in the performance of their duties would necessarily entail a significant risk of harm to the public interest. If defendants are enjoined from making expenditures from the mitigation fund pending trial on the merits then they may very well delay or forgo mitigation projects with resulting harm to the public interest.¹⁰

With respect to TKPOA's request for an injunction against further collection of mitigation fees from individual lot owners, we find significant potential harm to defendants. TKPOA is acting in a representative capacity in seeking to restrain defendants from collecting mitigation fees from individual lot owners pending trial on the merits. No individual lot owner is a party to this action. Accordingly, if the defendants are provisionally restrained but ultimately prevail, the trial court will lack the ability to recompense defendants for the fees they will have been precluded from collecting in the interim. In that event the defendants will be relegated to the potentially expensive and time-consuming necessity of bringing multiple collection actions against individual lot owners in an effort to recoup their damages. This is a compelling reason for denial of TKPOA's request for provisional relief against the collection of mitigation fees from individual lot owners. (See *Santa Cruz F.B. Assn. v. Grant* (1894) 104 Cal. 306, 308, 37 P. 1034.)

Based upon these factors we find little risk of irreparable harm to TKPOA if provisional relief is denied and significant risk of harm to defendants if such relief is granted.

The next step in our analysis must be consideration of TKPOA's specific theories for relief and the likelihood that it will prevail on the merits. We turn now to those theories.

1. Nollan v. California Coastal Comm'n.

TKPOA asserts that the decision in *Nollan v. California Coastal Comm'n*, supra, 483 U.S. 825, 107 S.Ct. 3141, 97 L.Ed.2d 677 is dispositive and compels the conclusion that the mitigation fee involved here is unconstitutional. We disagree.

In *Nollan*, the plaintiffs were the owners of a beach-front lot on which a small, dilapidated bungalow stood. They desired to demolish the bungalow and replace it with a three-bedroom house consistent with the neighborhood. The Coastal Commission agreed to issue a building permit provided the plaintiffs would agree to record a lateral public easement across the beach-front portion of their property.¹¹ On review the United States Supreme Court noted that the right to exclude others is an essential attribute of private property and concluded that governmental action which vests outsiders with the permanent and continuous right to pass to and from across a person's land is a taking of private property. (*Nollan v. California Coastal Comm'n*, supra, 483 U.S. at pp. 831–832, 107 S.Ct. at pp. 3145–3146, 97 L.Ed.2d at p. 686.) Since the taking of such an easement outright without compensation would violate the federal Constitution, the question became whether requiring the conveyance of the easement as a condition for issuance of a land use permit would alter the outcome. (*Id.* at p. 834, 107 S.Ct. at p. 3147, 97 L.Ed.2d at p. 687.)

In addressing the redefined question, the high court made it clear that a physical taking of property as a condition for issuance of a land use permit will not per se violate the Constitution, but will instead be subjected to heightened scrutiny. (483 U.S. at pp. 836, 841, 107 S.Ct. at pp. 3148, 3150–3151, 97 L.Ed.2d at pp. 689, 692.) In general, if the government could deny a use permit in the furtherance of a legitimate police-power purpose then it may exact a physical taking to serve the same purpose. (*Id.* at p. 836, 107 S.Ct. at p. 3148, 97 L.Ed.2d at pp. 688–689.) The government may act to regulate land use to serve a broad range of purposes. (*Id.* at pp. 834–835, 107 S.Ct. at 3147–3148, 97 L.Ed.2d at pp. 687–688.) But to be valid as a land use regulation, a condition that results in a physical taking must “‘substantially advance[.]’” some legitimate government purpose connected with the project at issue. (*Ibid.*) This requires that the governmental purpose relate to the project at issue, and that there be a nexus between the condition and the governmental purpose. (*Id.* at p. 837, 107 S.Ct. at p. 3148, 97 L.Ed.2d at p. 689.) If the condition “utterly fails to further the end advanced as justification” then the condition is not a valid land use regulation and becomes an unconstitutional taking. (*Ibid.*)¹²

In *Nollan*, the justifications given by the Coastal Commission were essentially specious. Indeed, the Supreme Court found it “impossible to understand” how the condition exacted by the commission furthered the public purposes advanced as justification. (483 U.S. at p. 838, 107 S.Ct. at p. 3149, 97 L.Ed.2d at p. 690.)¹³ Accordingly, the taking as a condition for the issuance of a land use permit was invalid. (*Ibid.*)

TKPOA's assertion that the decision in *Nollan* is dispositive here cannot withstand scrutiny. In *Lucas v. So. Carolina Coastal Council* (1992) 505 U.S. 1003, 112 S.Ct. 2886, 120 L.Ed.2d 798, the United States Supreme Court noted that the “Takings Clause” reaches beyond a direct appropriation of private property and that while the use of property may be regulated, if the regulation goes too far it will be considered a taking. (505 U.S. at p. ----, 112 S.Ct. at p. 2892–2893, 120 L.Ed.2d at p. 812.) In “Takings Clause” jurisprudence, the cases involving alleged regulatory takings fall into three categories: (1) where the owner is compelled to suffer a permanent physical invasion of his property; (2) where the owner is denied all economically beneficial or productive use of the land; and (3) where the owner is subjected to other regulatory restrictions on the use of the property. (*Id.* at pp. ---- – ----, 112 S.Ct. at pp. 2892–2894,

120 L.Ed.2d at pp. 812–813.) The first two categories of regulatory actions have been described by the court “as compensable without case-specific inquiry into the public interest advanced in support of the restraint.” (Id. at p. ----, 112 S.Ct. at p. 2893, 120 L.Ed.2d at p. 812.) But most alleged regulatory takings fall into the third category and in such cases the court has eschewed rigid formulae, preferring instead to engage in ad hoc factual inquiries. (Ibid.) In making such inquiries the court will engage in the assumption that through the regulation the state is simply adjusting the benefits and burdens of economic life in an appropriate manner. (Id. at p. ----, 112 S.Ct. at p. 2894, 120 L.Ed.2d at p. 814.) However, as we have noted, in the relatively rare instance in which a case truly falls into one of the first two categories, compensation will be required without case-specific inquiry into the public purpose advanced in support of the regulation. (Id. at p. ----, 112 S.Ct. at p. 2893, 120 L.Ed.2d at p. 812.)¹⁴

In light of Lucas it appears that the first step in a “Takings Clause” analysis is to determine the type of case being considered. In Lucas, the regulation at issue forbade the plaintiff from any development of his land and the state court found this regulation deprived him of all economically beneficial or productive use of the land but upheld the restriction because it served a valid state interest. (Id. at p. ----, 112 S.Ct. at p. 2890, 120 L.Ed.2d at p. 809.) Since the findings of the state court placed Lucas squarely into the second category of takings cases, the Supreme Court held that inquiry into the legitimacy of the public purpose could not justify the restriction as a land use regulation and the matter was remanded for the consideration of other issues. (Id. at p. ---- - ----, 112 S.Ct. at pp. 2901–2902, 120 L.Ed.2d at pp. 822–823.) In making the remand, however, the high court made it clear that cases of this nature are rare. If any economically beneficial or productive use is left to the landowner then the situation falls into the third rather than the second category. (Id. at p. ----, especially fn. 8, 112 S.Ct. at p. 2895, 120 L.Ed.2d at p. 815.)¹⁵

In a decision rendered between Nollan and Lucas, the high court considered the standards for determining whether a case falls into the first category of “Takings Clause” cases, that is, physical takings. In *Yee v. Escondido* (1992) 503 U.S. 519, 112 S.Ct. 1522, 118 L.Ed.2d 153, the plaintiffs were owners of a mobile home park who contended that a local mobile home ordinance, in conjunction with the state's mobile home residency law, constituted a physical taking of their property. Together the laws restricted rents and rent increases, prohibited the owner from requiring the removal of a mobile home when it was sold, prohibited the owner from adjusting the rent or charging a transfer fee upon sale of the mobile home, and prohibited the owner from disapproving a purchaser who could pay the rent. The plaintiffs argued that the statutes and ordinances constituted a taking of their property by denying them the right to exclude others from their property and by transferring some of the value of the property to mobile home owner/tenants who would reap the benefit of frozen rents upon selling their mobile homes. The court rejected the claim that the laws constituted a physical taking, reasoning that (1) there was no compelled physical occupation because the decision to use the property as a mobile home park in the first instance was voluntary with the owner and, although it would take six to twelve months to do so, the owners could elect to change the use of the land; and (2) virtually all land use regulation involves a transfer of wealth and a transfer of wealth in itself does not convert regulation into physical invasion. (Id. at pp. ---- - ----, 112 S.Ct. at pp. 1528–1529, 118 L.Ed.2d at pp. 165–166.)

The decision in Nollan must be considered in light of Yee and Lucas. When we do so we perceive that the analysis in Nollan was actually directed to determining whether it would fall into the first or the third category of “Takings Clause” cases, that is, whether or not it was a physical

taking case. There the Coastal Commission attempted to avoid the conclusion that a physical taking was involved by asserting that the taking was part of its regulation of land use. However, the court held that where the government accomplishes a permanent physical invasion through its land use regulations the courts must be “particularly careful” to ensure that the regulations substantially advance a legitimate state interest since there is a heightened risk that the purpose is the avoidance of the compensation requirement rather than the attainment of the stated police power objective. (*Nollan v. California Coastal Comm'n*, supra, 483 U.S. at p. 841, 107 S.Ct. at pp. 3150–3151, 97 L.Ed.2d at p. 692.) Stated another way, the physical invasion of one's property, including the impairment of the right to exclude others from the property, “will invite exceedingly close scrutiny under the Takings Clause.” (*Lucas v. So. Carolina Coastal Council*, supra, 505 U.S. at p. ----, fn. 8, 112 S.Ct. at p. 2895, fn. 8, 120 L.Ed.2d at p. 815.) The court assumed arguendo the legitimacy of the public purposes advanced as justification by the state in *Nollan*, but since the condition exacted utterly failed to advance those purposes it was nothing but an uncompensated physical taking.

Unlike *Nollan*, this case falls squarely into the third, catch-all category of “Takings Clause” cases.

There has been no physical invasion of plaintiff's property nor is there any suggestion that landowners have been deprived of all economically beneficial or productive use of the land. This case is not entitled to the heightened scrutiny that a physical taking would entail. Instead, the court will “indulge [in] our usual assumption that the legislature is simply ‘adjusting the benefits and burdens of economic life,’ . in a manner that secures an ‘average reciprocity of advantage’ to everyone concerned.” (*Lucas v. So. Carolina Coastal Council*, supra, 505 U.S. at p. ----, 112 S.Ct. at p. 2894, 120 L.Ed.2d at p. 814, citations omitted.) In this type of case, resolution of a challenge to the regulatory measure requires a careful case-specific factual inquiry. In short, the decision in *Nollan* is not dispositive and standing alone that decision does not establish that plaintiff is likely to prevail in this litigation.

2. Regulatory Taking.

As we have noted above, this case cannot be resolved without a case-specific factual inquiry. (See *Blue Jeans Equities West v. City and County of San Francisco* (1992) 3 Cal.App.4th 164, 171, 4 Cal.Rptr.2d 114.) Alleged regulatory takings of this sort “necessarily entail[] complex factual assessments of the purposes and economic effects of government actions.” (*Yee v. Escondido*, supra, 503 U.S. at p. ----, 112 S.Ct. at p. 1526, 118 L.Ed.2d at p. 162.) Accordingly, such cases do not lend themselves readily to summary disposition without a fully developed factual record. (*Tahoe Regional Planning Agency v. King* (1991) 233 Cal.App.3d 1365, 1401, 285 Cal.Rptr. 335.) Since in this type of case courts will generally assume the propriety of the land use regulation (*Lucas v. So. Carolina Coastal Council*, supra, 505 U.S. at p. ----, 112 S.Ct. at p. 2894, 120 L.Ed.2d at p. 814), it falls upon the plaintiff to establish its invalidity. And, although a request for a preliminary injunction does not contemplate a full trial on the merits, the party seeking the injunction must present sufficient evidentiary facts to establish a likelihood that it will prevail. (*IT Corp. v. County of Imperial*, supra, 35 Cal.3d at p. 69, 196 Cal.Rptr. 715, 672 P.2d 121; *Camp v. Board of Supervisors*, supra, 123 Cal.App.3d at p. 357, 176 Cal.Rptr. 620.) In view of TKPOA's erroneous belief that the decision in *Nollan* is dispositive, it did not engage in a full factual development of its challenge to the mitigation fee. We are relegated to determining whether, upon the scant factual record and such facts as we may judicially notice, it appears likely that TKPOA will prevail upon a trial on the merits.

In considering challenges to the validity of land use regulations of this type, we must initially consider whether the regulation substantially advances a legitimate state interest. (*Agins v. Tiburon* (1980) 447 U.S. 255, 260–261, 100 S.Ct. 2138, 2141–2142, 65 L.Ed.2d 106, 112.) This is a two-pronged question. First, it must appear that the government interest set forth as justification for the restriction reasonably relates to the property and/or project in question and second, the restriction must reasonably serve that interest. However, contrary to TKPOA's assertion, it is not necessary that the governmental interest relate solely to the land or project in question, nor is it necessary that the regulation be limited to remedying the specific contribution to the problem that will be attributable to the project in question. (See *Associated Home Builders etc., Inc. v. City of Walnut Creek* (1971) 4 Cal.3d 633, 638, 94 Cal.Rptr. 630, 484 P.2d 606; *Ayres v. City Council of Los Angeles* (1949) 34 Cal.2d 31, 41, 207 P.2d 1.) Rather, it is established that the justification for a restriction is not limited to the needs or burdens created only by the proposed project. (*Remmenga v. California Coastal Com.* (1985) 163 Cal.App.3d 623, 628, 209 Cal.Rptr. 628.) The decision in *Nollan* did not cast doubt on this latter point. It specifically stated that the state could consider the effect of the project “alone, or by reason of the cumulative impact produced in conjunction with other construction.” (483 U.S. at p. 835, 107 S.Ct. at p. 3148, 97 L.Ed.2d at p. 688.) And the decision concluded that the Coastal Commission could have imposed conditions on the *Nollans* that would have been directed at remedying the cumulative impact of their project and others. (*Id.* at p. 836, 107 S.Ct. at p. 3148, 97 L.Ed.2d at p. 689.)¹⁶ The vice in *Nollan* was that the condition imposed utterly failed to further the end advanced as justification and not that it was not confined to the specific effects of the project in question. (*Id.* at p. 837, 107 S.Ct. at pp. 3148–3149, 97 L.Ed.2d at p. 689.)

The government may constitutionally engage in land use regulation to serve a broad range of interests. (*Nollan v. California Coastal Comm'n*, *supra*, 483 U.S. at pp. 834–835, 107 S.Ct. at pp. 3147–3148, 97 L.Ed.2d at p. 688.) The validity of the governmental interest in preserving the unique natural environment of the Tahoe Basin has been recognized by Congress and the Legislatures of California and Nevada, as well as by state and federal courts. (*Lake Country Estates v. Tahoe Planning Agcy.*, *supra*, 440 U.S. at pp. 393–394, 99 S.Ct. at pp. 1173–1174, 59 L.Ed.2d at pp. 405–406; *People ex rel. Younger v. County of El Dorado*, *supra*, 5 Cal.3d at p. 487, 96 Cal.Rptr. 553, 487 P.2d 1193.) Pollution of Lake Tahoe by virtue of development of the surrounding land is one of the obvious and primary dangers which led to the comprehensive regulation which has occurred. (*People ex rel. Younger v. County of El Dorado*, *supra*, 5 Cal.3d at p. 486, 96 Cal.Rptr. 553, 487 P.2d 1193.) Since the state's justification for the imposition of a mitigation fee upon Tahoe Keys property owners was to ameliorate the effects of pollution from the Tahoe Keys development, there can be no doubt that justification for the regulation at issue here does constitute an important state interest reasonably related to the development and build out of the Tahoe Keys.

The mitigation fee charged to TKPOA's members was calculated based upon estimates of the quantities of nutrients entering Lake Tahoe as a result of the development and continuing maintenance and operation of the Tahoe Keys subdivisions and lagoons. And the mitigation fund was specifically dedicated to partial mitigation of the effects of that source of pollution through projects to abate or at least offset the polluting effects of the Tahoe Keys. Thus, on the face of the regulation there appears to be a sufficient nexus between the effect of the regulation and the objectives it was supposed to advance to support the regulatory scheme. (See *Yee v. Escondido*, *supra*, 503 U.S. at p. ----, 112 S.Ct. at p. 1530, 118 L.Ed.2d at p. 167; *Nollan v. California Coastal Comm'n*, *supra*, 483 U.S. at pp. 834–835, 107 S.Ct. at pp. 3147–3148, 97 L.Ed.2d at pp. 687–688.)

In these circumstances our focus must turn to the question set forth by the United States Supreme Court in this manner: “[W]here the government merely regulates the use of property, compensation is required only if considerations such as the purpose of the regulation or the extent to which it deprives the owner of the economic use of the property suggest that the regulation has unfairly singled out the property owner to bear a burden that should be borne by the public as a whole.” (Yee v. Escondido, supra, 503 U.S. at p. ----, 112 S.Ct. at p. 1526, 118 L.Ed.2d at p. 162; see also Nollan v. California Coastal Comm'n, supra, 483 U.S. at p. 835, fn. 4, 107 S.Ct. at p. 3148, fn. 4, 97 L.Ed.2d at p. 688.)

While the public as a whole will doubtlessly benefit generally from the preservation of Lake Tahoe and its environs, we perceive no reason in the record to doubt that landowners in the area, such as TKPOA and its members, will benefit specially. After all, they are not simply transient visitors but plan to live there or at least have a concrete investment in the area. Since preservation of the area will confer benefits upon plaintiff and its members beyond those received by the general public, it is fair that they shoulder more of the burden. (See White v. County of San Diego (1980) 26 Cal.3d 897, 904, 163 Cal.Rptr. 640, 608 P.2d 728; City of Baldwin Park v. Stoskus (1972) 8 Cal.3d 563, 568, 105 Cal.Rptr. 325, 503 P.2d 1333.)¹⁷ When coupled with the fact that the government can act to preserve the area only through regulation of landowners such as TKPOA and its members, these special benefits convince us that, without more, the challenged regulation does not unfairly single out plaintiff and its members when compared to the general public.

In its argument TKPOA compares its members to a class that is more limited than the general public, namely, other landowners in the Tahoe Basin. It asserts that the \$4,000 mitigation fee applies only to the Tahoe Keys and that its members are thus singled out for payment of the fee.

The scope of this argument is too narrow. Land use regulations need not apply across the board to everyone arguably concerned. Rather, the government is permitted to adjust the benefits and burdens of economic life in a manner that secures an average reciprocity of advantage. (Lucas v. So. Carolina Coastal Council, supra, 505 U.S. at p. ----, 112 S.Ct. at p. 2894, 120 L.Ed.2d at p. 814.) Land use regulations often have differing effects on neighboring properties and this fact alone does not invalidate a regulatory scheme. (Yee v. Escondido, supra, 503 U.S. at p. ----, 112 S.Ct. at p. 1529–1530, 118 L.Ed.2d at pp. 166–167.) It follows that the fact that the regulatory restrictions imposed on one group are different in kind than the restrictions imposed on others does not in itself establish that the first group has been unfairly singled out to bear the burden of the governmental objective. That question must be answered by reference to such things as danger to the public interest created by the land use aspirations of the different property owners, the extent of the burdens imposed on the different property owners when compared to the burdens imposed on others, and, where applicable, the nature of any special benefits which will accrue to the different property owners by virtue of the regulatory program.

Governmental efforts to regulate land use in the Tahoe Basin have been of an unusually comprehensive scope, with the basic concept being “to provide for the region as a whole the planning, conservation and resource development essential to accommodate a growing population within the region's relatively small area without destroying the environment.” (People ex rel. Younger v. County of El Dorado, supra, 5 Cal.3d at p. 487, 96 Cal.Rptr. 553, 487 P.2d 1193.)

To accomplish this purpose virtually all landowners within the basin have been required to submit to regulation of their land use aspirations. Many landowners would consider the restrictions upon their aspirations to be Draconian when compared to the payment of a substantial, but hardly confiscatory, mitigation fee. (See Viso v. State of California (1979) 92

Cal.App.3d 15, 19, 154 Cal.Rptr. 580; *Sierra Terreno v. Tahoe Regional Planning Agency* (1978) 79 Cal.App.3d 439, 443, 144 Cal.Rptr. 776; *Tahoe–Sierra Preserv. v. Tahoe Reg. Planning Agency* (9th Cir.1990) 911 F.2d 1331, 1333–1334; *People of California v. Tahoe Regional Plan Agency* (9th Cir.1985) 766 F.2d 1308, 1313–1314.) For example, as a result of the severe use restrictions imposed on landowners outside of the Tahoe Keys, many such landowners claim to have suffered significant diminution in the value of their properties, both from an economic expectation perspective and from a market value perspective. (*Viso v. State of California*, supra, 92 Cal.App.3d at pp. 20–21, 154 Cal.Rptr. 580 [alleged loss of \$4.5 million from the property's value at its highest and best use]; *Sierra Terreno v. Tahoe Regional Planning Agency*, supra, 79 Cal.App.3d at p. 443, 144 Cal.Rptr. 776 [alleged drop in market value to no more than 25 percent of former value]; *Tahoe–Sierra Preserv. v. Tahoe Reg. Planning Agency*, supra, 911 F.2d at p. 1333 [claimed loss of all economically feasible uses of the land].)

On the other side of the ledger, we may consider the special benefits which will accrue to the parties. Through comprehensive land use planning in the Tahoe Basin the natural beauty of the region, and hence of the property of landowners in the basin, may be preserved. However, unlike many landowners, TKPOA's members will not be required to contribute to this end by forgoing their intended use of the land. Since TKPOA's members will be permitted to build residences upon their land, they are in a particularly advantageous position to reap the benefits of the regulatory program. In short, the preservation of the area will preserve the natural beauty that made their property desirable in the first place, that in turn will serve to maintain or enhance the market value of the property, and it is likely that the shortage of similarly situated properties that has been created or enhanced by governmentally enforced use restrictions will exert an upward pressure on market values of the homes in the Tahoe Keys.

When we consider the benefits and burdens of the regulatory program on a basin-wide basis based upon the facts shown in the record and those which we may judicially notice, we cannot conclude that TKPOA has shown a substantial likelihood that it will succeed in establishing that its members have been unfairly singled out to bear the burden of the governmental efforts to preserve the Tahoe Basin.

TKPOA also compares its members who have or will be required to pay the mitigation fee to members who built earlier and thus were not required to pay the fee. According to this argument the damage to Lake Tahoe from the Tahoe Keys development was caused by the original developer's dredge and fill operations and the consequent loss of the natural treatment capacity of the Truckee Marsh, most of the individual lot owners in the Tahoe Keys built upon their lots before CTRPA and Lahonton imposed the mitigation fee, and thus the remaining lot owners are forced to pay for all of the damage caused by development from which all lot owners benefited and that was caused by the original developer in any event.

The factual premises of this argument are not established in the record. Although CTRPA and Lahonton cited a loss of natural treatment capacity from the destruction of the Truckee Marsh, in their resolutions both agencies specifically found that continuing operation and maintenance of the Tahoe Keys subdivisions and lagoons contribute significant quantities of nutrients to the waters of Lake Tahoe. A computation of the mitigation fee was an attachment to the Lahonton resolution. Although full explanation of the computation would require testimonial evidence from the parties and probably from experts, on its face the computation appears to refute TKPOA's assertions. Thus, the fee was based upon the total dissolved nitrogen entering the lake as a result of the Tahoe Keys development. Of the 2,920 kilogram total, only 300 kilograms were attributed to lost natural treatment capacity.¹⁸ This was converted to an equivalent

suspended sediment load and an equivalent cost of mitigation was determined using the 1981 cost of the last 50 percent of erosion control projects, thus indicating a contributory rather than complete mitigation charge. Of this total, 63 percent was assigned to TKPOA, again indicating a contributory basis for computation of the fee. The resulting sum was used to calculate a per lot mitigation fee for new construction. From this computation we cannot conclude that those lot owners who were or will be required to pay a mitigation fee have been forced to pay for all of the mitigation of all of the pollution entering the lake as a result of the development, nor that the damage they are required to mitigate is entirely, or even largely, attributable to the original developer rather than the continuing operation and maintenance of the Tahoe Keys subdivisions and lagoons.

In any event, a landowner cannot defeat a land use regulation simply by pointing to someone else who by prior use escaped the regulation, for otherwise there could be no land use planning.

As a general rule, land use regulation must be prospective in nature because the state is constitutionally limited in the extent to which it may, through land use regulation, affect prior existing uses. (See *HFH Ltd. v. Superior Court* (1975) 15 Cal.3d 508, 516, 125 Cal.Rptr. 365, 542 P.2d 237; *Orinda Homeowners Committee v. Board of Supervisors* (1970) 11 Cal.App.3d 768, 775–776, 90 Cal.Rptr. 88.) Accordingly, preexisting use is a constitutional line of demarcation in land use regulation and prior uses are protected while expectations and aspirations are not. (*Ibid.*) In other words, landowners have no vested right in existing or anticipated zoning regulations. (*Ibid.*) The alleged disparity between those who built before CTRPA and Lahonton commenced their comprehensive regulation of development of the Tahoe Basin and those who built or will build later is a matter which may enter into the complex factual assessment required to determine whether the regulation goes too far, but it does not in itself compel invalidation of the regulation.

In addition to these matters, the defendants properly point out that there is substantial doubt that TKPOA will even be allowed to proceed to the merits of its claim. It is significant that TKPOA engaged in extensive negotiations with CTPRA and Lahonton over the reclassification of the Tahoe Keys; that it proposed a mitigation fee as a condition of reclassification;¹⁹ that it agreed to the conditions imposed in the resolutions, including the mitigation fee; that it did not administratively or judicially challenge the resolutions in a timely manner; and that it accepted the benefits of the resolutions for nine years before making any objection to the mitigation fee. A landowner or his successor in title is barred from challenging a condition imposed in a land use regulation if he has acquiesced therein by either specifically agreeing to the condition or by failing to challenge its validity while accepting the benefits afforded. (*County of Imperial v. McDougal* (1977) 19 Cal.3d 505, 510–511, 138 Cal.Rptr. 472, 564 P.2d 14; *Edmonds v. County of Los Angeles* (1953) 40 Cal.2d 642, 650, 255 P.2d 772; *J–Marion Co. v. County of Sacramento* (1977) 76 Cal.App.3d 517, 523, 142 Cal.Rptr. 723; *Pfeiffer v. City of La Mesa* (1977) 69 Cal.App.3d 74, 78, 137 Cal.Rptr. 804.) TKPOA has pointed to nothing which would indicate that this rule is not fully applicable to it in this instance.²⁰

Upon a consideration of the record, including the procedural hurdles TKPOA must overcome before addressing the merits of its claim and its preliminary showing upon the merits, we cannot conclude that TKPOA has established a significant likelihood that it will prevail on the merits after a full trial. In view of TKPOA's scant showing that damages are not an adequate remedy, we find no abuse of discretion in the denial of its request for preliminary injunctive relief on its constitutional claims.

3. Non-Constitution-Based Claims.

TKPOA's claim of irreparable injury in support of its request for preliminary injunctive relief was based primarily on the argument that its constitutional rights are being violated and that damages cannot be deemed an adequate remedy for constitutional violations. With respect to TKPOA's assertion of claims that are not based upon the Constitution, its showing of irreparable injury all but disappears. This is a substantial reason for denying provisional relief, at least in the absence of a strong showing of a substantial likelihood that TKPOA will prevail at trial. We find no such showing here and need only briefly discuss the nonconstitutional theories of relief.

TKPOA asserts that CTRPA should be enjoined from collection and expenditure of the mitigation fee and fund because it failed to obtain Lahonton's execution of the MOU reflecting the parties' agreement. We disagree. In challenging the imposition of the mitigation fee it is the resolution imposing the fee and not the MOU that TKPOA must attack. The CTRPA resolution referred to an MOU that had been prepared to set forth the mitigation package proposed by TKPOA, but neither the resolution nor the fee was made contingent upon execution of the MOU. In any event, if TKPOA believed execution of the MOU was essential that was a matter it could have and should have raised at the time. It cannot now challenge the resolution and fee on this basis. (See *Edmonds v. County of Los Angeles*, supra, 40 Cal.2d at p. 653, 255 P.2d 772.)

TKPOA asserts that Lahonton should be enjoined from making expenditures from the mitigation fund because it failed to execute the MOU. The Lahonton resolution was not contingent upon execution of the MOU. In fact, it did not refer to the MOU at all, although it did empower its executive officer to enter into any agreements necessary to ensure proper administration of the mitigation fund. As with the CTRPA resolution, if TKPOA believed that execution of the MOU was essential to the reclassification of the Tahoe Keys by Lahonton, that is a matter that could have and should have been raised at the time. (*Edmonds v. County of Los Angeles*, supra, 40 Cal.2d at p. 653, 255 P.2d 772.)

TKPOA asserts that collection and expenditure of the mitigation fees should be enjoined based upon conflicts between the CTRPA and Lahonton resolutions. We perceive no fatal conflicts. The MOU prepared to reflect TKPOA's proposal stated that it was the intent of parties that the mitigation fund be utilized for on-site mitigation if such mitigation is best effective. The CTRPA resolution said that the fund would be used for on- or off-site mitigation measures, but said that priority would be given to on-site measures. It also provided that expenditure of the fund would be determined jointly between it, TKPOA, and Lahonton. The Lahonton resolution provided for mitigation measures within the Tahoe Basin, but clearly contemplated that approval of projects would be a joint endeavor between it and any other affected agency with the active participation of TKPOA. Under these circumstances expenditures under the CTRPA resolution and expenditures under the Lahonton resolution will not inevitably conflict. In the absence of a concrete proposed off-site project endorsed by Lahonton but rejected by CTRPA and TKPOA, there is no basis for judicial intervention.

TKPOA asserts that unless expenditure of the mitigation fund is enjoined, the defendants may make expenditures in violation of its right to participate in the determination of how the fund should be spent. We have noted that both resolutions contemplated the active participation of TKPOA in the decisionmaking process. On the record it appears that TKPOA did actively participate in discussion and negotiations concerning expenditure of the fund until it adopted the position that the mitigation fee was invalid and began proceedings to challenge the fee.

TKPOA's right to participate in the decisionmaking process is satisfied if it is given the opportunity to do so; its refusal to participate as a litigation tactic cannot serve as the basis for enjoining CTRPA and Lahonton in the performance of their legal duties.

DISPOSITION

The order denying TKPOA's request for a preliminary injunction is affirmed.

I concur in the result but write separately because I believe it is unnecessary for this court to consider the question whether plaintiff is likely to prevail on the merits at trial.

In determining whether to grant or deny a request for a preliminary injunction, the trial court must consider the likelihood that the plaintiff will prevail on the merits at trial and must weigh the interim harm to the plaintiff if the injunction is denied against the interim harm to the defendant if the injunction is granted. (Cohen v. Board of Supervisors (1985) 40 Cal.3d 277, 287, 219 Cal.Rptr. 467, 707 P.2d 840.) Thus, the respective equities of the parties must be balanced to determine whether, pending a trial on the merits, the defendant should or should not be restrained from exercising the right it claims. (Ibid.) "When a trial court denies an application for a preliminary injunction, it implicitly determines that the plaintiffs have failed to satisfy either or both of the 'interim harm' and 'likelihood of prevailing on the merits' factors. On appeal, the question becomes whether the trial court abused its discretion in ruling on both factors." (Id., at pp. 286–287, 219 Cal.Rptr. 467, 707 P.2d 840, italics in original.) "Even if the appellate court finds that the trial court abused its discretion as to one of the factors, it nevertheless may affirm the trial court's order if it finds no abuse of discretion as to the other." (Id., at p. 287, 219 Cal.Rptr. 467, 707 P.2d 840, italics added.)

I agree with the majority's conclusion that the record shows little risk of irreparable harm to plaintiff if provisional relief is denied and significant risk of harm to defendants if such relief is granted. Therefore, the trial court did not abuse its discretion in denying the preliminary injunction. (Cohen, supra, 40 Cal.3d at pp. 286–287, 219 Cal.Rptr. 467, 707 P.2d 840.)

Because the trial court's order may be affirmed on the interim harm analysis alone, I decline to consider whether plaintiff has shown it is likely to prevail at trial on its claim that the mitigation fee charged as a condition for obtaining building permits is unlawful.

FOOTNOTES

1. The official actions of which TKPOA complains were taken, in part, by the California Tahoe Regional Planning Agency (CTRPA). CTRPA has been statutorily deactivated and the secretary of the Resources Agency has been designated as successor of CTRPA for litigation purposes. (Gov.Code, § 67132.) Defendants point out that the secretary of the Resources Agency rather than the agency should have been the named defendant, but they do not object to consideration of the issues on this ground. Since we are concerned here with a land use regulation imposed by CTRPA, we will refer to CTRPA in the body of this opinion, although it is the secretary of the Resources Agency who now represents those state interests.

2. Lake Tahoe is renowned for its clarity and it has been said that only two other sizable lakes in the world are of comparable clarity—Crater Lake in Oregon and Lake Baikal in what was formerly the Soviet Union. (See Lake Country Estates v. Tahoe Planning Agcy. (1979) 440 U.S. 391, 393, fn. 2, 99 S.Ct. 1171, 1173, fn. 2, 59 L.Ed.2d 401, 405.) Only Lake Tahoe, because it is not protected as part of a national park and is readily accessible from large metropolitan centers, is so vulnerable to excessive urban development. (Ibid.)

3. TKPOA states that the Tahoe Keys was designed to accommodate 335 townhouse units and 1,249 single-family residences. By 1981, before the actions at issue here, all of the townhouses and approximately 800 of the residences had been constructed.

4. The mitigation fee imposed by CTRPA is not in addition to the fee imposed by Lahonton; rather, it is the same fee. It also appears that the fee includes a \$750 fee imposed by TRPA. No issue is presented here with respect to any portion of the fee required by TRPA.

5. TKPOA attached a copy of the MOU to its complaint. The MOU recites that it is an agreement between TKPOA, CTRPA, and Lahonton. The CTRPA resolution by which the Tahoe Keys was reclassified refers to the MOU. The Lahonton resolution does not refer to the MOU, but does reflect that TKPOA was to be an active participant in determining how the mitigation fund would be used. TKPOA asserts that the MOU was never formally executed by Lahonton.

6. TKPOA states that following Lahonton's rejection of its demand it commenced a proceeding for administrative review by the State Water Resources Control Board pursuant to Water Code section 13320, subd. (a). TKPOA concedes that it has not exhausted that remedy. However, citing *National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419, at pages 450–451, 189 Cal.Rptr. 346, 658 P.2d 709, TKPOA asserts that the courts have concurrent jurisdiction over water issues. TKPOA asked the trial court to exercise its jurisdiction and to restrain further administrative proceedings pending resolution of the litigation. *National Audubon Society* is not squarely on point, since that case was concerned with water rights rather than water quality under the Porter–Cologne Water Quality Control Act. However, the defendants have not complained that TKPOA has failed to exhaust its administrative remedies and in view of our conclusion in this appeal that is not a question we must consider.

7. TKPOA asserts that no expenditure was made from the mitigation fund until this litigation was commenced, at which time Lahonton began to take action on proposed expenditures. Although it appears uncontroverted that no expenditure had been made before this litigation, it does not appear that Lahonton engaged in a sudden rush to spend the fund in light of the litigation. In fact, for several years the parties, with the active participation of TKPOA, had been engaged in negotiations, studies, and workshops with respect to proposed mitigation projects. One project proposed by TKPOA had become the focus of the discussions. That project involved the circulation of Tahoe Keys water to the Pope Marsh as a means of filtering the water before it entered Lake Tahoe. The proposal required the participation and approval of the United States Forest Service, which suggested an initial pilot project to test the efficacy of the proposal before a decision on full implementation. Shortly after this litigation commenced Lahonton was scheduled to consider funding the pilot project from the mitigation fund. However, the project required the participation of TKPOA and in light of its demand for repayment of the mitigation fund it informed Lahonton that it would not participate if the pilot project would be funded through the mitigation fund. That effectively prevented implementation of the pilot project and it does not appear that approval of any other expenditure from the fund was imminent.

8. The Civil Code refers to inadequacy of legal remedies rather than irreparable injury, but the Civil Code provisions with respect to injunctive relief govern only final injunctions and not preliminary injunctions. (Civ.Code, § 3421.) The Code of Civil Procedure, which governs both final and provisional relief, refers to irreparable injury. (Code Civ.Proc., § 526.)

9. TKPOA presented the declaration of Gregory A. Bennalack, an owner of an unimproved parcel within Tahoe Keys. He believes the mitigation fee is unconstitutional and unfair. He asserted the obvious, that if defendants are allowed to continue collecting the fee he will be unable to build upon his land without paying the fee. He did not suggest that continued collection of the fee would prevent or dissuade him from building upon his land and said nothing which would suggest that he could not be fully compensated by repayment of the fee in the event TKPOA prevails.

10. Even in the absence of a provisional injunction the litigation itself is likely to have a chilling effect on defendants' use of the mitigation fund, since they will have to make their decisions with an awareness that if TKPOA prevails the mitigation fund will have to be repaid. However, that is a matter the defendants will have to consider in the exercise of their administrative discretion; it is a different matter to assert that they should be judicially enjoined from exercising that discretion.

11. The public easement sought by the Coastal Commission was "lateral" because it was not an access easement from the public road to the beach, but crossed the back or beach side of the plaintiffs' property from one private property to another.

12. Governments are vested with the power of eminent domain which enables them to take private property to serve any legitimate public interest, provided that the property owner is compensated for the taking. Accordingly, the mere assertion that a taking serves a public interest is not sufficient to support an uncompensated taking, since the Constitution specifically requires that compensation be paid in such circumstances. While the government may engage in legitimate land use regulation, it cannot be permitted to use the occasion of an application for a land use permit as an excuse to extort private property from its owner where the taking would otherwise require compensation. Accordingly, to support an uncompensated taking it must appear both that the public purpose have a relationship to the property or the project at issue and that the taking advances that public purpose rather than some purpose unrelated to the property or the project at issue. (Ibid.)

13. The Coastal Commission asserted that the Nollans' new house would interfere with visual access to the beach, would somehow create a "psychological barrier" to beach use by interfering with the public's desire to use public beaches, and, somewhat inconsistently, would increase the use of public beaches thus creating the need for more beach access. The court accepted visual access as a legitimate public interest but noted that a lateral easement across the back of the Nollans' property could not alleviate that concern. The court appeared incredulous about the other justifications but did not specifically consider whether they were sufficient to constitute a legitimate public interest because a lateral easement could not advance those interests. (Ibid.)

14. This does not mean that any governmental action that appears to fall into one of the first two categories is necessarily invalid unless compensation is paid to the property owner. For example, the state may enforce its statutes against public and private nuisances even if doing so deprives an owner of all economic use of the land. (Id. at p. ----, 112 S.Ct. at p. 2900, 120 L.Ed.2d at p. 821.) And the state may assert a public right of way that was a preexisting limitation upon the landowner's title. (Ibid.) The question in these instances is whether the use interests asserted by the landowner were part of his title to begin with, that is, whether they were part of the bundle of rights obtained with the title. (Id. at p. ----, 112 S.Ct. at p. 2899, 120 L.Ed.2d at p. 820.)

15. In the ad hoc factual inquiry required for the third category of cases the extent to which a landowner is restricted in the use of the property is relevant in determining whether the regulation goes too far, but even where almost all of the economically beneficial or productive use of the property is prohibited a case-specific factual inquiry is still required. In short, whether a case falls into the second category is an “all-or-nothing” matter. (Ibid.)

16. In *Nollan*, the Coastal Commission asserted, among other things, that the plaintiffs' project in conjunction with prior development would create a visual barrier to the shoreline. The court said that to remedy that problem the commission could have compelled the Nollans to grant a permanent easement for viewing purposes as a condition for issuance of a building permit. The compelled dedication of such a “viewing spot” would obviously have addressed the cumulative impacts of beach-front construction but would have fallen upon the Nollans alone, yet the court saw no constitutional obstacle sufficient to invalidate such a condition without a case-specific factual inquiry.

17. The cited cases were concerned with the establishment of special assessment districts under California law. However, the legal standard for determining the validity of a special assessment district and that for determining the validity of a land use regulation as stated in *Yee*, *supra*, are strikingly similar and we find special assessment cases persuasive on this question.

18. The figure for lost treatment capacity was “30% of 1000 kg/yr”, apparently indicating that only 30 percent of the actual lost treatment capacity was used in the computation. This was added to 2,620 kilograms per year that was “contributed by current Tahoe Keys Development”.

19. In its initial request to CTPRA and Lahontan for reclassification of the Tahoe Keys, TKPOA proposed the creation of a mitigation fund to support offsite mitigation measures to be funded by the assessment of \$1,000 against new construction. Through negotiations the suggestion was altered in some respects, such as the amount of the fee, the manner of its collection, and the establishment of a priority for onsite mitigation projects. However, it does appear that the suggestion that a mitigation fee be imposed originated with TKPOA.

20. Even if we were to assume that this rule does not serve as a complete bar to TKPOA's claims, it still appears that TKPOA will be precluded from obtaining all of the relief it seeks. For example, it is regarded as fundamental that a landowner who obtains a building permit and complies with its conditions waives the right to assert the invalidity of the condition and thus TKPOA's members who paid the fee without protest will be precluded from pursuing a claim for refund. (*Pfeiffer v. City of La Mesa*, *supra*, 69 Cal.App.3d at p. 78, 137 Cal.Rptr. 804.) And those members of TKPOA who paid the mitigation fee beyond the applicable statute of limitations will be time-barred from obtaining refunds. It also appears that TKPOA will be precluded from litigating some of the factual issues it asserts. For example, in connection with the request for reclassification CTPRA commissioned scientific studies to evaluate the impact of further development within the Tahoe Keys. TKPOA retained an expert to advise it with respect to the studies. Although TKPOA indicated that it was not in agreement with the results of the studies, it specifically elected not to dispute the studies for purposes of its request for reclassification. That was a waiver of the right to contest the factual basis of the mitigation fee and even if TKPOA is permitted to challenge the reasonableness of the fee it will not be permitted to dispute the factual premise upon which the fee was imposed.

SPARKS, Acting Presiding Justice.

SIMS, J., concurs.

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Comments submitted by e-mail. Please confirm receipt.

Date: May 10, 2011

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Re: PROPOSED AMENDMENTS TO THE WATER QUALITY CONTROL PLAN FOR THE
LAHONTAN REGION: PESTICIDE PROHIBITION WITH EXEMPTION CRITERIA

We are filing these comments on the proposed amendments to the Lahontan Basin Plan as private citizens, in the public interest. We have been reviewing government documents on the use of rotenone formulations to remove unwanted fish species from the waters of California, and many other parts of the country, for the past 16 years. We have reviewed much of the published and unpublished literature on the impacts of rotenone to non-target species. We have reviewed over the last 10 years many documents in the Lahontan Regional Water Quality Control Board (LRWQCB) files and have filed comments on the proposed project to poison most of the remaining parts of the Silver King Creek basin. We have also filed comments with the

Environmental Protection Agency (EPA) on the impacts of fish poisons on the non-target aquatic animal community (Erman and Erman, 2005, 2006, 2007).

Our detailed comments refer largely to the use of rotenone formulations to remove fish from aquatic systems. The more general comments apply also to other forms of government poison applications in and over water for such things as eliminating plants in water and for mosquito abatement, etc. The documentation supporting the statements we are making are found in LRWQCB and EPA files and are available from us upon request.

The proposed Lahontan Basin Plan change is an attempt by the staff of the LRWQCB to relinquish their responsibility for oversight of government poisoning projects using pesticides in and over water, to lower the standards of the Clean Water Act Antidegradation Policy, and to reduce or remove the role of the public members of the LRWQC Board in assessing government poisoning projects in the Lahontan region.

The changes define water poisoning by government agencies as in the public interest by definition. The draft revisions remove much of the regulatory authority and responsibility of the LRWQCB where government agencies are the parties seeking to poison water. They can remove the need for individual NPDES permits and give full authority to the Executive Officer to permit poisoning projects without going to the public Board and without holding public hearings to grant individual NPDES permits. As long as government agencies are doing the poisoning, for whatever reason, the LRWQCB staff will not make judgments about need for poisons or impacts of poisons. They will merely require that "monitoring" be conducted by the agencies before and after the completion of poisoning.

The U. S. Fish and Wildlife Service has been added to the list of government agencies who can now poison water in the Lahontan Basin. Private entities will also be allowed to apply poisons into and over water for a variety of reasons.

Perhaps the chief reason for the staff's proposed changes is to protect the LRWQCB and State Water Board from legal responsibility for the many failures and

misrepresentations that have occurred in poisoning projects conducted by the California Department of Fish and Game in the Lahontan region over the past 25 years. We suspect the staff foresees a significant increase in aquatic poison applications in the region in the future including poisoning in more visible and popular areas like Lake Tahoe, Fallen Leaf Lake, and other high mountain lakes and streams for a variety of reasons deemed essential by various agencies.

At present the LRWQCB is not enforcing the current requirements of the Basin Plan, and therefore of the Clean Water Act, where rotenone formulations are concerned, and so the easiest route for the staff is to just get rid of those requirements through redefinition. The intent of the proposed changes is to weaken the Basin Plan rather than to protect the aquatic resources and beneficial uses in the Lahontan Basin. We think they also violate the required standards of the Antidegradation Policy of the Clean Water Act.

It is unclear from the proposed revisions whether or not individual NPDES permits will be required in the future or whether a blanket permit will be given for all projects. It is not clear whether or not public hearings will be held or that the citizen Board will even be involved in future projects. One possibility listed in the policy changes suggests that the Executive Officer alone could grant permission for individual projects.

Rotenone projects in the Lahontan basin serve as a useful example of what to expect from future poisoning projects in the Lahontan basin when requirements are less strict than they are now, should these proposed changes be adopted.

The rotenone picture has changed significantly in the last few years. Many studies over the past 10 years have shown a connection between rotenone and Parkinson's disease. Two of the principle pesticides that will be used under this proposed revision of the Basin Plan are rotenone and the herbicide paraquat—both approved for use in California. Both pesticides are documented in laboratory studies as mitochondrial Complex I inhibitors that lead to Parkinson's Disease-like symptoms. Both pesticides have been shown in a recent study to be definitively associated with

Parkinson's Disease in humans. The authors concluded "The current study helps connect the dots between basic research and human populations." (Tanner and 19 others. 2011. Rotenone, paraquat and Parkinson's Disease. *Envir. Health Perspectives*, available at ehponline.org).

The EPA conducted a review of rotenone in 2006. Subsequently, the manufacturers of rotenone withdrew it for all terrestrial use (insect and/or invertebrate control) in the U.S., Canada, and the European Union. The Environmental Protection Agency (EPA) asked the companies that produce rotenone to submit evidence on the neurotoxic effects of rotenone on humans. The companies chose to withdraw from the market the products containing rotenone rather than supply the data. (EPA website: www.epa.gov/oppsrrd1/reregistration/rotenone Docket ID: EPA-HQ-OPP-2005-0494)

In 2009, the EPA banned rotenone for use in marine and estuarine habitats.

The only use of rotenone now is as a freshwater poison to kill unwanted fish. It is, as the revision has stated, a non-specific poison that also kills aquatic insects, other aquatic invertebrates, and amphibians at the same time it kills fish. As a consequence, rotenone poisoning disrupts aquatic and terrestrial food webs for many years and affects many other species. These effects have been acknowledged by the EPA (see Erman and Erman, Silver King Creek, Draft EIS/EIR Comments, 2009). These proposed amendments to the Basin Plan admit the immediate, the long-term, the many-years and the probably permanent impact of rotenone poisons on aquatic invertebrates (Chapter 4).

Once poison has been applied to water, monitoring of either the poison or the animal life, no matter how thorough, cannot change the impacts of the poison, of the mistakes that were made, of information that was not known, revealed, or understood, or of species that were lost. And, yet, the LRWQCB has refused to require inventories of non-target species prior to rotenone projects. The assurances that "monitoring" will be "robust" and "rigorous" mean little based on past staff actions (e.g., see NPDES permit for Silver King Creek rotenone poisoning, 2010).

Monitoring is not mitigation. The monitoring being conducted by the agencies can and has documented the losses of broad taxonomic groups of organisms that represent many species, but it cannot bring back species that are permanently lost through poisoning. Many of the stream basins in the Lahontan region are isolated and likely contain endemic invertebrate species that are present nowhere else. The following two sentences in the proposed revision have no meaning : “Biological monitoring will be designed and conducted as long as needed, to effectively demonstrate that non-target macroinvertebrate populations have been fully restored to pre-project assemblages. These data will help determine realistic timelines for species recovery after treatment with aquatic pesticides.” Species and populations of species that are lost through poisoning may never return to the stream or lake and may be permanently extinguished. No amount of monitoring will change that reality. There is no mitigation for extinguishing a species.

Even the above requirement is later revised in the proposed revisions to say that an agency can apply for release from the obligation to monitor after five years.

The statement is misleading in another way as well: the monitoring being done by government agencies is not precise enough to identify species. Adult forms of invertebrates are not collected or identified. The “metrics” being used by the agencies are too crude to determine what species or how many are lost through poisoning. The LRWQCB staff passes off its responsibilities by leaving monitoring designs up to proponents and outside peer reviews selected by proponents.

The Clean Water Act allows the lowering of water quality under specified times and circumstances, but if and only if, such lowering assures protection of beneficial uses fully.

The following example from the EPA Water Quality Handbook is key (2nd Edition, updated through 2009, Appendix G, Questions and Answers:

Antidegradation): The question is asked and answered:

“THE WATER QUALITY STANDARDS REGULATION STATES THAT ‘EXISTING USES AND THE LEVEL OF WATER QUALITY NECESSARY TO PROTECT THE

EXISTING USES SHALL BE MAINTAINED AND PROTECTED.' HOW FULLY AND AT WHAT LEVEL OF PROTECTION IS AN EXISTING USE TO BE PROTECTED IN ORDER TO SATISFY THE ABOVE REQUIREMENT?

NO activity is allowable under the antidegradation policy which would partially or completely eliminate any existing use whether or not that use is designated in a State's water quality standards. The aquatic protection use is a broad category requiring further explanation. **Species that are in the water body and which are consistent with the designated-use (i.e., not aberrational) must be protected, even if not prevalent in number or importance. Nor can activity be allowed which would render the species unfit for maintaining the use. Water quality should be such that it results in no mortality and no significant growth or reproductive impairment of resident species.** (See Question 16 for situation where an aberrant sensitive species may exist.) Any lowering of water quality below this full level of protection is not allowed. A State may develop subcategories of aquatic protection uses but cannot choose different levels of protection for like uses. The fact that sport or commercial fish are not present does not mean that the water may not be supporting an aquatic life protection function. An existing aquatic community composed entirely of invertebrates and plants, such as may be found in a pristine alpine tributary stream, should still be protected whether or not such a stream supports a fishery. Even though the shorthand expression "fishable/swimmable" is often used, the actual objective of the act is to "restore and maintain the chemical, physical, and biological integrity of our Nation's waters (Section 101(a)(1). The term "aquatic life" would more accurately reflect the protection of the aquatic community that was intended in Section 101(a)(2) of the Act." (Emphasis added in bold).

The Department of Fish and Game (CDFG) has recently begun using a new rotenone formulation of rotenone called CFT Legumine. It was used for the first time in California in the 2007 poisoning of the Lake Davis and the surrounding streams and springs. It did not perform as expected. The CDFG was unable to apply the rotenone in CFT Legumine at target levels. Levels were far above the target levels (> 1000% above target levels at some stations in the first poisoning), and high concentrations were even more common in the second poisoning than in the first. These results indicate the inability of CDFG to deliver, under field conditions, the poison rotenone in CFT Legumine at designed concentrations (see Erman and Erman, 2010, Comments on Draft

NPDES permit, Silver King Creek; Erman and Erman, 2010, Comments on Final EIR/EIS Silver King Creek). Based on the Lake Davis watershed results, we think it highly likely that the Agencies will exceed the EPA/FIFRA label requirement for normal use of 50 μ g/L in Silver King Creek if this project is allowed.

The proposed new language in the basin plan eliminates monitoring of pesticide application during the treatment phase of a project. In so doing, the Regional Board staff eliminates any means of verifying pesticide label restrictions for maximum allowed rates of application.

Independent monitoring of rotenone projects is essential. The Department of Fish and Game (CDFG) has a poor record of compliance. In the Lahontan Region alone, 6 of 11 rotenone projects between 1988 and 1994 violated water quality standards. Rotenone, rotenolone, or naphthalene were detected downstream or persisted longer than limits established in the basin plan (LRWQCB files).

CFT Legumine contains 5% rotenone and 5% other cube resins (primarily deguelin and tephrosin) as active ingredients. Cube resins have not been analyzed and it is unknown if they are neutralized by potassium permanganate (verbal testimony by Bruce Warden, LRWQCB staff, April 14, 2010, NPDES hearing). Breakdown of deguelin and tephrosin, unlike rotenone, does not produce rotenolone (Caboni et al. 2004). Therefore, monitoring of either rotenone or rotenolone will not account for other cube resins in the active ingredients. Deguelin also has been shown in laboratory tests to elicit the same Parkinson's Disease-like changes in cells as rotenone (Caboni et al. 2004).

In other words, half of the active ingredients in CFT Legumine have not been analyzed or considered in any government document. We notice the same omission has appeared again in this proposed document (p. 4 pp 4.9-2125). It is assumed that the only active ingredient in rotenone formulations is rotenone. That is false. The statement is correct, however, in stating that many other chemicals are in the formulations. But the revision has omitted the information that some of these so-called "inert" chemicals are known carcinogens, or have other deleterious properties.

For example, N-methyl pyrrolidone (NMP) is 10% of the composition of CFT Legumine (i.e., twice the amount of rotenone). NMP is considered a Substance of Very High Concern by the European Union authorities and is on the candidate list for banning as of February 2011. The concern is over its toxicity to reproduction—teratogenic in children. (wiki.answers.com/Q/Will_N-methyl_pyrrolidone_be_banned_in_Europe). The California Department of Health Services issued a Health Hazard Advisory in October 2006 to workers exposed to NMP. "You should treat NMP as a potential human reproductive hazard".(www.cdph.ca.gov/programs/hesis/Documents/nmp.pdf)

There often is a delay in officially recognizing harm in chemicals used in our environment. In the case of rotenone, NMP and others, the evidence is accumulating about their harm. One of the reasons we enacted a Clean Water Act was so that we do not pollute our water systems and then find out later it was a mistake.

Rotenone persisted in the bottom sediments of Lake Davis for at least six months following the 2007 poisoning. Rotenone was measured in stream water 14 days after it had been applied. It had apparently persisted in bottom sediments and was being released back into the stream. These results indicate that CFT Legumine behaves in some unexplained and unknown ways. It is unknown if rotenone persisted in streams longer than this measured period. Monitoring was apparently not conducted beyond two weeks in streams (Erman and Erman, Comments on Draft NPDES permit, Silver King Creek, 2010).

The persistence of rotenone in stream sediments and ground water is a significant environmental concern that has not been analyzed by the LRWQCB. Hyporheic invertebrate life will be affected by the residual rotenone in the substrate. Ground water should also be monitored. The Agencies are assuming that hyporheic invertebrates will re-populate streams that are poisoned (Silver King Creek, Final EIS/EIR p. 5.1-45; 5.1-19; Response to Comments, pp. F-50, F-80). They seem to assume that the rotenone in bottom sediments will not affect these invertebrates. (Incidentally, even assuming they would not also be poisoned, these would only be the hyporheic invertebrates in the upper part of stream bottom sediments. Invertebrates lower in the

hyporheos are restricted to that habitat.) But the LRWQCB did not consider the effects of rotenone in the stream sediments and hyporheos in the NPDES permit issued in 2010 for poisoning Silver King Creek.

If the lower Silver King Creek rotenone project is carried out, rotenone concentrations in the stream water will be 2 to 4.6 times the mean concentration that was measured in the 1991–93 poisoning of the upper part of Silver King Creek. It is likely that even greater losses of invertebrate life will occur than did as a result of the 1991–93 poisoning. (Incidentally, this proposed revision gives the false impression that fish poisoning was conducted for only one year the last time on Silver King Creek. In fact, the poisoning was done twice a year for three consecutive years. The 2010 NPDES permit allows poisoning for the same duration.)

We note that all of the wording on the problems the CDFG has of applying potassium permanganate (another poison that kills aquatic animal life) to neutralize rotenone has been eliminated in the revisions, thus omitting the information that fish kills from potassium permanganate have occurred far below project boundaries in past poisoning episodes in the Lahontan Region.

The proposed revision to the Basin Plan ignores or incompletely or incorrectly states the provisions of the Clean Water Act Antidegradation Policy.

For example, new LRWQCB staff language in Exemption Criteria for Aquatic Pesticide Use, Purpose and Need for Exemption, paragraph 4, summarizes and re-words the federal Antidegradation Policy as "...that water quality shall be preserved unless it is determined that the lowering of water quality is necessary to accommodate important economic or social development. Additionally, it requires that water quality be maintained at levels capable of supporting existing beneficial uses." This last sentence changes the wording and meaning of the Antidegradation Policy which is, "In allowing such degradation or lower water quality, the State shall **assure water quality adequate to protect existing uses fully (40 CFR 131.12(a)(2)).**" (Our emphasis added).

The LRWQCB staff is using their creative interpretation of the Policy to claim that after water has been poisoned, even if species have been lost and the biological community has been altered, the water is still **capable** of supporting species once the poison is gone and, therefore, the staff maintains the revised plan is in compliance with the Antidegradation Policy.

The Antidegradation Policy says that the beneficial uses themselves must be fully protected in any project that proposes lowering of water quality “necessary to accommodate important economic or social development.” This distinction between the two components: 1) lowering of water quality under certain circumstances and 2) fully protecting beneficial uses if water quality is lowered, is fundamental to the Antidegradation Policy. The latest version of the EPA Water Quality Handbook (Section 4, 2nd Edition, last updated on 11/06/2009) provides ample discussion of these two distinct components.

Elsewhere, in Chapter 4, the proposed revision states that “Similarly, the federal Antidegradation Policy (40 CFR Section 131.12) dictates that water quality shall be preserved unless degradation is necessary to accommodate important economic or social development.” The section quoted conveniently leaves out the next sentence (40 CFR Section 131.12(2)) of the policy, which is “In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully.”

The state and LRWQCB are not at liberty to rewrite the Clean Water Act or change the plain meaning of the words used to define the regulations except “States may adopt antidegradation statements more protective than the Federal requirement.” (EPA Water Quality Handbook, 2nd Edition, Section 4.3)

It is also not at the discretion of a regional board to decide to vacate portions of the Clean Water Act Antidegradation Policy in favor of other acts of the state or federal government unless such acts so dictate. The Endangered Species Act, for example, does not specify what methods are necessary to carry out its provisions or claim superiority

over the Clean Water Act. The purpose of the Regional Boards (among other things) is to implement the provisions of the Clean Water Act and Porter-Cologne Act.

In section 4.4.2 of the Water Quality Handbook, the meaning of protection of beneficial uses is expanded.

“No activity is allowable under the antidegradation policy which would partially or completely eliminate any existing use whether or not that use is designated in a State’s water quality standards. The aquatic protection use is a broad category requiring further explanation. Non-aberrational resident species must be protected, even if not prevalent in number or importance. Water quality should be such that it results in no mortality and no significant growth or reproductive impairment of resident species.”

The intent of allowing lowering of water quality while fully protecting existing uses was reviewed and further explained in the Preamble by the EPA during the last revisions of rules for the Clean Water Act: “In Sec. 131.12(a)(2) a phrase was added that ‘In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully’. This means that the full use must continue to exist even if some change in water quality may be permitted” (Federal Register Vol 48, No. 217, Tuesday, November 8, 1983/ Rules and Regulations. (51402).

“In its entirety, the antidegradation policy represents a three-tiered approach to maintaining and protecting various levels of water quality and uses. At its base (Section 131.12(a)(1): all existing uses and the level of water quality necessary to protect those uses must be maintained and protected. This provision establishes the absolute floor of water quality in all waters of the United States” (Federal Register Vol 48, No. 217, Tuesday, November 8, 1983/ Rules and Regulations. (51402).

Further, in response to comments not discussed in the Preamble to the proposed rule, EPA discussed three options for changes in the existing antidegradation policy. “Option 3 would have allowed changes in an existing use if maintaining that use would effectively prevent any future growth in the community or if the benefits of maintaining

the use do not bear a reasonable relationship to the costs.” EPA response was “...commenters believed that allowances should be made for carefully defined exceptions to the absolute requirement that uses attained must be maintained. EPA rejects this contention as being totally inconsistent with the spirit and intent of both the Clean Water Act and the underlying philosophy of the antidegradation policy.” (Federal Register Vol 48, No. 217, Tuesday, November 8, 1983 / Rules and Regulations (51409))

The proposed new language on fisheries management recognizes the violation of Antidegradation Policy (Draft Waste Discharge Prohibition and Exemption Criteria Language: Pesticide Basin Plan Amendment, p. 4): “*It is not appropriate or possible for the Regional Board to find that discharges within the zone of impact comply with federal and state antidegradation policies.*” Not only is the use of rotenone formulations at odds with the policies during the period of treatment, the Regional Board acknowledges (Chapter 4, p. 4.9-21–25 revised Plan) such use has long-term and permanent adverse effects on aquatic invertebrates and frogs – beneficial uses protected by the state. The staff’s justification for approving such a project anyway, is that the purpose of the project is of value to the people of the State.

What the Regional Board staff is doing by these proposed revisions is to eliminate the elements of the Antidegradation Policy that fully protect beneficial uses when government agencies, and some private entities, claim they need to lower water quality through use of aquatic pesticides. They have chosen to focus on the aspect of the Federal policy that allows, under limited circumstances, the lowering of water quality, while ignoring or redefining the simultaneous requirement of fully protecting resident aquatic life.

In conclusion, these proposed revisions by the staff of the Lahontan Basin Plan seem to reduce the responsibility and liability of the LRWQCB for all poison applications in the basin by public agencies and to permit an increase in poisoning by private agencies. The public will have to decide whether it serves the purposes of protecting health, safety and the environment, as claimed

repeatedly in this staff document, to spray or pour an increasing amount of poison over or into water for an ever-expanding variety of reasons, under the banner of “in the public interest.” We urge the Regional Board to deny these suggested revisions to the Lahontan Basin Plan.

April 12, 2011

Tahoe Area Sierra Club

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TASC BRIEF COMMENTS ON THE BASIN PLAN AMENDMENTS TO ACCOMMODATE PREVIOUS PESTICIDE USE PRACTICES AND INCREASE THE OPPORTUNITY FOR MORE USE OF MORE POISON IN THE LAKE TAHOE BASIN, THE EASTSIDE OF THE SIERRA AND THE EASTSIDE OF THE CALIFORNIA DESERTS.

The TASC opposes unlimited poisoning experiments that last an unlimited amount of time, and produce unknown results. The accumulation of hundreds of these experiments is fraught with potential short and long-term impacts and it is entirely unknown whether the experiments will actually benefit the public in the long-term. All comments below apply equally to the entire Lahontan Basin and references to Lake Tahoe do not exclude the entire Lahontan Basin.

Comments

Lahontan RWQCB is proposing a basin plan amendment that accommodates and facilitates use of pesticides, herbicides and piscicides in the waters of the Lake Tahoe Basin and its tributaries. While mosquito abatement is expected to continue with or without the basin plan amendment, the application of these poisons directly to the waters of the basin is intended to kill plants, fish, bugs and macroinvertebrates in the waters and the bottom sediments.

The piscicide rotenone is prohibited for use on land and in marine bays, lagoons and estuaries. It is only allowed to be used in fresh water. It is banned in the EU for all applications. This poison kills everything in the water that uses oxygen.

The amendments to the Basin Plan constitute a dangerous action that permits long-term impacts that are unknown to be undertaken over an unlimited amount of time until results are actually known, and that time is not known. The fact that the permit allows three unknowns (amount of time to test the poison and its killing ability in the lake and tributaries, a date when the results will be known, and the long-term impacts) all in the name of the public benefit is precarious at best.

The long-term impacts are unknown and the public benefit is unknown.

This is an experiment with no limits. Projects can receive a permit, take three years to complete, and two years later the monitoring of results begins, and

sometime after that, results will be released, giving the public a five year project plus at least five to ten years for long-term results to be known

The process of permit to results described above is not limited to the number of experiments that can be conducted at any time. The only alleged limit is the requirement of an environmental document by the applicant. That kind of limit is about as fungible as possible – the agency can change the environmental document requirement to accommodate the poisoner. The agency can reduce the scope of the environmental document to accommodate the poisoner. The agency can waive the environmental document to accommodate the poisoner.

There is no limit on the number of projects that can be undertaken anywhere in the Tahoe Basin or in the entire eastside of the state in the Lahontan Region. In the next 20 years, hundreds of large poisoning projects can be undertaken even though most of the results of these poisonings won't be known for years.

WHERE IS THE PUBLIC BENEFIT?

The Proposed Basin Plan amendment claims a rigorous monitoring program. There is no contingency for a poisonier failing to monitor because of taxpayer funds being cut. There is no contingency for a poisoner failing to monitor because a contract was flawed. There is no contingency for a poisoner failing to monitor because climate change thwarted the monitoring regime. In short, there is no backup plan for the failure to perform the monitoring that is allegedly so rigorous.

The Lahontan RWQ basin is faced with using an old technique (poisoning) because it is both accommodating and facilitating for short-term solutions.

The action is unconscionable. TASC requests that the Regional Board at the very least reduce the number of poisoning experiments to two and await complete results of long-term trends until authorizing any more such projects.