



# CLARION

A PUBLICATION OF THE COLORADO LAKE AND RESERVOIR MANAGEMENT ASSOCIATION  
OCTOBER 2006

[www.CLRMA.org](http://www.CLRMA.org)

PO BOX 260214 HIGHLANDS RANCH, COLORADO 80163

## Colorado Lake & Reservoir Management Association [CLRMA]

### 2006 Lakes Appreciation Day at Cherry Creek Reservoir

On July 29<sup>th</sup>, Cherry Creek State Park, CLRMA, Colorado Cares Day and several watershed management groups celebrated Lakes Appreciation Day at Cherry Creek Reservoir. This state park is the oldest and most visited park in Colorado. The Army Corps of Engineer built Cherry Creek Reservoir in the early 1950's, just a few miles upstream of Denver, for flood control. Now 56 years later, over 1.6 million visitors enter the park each year to play on or near the water. In July alone, 250,000 users visit Cherry Creek State Park. This kind of popularity, plus the water quality and political attention over the years, meant it was time to give back to Cherry Creek Reservoir.

Activities started off at 8:00 am with just over 90 volunteers heading out around the shoreline to remove noxious weeds and trash. Five hundred pounds of trash was removed, 5 acres cleared of upland weeds, and a half-mile of shoreline cleared of Russian olive. Fifteen exhibitors showed off their water quality education material for most of the day. CLRMA handed out free Secchi disks made from aluminum pie pans, nylon rope and a few washers! At 11:00 am, Lieutenant Governor Jane Norton and Governor Bill Owens both showed up to help out. Ms. Norton and 15 other volunteers went out on the water to take the official Secchi depth measurement (3.0 feet). At 11:30 am, speeches were conducted and proclamations handed out. Then a barbecue luncheon was provided for all the volunteers. In the afternoon, the fun activities



Volunteers check out H2O Joe.



Introducing Lieutenant Governor Jane Norton.



Pontoon boat taking volunteers to work sites.

included a free fishing clinic and gear for kids, ride-alongs in the park ranger patrol boat, Dreyers™ ice cream, NALMS Lakes Appreciation Month t-shirts, and paddleboat rides.

Finally, the day ended with a coincidental fireworks show at sundown out over the water. Whether they knew it or not, those few hundred spectators and boaters who enjoyed the evening fireworks were also appreciating the reservoir for its beauty, coolness, serenity, and spectacular reflections. That is lakes appreciation! As the day ended, Cherry Creek Reservoir was cleaner, better protected, and appreciated by hundreds more people who will now see it from a different perspective.

## Ask the Lakespert

**Q:** *I have been fishing a lot this summer and have seen several signs near boat ramps talking about 'hitchhikers'. What are they, and should I pick one up to be nice?*

*Will Foil (Salt Cedar, CO)*

**A:** No, you definitely should not pick one up. The signs posted near boat ramps are talking about the exotic, non-native, aquatic species that can get attached to your boat, trailer, or fishing gear. These nuisance "hitchhikers" can then be taken to the next body of water where your boat, trailer, and equipment will be immersed, thus causing a new infestation of that exotic plant or animal.

The biggest fear is spreading exotic aquatic macrophytes such as: Eurasian water milfoil, Brazilian elodea, hydrilla, curly-leaf pond weed, and many others. Most of these exotic plant fragments can survive out of water for many days and then be viable once back in the water. Exotics, once in a lake, are basically there for good. The only way to then control these invasive species is with expensive chemical treatments and/or intensive manual removal techniques.

The best way to make sure you don't transport exotics is by cleaning the underside of your boat trailer, your boat prop, and between your boat and trailer where plant parts can be trapped. Power washing with hot water is a great way to avoid "hitchhikers". Just make sure the runoff from the power washer is not connected to any storm water drains that lead to a lake. "Hitchhikers" are very tricky and are serious. Please do your part.

**(If you have a lake question, please send it with your name and location to the CLARION editor, Travis Bray.)**



## Spotlight On... John Stahl, PhD

John is a new member of the Board of Directors of the Colorado Lake and Reservoir Management Association, but he is not new to Colorado. He grew up in Boulder and is now retired and living on the south shore of Grand Lake. He is an engineer by training (Caltech PhD) and was an executive in the data storage industry, managing product development, manufacturing and quality organizations worldwide.

He is married and has two children, both of whom have been influenced by growing up on Colorado's waters. His daughter Karen, now living in Panama, is a marine biologist with an emphasis in aquatic toxicology, and his son Eric owns and operates a charter sailing company in the Virgin Islands. Both developed their interests by spending summers on Grand Lake.

John is also on the Board of Directors of the Three Lakes Water and Sanitation District, and President of the Greater Grand Lake Shoreline Association, a 501(c) 3 non-profit organization. GGLSA is dedicated to preserving and protecting Grand Lake and its surroundings ([www.gglsa.org](http://www.gglsa.org)). He can often be found fishing locally on the Colorado River, but also admits to fishing Utah, Idaho, Montana and Wyoming when the need for a road trip arises.



*Spring. Summer. Fall. Winter.*  
And *that's* just the beginning.

Local Representative:  
Ted D. Miller Associates, Inc.  
303-989-7737  
[sales@tdma-inc.com](mailto:sales@tdma-inc.com)

Season after season, the **YSI 6600 Extended Deployment System** accurately and reliably measures 15 parameters in lakes with even the most severe fouling. Our unique wiped sensors – for turbidity; chlorophyll or rhodamine; dissolved oxygen; and pH/ORP – increase deployment times while decreasing site visits and maintenance costs. True long-term monitoring...it's the reason for the seasons.

Call us year-round at 800-897-4151  
[environmental@YSI.com](mailto:environmental@YSI.com) • [www.YSI.com](http://www.YSI.com)



**YSI Environmental**  
Pure Data for a Healthy Planet.™



## Another Successful year for our Volunteers

In its second year, the Colorado Volunteer Lake Monitoring (CVLM) program was very successful at getting more people out on their favorite lake, reservoir, or pond. This year, there were 21 lakes or reservoirs that were monitored. Eleven of these 21 water bodies were new to this year.

A major thanks goes out to all the volunteers that participated this year. As the final volunteer data rolls in this fall, a lake-specific report card will be made similar to last year. Volunteers should be expecting their annual report card sometime in late December.

For next year, we hope to select a few dedicated volunteers to collect additional data, possibly doing temperature and dissolved oxygen profiles and collecting water samples for chlorophyll-a and nutrient analysis. Stay tuned.

For those who are interested in joining this program for 2007, please contact Steve Lundt at [slundt@mwr.dst.co.us](mailto:slundt@mwr.dst.co.us).



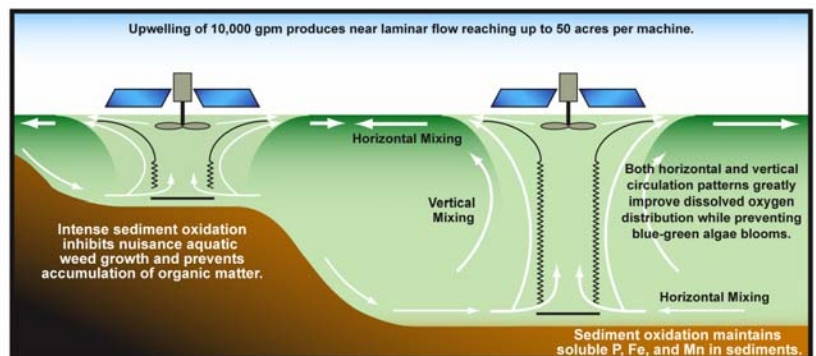
For more info contact:  
Travis Bray  
[travis.bray@denverwater.org](mailto:travis.bray@denverwater.org)  
303-628-6551

The **SolarBee®** is a floating solar-powered circulator with a unique capability to:

- eliminate cyanobacteria (blue-green algae) blooms,
- enhance water clarity and secondary production,
- oxygenate lake bottom waters and sediments to prevent release of hydrogen sulfide, iron, manganese, and phosphorus,
- prevent seasonal fish kills, and
- reduce nuisance aquatic weed growth,



*all without either toxic chemicals or fossil fuel consumption.*



In addition, the SolarBee is economical for virtually any size of lake or reservoir, requires minimal maintenance, no infrastructure changes, and can operate 24/7 using only solar energy.



**SolarBee®**  
Solar-Powered Reservoir Circulator  
"Quality Water, Naturally"

See [www.solarbee.com](http://www.solarbee.com) or call toll free 1-866-437-8076

Volunteer Lake Monitoring



**CLRMA WANTS YOU!**

303-286-3272

## President's Dock – Sharon Campbell

CLRMA is entering the final quarter of 2006 and my favorite time of the year (fall) is finally here! It's been a busy and successful year for the organization that kicked off with the 2<sup>nd</sup> Biennial Rocky Mountain Regional Lake and Reservoir Management Conference in February, followed by a spring luncheon in April, our Lakes Awareness Month activity at Cherry Creek Reservoir in July and ending with our fall conference in September. There have been other accomplishments such as the Colorado Lake Volunteer Monitoring program now in its second year with Steve Lundt as our CVLM coordinator. We also continued the CLRMA scholarship program by awarding a \$500 scholarship to Erin Hotchkiss from the University of Wyoming. CLRMA donated \$500 to the Colorado Watershed Association Conference in Breckenridge in October, 2006. You may recall that CLRMA declined participation in this joint conference because we felt that the Rocky Mountain conference needed to be our first priority. However, the successful RMRC event left the organization "flush" financially and the participation in a joint conference next year is a distinct possibility. Because we had additional funding, we also initiated the Colorado Lakes database by awarding a "Work and Learn" scholarship to Sandra Lischert, a PhD candidate at CSU in Fort Collins.

As always, CLRMA depends on volunteer efforts from our membership to staff the organization and do the real work for all of our activities, the Clarion newsletter, the CVLM program, and the website. Heartfelt thanks go to everyone one involved in these efforts and to our members whose continued interest and support for lake management in Colorado provide the foundation for CLRMA's continued existence. After 11 years of growth and change, let's hope that the trend continues into the future with the next CLRMA President, Vic Lucero in 2007!

On a final note, Kelly DiNatale, Tom Settle and I plan to convene an informal lunch meeting sometime in October to begin writing a history of CLRMA that will record how the organization began and developed during its first 10 years. If you have any pictures that you have taken over the years at any CLRMA event, please send copies to one of us for inclusion in this historical record.



### From the editor – Travis Bray

After three years and 12 issues as editor of the CLARION, I will be turning the printing press over to Sharon Campbell next year. It has been a wonderful experience and a fun ride.

Thanks to all the authors who have done a terrific job of submitting articles for the newsletter. All the authors made the job fun and enjoyable. Special thanks to Steve Lundt and Chris Knud-Hansen. I'm not sure how they managed to come up with new topics for each issue, but they sure were creative and informative. Thanks also to our two advertisers, Ted Miller Associates and Solar Bee.

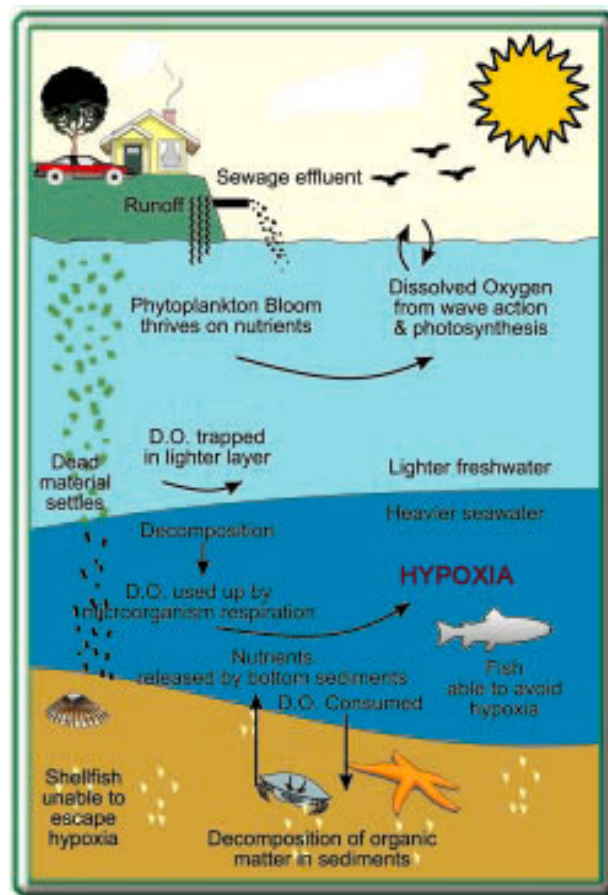
## Limno 101: Dissolved Oxygen

Chris Knud-Hansen

Oxygen is arguably the most important component of lakes. Not only is oxygen the “O” in H<sub>2</sub>O, the ability of O<sub>2</sub> to dissolve in water allows aerobic aquatic organisms to live in water environments. Air contains about 21% oxygen, with the remainder being nearly all nitrogen. But because oxygen is more soluble than nitrogen, concentrations of dissolved oxygen (DO) in water are greater than dissolved nitrogen. Nevertheless, the concentration of oxygen is still about 10,000 times greater in air than in water.

The solubility of oxygen in water is a function primarily of water temperature, atmospheric pressure, and salinity. The relationship of DO saturation with temperature is non-linear, with cold water holding more DO at 100% saturation than warm water. For example, water at 0°C at sea level can hold about 14.6 mg/L DO, while the same water at 25°C holds only about 8.3 mg/L. Because greater atmospheric pressure permits higher saturation concentrations, DO saturation values decrease with increasing altitude. So, surface waters in a mile-high lake in Colorado can hold a little over 12 mg/L DO at 0°C, and about 6.7 mg/L DO at 25°C. Furthermore, oxygen solubility decreases exponentially with increasing salinity, with about a 20% reduction in seawater when compared to fresh water at the same temperature and atmospheric pressure.

The two main sources of DO are from the diffusion of atmospheric oxygen into surface waters, and as a by-product of photosynthesis from algae and submersed aquatic plants. The diffusion rate of O<sub>2</sub> into water is relatively slow, but can be greatly enhanced through circulation. Algal photosynthesis is very effective at producing DO, and daytime concentrations in very green ponds can reach 20 mg/L or more in subsurface waters - the hydrostatic pressure of overlying water allows waters to be supersaturated without creating bubbles. DO concentrations are reduced primarily from respiratory consumption by aquatic organisms, particularly bacteria and algae. As indicated above, increasing water temperatures will also reduce DO concentrations if concentrations are at saturation levels.



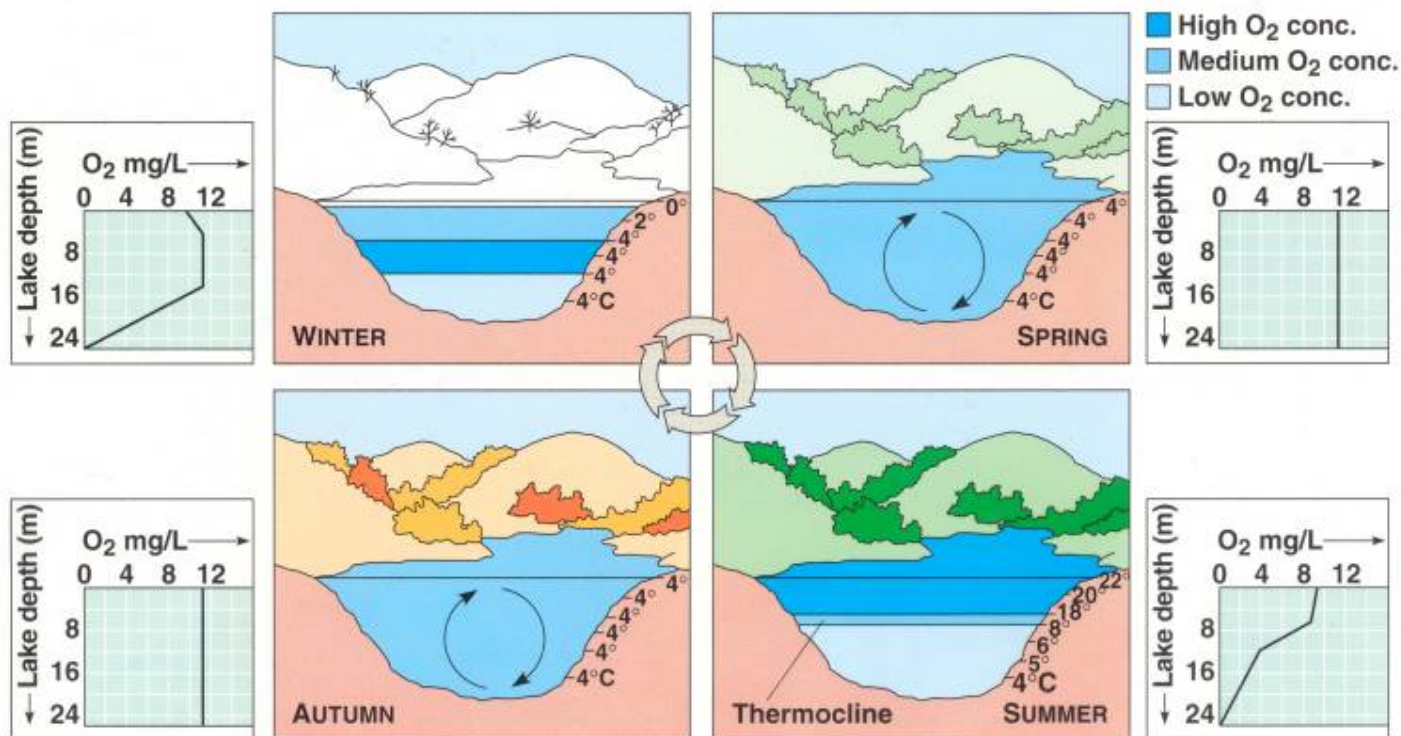
The seasonality of water temperatures, circulation patterns, and biological activity create very dynamic DO distribution characteristics over the course of a year. When lakes mix naturally during winter months or following spring ice out, waters are cold and DO is often at or near saturation throughout the water column. As spring moves into summer, surface waters warm up creating a thermally stratified lake. In very unproductive lakes, DO concentrations can remain around saturation concentrations. Since warm water holds less DO than cold water, however, DO concentrations will increase with depth. This type of summertime vertical profile is called an *orthograde* profile, and may be found in pristine mountain lakes.

The rest of the 99% of the lakes typically exhibit what is called a *clinograde* vertical profile, with DO concentrations higher in surface waters above the thermocline than

in deeper waters beneath the thermocline. While algal photosynthetic activity produces oxygen in surface waters (with maximum surface water DO concentrations typically around mid afternoon), the sinking of decomposing algal biomass also increases the rate of oxygen consumption in bottom waters. When the algal community is dominated by inedible blue-green algae, a much larger percentage of algal biomass sinks into bottom waters promoting anoxic conditions more rapidly. In more shallow lakes, much of the organic loading to the lake bottom can come from terrestrial, stream and wetland sources. Although there is substantial bacterial activity throughout the water column (as noted by dropping DO concentrations throughout the night), most bacterial decomposition and oxygen consumption occurs on the lake bottom. Therefore, summertime oxygen depletion typically begins at the sediment/water interface and moves upward into the water column. Because the thermocline acts as a barrier to mixing, there is essentially no oxygen renewal beneath the thermocline (unless waters are sufficiently clear to permit aquatic plant activity beneath the thermocline) and anoxic conditions may reach the depth of the thermocline by late summer.

Shallow lakes with more extensive submersed aquatic macrophyte beds may show a different profile, with higher DO concentrations around the plants than measured in overlying waters or in deeper waters where the plants are not growing. However, decomposition following the fall senescence of these plants can deplete the DO to the point of causing a catastrophic fish kill, called a *summer kill*. Similarly, low DO production under ice coupled with high DO demand from decomposing summer and fall organic production in shallow eutrophic lakes can lower the DO concentrations sufficiently to cause a *winterkill*. DO can be a scarce commodity in a dynamic lake ecosystem, so it makes sense that aquatic life evolved to utilize atmospheric oxygen – take a deep breath and be thankful we don't need gills to survive!

### Lake turnover



## JOIN US

CLRMA is a grass roots organization of people dedicated to the protection of Colorado lakes and is an affiliate of the international, North American Lake Management Society, NALMS. The primary objectives of CLRMA are to provide a forum for sharing information and experiences and to foster cooperation between various public and private entities to facilitate appropriate lake and watershed management strategies.

If you are a person who is currently working in the lake management arena or just would like to participate in some way to enhance the quality and amenities of our state's precious water resources, CLRMA would like to invite you to join the 150 members who are leaders in lake and watershed stewardship and protection throughout the state.



### Benefits of Membership

- Staying Informed – Being connected with water professionals provides access to the most current information and real life work experiences.
- National Resources – CLRMA can assist with direct access to NALMS professionals and committees.
- Newsletter – The CLARION contains important information and technical articles and is published quarterly.
- Conferences - CLRMA sponsors Spring Luncheons, Fall Conferences, and Bi-Annual Regional Lakes Conferences. Members receive a 10% discount on all CLRMA conferences and functions.
- Merchandise – Members receive a 10% discount on all CLRMA merchandise.
- Participation With Others – Members meet other people with similar interests and concerns and can make a difference through participation with committees and volunteer projects.



### How Do I Become a Member?

Membership in CLRMA is open to anyone interested in the preservation of lakes. You may complete the attached form at the end of the newsletter and mail or fax to the contact information at the bottom of the form. You can learn more about CLRMA by visiting [www.clrma.org](http://www.clrma.org).

## New Fireboat to Service Grand Lake and Shadow Mountain Reservoir



The Greater Grand Lake Shoreline Association recently completed an initiative to raise money for the purchase of a fireboat. Working with Fire Chief Mike Long of the Grand Lake Fire Protection District, GGLSA members identified this approach as the best means of improving fire and rescue protection along the shorelines of Grand Lake and Shadow Mountain Reservoir.

The fireboat is similar to the one pictured above, comparable in pumping capacity to that of the Fire District's medium size Pumper trucks. This boat can either fight fires directly on or near the lakes with its bow-mounted nozzle, or firefighters can attach its pump directly to standpipes or fire hoses allowing water to be pumped long distances from the lake. This is useful not only to lakefront residents but also to those some blocks from the shore. In the event of electrical power loss to the town while a fire is in progress, the boat can provide non-disruptive service that is not available today.

Many lakefront locations uphill from the lake cannot be served by Pumper trucks alone, since raising water by suction at Grand Lake altitude is limited to 10 feet of vertical rise. Since this fireboat will carry a 50 horsepower \$30,000 pump to any location on either lake, it provides a far better alternative than smaller home-based pumps whose capacity is miniscule by comparison.

The boat can also rapidly deploy firefighting crews to attack wildfires on the eastern shore of Shadow Mountain reservoir, where today crews must trek in carrying 5 gallon backpacks. Once there, the 500 gallon per minute capacity provided by the boat can in one minute supply the water carried in by a crew of 100 firefighters. Hazardous waste flotation booms are included to contain debris from lakefront fires, minimizing water pollution.

For on-lake rescue operations the Fireboat has a side door that allows rescue workers to easily load water-bound victims into the boat with minimal effort.

Response to GGLSA's fireboat initiative from the small community of Grand Lake has been overwhelming, with over \$130,000 raised locally in a two month period this summer. Donors realize that we live and vacation here not only to enjoy our own homes but also for the unique environment provided by the lakes, Rocky Mountain National Park, and Arapahoe National Forest. The Fireboat will help stop a single-structure fire from becoming a large conflagration that could affect the greater Grand Lake environment for decades.

The Commercial and Government Products division of Brunswick Marine Corporation is building the Grand Lake fireboat. The boat is based on a Boston Whaler 22' Guardian with a 250 HP Mercury Marine outboard motor. The firefighting equipment on board is made by the American LaFrance Corporation. Delivery to Grand Lake is scheduled for mid-September.

The Greater Grand Lake Shoreline Association is a 501 (c) 3 non-profit corporation formed by a group of Grand County residents. More details about the organization can be found at [www.gglsa.org](http://www.gglsa.org).



## Cherry Creek Reservoir In-lake Destratification Project

The Cherry Creek Basin Water Quality Authority expects to begin construction this November on a large scale aeration system to improve the water quality of Cherry Creek Reservoir. The goal of the aeration system is to destratify the reservoir during the summer months and to reduce the growth of blue-green algae.

The mixing will help reduce the blue-green algae in the Reservoir by limiting their time near the surface, where they use natural light and nitrogen in the air to multiply. By keeping algae in the dark by forcing them to the bottom of the lake, the amount of algae in the Reservoir is expected to be noticeably less.

The \$800,000 aeration system will include: 125 diffusers below 10 feet of water, a 125 HP air compressor, 2,600 feet of four inch pipe line, 1,500 foot long burm along the dam that might allow for a new trail that encircles the entire reservoir, and 41,000 feet of air hoses. The goal is to reduce the chlorophyll-a down to around 10 ug/L, the total phosphorus down to 54 ug/L, increase the dissolved oxygen in the hypolimnion up to 5.0 mg/L, and reduce the blue-green algae blooms.

The Authority is responsible for controlling the amount of algae in the Reservoir by the Colorado Water Quality Control Commission, which has set a strict standard for Chlorophyll a (15 ug/L).

The Authority has obtained approvals from Colorado State Parks and the U.S. Army Corps of Engineers, both which have helped to refine the plan. The Authority also worked with the Colorado Division of Wildlife and the Water Quality Control Division during preparation of the design to gain acceptance. The project has also gained support from the Marina, the Sailing Association of Intermountain Lakes, and a representative of local fishermen. For additional information go to [www.cherrycreekbasin.org](http://www.cherrycreekbasin.org)



### 2006 CLRMA BOARD OF DIRECTORS

Sharon Campbell	President	970-226-9331	sharon_g_campbell@usgs.gov
Chris Knud-Hansen	Past-President	303-469-9606	chris@solarbee.com
Vic Lucero	President-Elect	303-255-7771	vic.lucero@cityofthornton.net
Steve Lundt	Secretary	303-286-3272	slundt@mwr.dst.co.us
Travis Bray	Treasurer	303-628-6551	travis.bray@denverwater.org
Joni Nuttle	Director	303-692-3533	joni.nuttle@state.co.us
Kevin Urie	Director	303-628-5987	kevin.urie@denverwater.org
K. John Stahl	West Slope Director	970-627-9254	kjohnstahl@aol.com
Randy Giffin	Director	303-739-6770	rgiffin@ci.aurora.co.us
Kelly Cline	Director	303-430-2400	kcline@ci.westminster.co.us
Joni Nuttle	NALMS Reg 8 Dir.	303-692-3533	joni.nuttle@state.co.us

## CLRMA's 11<sup>th</sup> Annual Fall Conference

Our fall conference this year was held at the City of Thornton Margaret Carpenter Recreation Center at 11151 Colorado Blvd on September 20, 2006. We had over 55 participants including our presenters and panelists for the Shadow Mountain Drawdown to Control Aquatic weeds discussion.

The first session of the day focused on water re-use in Denver, Westminster, Aurora, and Highland Hills for irrigation of golf courses, parks and Homeowners Associations. We had an update on the CLRMA volunteer lake monitoring program from Steve Lundt, a combined presentation on the upcoming National Lakes Assessment by Sandra Spence, EPA Region VII Coordinator and Jim Saunders, the Colorado Department of Public Health and Environment. We also heard about Cherry Creek Reservoir planned destratification unit to decrease phosphorus and chlorophyll concentrations.

CLRMA Special Recognition Award Winners were: Vic Lucero, Steve Lundt, Jim Stahl, Linda Rosales, and Jim Stokes. The Public Outreach award went to Bob Toll, Cherry Creek State Park Manager. Two Secchi Disk Winners were recognized, Stacey Smith, Quality Water Biosystems, and Travis Bray, Denver Water.



Secchi Disk Award winner Travis Bray with Mary Hattendorf and Brad Wind from the Northern Colorado Water Conservancy District, panelists for the Shadow Mountain Drawdown discussion panel.



CLRMA exhibit at the 11<sup>th</sup> Annual Fall Conference



From the left, Linda Rosales, Secchi Disk Award Winner Stacey Smith, Anthony Smith and Vic Lucero, the 2007 CLRMA President Elect.



COLORADO LAKE AND RESERVOIR MANAGEMENT ASSOCIATION  
WWW.CLRMA.ORG

---

## 2007 Membership Invoice

---

### 1. PLEASE FILL OUT FORM COMPLETELY

First & Last Name: \_\_\_\_\_ Day Phone: \_\_\_\_\_  
Organization: \_\_\_\_\_ Fax: \_\_\_\_\_  
Address: \_\_\_\_\_ E-mail: \_\_\_\_\_  
City & State: \_\_\_\_\_ Membership Type: \_\_\_\_\_  
Zip: \_\_\_\_\_

---

### 2. PLEASE CIRCLE YOUR MEMBERSHIP COST BELOW:

Category	Length of Membership		
	1-year	2-year	3-year
Individual	\$20	\$35	\$50
Organization*	\$85	\$140	\$170
Student	\$10	\$15	\$20

\*Include Name and contact information for up to 5 individuals

---

### 3. PLEASE SEND CHECK PAYBLE TO:

"Colorado Lake & Reservoir Management Association" and return with this form to:  
CLRMA, P.O. Box 260214, Highlands Ranch, CO 80163

(To charge your membership to a credit card, please provide the following information:)

Type of card: \_\_\_\_\_

Credit card #: \_\_\_\_\_ Exp. Date \_\_\_\_\_

Signature: \_\_\_\_\_  
(Payment by credit card will be in accordance to card issuer agreement.)

---

### 4. PLEASE SIGN UP FOR ONE OF THE FOLLOWING ACTIVITIES:

CLRMA Web Page Help \_\_\_\_\_ 2008 Regional Conference \_\_\_\_\_  
Fall Conference \_\_\_\_\_ Presenter \_\_\_\_\_  
Lake Awareness Month \_\_\_\_\_ Newsletter Articles \_\_\_\_\_  
Student Scholarship Committee \_\_\_\_\_ Membership Committee \_\_\_\_\_  
Volunteer Lake Monitoring \_\_\_\_\_ Board of Directors \_\_\_\_\_