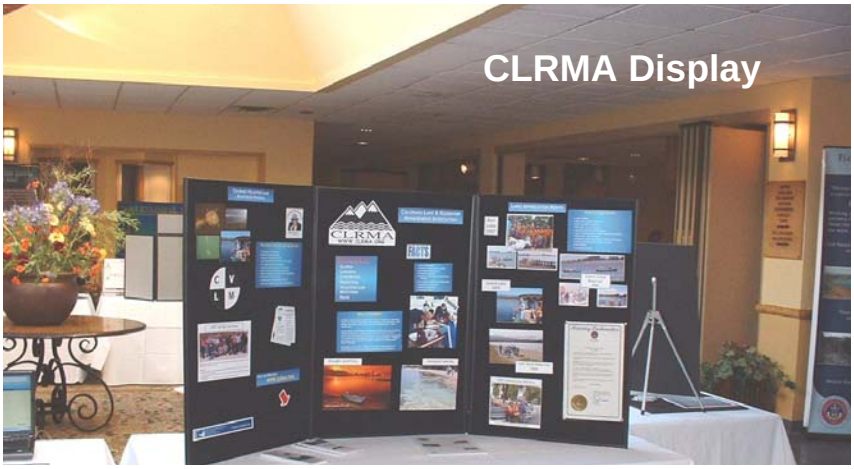
OCTOBER 2007

CLARION

A Publication of the Colorado Lake and Reservoir Management Association



The "Sustaining Colorado's Watersheds Conference" was held in Breckenridge October 2 – 4, 2007. The conference was well attended by approximately 281 registered attendees including approximately 20 CLRMA members. This second annual watershed conference was the first year of participation for CLRMA. CLRMA has traditionally held a fall conference or a Regional Lakes Conference as their primary funding raising event. CLRMA decided to join with four other conference partners to avoid competition with other conference dates and training and travel budgets. The other conference partners were the Colorado Riparian Association, Colorado Watershed Network, Colorado Watershed Assembly, and AWARE Colorado.

The conference opened with a welcome by a representative of each conference partner, followed by a panel discussion "Balancing Water Quality, Quantity and Energy Development."

Keynote speaker Rick Cables, Regional Forester, U.S. Forest Service addressed the dinner guests the evening of October 2nd with a presentation, "Connecting with our Forest Headwaters." His point was well taken that most of Colorado's waters originate in the forest which makes the connection of protecting the forests, protects water quality.

Vic Lucero, Curry Rosato, Linda Rosales, Steve Lundt and Sarah Sauter in Breckenridge.

Two concurrent tracks were run on October 3rd with many interesting topics such as Connecting Water Quality and Supply, Wildlife and Habitat, Understanding the Health of Colorado Waters, Multi-System Impacts to Water Resources, Linking Land Use and Water Quality, and Looking for New Solutions.

The conference closed with a panel discussion about "Watershed Monitoring Across Colorado." The keynote speaker at lunch on October 3rd was Luther Propst, Executive Director, Sonoran Institute gave a well received presentation, "Protecting and Restoring Our Watersheds in a Changing West; Challenges and Reasons for Hope." There were also many interesting poster and vendor displays. Thanks to the many volunteers and sponsors who makde this conference a huge success.

CLRMA

Colorado Lake and Reservoir Management Association
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Cheesman and Antero Reservoirs Open After 2002 Drought and Hayman Fire

By: Neil Sperandeo

The 2002 drought and Hayman fire will always be remembered as a dark year in Denver Water's long history of providing water to the Denver Metro area. The record breaking 2002 drought was as difficult as it was heartbreaking.

Antero Reservoir, one of Colorado's most prolific fisheries, had to be drained in 2002 because of serious evaporative losses. Antero was a key component in getting through the unprecedented drought of 2002.

The water drained from Antero helped Denver residents by providing much needed water supply, and by buffering the effects of the Hayman fire.

Cheesman Reservoir, located at ground zero of the Hayman fire, was closed as Denver Water worked on reclamation projects and other measures to stop post-fire sediment and ash from entering Denver's water supply. These reservoirs had been two of Colorado's favorite recreational destinations and had remained closed since 2002.

But 2007 became the year to erase the memories of 2002. Both reservoirs reopened to the delight of recreationalists throughout Colorado.

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Cheesman Reservoir

At dawn on the morning of June 20th 2007, Cheesman Reservoir opened its gates to the public. By 9:00 the parking lot was full and about 50 excited anglers were casting and catching fish once again. The ravages of the Hayman fire were still visible, but beneath the fire's devastation, the pale green color of grasses and shrubs could be seen on the surrounding hillsides.

Because of post-fire safety concerns, Denver Water worked with the Colorado State Forest Service to remove burned trees and construct a new access trail next to the shoreline of the Goose Creek arm of the reservoir. This mile and a half shoreline is the only area open to the public at this time. New picnic tables were installed as well as bear-proof trash cans.

The Colorado Division of Wildlife stocked smallmouth bass, northern pike, yellow perch, rainbow trout, brown trout, splake, and kokanee in the reservoir. While the fishery is not the best in the state, the setting is excellent.

Cheesman Reservoir is located six miles southwest of the town of Deckers. Named for Denver water pioneer Walter S. Cheesman, the Cheesman dam was the world's tallest at 221 feet above the streambed when completed in 1905. The reservoir and related facilities were purchased in November 1918 by the Denver Water Board. Cheesman was the first reservoir of Denver's mountain storage facilities and the dam has been designated a National Historic Civil Engineering Landmark. Denver Water celebrated Cheesman Dam's century of service in 2005.

Antero Reservoir

The name Antero was derived from the Spanish word "first", as it is the first and highest dam on the South Platte River system. Consequently, there is not a lot of inflow to the reservoir.

Much of that inflow is owned by the city of Aurora, and would normally have to be bypassed. However, Denver Water was able to cooperate with Aurora and work out a trade where Denver Water could store Aurora's water in Antero, thus filling the reservoir more quickly.

In addition, ongoing conservation by Denver residents allowed more water to be stored, helping to refill Antero more quickly. This shows the connection between conservation and other benefits and uses of Denver Water's system. The water saved by Denver Water customers is used to enhance recreation and the natural environment.

Before Antero was drained in 2002, it was the most productive fishery in Colorado. Denver Water worked with the Colorado Division of Wildlife to stock trout in the reservoir as it was refilled. The fishery has already come back to its world class form. Trophy sized trout once again grow at an unbelievable rate of up to two inches per month during the summer months.

Antero reservoir reopened at 9:00 AM on Tuesday July 17, 2007. Vehicles filled with avid anglers began to arrive the day before. By the time the gates were opened, the entrance roadways were lined with vehicles all the way to Colorado State Highway 24. By 10:00 am visitors had to be turned away because every available parking spot was filled. Anglers happily caught their limit on opening day.

To the surprise of everyone involved, the state record Cutbow trout was caught on opening day. It tipped the scales at 18 pounds 8 ounces and was 28 ½ inches in length. That's a big fish. The Division of Wildlife theorizes that this fish could have survived Antero's draining by living in one of the few spring fed pockets of open water at the site.

Antero Reservoir is located five miles west of the Town of Hartsel in the South Park area of the state. The earth-fill dam was completed in 1909 and holds about 20,000 acre feet of water.

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Presidents Dock - by Vic Lucero

As I reflect over the last year, with my term as President coming to an end, several thoughts come to me immediately. First I can't believe how quickly the time has gone by yet how much was accomplished by this organization. There was an annual Spring Luncheon, a Lake Appreciation Day celebration at Barr Lake, the volunteer EPA Lake Monitoring event, the awarding of three scholarships, the partnering and sponsorship of the Sustaining Colorado Watersheds Conference in Breckenridge, continuation of the Lake Volunteer Program, updating of the website with Colorado lake data, and now the planning of the CLRMA Annual Meeting in November is underway. The officers, directors, and volunteers of this organization have worked very hard to accomplish this much in one short year. I am very happy to have been part of this effort.

Another reflection I have is all of the great volunteers that made these events so successful. There were hundreds of students, many State Park employees and volunteers, numerous lake monitoring volunteers, speakers, contributing organizations such as Barr Milton Reservoir Watershed Association, Farmers Reservoir and Irrigation Company, and many other organizations who contributed funding and human resources for conferences and events. All of these people contributed significantly to CLRMA's success this year. This speaks loudly to me that there are a lot of people who are passionate about promoting the importance of preserving Colorado lakes and want to play a significant part in this effort.

Lastly I reflect on what CLRMA has the potential to become. CLRMA is the only organization that I am aware of that is trying to be a truly state-wide organization that specifically targets the preservation of lakes. CLRMA has pursued this mission by holding conferences that feature lake protection related presentations, recruiting lake monitoring volunteers, holding Lake Appreciation events, and publishing a Newsletter with information regarding lake management educational topics. It was a big step forward for CLRMA when over 300 student volunteers showed up to help pick up trash and participate in the Lake Appreciation Day events at Barr Lake. This tells me that CLRMA has been successful in planting seeds to accomplish its' mission. I can envision a day when CLRMA is an organization with many hundreds or even thousands of members who are actively promoting lake protection awareness throughout the state. With the increase in volunteers, hopefully there will also be more on the ground projects that will benefit water quality and further promote the cause. The work CLRMA is doing today is building a solid base for the future. I would encourage you to become involved in this worthwhile cause. Plan on attending the CLRMA Annual meeting in November to find out more about the organization and how you can participate. Information about the annual meeting is posted in this newsletter. I want to sincerely thank everyone who contributed in any way to the events and successes of this year. You all made my involvement very satisfying.

CLRMA President – Vic Lucero

LAM Day at Barr Lake, Vic, his son B.J and Alice Wood heading out to get the Offcial Secchi Disk Reading

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Reflections – Twin Lakes, Colorado – the "Lake Mendota of the Rockies"
By: Sharon Campbell

I came to Colorado in June, 1978 with a relatively new degree in Biology from the University of Puget Sound in Tacoma, WA. I had been hired as a Biological Technician by the Bureau of Reclamation in the Environmental Sciences Section for the Mt. Elbert Pumped-Storage Powerplant studies of the effects of powerplant operation on the ecology of Twin Lakes, Colorado. I worked with several other scientists collecting limnological data at Twin Lakes for over 8 years. Data collection was supposed to consist of 1 - 2 years of pre-operational, and 1- 2 years of post-operational efforts to determine how the ecology of the lake responded to powerplant operation. We ended up with 14 years of pre-operations data and just 2 years of post-operational data collections because construction and equipment installation was delayed.

In retrospect, the data collection and sample processing for the studies at Twin Lakes were the ultimate limnology training course for the group of scientists who participated in the process. In September, we had a small reunion to honor Jim Sartoris, who retired to Hawaii 2 years ago. Jim LaBounty, Jim Sartoris and I spent part of the evening remembering Twin Lakes and all of us agree that it was the best time of our professional careers. We all shared a common body of work that was interesting, challenging, and rewarding. We were all stimulated creatively by the depth of understanding we gained about lake ecology and Twin Lakes response to hydrology, meteorology, and perturbation, once the powerplant began to operate.

We were also challenged by working at high altitude, doing year-round surveys using boats during the ice-free seasons and snowmobiles, dragging sleds or on snowshoes during the winter.

Before the powerplant began operation, we actually drove a big suburban out on the ice and drilled through up to 3 feet of ice to lower our equipment and sampling gear. On many occasions in winter, the handlines froze solid as we pulled them out of the hole in the ice and made a free-form ice sculpture behind us! We have tales of frostbite, breaking through the ice and having to be winched out, wind and thunderstorms in both summer and winter that caused us to run for cover. During one memorable winter survey, there was so much static electricity in the atmosphere that the spud bar we used to break ice with, was actually vibrating and humming as it stood upright in the ice. My acrylic knit hat had an aura of fuzz sticking straight out in all directions and every time my colleague, Steve Hiebert, bent down and straightened up, he got a shock from his metal framed eyeglasses. We could hear thunder rolling across the lake and the snow was falling around us like giant feathers sifting down from a featherbed that had somehow split in the clouds above us. We should have run for cover that time as well, but were too ignorant to realize the danger that the ionic charge represented. Fortunately, we completed the survey without harm to either us or any of the equipment.

Twin Lakes was the place where I actually experienced “lake turnover”, as the lakes developed a thermocline each summer in the ice-free season. I learned to recognize diatoms, desmids, chrysophytes, copepods, rotifers, and cladocerans in the plankton samples I processed. I learned to conduct radioisotope uptake tests and process samples. I learned to collect and process cholorphyll biomass samples and did the same for benthic invertebrate samples. I learned to measure physical-chemical parameters and collect samples for water quality constituents. I learned to work and share information with a group of colleagues who shared the same interests and were always willing to discuss, inform and teach each other about lakes, lake functioning and ecology. And at the end, I also learned how to enter the data to both mainframe and desktop computers and utilize the information to analyze and interpret the results to help us all understand how the ecology of Twin Lakes responded to perturbation from pumped-storage powerplant operation. I will be forever grateful for being able to participate in the Twin Lakes studies and be a graduate of the LaBounty school of limnology at the “Lake Mendota of the Rockies”.

Photo taken July 9, 1993 at the Twin Lakes Monograph party, with principals from the Twin Lakes Study celebrating the completion of the Engineering Monograph titled “Aquatic Ecology Studies of Twin Lakes, Colorado 1971-86: Effects of a Pumped-Storage Hydroelectric Project on a Pair of Montane Lakes.” From left to right are: Steve Hiebert, Eric Bergersen, Wes Nelson, Jim Yahnke, Sharon Campbell, Lloyd Timblin, Jim Sartoris, Dale Hoffman, Rick Roline, Gene Otto, Rich Walters, Tom Bartley, and Jim LaBounty. Not shown are Davine Lieberman, John Boehmke, Melo Maiolie, Tom Nestler and a variety of summer temporary employees and students who assisted in the studies at various times.

Ask the *Lakespert* – By: Steve Lundt

Q: *It is the middle of summer and our lake just had a fish kill. What would cause a fish kill this time of year?*

Thanks, (Wideawake, Colorado)

A: The typical first reaction is to suspect that someone poisoned the water. Most fish kills (as far as I can tell Colorado does not have an official definition); however, are caused by suffocation caused by low dissolved oxygen levels. In fact, in some cases the low dissolved oxygen is not the culprit but the accomplice. Common viruses and bacteria present can be the killer due to the additional stress from low dissolved oxygen. Summer time fish kills are usually a result of several contributing factors that occur simultaneously: cloudy weather pattern, cold spell, high water temperature, depth and water quality, algae species, crowed fish populations, and drought patterns.

If the kill occurs over night and is sudden, then it most likely caused by fish suffocation caused by nightime oxygen depletion. Symptoms of oxygen depletion may include an abnormal distribution of fish gulping at the water surface or lake's edge. Large fish may die first, but all sizes of fish are usually affected. If the kill occurs over a course of 3-4 days, then it is most likely due to viral or bacterial infections. The only thing that can be done once a kill has been noticed is to remove the dead fish and monitor the water quality of the lake.

Very few fish kills result in total loss of the population. But if they do reoccur, then the more tolerant "trash fish" will start dominating the fish community in your lake. An aeration system that can increase dissolved oxygen and/or help with circulation can help prevent further fish kills.

The best approach is to prevent nutrients from entering your lake, causing the imbalance of algae growth and then decay, which eventually causes the dissolved oxygen lags.

Other possibilities: If you monitor your dissolved oxygen and it is fine, then you may won't to see if any herbicides have been applied near the lake. Some pesticides are lethal to fish. Other spills of gasoline, chlorine, ammonia fertilizer, acids, or other toxic chemicals can also do the trick. If it is just one species and it is closer to spring time, then some fish kills have been known to be caused by post-spawning stress. Fish do get old and sick naturally, so a couple of fish washing up to shore might be due to the natural cycle of life.

Good luck !

Al. D. Compost

Don't forget about the CLRMA Annual Membership and Board Meeting! November 14, 2007 at the Thornton Recreation Center, **11151 Colorado Blvd.** A free box lunch, soft drinks and cookies will be provided. Hear all about the Colorado National Lakes Survey sampling from George Ingersoll, U.S. Geological Survey, who has pictures and much valuable information. Lunch starts at 11:30 am!

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CLRMA Spotlight Questionnaire – Isaac Anthony – CLRMA Webmaster

Age: 20

Yrs w/ CLRMA/NALMS: .75

Yrs in CO: 20

What do you do: Full Time Student at CSU studying Civil Engineering

Family: Mother and one older brother

When I'm not working I am... Going to school, working on my car, 'laxing around home.

Your idea of happiness: Playing poker with some of my closest friends

Not many people know that... I am very clean and orderly—borderline obsessive compulsive.

What do I like to do most: Relax by watching tv, browsing the internet, hanging around cars and friends.

If I won the lottery: I would buy really nice furniture, a house to put it on, cars to fill the garage, and all the go-fast-gadgets for the cars.

Last book I read: Harry Potter and the Deathly Hallows

What political office: Democrat

Toughest aspect of my job: Nothing too hard, just getting around to my work which is usually near midnight.

What famous person would you like to meet most: John Williams—The master of the orchestra

Isaac's Hobby

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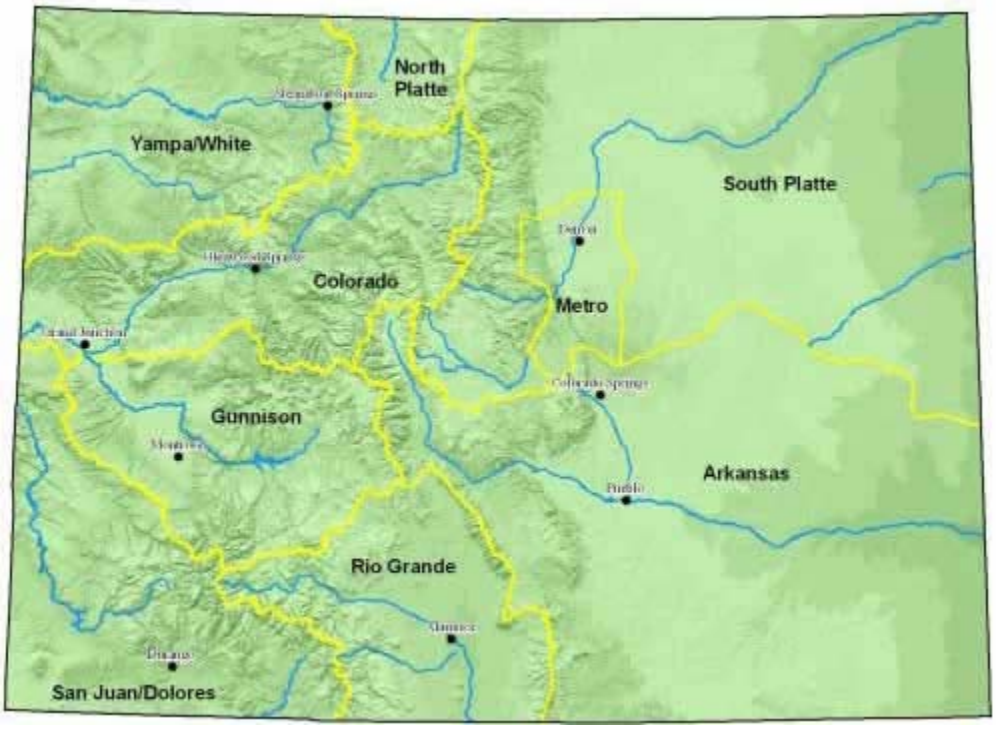
Limno 101: Watersheds

By: Chris Knud-Hansen

Previous Limno 101s have focused on ecological relationships within the watery world bounded by where the lake meets the shore. But in reality, what we call a lake is really just a temporary residence for water coming into a basin before it leaves again. Thanks to precipitation, sloped terrain, and the force of gravity, surface water travels towards the sea with flows impeded by stream/river impoundments and catchment basins – both natural and man-made. The term watershed refers to upland areas that drain rain and snowmelt into a specific stream, river, lake, reservoir, and/or ocean. The average time water will remain in a particular basin is called the residence time, which can vary from days in a small reservoir with a relatively large watershed, to several hundred years for a large lake with a relatively small watershed (e.g., Lake Tahoe).

Watershed boundaries are typically defined by the combination of topography and the location of the receiving basin, with smaller watersheds being a part of larger watersheds. High mountain streams drain relatively small areas representing the headwaters of the watershed. As water flows down hill, streams merge becoming larger rivers joining their respective watersheds. In Colorado the four main watersheds are Colorado River Watershed, Rio Grande Watershed, South Platte Watershed, and Arkansas Watershed. Ultimately, surface water will sink into the ground, evaporate into the atmosphere, or flow to the sea as part of the hydrologic cycle.



Colorado Major Watersheds

There are four major natural influences on water quality within a watershed: parent rock, climate, topography, and vegetation. The weathering of parent rock yields different solutes depending on the nature of the rock. For example, Rocky Mountain granite will yield few solutes and the runoff is similar to rainwater, while sedimentary rocks (e.g., limestone) dissolve more readily making waters more mineral rich. Climate affects weathering rates, with greater erosion occurring in areas with more extreme temperatures and periods of high runoff, such as much of the Southwest. Basin topography affects rock and soil exposure to weathering and subsequent erosion rates. And, watersheds dominated by forests

and natural vegetation will have less erosion and weathering than open and tilled agricultural fields. On the other hand, the loss of vegetation through forest fires can result in tremendous sediment and nutrient transport from the watershed during subsequent rain events.

With human development, natural contributions to a receiving lake or reservoir are easily overwhelmed by man-made sources and influences. Municipal wastewater discharges carry nutrients and dissolved minerals into streams, rivers and lakes that may have originated from a different watershed, or even a different continent! Accelerated nutrient loading from urban stormwater runoff and agricultural drainage are at rates orders of magnitude larger than natural processes.

Watershed management has taken greater importance in the last few decades, both in terms of protection as well as to control the rate of soil erosion and nutrient transport into receiving waters. A major obstacle, however, has been dealing with the reality that watershed boundaries and political boundaries are rarely the same. In response, watershed protection organizations have united stakeholders within a watershed to spearhead a "watershed approach" towards protecting their downstream rivers and lakes. A good example is the Big Thompson Watershed Forum (www.btwatershed.org/), headquartered in Loveland, CO. The Big Thompson River watershed covers about 900 square miles within the South Platte watershed, but adding to the complexity are trans-boundary diversions across the Continental Divide (through the Colorado-Big Thompson (C-BT) Project) that brings East Slope water to the West Slope, confusing the watershed concept but not the mission!

For those wishing to learn more about protecting the watershed you live in, there are several good resources in Colorado. The *Colorado Watershed Network* (www.coloradowatershed.org/) has the goal of "promoting the health of Colorado's watersheds through nonbiased community based science and support." The *Colorado Watershed Assembly* (www.coloradowater.org/) is a "501(c)(3) nonprofit advocate for citizen conservation groups promoting community-driven leadership through cooperation, communication, and consultation. " *Colorado Watershed Protection Efforts* through Colorado State University (http://waterknowledge.colostate.edu/colorado_watershed1.htm) "is an effort by the Colorado Water Resources Research Institute to facilitate sharing of information about local watershed protection efforts in Colorado." *Colorado Water Protection Project* (www.ourwater.org/) gives advice at what not to put into our waters. *Aware Colorado* (www.awarecolorado.org) is a "a statewide program to educate local decision makers about the impacts of land use choices on water quality" in order to "help protect Colorado's water and natural resources from polluted runoff through innovative land use strategies." And finally, sage advice from H_2O Jo & Flo (www.basin.org/) "Keep it clean 'cause we're all downstream".

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Grand Lake Update By K. John Stahl

During the summer of 2007, Grand Lake experienced a blue-green algal bloom dominated by *Microcystis.* Secchi depths at the peak of the algal bloom in Shadow Mountain reservoir were less than 1 meter.

The photo at the left shows the flow out of SM reservoir into Grand Lake, and the second photo is at the eastern end of Grand Lake by the Adams tunnel entrance.

The photo at the right is at the eastern end of Grand Lake by the Adams tunnel entrance. It only took a couple of days for the pumped water to fully cover Grand Lake with this algae-laden water. (At peak flow, 1000 acre-feet per day can be pumped into and through Grand Lake, which has a surface area of just over 500 acres.) As a result, Grand County issued a water advisory on August 15, 2007.

Grand County Public Health Nursing Service and the Grand County Board of Health otherwise known as the Grand County Board of County Commissioners are issuing an advisory to all Three Lakes water users. It has come to our attention that the Microcystin toxin results are as follows as of testing done on 08-06-07:

Shadow Mountain Reservoir 1.15 ug/L
Grand Lake 1.48 ug/L

The World Health Organization (WHO) has issued guidelines that daily consumption of drinking water with over 1.00 ug/L of Microcystin may be considered a serious health threat. The advisory continued on to warn against boiling water to drink, advised drinking bottled water, and avoiding recreation activities such as water skiing that might cause water spray to be inhaled.

CLRMA Annual Membership and November Board Meeting

DATE: November 14, 2007

Where: Thornton Recreation Center, 11151 Colorado Blvd.

When: 11:30 am to 1:30 pm

CLRMA will hold its annual membership meeting in conjunction with the November Board Meeting. George Ingersoll, USGS, who headed the Colorado National Lakes Survey this summer will be there to talk about what went right, what went wrong, what Colorado lakes were sampled and the types of sampling that was done and may be able to tell us when a report on the Colorado results will be available. Please join us for the membership meeting, lunch, and a wonderful and informative talk on Colorado lakes on November 14, 2007 at the Thornton Recreation Center, 113th and Colorado Blvd. from 11: 30 – 1:30 pm. Because CLRMA shared in the joint conference proceeds, we are able to offer a box lunch for everyone at no cost. CLRMA Board members are donating soft drinks and cookies for dessert in addition to the box lunch. We will have our elections for Board and Officers positions that are coming available, awards, and organization reports. We plan to invite our CLRMA scholarship winners and hope they will be able to attend as well. Please RSVP if you are planning to attend to Sharon Campbell at 970-226-9331 or campbells@usgs.gov. We will need to have a seat and a lunch for you! See you there!

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Ripples: CLRMA Student Scholarship Winners – Volunteers for the National Lakes Survey

Three students from the Colorado School of Mines participated in the National Lakes Survey with U.S. Geological Survey at Windsor Lake in July, 2007. CLRMA provided a $500 scholarship to each student who participated as a volunteer in the National Lakes Survey and we were pleased that Emily Lescher, Ruth Tinnacher, and Angelique Diaz, from the Colorado School of Mines completed the volunteer assignment. In their own words, the essays that each of them wrote to complete the scholarship requirements are included in this issue of the *Clarion.* Here is a photo of our happy scholarship winners from left to right: Angelique Diaz, Ruth Tinnacher, and Emily Lescher.

August 21, 2007

To: CLRMA members
From: Emily Lesher, Student Volunteer
Subject: Windsor Lake National Lake Survey Sampling, July, 2007

The natural world has always captivated me. My pastimes have gone from running around in the woods as a child to hiking, backpacking, kayaking, and biking more recently. Over these years,

my relationship with the environment has matured. Early on, the world around me held endless curiosities and challenges to my physical and mental fitness – cliffs to climb, ravines to explore, rocks and trees to identify – but now, while I still enjoy these pursuits, I also think more about my role in preserving the environment. The writer Aldo Leopold is perhaps the greatest influence on my understanding of preservation. In *Round River*, he writes that "we shall never achieve harmony with land, any more than we shall achieve absolute justice or liberty for people. In these higher aspirations the important thing is not to achieve, but to strive."

My years in the woods merged with an interest in applied science to land me at the Colorado School of Mines Division of Environmental Science and Engineering. My studies at Mines have helped me better understand the nuance of Leopold's quote, and I draw on this understanding in reflecting upon my experience helping to sample Windsor Lake back in July, and upon the importance of the Colorado Lake and Reservoir Management Association's involvement with the National Lake Survey.

Lakes often serve multiple uses. Ecologically, they are critical habitat for a variety of species. Many species of water fowl, amphibians, fish, and small mammals rely on small bodies of water for vital stages of their lives. These species are also links within a larger web of interdependence. For example, amphibians may keep insect populations in check, and small mammals may be prey to larger predators that range in the area. Decades of research in ecology have shown that while ecosystems may be resilient, the interdependence requires health throughout the community. In other words, problems in one part of the ecosystem may very well affect every part of it.

But beyond their ecological importance, lakes provide other services. As we were leaving Windsor Lake the day we sampled, we saw a couple of water skiers carving through the tranquil water, and a number of people – seniors, families, and others – just enjoying a nice walk around the lake. We also observed a system of ditches; it looked like it was somehow being used for irrigation. In turn, it seemed that the nearby agriculture must be impacting the lake.

Multiple uses can stress a land or water, as they might be competitive. For example the boats pulling the water skiers could be losing a little gasoline. Gasoline contains a number of chemical compounds, many of which are toxic to aquatic life at low concentrations. But pragmatically, I believe that competing uses are a fact of life because these different uses are all valued by people. I think Leopold hints at this in the passage I quoted. In striving for harmony we are striving to maximize benefits – environmental and recreational as well as economic. Environmental and recreational benefits have intrinsic economic value, but that value is harder to determine than the dollar value of, say, irrigation rights. The studies of valuation and economic decision-making attempt to do just this. Many economists are encouraging decision makers to calculate the true costs and benefits, including environmental and recreational, when considering use or preservation of lakes and other natural resources.

As we strive to maximize benefits, it is important to know how well we're doing. The National Lake Survey will provide this information. The Survey is documenting current conditions, which will be viewed as a baseline in future surveys (to be carried out every five years). One especially important outcome will be enhanced understanding of the external costs of lake uses; for example, the impact of recreational use of a lake. Likewise, it could show the benefits of improvement projects. Not only will this year's measurements give some indication of the cost uses are having on a lake, but the five year measurement intervals will create a timeline of how use trends affect scientifically assessed quality measures. These baseline and monitoring components are critical; it is difficult, if not dangerous, to make good decisions on the uses of the lake without solid scientific observations.

My involvement with this program intersects with my professional goals. After I achieve my MS degree, I plan on continuing in research. I have not yet narrowed down the many possible options, but working with the USGS and CLRMA on the *National Lake Survey* showed me what it would be like to work on a big, national project. It helped me understand the challenges of organizing

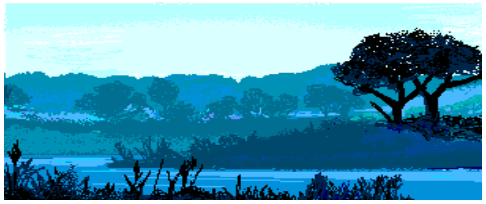
volunteers and those contracted to sample. Perhaps the most important part of this project is that it will produce a consistent dataset that encompasses the whole country, but that outcome is completely dependent on quality control and assurance of the data collection and recording methods used by the hundreds of involved individuals. I need to be able to excel at challenging tasks such as these to succeed in my field.

I intend to use my scientific background in an applied setting. The key skill I took out of my experience was monitoring. Even if I am not working in surface water in the future, monitoring quality over time sheds light on the hazy economics of competitive uses and hard-to-value costs and benefits. This can be applied to groundwater, land with mineral deposits, the atmosphere, and many other natural resources that are in heavy demand.

Beyond my professional goals, this experience has impacted me in other ways. I believe personal decision making and responsibility to be a major force in conservation. Education allows one to make better decisions, and necessarily leaves a person more responsible when it comes to sustaining our planet. Thus, I am now more responsible for protecting waters than I was before. While my own research will probably not be directly related to lakes and reservoirs, applications of it may be. I will look for these applications. And as an informed citizen with a voice in the decisions that affect surface waters, I will critically evaluate - with keener vision due to my experience - the EPA's report when it comes out.

I also have an interest in education; in fact I taught high school science for a few years before starting my masters. I usually do not pass up chances for informal debates or discussions on matters of which I am at least a little informed. I see these as learning and teaching opportunities; I learn from someone else and they learn from me. So the next time I am strolling around a lake with my young nephew, my friend, or my dad, I will likely tell them about the National Lake Survey and the work being done by CLRMA and all the people that are working hard to make this program a success.

Emily Lesher
MS candidate at Colorado School of Mines



August 28, 2007

To: CLRMA members
From: Ruth M. Tinnacher, Student Volunteer
Subject: Sampling at Windsor Reservoir: a great learning experience

In my PhD research, I investigate the effects of natural organic matter on the transport of radioactive contaminants in saturated groundwater systems. Due to safety considerations and in order to limit the production of radioactive waste, all my lab-scale experimental systems are designed for the smallest size possible. In addition, I usually test very homogeneous, controlled systems that obviously represent a strong simplification of the natural, heterogeneous environment. Therefore, I was very excited, when I learned about the opportunity to participate in field work for the Lake Survey program for one day. My goal was to learn more about lake chemistry as well as about field work in a large environmental ecosystem.

On this sampling trip, three students from the Colorado School of Mines joined George Ingersol from the USGS and his summer intern Chad for their work at Windsor Reservoir located in Windsor, Colorado, south-east of Fort Collins. At the first look, the reservoir seemed relatively clean and well preserved.

After meeting George and Chad, we learned how well they had planned the sampling event and organized the sampling equipment. Considering the fact that it is impossible to manage things at the last minute in the field, this makes a lot of sense. We started with the calibration of a combined

pH-conductivity probe using the back of the truck as a lab bench. Compared to my lab experiences, all the equipment used in the field was significantly larger, and a lot of thought had been put in for the optimization of procedures and resources under limiting field conditions.

First, we focused on the chemical characterization of the reservoir. Based on the measurements of a GPS device, we found the deepest point in the lake, where we took additional measurements of depth and of turbidity using a Secchi dish. At this point, it had already become obvious that the lake was affected by significant amounts of algae growth, which gave the water a dark green color. This may have been caused by agricultural run-off possibly containing high phosphate concentrations. Furthermore, we retrieved a series of lake water samples for later chemical and biological analysis. Lastly, we tried to sample lake sediment using a specifically designed hand-held sampling device. However, the sediment sampling proved to be very difficult, and we were only able to retrieve small amounts of slimy-looking material. After 24 sampling attempts at four different locations, we decided to shift our focus to different aspects of lake quality. As we learned from the local personnel in charge of the lake, the reservoir had been completely emptied in order to build irrigation channels a couple of years earlier. This must have dried up and hardened the sediment significantly, which made our sediment sampling attempts very difficult. I believe that this may have affected the community of benthic organisms as well.

After a brief lunch break, we took a closer look on the ecology of the lake at approximately 10 different sampling locations. These locations had been selected arbitrarily prior to the sampling event. We determined the 10-meter-depth from the shore, which was always a couple of meters deep. Furthermore, we evaluated the distribution of natural and introduced organisms, the vegetation along the shore line and within a specified area a few meters away from the shoreline, as well as the general human impact at the specific sampling locations. Finally, we also provided a general evaluation of the quality of the lake. After reviewing these aspects, we realized that the reservoir may have been affected by human impact more strongly than what was initially obvious. Especially, the strong presence of algae was worrisome.

Back on the land, we helped George and Chad to prepare the previously collected lake samples for the shipment to various laboratories for analysis. Again, I was impressed by the creative approach the researchers took to overcome the limitations in the field. For instance, the boat battery was used as power source for the vacuum-filtration of water samples. Sample vials were wrapped with parafilm against the opening direction of the screw-caps in order to avoid accidental spilling and sample loss. Dry-ice was put on top of the cooler containing regular ice-packages in order to preserve the ice for a longer time in the hot Colorado weather. While all these things may sound trivial to an experienced field-investigator, they gave me a great taste of the relevant issues in environmental field work.

Looking back on this experience, I realize that I would really enjoy getting involved into more field-work in my own research. Regarding the quality of lakes, however, I learned that my first impression may not always provide a good judgment. Only after spending a full day at Windsor Reservoir and a more detailed ecological evaluation, I realized that the quality of the lake could be further improved.

Lakes represent sensitive and important environments, and we should take more active measures to preserve them. They play important roles in local ecosystems and are great environments for recreational activities like fishing, boating and swimming. Actually, some of my dearest childhood memories are related to my days of swimming in our local bathing lake. Looking back now, I believe that I feel strongly about preserving the environment because I have had so many great experiences in a well-preserved ecosystem. It seems that people try to preserve what they appreciate, and we usually tend to appreciate what we can connect to positive experiences. Clean, pristine lake environments can help to create this kind of experiences for a large number of people. Therefore, the preservation of lakes will not only help to sustain the quality of local environments for the future, but can also help to promote awareness regarding other global environmental issues.

Last year, I had the opportunity to teach an Environmental Chemistry class to graduate students at the Colorado School of Mines. In this class, we also discussed the changes in the redox chemistry of lakes over seasons, as well as its effects on the solution speciation in lake waters. I believe that in the future I will be able to transfer a little bit of my experience at Windsor Reservoir to my students. I will try to explain to them what the relevant chemical and ecological parameters are that can help us to determine the overall quality of a lake. Hopefully, this will create a greater awareness among my future students regarding the quality of lakes in their own local environments.

Ruth Tinnacher
Ph.D. Candidate

August 31, 2007

To: CLRMA Members
From: Angelique D. Diaz, Student Volunteer
Subject: Windsor Lake Assessment: More than Just a Day on a Lake

For weeks I looked forward to Friday, July 21, 2007. This was the day that two fellow Colorado School of Mines (CSM) students and I would assist with the survey of Windsor Lake in Windsor, Colorado. My excitement may have been due to the fact that I have never been involved in the field of limnology. I earned a B.S. in Chemical Engineering and Petroleum Refining in 1998 from the CSM and then went on to work for ExxonMobil Refining and Supply Company. I returned to CSM in 2001 and earned an M.S. in Environmental Science and Engineering (ESE) in 2003, focusing on onsite wastewater treatment facilities. I am currently working on completing my PhD in the ESE Division, investigating the fate of plutonium as affected by natural organic matter. Despite my background being outside of the realm of lake assessments, I enjoyed all aspects of our day on the lake. It was that much more enjoyable due to the fact that it was not only a learning experience but after working in the office and lab every day, being on the lake was a welcomed change.

The Windsor Lake assessment is a part of a greater effort taking place throughout the United States, the National Lake Assessment (NLA). The NLA is a nation-wide initiative whose objective is to assess the health of lakes throughout the United States. Multiple lakes in all 50 states are being tested over a short timeframe. This is a daunting task, one which requires an enormous amount of manpower and data analysis. The information collected will provide a basis for future protection and improvement activities. The assessment of the lakes is planned to be conducted every 5-years. These assessments will provide information on the progress of any implemented protection/improvement activities.

Upon arrival at Windsor Lake we met with two representatives from the USGS. We learned how to calibrate the dissolve oxygen, pH, and conductivity probes for use at the lake's "index point". The weather was great for the Windsor Lake survey, and once all the necessary gear was loaded

onto the boat we cruised around the lake while keeping an eye on the sonar to find the deepest point in the lake. This point is considered the index point and for Windsor Lake this was approximately 32 feet. We dropped anchor and begin the assessment process. At the index site we used a weight and measuring tape to confirm the sonar's measured lake depth. We also measured pH, conductivity, temperature and dissolved oxygen using our calibrated probe. Two different sized mesh screens were used to collect organisms from the lake. Samples were taken for general water chemistry analysis. We also determined the depth to which light is transmitted and collected water samples for general chemistry and phytoplankton analysis. All samples taken were sent off for analysis. This in itself is quite an undertaking. Packaging and shipping labels are provided for each lake being sampled. All I could think of at the time was the huge number of labels and those who are responsible for managing them.

After the index point assessment we performed an assessment of the lake perimeter. The lake was divided into 10 equidistant points and at each point we assessed the littoral zone, shoreline, riparian zone and human impact. This assessment will forever make me look at lakes in a whole new light. There are many things to consider in the health of a lake that I was formerly unaware of. Examples of what we looked at are the types of media present on the shore (e.g., cobblestones, pebbles) as well as the lake's proximity to different types of human impacts.

Upon completion of my PhD I plan on working within the consulting industry, doing my part to help achieve a sustainable environment. To me this means cleaning up any previous environmental damage as well as ensuring that future work does not further damage the environment. Because I now have knowledge on what is being assessed will help me to consider the proximity to lakes when working on future environmental projects. I may even work on a project related to lake restoration and having this experience sampling Windsor Lake has put me ahead with regard to lake knowledge.

Another important lesson from my lake assessment participation is the reinforced importance of lakes and their preservation. Lakes provide a habitat for a variety of both micro- and macro-organisms important to the environment. In addition, some lakes are recreational lakes and/or a drinking water source for nearby towns. In these situations, if a lake is unhealthy there may not only be environmental impacts but also public health and economic impacts. This is an example of how lakes are important to society as a whole.

There are a number of things that I can do to promote the importance and preservation of lakes. First and foremost I can share my experience and my newfound knowledge of lakes with family, friends, and colleagues. I can also volunteer to help with local lake clean-ups or to help educate the public on the importance and preservation of lakes. I participate in variety of outreach activities with elementary through high school age children. For future events, where relevant, I will incorporate a piece on the importance and preservation of lakes. Overall, I thoroughly enjoyed my day at Windsor Lake, and from my experience I am taking away a newfound knowledge and concern regarding the health of our nation's lakes.

Angelique Diaz
Ph.D. Candidate