



# **Montana Water Center**

**Annual Report  
Fiscal Year 2007**

September 2007

# Table of Contents

From the Director .....	1
NEW LESSONS AND OPPORTUNITIES .....	1
PROGRAM HIGHLIGHTS.....	2
INSIDE THE WATER CENTER.....	3
Our Founding Program: USGS Water Research and Outreach .....	4
RECENTLY FUNDED PROJECTS .....	4
ONGOING RESEARCH PROJECTS .....	4
STUDENT RESEARCH FELLOWS .....	7
OUTREACH PROGRAM .....	10
Whirling Disease Initiative.....	12
OUTREACH .....	12
WHIRLING DISEASE INITIATIVE DATA REPOSITORY .....	13
ONGOING RESEARCH PROJECTS .....	13
COMPLETED RESEARCH PROJECTS .....	15
Wild Fish Habitat Initiative.....	18
TECHNOLOGY TRANSFER.....	18
RESEARCH.....	20
Aquatic Sciences Laboratory.....	24
Technical Assistance to Small Public Water Systems.....	26
TRAINING TOOLS .....	26
Montana Watercourse.....	29
COMMUNITY EDUCATION .....	29
OUTREACH FOR EDUCATORS AND STUDENTS.....	32
VOLUNTEER WATER QUALITY MONITORING.....	33
FY 2007 Advisors to the Water Center .....	35



**COVER PHOTO:**

**Centennial Valley**

Aerial photo by

***Kestrel Aerial***  
[WWW.KESTRELAERIAL.COM](http://WWW.KESTRELAERIAL.COM)



## NEW LESSONS AND OPPORTUNITIES



Montana Water Center Director,  
Gretchen Rupp.

One of the benefits of being at Montana State University is the abundant opportunity for interaction with colleagues from other states and nations. The enlarged perspective that results is not always cheering, but it does impart all kinds of new ideas and insights, some of which might have relevance in Montana. My interactions this past year with Chinese, Mongolian, Australian and Middle Eastern water professionals have caused me at times to view my home state as a soggy place with trivial water problems. It is neither, of course. But conditions so arid we can hardly imagine them prevail over much of the globe, and in many of these dry places human societies cope with acute population pressure, cultural tensions and poverty. These examples convince me that a place as wealthy in

natural, human and institutional resources as Montana should certainly be able to resolve its water challenges. Acquaintance with the work of my academic peers and water managers from elsewhere in the western U.S. strengthens me in this conviction. It's true that water management debacles have occurred in other states in recent years, but we should be able to learn from these, as well as from the many innovative and successful measures that have been implemented.

Consequently, I'm cautiously optimistic for the outcome from our 2007-2008 Legislative Water Policy Interim Committee, and for an accompanying study being conducted by the Montana Bureau of Mines and Geology. The charge given to the committee of eight legislators is very broad – in essence, it must examine every facet of state water management, then formulate recommendations for new laws to be introduced in the 2009 Legislature. Our system of water rights cannot be upset, but nearly everything else is fair game. Should the state introduce and manage a 'market' for water? How should water banking be implemented in Montana? Can water be deliberately stored in aquifers for later use? In practical terms, how can new ground water users compensate surface water right holders for their impacts?

These first-level questions quickly engender much more difficult ones. How can fairness be guaranteed in an exchange system? If water rights have monetary value and are freely traded, will public-spirited irrigators continue to leave water in the streams for fish? If not, can we count on private philanthropy to keep streams flowing? When water rights are severed from land, is that land ever again suitable for agricultural production? Do we care? Should thirsty growing cities have a privileged position in the marketplace? The recommendations of the Water Policy Interim Committee will have to be grounded in what Montana citizens collectively want their state *to be like* in the 21st century – that is, in our most basic community values.

As I noted above, other states have pertinent experience upon which we can draw. For decades, several states have conducted aquifer storage and recovery on scales large and small. A number of water banks are in operation. There are monetary water markets in a handful of western states, with varying degrees of state involvement and control. The one factor no one has faced before is the new climate of the 21st century. Climate scientists tell us this will be far warmer than any experienced since humans first developed agriculture and began living in settled communities. If this summer's conditions were representative, we need to augment our consideration of water



transfer mechanisms with consideration of water efficiency, conservation and allocation measures much more far-reaching than anything discussed to date. If we desire trout in Montana streams, and irrigated agriculture, and thriving cities and towns, something's got to give. We had best start now, examining how chronic drought and extreme heat are handled, successfully or not, in central Asia, Australia and the Middle East. These are now the places that can give us an accurate perspective on our changing state.

### PROGRAM HIGHLIGHTS

**Drinking Water:** This year our multimedia training team really came into its own. Its new *Small Utility Board Training* responds to the numerous requests for basic training from the many volunteers across the nation who oversee their communities' water or wastewater systems. Besides overviewing the basics of water regulation, open meeting laws and the like, the course focuses on the experiences of several board members, making use of interviews and video footage of board meetings. The *Contamination Explorer* course pushes the limits of 3D simulation to show how water becomes contaminated and how contaminants act within the human body. Both new courses are deployed via CD. In addition, we've had to re-publish our *Operator Basics* course, since it is approved for continuing-education credit in most states, and water- and wastewater-treatment operators nationwide wish to make use of it. Thousands of files are downloaded from our training website each month, and more than 30,000 of our training CDs have been distributed. There's no doubt that the Water Center sets the gold standard for distance learning tools for water operations personnel.

**The Montana Watercourse:** These days, a vital role of the Watercourse is empowering local people to understand their watersheds and waters, so that they can teach their neighbors about these resources and make informed management decisions. This relationship stands in contrast to that of earlier times, when the clientele were often passive consumers of knowledge. Our educators find themselves developing curricula, training trainers and helping watershed groups secure grants for their own activities. This year the training of volunteer water quality monitors took priority. Volunteer monitors must not only know how to dip a bottle into a stream, but be able to conduct tests on the water, assess and document the quality of the resulting data, enter it into a database, and interpret and share the results. The willingness of non-scientists to take on this responsibility is an excellent trend, and I'm certain that support of water monitoring by concerned Montana citizens will be a continuing priority for the Watercourse.

**Fisheries Health:** This year, *Whirling Disease Initiative* research has been complemented by three internal projects aimed at securing the long-term legacy of the program. Data and metadata from research projects are being posted on a publicly-accessible site administered in conjunction with the federal National Biological Information Infrastructure (NBII). The information will thus be available to other researchers long after the initiative closes up shop. Secondly, current information on the geographic range of whirling disease is being mapped and made available. These maps will be updated every two years. Finally, Leah Elwell, Kajsa Stromberg and Eileen Ryce have undertaken the mammoth task of synthesizing current understanding of the disease in a comprehensive "white paper." Collectively, this set of resources is sure to be consulted by biologists and fishery managers for some years to come.

This year, under the aegis of the *Wild Fish Habitat Initiative*, we began to assist a new partnership, the Western Native Trout Initiative. The WNTI is a collaboration among public agencies and non-governmental organizations to conserve the 15 species and subspecies of inland native trout of the western U.S. It's a careful program to assess their status, identify threats to the fish, then develop and implement strategies to ameliorate the threats and secure the future of these fish. The WNTI and its counterparts elsewhere across the nation are modeled after a major collaborative conservation effort that targeted migratory waterfowl in the 1980s and 1990s, with strong success. The Water Center's role is to assist with outreach, especially by developing the WNTI's publications.

**Water Information and Services:** This year we jumped into a new pond - water policy - by organizing the *Northwest Water Policy & Law Symposium*. While we've dipped our toes into the policy pond before - co-producing booklets with the Legislative Environmental Quality Council, arranging speakers and panelists at the annual *Montana Water Conference* - the symposium represented a major commitment. Since water policy issues are coming to a boil at the county and state levels in Montana, it seemed like the right time to bring in folks from other states and see what we could (collectively) learn. The symposium won't guarantee smooth sailing from here on out, but it definitely brought to our awareness various tools - and cautions - that should be useful to Montana as we try to equitably allot water in a warmer, more populous 21st century.

# Our Founding Program: USGS Water Research and Outreach

Each year since 1964, the 54 water research institutes nationwide have received support through the U.S. Geological Survey to sponsor or conduct water research and outreach specific to each state's unique water problems. This year, the Water Center gathered results from three ongoing research projects, funded two new two-year studies, supported five new student fellows, and transferred project findings to other experts, future professionals, and communities through symposia, websites, and other outreach avenues. This program is guided by our Water Research Advisory Committee, which helps develop research priorities for competitive proposals.



## RECENTLY FUNDED PROJECTS

Five research teams received awards for 2007-2008 projects under the USGS 104(b) program. Principal investigators for those projects are:

- Dr. Chris Gammons, Montana Tech, to study "Temporal and spatial changes in the concentration and isotopic composition of nitrate in the upper Silver Bow Creek drainage, Montana: Year 2."
- Dr. Lucy Marshall, Montana State University, for her study "Predictive modeling of snowmelt dynamics: thresholds and the hydrologic regime of the Tenderfoot Creek Experimental Forest, Montana."
- Dr. Steve Parker, Montana Tech, for the project "Identifying and characterizing sources of dissolved organic carbon in the Big Hole and Clark Fork Rivers, a continued investigation."
- Dr. Joel Harper, University of Montana, for his study of "Historical and future stream-flow related to small mountain glaciers in the Glacier Park Region, Montana."
- Dr Clayton Marlow, Montana State University, for his study of "Sediment and heavy metal source determination and reduction at a reclaimed abandoned mine site, Alta Mine, Jefferson County, Montana."

## ONGOING RESEARCH PROJECTS

Three research teams began new projects in spring 2006, and these are described below.

**Impacts of beaver on invasion ecology of brook trout. Lisa Eby and Magnus McCaffery, University of Montana.** Invasion by brook trout has been implicated in the decline of westslope cutthroat trout, a native species of special concern in Montana. The presence of beaver on the landscape may strongly influence the outcome of interactions between these two fish spe-



*Adam Shreading, Tubbee Moua, and Angela Patrick conducting habitat survey on a study section.*

### Fellowship Leads to Surprising Answers

microbial geochemistry at Montana State University. Lisa's interest in microbial geochemistry was the result of unanswered questions raised during her consulting work on selenium at phosphate mine waste sites in Idaho. When selenium attenuation observed in field and laboratory experiments could not be explained strictly on chemical grounds, Lisa hypothesized that a microbial process could be responsible. MSU's Thermal Biology Institute (TBI) seemed like a perfect venue for her research, one that could supplement her background in geochemistry-- which, according to Lisa, "is just rocks and water"-- with an in-depth understanding of the role microbes play in transforming water-soluble pollutants, such as selenium, into insoluble compounds that have low environmental impact. Lisa's Water Center fellowship helps support her work.

Why is the study of selenium important? "We call selenium 'an essential toxin,'" Lisa explained. "The human body needs selenium for protein synthesis. It is also an important anti-oxidant. However, too much selenium causes digestive, respiratory and neurological problems in humans. It also accumulates in plants and can severely impact domestic livestock and wildlife."



Preparing samples.

Lisa has long been committed to the premise that resource extraction needs environmental management, and the promise that science can help mining companies operate without severe environmental impact or the need for expensive remediation. To that end, the companies with which Lisa has worked have embraced her approach to help them reduce cleanup expenses and stop water pollution before it starts.

"Early in my work," Lisa said, "we could only sample ground and surface water for selenium-transforming microbes. But, in 2006, Idaho phosphate mining companies drilled several holes into backfilled waste rock that is deposited in mined-out phosphate panels. These panels, which are where most waste rock winds up, have the largest potential to release selenium to surface and ground water." Samples from these deposits are

enabling her to investigate why microbial transformation limits soluble selenium in some locations, but not in others, where concentrations far exceed the accepted standard.

Microbial assays have led to the important discovery that the microbe *Dechloromonas* is changing the form of selenium. In an environment lacking oxygen, *Dechloromonas* uses selenate, a positively-charged water-soluble form of selenium, in place of oxygen. Through microbial biological processes, selenates can be readily transformed to selenide and ultimately to elemental selenium, which is relatively insoluble and slow to oxidize, and has low environmental mobility.

Now Lisa is concentrating on what *Dechloromonas* needs during panel backfill construction to optimally immobilize selenium in phosphate waste deposits. In the longer term, her findings will inform waste management practices for selenium and other microbially-influenced contaminants associated with multiple types of mine wastes. Lisa anticipates completing her dissertation in 2009 and her family is very supportive of her work. "But with two teenage daughters, one of whom will begin college this fall and the other approaching college age, my husband is terrified of having three girls in college at the same time!"

Lisa Bithell Kirk, a geologist and consultant to the mining industry for the past twenty years, returned to school in 2004 to pursue a Ph.D. in



Lisa Bithell Kirk.



*Montana State University Campus and the Gallatin Valley.  
Photo courtesy of Rick Jackson.*



Montana State University-Bozeman does not discriminate on the basis of race, color, national origin, sex, sexual preference, marital status, age, religion, creed or political belief, mental or physical handicap or disability, or status as a Vietnam era or disabled veteran in admission, access to, or conduct of its educational programs and activities nor in its employment policies and practices.