

7<sup>th</sup> Annual Salt Lake County

# Watershed Symposium

October 23-25, 2013

Utah Cultural Celebration Center  
West Valley City, Utah



Watershed Planning & Restoration Program  
Salt Lake County Government Center  
2001 South State Street, Suite N3100, Salt Lake City UT 84190  
(385) 468-6600 | [www.watershed.slco.org](http://www.watershed.slco.org)

# Welcome!

As the host of the 7<sup>th</sup> Annual Salt Lake County Watershed Symposium, Salt Lake County welcomes its community of water stewards and environmental advocates. This free 3-day event is made possible through collaboration with numerous individuals and agencies. In particular, we would like to thank the presenters and field trip leaders for their willingness to share their experience and expertise with us—this event would not be possible without them. Additionally, we would like to thank Salt Lake County Mayor Ben McAdams and the Salt Lake County Council for their support in helping to make the Symposium a reality.

The goal of the Watershed Symposium is to encourage a comprehensive review of the current state of our watershed, and facilitate discussions between environmental advocates, policy makers, teachers, students, water quality experts, members of the interested public, and those working in related professions. Feature presentations and field trips—from general interest to technical—explore a broad scope of watershed issues.

In order to assist in future efforts, please take a moment to fill out the Comment Card included in the packet. Your feedback and suggestions are greatly appreciated.

Thank you and enjoy!

*Salt Lake County  
Watershed Planning & Restoration Program*

*Marian Hubbard, Bob Thompson, and Lynn Berni*

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# Schedule

<b>WEDNESDAY October 23, 2013</b>			
<b>Time</b>			
8:30 - 9:30	Check-in/Registration		
9:30 - 10:00	<b>Great Hall</b> <b>Opening Comments</b> —Deputy Mayor Nicole Dunn, Salt Lake County <b>Keynote</b> — <b>Making Mountain Boundaries, Simple and Safe Mole Hills</b> Patrick A. Shea, University of Utah		
	<b>Room</b>	<b>Plaza Suite B</b>	<b>Room 104/105</b>
10:10 - 11:00	<b>Wasatch Legacy Project Panel Discussion</b>  <b>Panelists</b> Dave Fields, Snowbird Resort; Dave Whittekiend, US Forest Service; Carl Fisher, Save Our Canyons; David Gellner, Salt Lake County; Laura Briefer, Salt Lake City; Jessie Walthers, Cottonwood Canyons Foundation	<b>Geologic, Hydrologic and Anthropogenic Constraints on the Restoration of Red Butte Creek</b>  Emy Maloutas, Salt Lake City Eric McCulley, Intermountain Aquatics	<b>Vegetation Inventory of the Jordan River Galena Site</b>  Marc Coles-Ritchie, Vegetation Ecologist Arthur Morris, Utah Open Lands
11:15 - 12:05	<b>Moderator</b> Jeff Niermeyer, Salt Lake City  <i>NOTE: This panel will run 90 minutes (10:10-11:40)</i>	<b>Live-growing Plants Offer Real Benefits Over Dormant Plant Materials for Stream Restoration in Some Landscapes</b>  Jeff Klausmann, North Fork Native Plants	<b>“A River Runs Through Us”: Expanding Watershed Education with Interactive Data Displays</b>  Brian Greene, Utah State University
12:05 - 1:20	<b>Great Hall: Lunch &amp; “The Red Desert Trio” performing live</b>		
1:35 - 2:25	<b>Engaging Fiscal Conservatives in Water Conservation and Protection</b>  Zach Frankel, Utah Rivers Council	<b>Streambank Bioengineering: Natural Bank Stabilization Techniques for the Intermountain West</b>  J. Chris Hoag, Hoag Riparian & Wetland Restoration	<b>Metal Concentrations in the Water Column and Brine Shrimp of Great Salt Lake</b>  Jodi Gardberg, Utah Div. of Water Quality
2:40 - 3:30	<b>Green Infrastructure in Practice in Semi-Arid Climates</b>  Christine Pomeroy, University of Utah	<b>Engaging Youth in Collaborative Riparian Restoration</b>  Dave Bastian, Utah Conservation Corps	<b>An Ecological Status Report on the Post Oil Spill Fauna of Red Butte Creek</b>  Dan Potts, Salt Lake County Fish & Game Association

THURSDAY October 24, 2013			
Time			
8:30 - 9:30	Check-in/Registration		
9:30 - 9:50	<b>Great Hall</b> Keynote—Strengthening Partnerships for Water Sustainability Jim Ehleringer, University of Utah		
Room	Plaza Suite B	Room 104/105	Room 101/102
10:10 - 11:00	<b>Jordan River Total Maximum Daily Load (TMDL) Phase 2 Research, Data Collection &amp; Progress</b>  Hilary Arens, Utah Div. of Water Quality Michelle Baker, R. Ryan Dupont, Jacob Richardson, Utah State Univ Merritt Frey, River Network Erica Gaddis, SWCA Ramesh Goel, Univ. of Utah; Theron Miller, JR/ FBWQC; Tom Ward, Jason Draper, Salt Lake City  <i>NOTE: This session will run 90 minutes (10:10-11:40) ~60 min. presentation ~30 min. Q&amp;A/discussion</i>	<b>Land Cover and Geomorphic Changes Over 30 Years: Can They Inform Management and Restoration on the Jordan River?</b>  Suzanne Walther Utah Valley University	<b>Assessment of Utah's Nonpoint Source (319) Program</b>  Nancy Mesner, Utah State University
11:15 - 12:05	<b>Best Practices for Riverfront Communities: A "How To" Guide for Implementing the Blueprint Jordan River</b>  Laura Hanson, Jordan River Commission Nancy Monteith, Landscape Architect	<b>Landfills and Recycling and Their Positive Relationship to Water Quality</b>  Eleanor Diwer, Salt Lake County	
12:05 - 1:20	<b>Great Hall: Lunch &amp; "The Red Desert Trio" performing live</b>		
1:35 - 2:25	<b>Utah Water Right Laws and Policies as They Affect the Jordan River and Its Tributaries</b>  John Mann, Utah Div. of Water Rights	<b>Recent Changes in Utah Pollution Discharge Elimination (UPDES) Permitting for Great Salt Lake</b>  Christopher Bittner, Utah Div. of Water Quality	<b>Sources, Sinks, and the Fate of Organic Carbon in Urban Streams in the Context of the Jordan River</b>  Ramesh Goel, University of Utah
2:40 - 3:30	<b>Past, Present, and Future of Agricultural Water Rights in Salt Lake County</b>  Nick Schou, Utah Rivers Council	<b>The Jordan River Corridor: Is There Any Hope Left for the Dream of a Robust Greenway?</b>  Jeff Salt, Great Salt Lakekeeper	<b>Ground Source Heat Pumps: Balancing Drinking Water Protection with New Energy Technologies</b>  Ron Lund, Salt Lake County; Tracie Kirkham, Salt Lake City

## FRIDAY October 25, 2013

Time	
8:15-1:00	<b>FIELD TRIP</b> <b>Trip 1: Ecological Restoration in the Red Butte Creek Watershed: Where We Are Today</b>  <b>Guides:</b> Eric McCulley, Intermountain Aquatics Lynn Berni, Salt Lake County Watershed Bob Thompson, Salt Lake County Watershed  <b>***Check-in at 8:15, vans will leave at 8:30***</b>  Meet at the Tracy Aviary Visitor Center parking lot in Liberty Park (Salt Lake City). Use park entrance on 900 South, between 500 and 700 East. The Aviary parking lot is shortly past the tennis courts.  Limit 20
2:30-4:30	<b>FIELD TRIP</b> <b>Trip 2: Watershed Education for All Ages at Tracy Aviary</b>  <b>Guide:</b> Anne Terry, Tracy Aviary  Meet in the Tracy Aviary Visitor Center in Liberty Park (Salt Lake City). Use park entrance on 900 South, between 500 and 700 East. The Aviary parking lot is shortly past the tennis courts.  Limit 30
<b>Field Trip Info:</b> <ul style="list-style-type: none"> <li>• Must be pre-registered to attend</li> <li>• Bring your own food and drink</li> <li>• Dress for the outdoors (walking shoes recommended)</li> </ul>	

## Key

- Non-technical  
 Technical



# Opening Comments

## **Deputy Mayor Nicole Dunn**

Salt Lake County

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# Keynotes

## **Making Mountain Boundaries, Simple and Safe Mole Hills**

### **Patrick A. Shea, Attorney**

External Advisor to College of Science

Associate Research Professor of Biology

University of Utah, Salt Lake City, UT

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Human beings are social animals. As a species we feel comfortable with others of our type. Yet, when we form organizations we tend to cause divisions that do not assist the group in achieving their goal. John Wesley Powell urged Congress to form governmental units in the West by their drainage area. This logical division was not followed and instead drunken surveyors drew artificial lines which defied nature's lines and since have been the basis of divisions between humans. Since humans have attempted to govern themselves, budgets and the resulting allocation of resources have been the determining factor of whether different governmental enterprises succeed or fail. In our Internet digital-age budgets will become increasingly transparent which could eliminate or at least lessen jurisdictional squabbles. Might we aspire to the future together.

## **Strengthening Partnerships for Water Sustainability**

### **Jim Ehleringer, Distinguished Professor of Biology**

Department of Biology

University of Utah, Salt Lake City UT

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Over the last several years, the state's colleges and research universities have been building stronger bridges among campuses as well as to local and state agencies. The overall objectives are to strengthen ties in basic research, training, and outreach in urban watersheds along the Wasatch Front. The innovative Urban Transitions and Aridregion Hydro-sustainability Project (iUTAH), a 5-year multi-university program, is one example of this effort. Other efforts focus on increasing university stewardship of urban streams through monitoring, education, outreach, and restoration, especially when these waters pass through a university's campus (such as Red Butte Creek through the University of Utah). Still other efforts are focusing on how the general public can become better engaged in water sustainability issues, particularly at the level of landscaping your yard. Here, for example, Red Butte Gardens is leading the way through the development of its new Water Sustainability Garden. In this talk, the focus will be on describing progress and new opportunities to further strengthen these ties among academic and government interests. The talk will conclude with ideas to better engage K-12 and to inform our citizens.

## Breakout Sessions (listed alphabetically by title)

### **“A River Runs Through Us”: Expanding Watershed Education with Interactive Data Displays**

**Brian Greene**, Utah Water Watch Program Coordinator  
Water Quality Extension  
Utah State University, Logan UT  
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Water quality monitoring is increasingly relying on technology. Continuous monitoring stations provide automated data that can be shared via the Internet. Making this data available to the public is a unique challenge and opportunity. Utah State University Water Quality Extension partnered with the Utah Division of Water Quality and Swaner Ecocenter to create an interactive educational display for East Canyon Creek, called “A River Runs Through Us” ([swaner.web.usu.edu](http://swaner.web.usu.edu)). This project displays data collected from the stream along with educational materials suitable for all ages. This is a fun and novel way to engage the public and inform them about water quality issues. This platform can serve as a model for other watersheds and locations to display data and information about local lakes and streams. In this talk we will present the project, talk about the technology supporting it, and discuss potential future applications.

*Level: Non-Technical*

### **An Ecological Status Report on the Post Oil Spill Fauna of Red Butte Creek**

**Dan Potts**, President  
Salt Lake County Fish and Game Association, Murray UT  
dan\_karen\_potts@msn.com | (801) 596-1536 | <http://slcfga.org/>

Fast paced presentation of Red Butte Creek fauna and current threats to its ecosystem from Chevron’s pipeline crossing downstream to the Liberty Park Pond (Liberty Lake). Presenter will evaluate the most significant threats to the well-being of the stream’s fauna and local residents, and hence their wildlife watching opportunities. Comparisons will be made between the different functional stream reaches, and also observations made of Liberty Lake. The presentation will focus on the stream’s current top level predator, our state fish, the threatened Bonneville cutthroat trout, and the relative success of past, current, and future in-stream restoration efforts. Presenter will provide recommendations for future restoration efforts and management of the Red Butte Creek and Liberty Lake.

*Level: Technical*

### **Assessment of Utah’s Nonpoint Source (319) Program**

**Nancy Mesner**, Associate Professor/Water Quality Extension Specialist  
Department of Watershed Sciences  
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In 2010, our USU research team began a critical assessment of Utah’s 319 (nonpoint source) program. One element of this project was to assess the impact, effectiveness and long term maintenance of the nonpoint source best management practices that have been implemented in Utah under this program. We evaluated a total of 66 different Best Management Practice (BMP) projects in 6 different watersheds in the state. We reviewed project files, interviewed producers or landowners, conducted a field survey of the BMPs and in some cases conducted additional site specific assessment. We also modeled watershed scale responses of each of the 6 watersheds. This talk will cover key findings and recommendations from this study, focusing on how best to demonstrate and quantify water quality impacts of these practices.

*Level: Non-Technical*

## **Best Practices for Riverfront Communities: A “How To” Guide for Implementing the Guiding Principles of the Blueprint Jordan River**

**Laura Hanson**, Executive Director  
Jordan River Commission, Salt Lake City UT  
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<http://jordanrivercommission.com/>

**Nancy Monteith**, Landscape Architect  
Salt Lake City UT  
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The Jordan River flows 50 miles from Utah Lake to the Great Salt Lake, and connects together 15 cities, 3 counties and hundreds of thousands of people. Because it connects us all together, what one person or community does affects another. The goal of this project was to provide a foundation for consistent, but flexible management of the river corridor; and ultimately, for each stakeholder along the river to apply the Best Practices through local planning and zoning regulations, and through improved agricultural, residential, parks and stormwater management. The Best Practices provide cities, counties, and other stakeholders with a set of recommendations, practical “how to” instructions, and resources on how to implement the guiding principles of the Blueprint Jordan River while still meeting the individualized needs and goals for their community or project. Additional implementation and education tools include: a model ordinance, community evaluation and development review checklists, considerations for agricultural protection, opportunities for technical training, and a variety of outreach and educational materials. This session will provide an introduction to the Best Practices toolbox, share opportunities for additional training and education, and identify ways that individuals can help ensure implementation of the Best Practices at the local level.

*Level: Non-Technical*

## **Conservation Corps Engaging Youth in Collaborative Riparian Restoration**

**Dave Bastian**, Program Coordinator  
Utah Conservation Corps  
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Unemployment rates for 18-25 year-olds continues to be alarmingly high and opportunities for young adults continues to be scarce. Youth conservation corps such as the Utah Conservation Corps (UCC) are based upon the post-depression legacy of the Civilian Conservation Corps and assist in meaningful service opportunities for young adults. We partner with project managers to provide new job skills, education, conservation and experiences in the great outdoors. In recent years the southwest United States has seen a significant growth in collaborative efforts to restore riparian habitat on a watershed scale. Land managers, non-profits, private landowners, municipalities, conservation organizations and others have come together to rally around a host of issues. In early 2013 the Utah Conservation Corps partnered with Salt Lake County on a bioengineering project in Red Butte Creek. The UCC helped provide hand power for this project that involved bank stabilization and planting. Engaging young adults in these efforts provides economic, educational, and stewardship benefits to communities, transforming restoration projects into multifaceted capacity building efforts. Learn about the capacities of the Utah Conservation Corps and the work we did with Salt Lake County on the Red Butte project and how Youth Corps can assist in riparian restoration projects.

*Level: Non-Technical*

## Engaging Fiscal Conservatives in Water Conservation and Protection

**Zach Frankel**, Executive Director  
Utah Rivers Council, Salt Lake City UT  
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Utah's many fiscal conservatives are often surprised to learn about the financial risks of subsidizing water use, which in turn creates wasteful government spending. Utah is unique in subsidizing urban water rates with property taxes to encourage water use and water waste. Property tax subsidies lower the price of water, thereby driving up water waste. That's why Utah is the 1st or 2nd highest user of water in the U.S. each year. Property tax revenues often lead to unnecessary government spending for new capital projects. Phasing out property taxes in urban areas could eliminate or defer the need for expensive capital projects, saving Utah taxpayers billions. Because each year new taxes are proposed to fund billion dollar capital projects, many fiscally conservative Utahns are getting engaged in the discussion and feel we should embrace market economics and make the biggest users of water pay for it, which is not currently the case throughout Utah and the Salt Lake Valley.

*Level: Non-Technical*

## Geologic, Hydrologic and Anthropogenic Constraints on the Restoration of Red Butte Creek

**Emy Maloutas**, Department Projects Coordinator  
Salt Lake City Public Services, Salt Lake City UT  
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**Eric McCulley**, Senior Scientist  
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Efforts to restore the biological condition and function of Red Butte Creek are significantly constrained by both natural and human caused forces. The chemistry of the rocks and configuration of the watershed create the basis for all processes occurring in this ecologically significant riparian corridor. Climate change over time coupled with human use of the water in the stream has created an unsteady and unnatural flow regime along some reaches in Salt Lake City. Improvements in the condition of the stream are incremental, but gradual improvement of the aquatic and riparian ecosystems will also improve the societal benefits of natural areas imbedded in the urban matrix. In this discussion, we will look at the physical and societal issues related to restoration of wildlife habitat in highly built environments.

*Level: Non-Technical*

## Green Infrastructure in Practice in Semi-arid Climates

**Christine A. Pomeroy**, Associate Professor  
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University of Utah, Salt Lake City UT  
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Green infrastructure has advanced in practice in many parts of U.S., however there remains uncertainty regarding design, installation, policy, and performance in the semi-arid climate and the western water law framework. The past five years we have been working at the University of Utah to address the gaps in knowledge regarding performance of green infrastructure and developing advances to guide design and analysis. In this presentation we will summarize research findings from experimental and modeling studies of the performance of bioretention, rainwater harvesting, and green roof systems with focus on those implemented in a semi-arid climate. A summary of experimental results will be presented for studies of bioretention and green roof performance. Results of studies of water flux and nutrient dynamics in bioretention systems at the University of Utah Green Infrastructure Research Facility (GIRF) will be

presented to show measured infiltration rates, the impact of vegetation on evapotranspiration (ET) and nitrogen removal, as well as the potential volume capture of long-term stormwater runoff volume. In addition, results of green roof lysimeter experiments will be presented that quantify ET dynamics from an extensive green roof in a semi-arid climate and the amount of irrigation water required to support the vegetation. A summary of modeling studies will also be presented to quantify the impact of watershed-scale rainwater harvesting programs on stormwater volume reduction as a function of implementation design and climate variability for cities throughout the United States. These studies will be synthesized to show that rainwater harvesting provides moderate levels of long-term runoff volume control in most locations, but smaller levels of peak discharge and flood control unless combined with other green infrastructure practices.

*Level: Technical*

## **Ground Source Heat Pumps: Balancing Drinking Water Protection with New Energy Technologies**

**Ron Lund**, Environmental Health Supervisor,  
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**Tracie Kirkham**, Water Resources Scientist  
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Ground source heat pumps, also known as geothermal heat pumps or heat exchange units, can be a highly efficient renewable technology; however, they have the potential to irreversibly impair ground water drinking water sources in Salt Lake County. Drinking water in Salt Lake County comes from a combination of surface and ground waters. Groundwater in Salt Lake County comes from a network of underground aquifers. Although it's difficult to see these aquifers, they underlie most of the valley and are a vital source of drinking water for Salt Lake County. Once these drinking water sources are contaminated, remediation is either very costly or unfeasible. It is the responsibility of the Salt Lake Valley Health Department and individual public water systems to protect these essential resources. This presentation will discuss what ground source heat pump systems are, the Mill Creek Well incident, the guidelines that have been created, and the future efforts to create a Salt Lake County Ordinance.

*Level: Non-Technical*

## **Jordan River Total Maximum Daily Load (TMDL): Phase 2 Research, Data Collection and Progress**

**Hilary Arens**, Jordan River Basin Coordinator (DWQ)  
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**Michelle Baker**, Professor and Associate Head (USU)  
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**Merritt Frey**, Rivers and Habitat Program Director (RN)  
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**Erica Gaddis**, Principal Scientist (SWCA)  
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**Ramesh Goel**, Associate Professor (U of U)  
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**Theron Miller** (JR/FBWQC)  
Jordan River/Farmington Bay Water Quality Council  
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**Tom Ward**, Deputy Director (SLCPU)  
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**Jason Draper**, Storm Water Quality Program Manager (SLCPU)  
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The Jordan River is a 57-mile long 4th order urbanized stream flowing from the Utah Lake to Great Salt Lake. Past evaluation efforts have identified some reaches in the Jordan River to be impaired for low dissolved oxygen. Through extensive research, modeling and stakeholder involvement, it has been accepted that breakdown of organic matter, both autochthonous (originated from within the river) as well as allochthonous (originated from outside the river), is the most significant cause of the depletion of oxygen in this system. The breakdown of organic matter in the water column and sediments utilizes oxygen and creates oxygen deficiencies in the water column and sediments. The Jordan River ecosystem is a highly complex and complicated system to study, and the strides that have been made to achieve recent EPA approval of Phase 1 show important progress in moving forward to repair and improve this important water body and ecosystem. The purpose of this presentation is two-fold: (1) update the community, researchers and managers on the outcomes from the organic carbon study related to the Jordan River; and (2) bring together the primary researchers and managers to report on progress and seek input for Phase 2 of this Total Maximum Daily Load (TMDL). Topics will include: a recap of where the current TMDL stands and progress made to date (DWQ); the source and fate of organic matter in the Jordan River (U of U); a preliminary organic matter budget for the river (USU); organic matter sampling in storm water runoff (SLCPU); re-aeration study for the Lower Jordan River (SLCPU); flow moderation study in the Lower Jordan River to affect organic matter deposition (RN); continuous water quality monitoring in the Jordan River (JR/FBWQC); tributary organic matter sampling (JR/FBWQC); and water quality improvements through rehabilitation of wetland and storm water treatment systems on the Jordan River (USU).

*Level: Technical*

## **Land Cover and Geomorphic Changes Over Three Decades: Can They Inform Management and Restoration of the Jordan River?**

**Suzanne Walther**, Assistant Professor  
Department of Earth Science  
Utah Valley University, Orem UT  
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The Jordan River in Utah has been highly regulated for many years through intense irrigation, channelization, and managed releases from Utah Lake. As the only outlet of Utah Lake flowing north into

the Great Salt Lake, it is important to the riparian ecosystem and the surrounding human population as well. The river has a long history of mixed-uses, but it is emerging as a popular recreation site for the numerous adjacent communities. Human interaction on the individual and commercial scale influences the river through development and urbanization. The physical characteristics of the river and its riparian zone can be monitored to understand how the landscape is changing over time. In this study we use GIS and aerial imagery to evaluate channel mobility and land cover changes in the riparian zone of the upper one-third of the river flowing out of Utah Lake in Utah County between 1992-2011. Using Anderson's classification system of land cover, specifically, Urban or Built-Up Land, Agriculture, Vegetation, and Barren Earth, we quantified the changes in vegetation within a 100 meter buffer of the river's wetted channel. While there are areas where little change is observed, areas of greatest change occurred downstream of the outlet, where a number of new communities have been developed in the last decade. Urban planning and invasive species removal along the river need to be further considered as potential future recreation and restoration efforts are advanced on the river.

*Level: Technical*

## **Landfills and Recycling and Their Positive Relationship to Water Quality**

**Eleanor Divver**, Recycling Specialist  
Salt Lake Valley Landfill/Recycling Center  
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The presentation will be less technical than informational but touching on the following areas. We will discuss what regulations we have in relation to storm water and how we test and monitor that water. Along that same vein we will discuss our leachate: why it is important, what it tells us about our landfill, how we manage it, what we do with it, and storm water and surface water monitoring. We will also discuss ground water monitoring wells: up and down-gradient wells, semi-annual testing, regulations, past and present monitoring, how slowly water travels underneath the landfill etc. In addition, we would also like to speak about how our landfill can keep garbage out of our watershed areas. When garbage, especially plastics, is left in waterways chemicals can leach out of the plastics and contaminate our water. Another discussion example is yard waste. Currently, yard waste makes up 20% of the waste stream going into our landfills and by creating more awareness of the problems that yard waste can have with total dissolved solids in our streams and waterways - we can have a positive effect.

*Level: Non-Technical*

## **Live-growing Plants Offer Real Benefits Over Dormant Plant Materials for Stream Restoration in Some Landscapes**

**Jeff Klausmann**, Principal and Co-owner  
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North Fork Native Plants has been supplying innovative products for restoration and reclamation projects throughout the intermountain west for over ten years. Our primary focus has been prevegetated coir mats (aka Wetland Sod), biologs, and deep-rooted container plants. Product development has been largely driven by the needs of our sister company Intermountain Aquatics (IMA) a leader in western ecological restoration. IMA is focused on soft engineering to restore functional fish and wildlife habitats. Bioengineering and aquatic restoration have traditionally focused on using dormant wild collected plant materials (e.g. live stakes, fascines) installed outside of the growing season. This presentation will provide a brief overview of live-growing plant material options and applications. Live-growing plant materials can have many advantages over dormant materials including greater flexibility with project timing and higher survival, establishment and initial growth rates. Live-growing plants can be more expensive on the front

end because they are nursery propagated and usually involve supplemental irrigation for the first growing season. The benefits from added front end costs usually outweigh overall cost considerations in urban and highly regulated settings where the cost of failure can be quite expensive.

*Level: Technical*

## **Metals Concentrations in the Water Column and Brine Shrimp of Great Salt Lake**

**Jodi Gardberg**, Great Salt Lake Water Quality Coordinator  
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Under both state law (UAC R317) and federal Clean Water Act authority, the Utah Division of Water Quality (UDWQ) is entrusted with the responsibility of protecting the Great Salt Lake's "beneficial uses"— water quality necessary for recreational activities such as swimming and duck hunting and protection for waterfowl, shorebirds and other water-oriented wildlife including their necessary food chain. Yet the extent that the Lake is resilient to or threatened by pollutants and their effect on the Lake's beneficial uses is not fully known. Great Salt Lake's unique characteristics, particularly salt concentrations that range from freshwater conditions to conditions tenfold greater than the ocean, require an approach that is specific to the Lake. In 2012, UDWQ proposed a Great Salt Lake Water Quality Strategy designed to develop site specific numeric water quality criteria, improve water quality monitoring and prioritize research. As part of the strategy, UDWQ initiated the Great Salt Lake baseline sampling plan to sample a set of key water quality parameters in order to determine long-term water quality trends, quantify water quality problems, establish water quality goals, assess beneficial use support, and determine the effectiveness of pollution control programs. UDWQ will present the sampling results from 2011 and 2012 including metals concentrations in the water column and brine shrimp.

*Level: Technical*

## **Past, Present and Future of Agricultural Water Rights in Salt Lake County**

**Nich Schou**, Water Outreach Manager  
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What runs down the gutter, under the street, and is used to quench farms right under your feet? Unused agricultural water that is still diverted through forgotten irrigation canals. Many of these dormant waterways merely serve as reminders of the Salt Lake Valley's past agrarian roots. Today, Salt Lake County alone loses 30 acres of farmland each day and whenever irrigated farmland is converted to municipal uses like urban housing, there is always a surplus of water created. So where exactly does all this water go? This presentation will explore the crucial role of agricultural water rights in Salt Lake County and why the Valley's forgotten past is an essential missing piece of present water management policies—concluding with a discussion of how this surplus water can aid collaborative efforts to manage local watersheds sustainably in order to support key ecosystems like the Great Salt Lake and a growing human population in Salt Lake County well into the future.

*Level: Non-Technical*

## **Recent Changes in Utah Pollution Discharge Elimination System (UPDES) Permitting for Great Salt Lake**

**Christopher Bittner**, Water Quality Standards Coordinator  
Utah Division of Water Quality, Salt Lake City UT  
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The Utah Division of Water Quality's water quality standards include uses (e.g., aquatic life), numeric and narrative criteria protective of those uses, and antidegradation. Effluent limits for Utah Pollution Discharge

Elimination System (UDPES) permits are based on the more restrictive of Categorical limits, Secondary limits, or water quality-based effluent limits. Water quality-based effluent limits are limits to specifically protect the uses. Until numeric criteria are derived for Great Salt Lake, interim methods are needed to determine the need for water quality-based effluent limits in discharge permits. For discharges directly to Great Salt Lake or to upstream receiving waters that do not have numeric criteria for the protection of aquatic life, permittees are now required to conduct an analysis to determine if water quality-based effluent limits are required. Approaches and lessons learned will be discussed.

*Level: Technical*

## **Sources, Sinks and the Fate of Organic Carbon in Urban Streams: An Overview in the Context of the Jordan River**

**Ramesh Goel**, Associate Professor  
Department of Civil & Environmental Engineering  
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Biological degradation of organic carbon present in the water column and sediments is one of the primary factors responsible for DO depletion from the water column in surface water bodies including in streams. Hence, the knowledge of fate of organic carbon in streams is important to estimate total organic carbon loading for total maximum daily load (TMDL) studies from the management perspective and, to understand the overall biogeochemical cycle from a scientific view point. Organic material introduced to river/stream ecosystems is classified as being derived from either autochthonous (generated within the stream) or allochthonous (generated from the watershed) sources. Understanding the origin, decomposition and types of organic matters in streams is not only essential to better understand the dynamics of DO in streams but also important to get a better grasp on global carbon cycle. Autochthonous organics, such as due to primary production, can form into the water column or on sediments (benthic community). The allochthonous organics from various sources get into the water column first and a portion of these eventually settle down in sediments contributing to the reservoir of organics in sediments. The contribution of riparian zone and terrestrial vegetation on dissolved organic carbon inputs to Jordan River need to be better understood. In this presentation, we will talk about the importance, sources and fate of organic carbon in Jordan River. The role of society in meeting TMDL goals will be discussed as well. The role of climate change on stream water quality will also be discussed. The presentation will conclude with identifying key research questions that needs to be addressed for Jordan River phase II TMDL.

*Level: Technical*

## **Streambank Bioengineering: Natural Bank Stabilization Techniques for the Intermountain West**

**J. Chris Hoag**, Riparian Plant Ecologist  
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Riparian restoration should involve restoration of the herbaceous and woody riparian plant communities. A variety of bioengineering treatments are described along with information about where to install them, how to install them, what to expect, and time lines for "success". Understanding and identifying riparian planting zones is key to the successful establishment and long term survival of most woody species. Ensuring that the woody plant materials are always in the lowest water table of the year is the best way to ensure establishment. Bioengineering takes lots of patience. Small plants take 10-15 years to grow big enough to improve habitat values. Larger plants take 5-9 years. Development of detailed project objectives decreases unfounded expectations. Overall, unrooted or pole cuttings are moderately successful, but tend to take longer than most people expect to provide function to a riparian system.

Unrooted cuttings are cheaper and easier to plant in large numbers than rooted stock, but sacrifice adaptation to very wet locations. Rooted cuttings are more expensive and will give high establishment success rates. Planting techniques with rooted cuttings are limited and much more exacting. Clump plantings are the best treatment over all. When harvested and planted correctly, they establish quickly and provided both root binding capacity and above ground biomass for bank protection. Clumps also provide stream function much faster than almost any other treatment. Brush Mattresses are difficult to install correctly and require significant plant material to build. They are equal to 8 inch diameter rock riprap bank protection after sprouting. Fascines are the most difficult to establish in dry parts of the country. They are often installed either too low or too high which means they tend to drought out or drown out. Brush revetments are one of the easiest and cheapest treatments that can provide velocity reduction, sedimentation, and protection for establishing vegetation. Since they are dead material, planting live willows with them is required. Native collected wetland sod is a superb treatment in the toe zone on lower energy systems that covers bare ground with an extensive root system. This root system provides significant streambank protection. There are many different bioengineering treatments that can be used to reestablish vegetation to the streambank and floodplain. No riparian restoration effort will be successful without the establishment and growth of herbaceous and woody riparian plants. Knowing how to establish them correctly will increase the ability of the plants to rapidly grow and spread which translates into successful riparian restoration.

*Level: Technical*

## **The Jordan River Corridor: Is There Any Hope Left for the Dream of a Robust Greenway?**

**Jeff Salt**, Executive Director

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Since the 1960s, Utahns have dreamed of a robust greenway along the Jordan River. In response to pressures applied by grassroots organizations, the Jordan River Parkway Plan was developed in 1971 to guide fulfillment of the public vision for the river corridor. The 1971 Parkway Plan was based upon several complimentary goals, including: 1) preserving natural open space, 2) enhancing wildlife habitat, 3) providing natural flood control, 4) accommodating outdoor recreation, and 5) stimulating urban renewal and economic growth. The Parkway Plan prioritized preservation and revitalization of the river's natural resources first as a means to accomplish the secondary goals of providing flood control, urban renewal, and economic development. Through grassroots efforts, significant accomplishments were made during the early 1970s to implement the Parkway Plan and public vision for the Jordan River corridor, including the establishment of the Parkway Authority, passage of preservation-oriented statutes, appropriation of funds, and the acquisition of critical lands. However, these grassroots accomplishments were short-lived, and reversed, because of government acquiescence to the demands and pressures of private land owners and special interests who favored development of the river corridor over preservation. Since the late 1970s, development of the river corridor has far outpaced preservation and restoration efforts, with local governments and government agencies providing the catalyst for development through various actions, including: 1) rezoning of properties; 2) amending general plans, zoning ordinances, and preservation-oriented statutes; 3) granting permits and variances; 4) offering tax incentives; 5) selling public lands to private interests; 6) redrawing floodplain boundaries; and 7) ignoring existing plans and statutes. As a result of these development-centric actions by government entities, the river corridor has been radically transformed from a natural river system with a broad, well-connected riparian floodplain into a fragmented corridor with isolated islands of natural open space and a paved trail that slithers behind or around large office complexes, housing projects, industrial facilities, and parking lots. In many locations, the so-called "parkway" is so restricted and confined that it functions more like a large-scale urban alleyway than a robust greenway. Currently, only a fraction of the river's natural floodplain remains for preservation, with ever-increasing pressure placed on local governments and government agencies to

develop the remaining land for economic growth and tax increment; what remains for preservation are mainly scraps of land. However, the public overwhelmingly supports preservation and restoration of the river corridor for natural values and outdoor recreation and the creation of a parkway. Local governments claim to support the public's vision for preserving the river corridor, and have passed public resolutions in support of preservation, but in practice, they have facilitated more development of the corridor than preservation. The dream of preserving the Jordan River corridor as a robust greenway is at a critical tipping point, and may be lost altogether if significant actions are not taken soon by the public to change the way local governments and government agencies act to preserve what little natural open space remains.

*Level: Non-Technical*

## Utah Water Right Laws and Policies as They Affect the Jordan River and Its Tributaries

**John Mann**, Assistant State Engineer

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This talk will review Utah water right laws and policies as they affect the Jordan River and its tributaries and the state generally, as well as provide an overview of the waters flowing into the Jordan River and its tributaries. Water supply issues generally may also be discussed as time allows. The presentation will include facts and sound information regarding Utah's waters and the administrative procedures for water use in the state.

*Level: Non-Technical*

## Vegetation Inventory of the Jordan River Galena Site

**Marc Coles-Ritchie**, Vegetation Ecologist

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**Arthur Morris**, Conservation Stewardship Director

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Vegetation data were collected in the floodplain of the Jordan River, at the Galena site, during the 2013 field season. A total of 15 transects (ranging from a few meters to 400 meters) were extended across the eastern portion of the floodplain, from the stream to the floodplain edge. Plant species and cover data were recorded. Over 60 species were observed in the understory, and 7 shrub and tree species were observed. Approximately half of those species were introduced (non-native) plants. The most abundant understory species were: *Bromus tectorum* (cheatgrass); *Cardaria draba* (whitetop); *Phragmites australis* (common reed); and *Phalaris arundinacea* (canary reedgrass). The most common shrub and tree species were: *Tamarix* sp. (salt cedar); and *Elaeagnus angustifolia* (Russian olive). A relatively small percentage of the plant cover was from species typically found in wetlands, although there were patches of native wetland vegetation that included numerous wetland species of sedge, spikerush and bulrush. Those wetland plant communities seem to support a variety of animal species, such as waterfowl, shorebirds, and amphibians.

*Level: Technical*

## Wasatch Legacy Project Panel Discussion

**Laura Briefer**, Water Resources Manager

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**Dave Fields**, VP Resort Operations

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**David Gellner**, Planner

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**Jessie Walthers**, Executive Director

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**Dave Whittekiend**, Forest Supervisor

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**Moderator:**

**Jeff Niermeyer**, Director

Salt Lake City Public Utilities, Salt Lake City UT

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Following a 15-minute introduction and overview of the Wasatch Legacy Project by Uinta-Wasatch-Cache Forest Supervisor Dave Whittekiend, this panel will describe the accomplishments and challenges of public-private partnerships that involve multiple geographic areas, jurisdictions, interests and timelines. From planning to private sector and public funding to implementation and reporting, combining resources is a complex but essential strategy for sustaining healthy watersheds amid shrinking governmental budgets.

*Level: Non-Technical*

## Field Trips

### Trip 1: Ecological Restoration in the Red Butte Creek Watershed: Where We Are Today

**Eric McCulley**, Senior Scientist

Intermountain Aquatics, Salt Lake City UT

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**Lynn Berni**, Watershed Planner/Scientist

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Salt Lake County Watershed

Planning & Restoration Program, Salt Lake City UT

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**Bob Thompson**, Watershed Planner/Scientist

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Stop 1: Red Butte Reservoir

Discuss the watershed and historical changes over time for water use and a broad overview of the importance of headwaters to humans in the Salt Lake Valley.

Stop 2: Restoration sites on University of Utah Campus/Research Park reach

The riparian ecosystem of Red Butte Creek sustained serious damage as a result of the crude oil spill in 2010, whether from direct contact with toxic substances, or as a result of the subsequent cleanup activities. In 2012 Salt Lake County Watershed Planning & Restoration was awarded funding to restore vegetation in the stretch of creek that runs through the University of Utah Campus and Research Park—just below Red Butte Garden to above Foothill Drive. A variety of streambank bioengineering techniques were utilized to revegetate and restabilize streambanks with minimal impact on the ecosystem.

Installation was completed in April 2013, with 42 sites (approx. 775 linear feet) receiving one or more of the following restoration techniques: instream rock work, live stakes (aka dormant cuttings, pole plantings), conifer revetment, fascine, vertical bundle, brush mattress, and brush spur. Given the difficult creek access and the desire to minimize any further impacts in the stream corridor, all work was done by hand with the help of Utah Conservation Corps crews. Monitoring is currently in progress.

### Stop 3: Miller Park

In this section of the field trip, we will look at the physical and societal issues related to restoration of wildlife habitat in highly built environments. Efforts to restore the biological condition and function of Red Butte Creek are significantly constrained by both natural and human caused forces. The chemistry of the rocks and configuration of the watershed create the basis for all processes occurring in this ecologically significant riparian corridor. Climate change over time coupled with human use of the water in the stream has created an unsteady and unnatural flow regime along some reaches in Salt Lake City. Improvements in the condition of the stream are incremental, but gradual improvement of the aquatic and riparian ecosystems improve the societal benefits of natural areas imbedded in the urban matrix. Discussion will include the historical human alteration of this reach and how ecosystem function will be improved with restoration of aquatic and riparian ecosystems.

*Level: Non-Technical*

## Trip 2: Watershed Education for All Ages at Tracy Aviary

**Anne Terry**, Bird Programs Educator

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Situated in Salt Lake City's Liberty Park, Tracy Aviary inspires curiosity and caring for birds and nature through education and conservation. One element crucial to the success of Tracy Aviary's education goals is engaging audiences in age-appropriate ways. With funding from the Utah Division of Water Quality, Tracy Aviary has designed a variety of programs focused on inspiring Utahns (and visitors) of all ages to appreciate and protect our watersheds, with special emphasis on the critical wetland habitat of the Great Salt Lake. These programs are delivered both on and off Tracy Aviary grounds, and implement techniques that can translate to a variety of environmental education applications. Join Anne Terry, Bird Programs Educator at Tracy Aviary, in exploring how to ignite an interest in watersheds in people ages 2 to 92!

*Level: Non-Technical*

## Bios

**Hilary Arens** works as the watershed coordinator for the Salt Lake valley for the Utah Division of Water Quality. Over the years, she has worked in watershed management in Vermont, Colorado and Alaska, and as a volunteer with water groups in Vermont, Oregon and Utah. Hilary received her B.A. in biology from Colby College (Maine) and her M.S. in watershed science from Colorado State University. An avid boater, skier and cyclist, she and her husband enjoy bringing their toddler twins on adventures where few toddlers go. She is also on the Board of River Network, a national organization that works to help non-profit watershed organizations.

**Michelle Baker** is a professor and associate head of biology, and an associate of the Ecology Center at Utah State University. She holds a B.S. in Biology from Lafayette College and Ph.D. in Biology from the University of New Mexico. Dr. Baker spent a year in Toulouse France on a NSF-NATO postdoctoral fellowship before joining the faculty at Utah State University in 1999. Dr. Baker is an ecosystem ecologist whose research program focuses on hydrological and

biogeochemical processes that control material transport and retention in streams and rivers, including the effects of land use on these processes. Current studies investigate nutrient and organic matter transport in rivers, how stream network configuration and human activity affects nitrogen and organic matter cycling, and how ecological tools can inform development of nutrient criteria for streams.

**Dave Bastian** is the program coordinator for the Utah Conservation Corps (UCC). Prior to coming to the UCC, Dave was the director of operations at Save Our Canyons and the membership and outreach coordinator for the Utah Rivers Council. When not at work, Dave spends his time riding his bike, playing guitar, mandolin or banjo, backcountry skiing, kayaking, climbing, or sitting in a chair reading.

**Lynn Berni** is a watershed planner/scientist for the Salt Lake County Watershed Planning & Restoration Program. She is currently focused on streambank bioengineering restoration projects and watershed outreach. Prior to her move to Utah, Lynn was a Park Planner with the Washtenaw Parks and Recreation Commission in Ann Arbor Michigan. There she focused on natural areas conservation and development for passive recreational use; regional trail development; and interpretive and trail signage design. Lynn holds a Post-baccalaureate Certificate in Geographic Information Systems from Penn State, a Master of Landscape Architecture from the University of Michigan's School of Natural Resources and Environment, and a B.A. in Psychology from Cornell University.

**Christopher Bittner** is the water quality standards coordinator for the Utah Division of Water Quality. Mr. Bittner earned a Master of Science in environmental toxicology and has over 20 years of experience with conducting ecological and human health risk assessments.

**Laura McIndoe Briefer** is the water resources manager for Salt Lake City Department of Public Utilities (SLCDPU), a municipal water supplier responsible for the provision of drinking water to more than 400,000 people in the Salt Lake Valley. Laura has worked at SLCDPU for the past five years, and has 18 years' experience in natural resource and environmental professions in the public and private sectors. She has a degree in environmental studies from the University of California at Santa Barbara, and is a graduate student at the University of Utah studying public administration. Laura spends much of her free time running, cycling, and skiing in the Wasatch foothills and mountains with her husband and two children.

**Marc Coles-Ritchie** has many years of experience in vegetation ecology and monitoring across the western US, Alaska, Mexico and Ecuador. Currently he works for METI, Inc. as an expert in ecology and monitoring on various contracts with the US Forest Service. Marc has developed multiple protocols for the Forest Service to monitor wetlands and riparian areas and has trained others in the use of those protocols across the US, including seven years as lead ecologist for the Forest Service PIBO effectiveness monitoring program, for the interior Columbia River Basin. Marc has published articles, technical guides and book chapters on vegetation ecology and management. He has also taught ecology courses at Utah State University. Marc earned a BA in literature from the University of Massachusetts, an MS in environmental studies from Bard College in New York, and a PhD in ecology from Utah State University.

**Eleanor Divver** worked for the Salt Lake Valley Health Department in Environmental Health when she graduated from the University of Utah with her degree in Health Promotion and Education. As an Environmental Health Scientist for the Health Department she was able to work in several areas, including water and solid waste disposal methods. She went on to get her Master's in Public Health and has taught Environmental Health and Public Health at the University of Utah for many years. She is currently working for the Salt Lake Valley Landfill as a contract employee and teaching at the University of Utah. She has 3 darling girls that also keep her very busy.

**Jason Draper**, storm water quality program manager with Salt Lake City Public Utilities

**Nichole Dunn** has been the Salt Lake County Deputy Mayor since 2009, first under former Mayor Peter Corroon, and now under Mayor McAdams. Prior to being the Deputy Mayor, Nichole joined Mayor Peter Corroon's administration in January of 2005, where she served as the Intergovernmental Relations Specialist. She has worked for over a decade in state and local government and the non-profit sector; her background is in government relations and public policy. Nichole is a Salt Lake County native with a strong commitment to serve her community. She lives in Salt Lake City with her husband and two children.

**R. Ryan Dupont** has a BS in Civil Engineering and an MS and PhD in Environmental Health Engineering from the University of Kansas. Dr. Dupont has been a member of the CEE Faculty and the Utah Water Research Laboratory since coming to Utah State University in 1982. He is involved in applied water research in soil and groundwater remediation, the use of natural systems for wastewater treatment, and in the role of aquatic and terrestrial plants in improving wastewater and storm water treatment.

**Jim Ehleringer** is a Distinguished Professor of Biology at the University of Utah and director of Utah's Global Change and Sustainability Center. His research spans from ecological studies of natural and urban ecosystems through forensic science. Jim's recent research projects meld stable isotope analyses with process studies to understand carbon and water cycles, air quality in urban zone, humans and our foods, biomarkers in climate studies, and forensic issues.

**Dave Fields** is vice president of resort operations at Snowbird Ski and Summer Resort. Dave is a Utah native who grew up skiing Alta and worked in journalism prior to joining Snowbird in 2000. Dave represents the four Cottonwood Canyon resorts (Alta, Brighton, Solitude and Snowbird) on the Wasatch Legacy Project and has been involved since the beginning of this public private partnership.

**Carl Fisher** is the executive director of Save Our Canyons, a local non-profit organization dedicated to protecting the wildness and beauty of the Wasatch mountains, canyons and foothills. Carl grew up along the foot of the Wasatch Mountains where he enjoys spending time with friends and family mountain biking, climbing, hiking, fishing and backcountry snowboarding. In 2005, he graduated from the University of Utah with degrees in geography and environmental studies. He began volunteering at Save Our Canyons in 2001 while working in the hospitality and tourism industries at the Hotel Monaco and Snowbird Ski Resort. He then joined the Save Our Canyons staff in 2006. The Wasatch Mountains and their unmatched beauty and access to world-class recreational opportunities are the sole reason the Salt Lake Valley remains his home. He is married, has a daughter, two dogs and is passionate about protecting public lands, wildlife habitat and our environment.

**Zach Frankel** is the founder and executive director of the Utah Rivers Council, a 501(c)3 nonprofit organization that was started in 1995. Zach has over 20 years' experience in for profit and nonprofit environmental businesses in and around Utah. In his work at the Utah Rivers Council, Zach drafted Utah's first water conservation legislation, the Water Conservation Plan Act in 1998 and worked to protect both the Bear River and the Diamond Fork River from proposed diversion dams that would have inundated these river corridors. Zach has a B.S. of Biology from the University of Utah and enjoys all manner of outdoor water sports.

**Merritt Frey** is River Network's habitat program director, running several restoration projects, delivering policy analysis, and training watershed groups in policy and technical areas. Merritt has fifteen years of Clean Water Act policy experience, with a focus on water quality standards, pollution control permits, and Total Maximum Daily Loads (TMDLs). Her current work also focuses on the intersection of water quality and water quantity issues and on wetland permitting. Previously, Merritt was the executive director of the Utah Rivers Council and a policy analyst for both the Clean Water Network and the Natural Resources Defense Council in Washington DC. She has also worked for West Virginia Rivers Coalition, Union of Concerned Scientists, and National Tree Trust. In 2005, Merritt received the W.C. Kenney Foundation Leadership Grant to support outstanding work in the water community. Since 2007, Merritt has served on the Utah Water Quality Board.

**Erica Gaddis** is a principal scientist with SWCA Environmental Consultants in Salt Lake City, Utah. She primarily works on water resource projects related to water quality, watershed and lake management, and ecological restoration in Utah and Wyoming. She is currently managing a project to analyze the effects of flow on dissolved oxygen in the lower Jordan River and a habitat and pathogen TMDL for the Blacks Fork watershed in Wyoming. Erica received her Ph.D. in Natural Resources from the University of Vermont, Gund Institute for Ecological Economics in 2007. Her dissertation focused on watershed modeling and cost optimization of best management practices to improve water quality.

**Jodi Gardberg** is the Great Salt Lake water quality coordinator for the Utah Department of Environmental Quality, Division of Water Quality (UDWQ). In this capacity, she coordinates UDWQ activities pertaining to the lake including

development of numeric water quality criteria, monitoring and assessments of the open water and wetlands, UPDES and 401 certification planning and staff support for the legislatively appointed Great Salt Lake Advisory Council. In addition, she is one of the statewide mercury coordinators and assists with mercury research and issuance of fish consumption advisories.

**David J. Gellner** is a land use planner with Salt Lake County Planning & Development Services. David's work is focused on coordinating developments and land use policy for the County's Wasatch Canyons. He is currently leading the formulation of new general plans and land-use ordinances to guide development in these environmentally sensitive areas. David has worked as an environmental planner and project manager for 15 years in Utah, Texas and Ohio. He previously worked on watershed planning issues in northeast Ohio, and, worked for various governmental organizations in Austin, Texas on a variety of planning, grant and environmental projects. David has a Master's degree in Applied Geography specializing in Resource and Environmental Studies from Texas State University at San Marcos and a Bachelor's degree in Geography from the University of Windsor, Canada.

**Ramesh Goel** is an Associate Professor of Environmental Engineering at the University of Utah. He obtained his Doctoral in Environmental Engineering from the University of South Carolina in 2003 and then moved to the University of Wisconsin for his post doctoral training. In both degrees, he extensively studied biological nutrient removals. Since joining the University of Utah in 2006, Dr. Goel has been conducting applied as well as fundamental basic research in environmental engineering and science. Dr. Ramesh Goel is recipient of NSF-CAREER award in his transformative research related to bacteriophages in engineered bioreactors. His current research projects include developing start up strategies for suspended, attached growth and hybrid system for anaerobic ammonia oxidation, urine separation and treatment, sludge minimization, effect of illicit drugs on nitrogen and carbon cycling in natural systems, dynamics of organic carbon in urban stream sediments and nutrient fluxes and microbial ecology wetlands.

**Brian Greene** works for Utah State University Water Quality Extension as the program coordinator for Utah Water Watch. His work focuses on water quality and citizen science projects. When not studying lakes or streams he enjoys, playing in them or the watersheds that support them.

**Laura Hanson** is the executive director of the Jordan River Commission. The JRC is a voluntary cooperation of three counties, ten cities, two special service districts and dozens of community partners working together to implement an ambitious vision for the 50-mile long Jordan River corridor. This vision includes expanded recreation opportunities, open space preservation, habitat restoration, water quality improvements, regional transportation connections, and community development that embraces and protects the river. Laura has applied her twelve years of professional long-range planning experience to her position with the JRC, and is now enjoying the tangible work of implementing such a plan for the Jordan River. She holds bachelor degrees in urban planning and environmental studies, and a Master of Urban Planning degree from the University of Utah.

**J. Chris Hoag** is a riparian plant ecologist with Hoag Riparian & Wetland Restoration. Chris has been working on riparian and wetland systems for over 37 years. He is the author of over 120 technical papers on applied planting techniques for riparian and wetland ecosystems. He has been working with streambank soil bioengineering techniques for 35 years and he has developed 2 practical field manuals on bioengineering and over 75 papers describing these techniques, how to install them, materials needed, management after installation, and what zones riparian plants go in. Chris was formerly the project leader of the Interagency Riparian/Wetland Plant Development Project, USDA NRCS Plant Materials Center, Aberdeen, Idaho. He retired at the end of 2009 and opened up a small consulting business. He has worked, taught, and consulted all over the US, Canada, Mexico, and made two trips to Afghanistan to provide technical assistance to the Afghan Ministry of Forestry and Range.

**Tracie Kirkham** is a water resources scientist with the Salt Lake City Department of Public Utilities. She has worked at the Department of Public Utilities for the past 10 years. Her projects at the Department have included watershed education and outreach projects, working with various researchers to understand the impacts climate change will have on the City's water supply, and among other responsibilities, preparing guidelines and water resource protections in the light of Ground Source Heat Pumps Systems. She has a Bachelor's degree from Utah State in Watershed Science and a Master's degree from Oregon State University in Forest Engineering.

**Jeff Klausmann** is a co-owner of Intermountain Aquatics and North Fork Native Plants in Driggs, Idaho. He has over 15 years' experience in ecological restoration. Jeff earned a BS Degree in wildlife diology from the University of Vermont and a MS degree in land rehabilitation from Montana State University.

**Ron Lund**, environmental health supervisor, Salt Lake County Health Department

**Emy Maloutas** has worked for Salt Lake City since January 2008. She was the open space lands program manager and then the director of the City's Parks and Public Lands Division. In these roles she facilitated open space acquisition, conservation of natural areas, enhanced trail and open space connectivity and promoted increased access and public participation. Currently she is a Public Services Department project coordinator. Prior to her career in Utah she worked for the Mountains Recreation and Conservation Authority, a California State funded agency, focused on open space conservation, park development and regional trail connections in the Los Angeles region. She has a master's degree in landscape architecture from California State Polytechnic University Pomona and earned a bachelor's in humanities with a concentration in ecology, culture and sustainability from New College of California.

**John Mann** is employed with the Utah Division of Water Rights and currently serves as the assistant state engineer for the Applications and Records Program of the Division. He is a licensed engineer in Utah.

**Eric McCulley**, senior scientist and watershed ecologist, has experience planning, implementing, and following up on numerous ecological restoration and wetland mitigation projects. His experience ranges from assessment of ecological integrity of wetlands to migratory bird inventory to zooplankton biomass evaluation. He provides guidance to decision makers and their staff on optimizing use of project funds for maximum ecological and societal benefit. He has completed projects related to mapping of hydrology, soils, and vegetation; analysis of data on water, plants, and birds; monitoring for adaptive management of open spaces, ranches, and nature preserves; and restoring wildlife, stream, and wetland habitats. He is currently helping several large land owners in the Intermountain West develop sustainable land management programs and regularly provides training and guidance to land stewards and habitat managers. He has provided input on design and oversight for implementation of many stream and wetland restoration projects and currently assists with upland and wetland habitat management on thousands of acres throughout the Intermountain West. M.S. Watershed Science (pending), Utah State University; B.S. Geology, James Madison University.

**Nancy Mesner** is an associate professor in USU's Department of Watershed Sciences and an extension specialist in water quality. Her general research interests include the effectiveness of nonpoint source best management practices and design and implementation of monitoring programs to meet specific data objectives. Her extension program focuses on citizen science and best practices for water science and watershed education and engagement. Each year USU's Water Quality Extension provides over 7000 youth with hands-on monitoring and water exploration activities and trains hundreds of teachers on how to use these activities in the classroom.

**Theron G. Miller**, Jordan River/Farmington Bay Water Quality Council

**Nancy Monteith** is a licensed landscape architect in Utah with over 12 years of experience in the Intermountain West. She brings an artistic sensibility and a foundation of sustainable principles to create places that connect people to natural systems. In addition to her design and planning work she is an adjunct professor teaching landscape architecture and open space design courses at Utah State University and the University of Utah. Her current work includes campus planning and design, parks and open space planning and design, and small-scale design projects. Nancy has contributed to numerous award winning projects including Daybreak Parks and Open Space, Salt Lake City's Pioneer Park Master Plan, and the Natural History Museum of Utah. Nancy received a Masters in Landscape Architecture, with an ASLA Award of Honor, from Utah State University's Landscape Architecture and Environmental Planning program. Her undergraduate degree is in fine arts and she has completed extensive coursework in botany and ecology and worked as a field biologist for the University of New Mexico and the Nature Conservancy. Nancy also enjoys being outside exploring Utah's landscapes through plein-air painting.

**Arthur Morris** works as conservation stewardship director for Utah Open Lands. He has extensive experience with conservation easements, ecological restoration, ecosystem assessment, teaching/outreach, and project supervision.

Work and research have included focus on reciprocal relationships across riparian boundaries, plant and animal interactions, practical restoration and conservation, and landscape ecology. He has published articles on isotopic fractionation, riparian ecology, and fish assemblages in landscape settings, and has presented at national and international conferences. Arthur has taught ecology, biology, environmental science, and math classes at Utah State University, Salt Lake Community College, Westminster College, and currently at Brigham Young University-Idaho. Arthur earned Bachelor's degrees in Elementary Education (Utah State University), Biology (University of Utah) and Mining Engineering (University of Utah). He earned a master's degree in Biology/Ecology from Utah State University and a doctorate in Natural Resources with an emphasis on Ecological Restoration from the Ohio State University.

**Jeff Niermeyer**, director, Salt Lake City Public Utilities Department

**Christine A. Pomeroy** is an associate professor in the Urban Water Engineering & Sustainability Group in the Department of Civil and Environmental Engineering at the University of Utah, where she teaches courses in hydraulics, stormwater management and urban water infrastructure. She has 18 years of academic and consulting experience in urban water infrastructure, green infrastructure, stormwater best management practices, watershed management and permitting and compliance. Dr. Pomeroy earned a B.S. in Civil Engineering from Michigan State University and an M.S. and Ph.D. in Civil Engineering from Colorado State University. She is a registered professional engineer in Michigan.

**Dan Potts** is the current president of the Salt Lake County Fish and Game Association, a longtime wildlife-oriented non-profit foundation that has been engaged in issues and projects since it originally started organizing in 1921. He has a BS in Sport Fisheries Management from Utah State University, where his studies focused on Western stream restoration and aquatic ecology. He also has a MS in Sport Fisheries Management, Ichthyology, and Aquatic Ecology from Auburn University's world renowned fisheries program. A well-known local naturalist, he recently compiled the list "The Fauna of the Jordan River Corridor", which is now available through the Jordan River Commission. He teaches classes in foraging wild foods, fishing, hunting, and intensive vegetable gardening, and was recently appointed to the Utah Wildlife Board's Central Region Advisory Council to represent non-consumptive interests. He and his wife, Karen, have been heavily involved in many wildlife issues for more than 30 years.

**Jacob Richardson** is currently a graduate student at Utah State University in the Civil and Environmental Engineering Department. He is originally from Arizona where he worked as a consultant in storm water management permitting and infrastructure design and for national retail clients."

**Jeff Salt**, a native Oregonian, is one of Utah's leading advocates for clean water, watershed protection, and defense of public trust resources. Mr. Salt is the founder and executive director of Great Salt Lakekeeper. He currently serves as a board member of Salt Lake County Fish & Game Association, member of Utah's Mercury Work Group, and member of the Utah Angler's Coalition. Previously, Mr. Salt has served as board member of Waterkeeper Alliance, board member and president of the Jordan River Foundation, executive director and education director of Great Salt Lake Audubon, co-chair of the Utah Watershed Coordinating Council, chairman of the Salt Lake City Mayor's Open Space Advisory Committee, steering committee chair of the Jordan River Natural Areas Forum, and member of former Utah Governor Walker's Watershed Initiative planning committee. Mr. Salt co-authored the Jordan River Natural Conservation Corridor Report (2000) and developed the Jordan River Water Trail Plan.

**Nick Schou** is the water outreach manager for Utah Rivers Council, a grassroots non-profit organization dedicated to the conservation & stewardship of Utah's rivers, sustainable clean water sources & natural ecosystems for both Utah's people & wildlife. He received a B.A. in History from Westminster College and an M.S. in Environmental Humanities from the University of Utah and spent five years with the US Fish and Wildlife Service working for the Upper Colorado River Endangered Fish Recovery Program.

**Anne Terry** is a bird programs educator at Tracy Aviary. She got her start in environmental education by volunteering at a zoo in Texas at the age of thirteen and quickly realized it was the field for her. She has a B.S. in biology from the University of Texas and obtained her Teacher's Certification in science through the UTeach Natural Sciences program. An internship with the City of Austin Watershed Protection Department introduced her to watershed education, and she continues to enjoy finding new ways to connect people to their watersheds. She loves bike commuting (and all sustainable transportation), yoga, bar trivia, and of course, birding.

**Patrick A. Shea** Dilworth Elementary School, Salt Lake Country Club Caddy, Hillside Junior High School, Highland High School, University of Utah, Stanford University, Oxford University, Harvard University, Yale University, Brigham Young University, Westminster College and the University of Utah. Learned most about humans as a caddy. Worked for Robert Kennedy's 1968 Presidential campaign, Sen. Frank Moss, Sen. Birch Bayh, Sen. Mike Mansfield, Sen. Frank Church, Congressman Don Edwards. Conducted investigations on shooting at Kent State, 1972, Assassination of Foreign Leaders by U.S. Government, 1975/76, Unauthorized Disclosure of Classified material to the Israeli, 1979, Gore Commission on Aviation Safety and Security, 1996/97, Deputy Director of Senate Intelligence Committee 1975/76, Counsel to Senate Foreign Relations Committee 1979/80, National Director of Bureau of Land Management, Department of Interior 1997/99, Deputy Assistant Secretary of Interior for Lands and Minerals, 1999/2000. Adjunct Professor Brigham Young University 1994/6, Adjunct Professor of Agronomy, Kansas State University 2001/07, Advisor to the Dean of the College of Science, University of Utah, 2001 to present, Associate Research Professor of Biology, University of Utah 2010 to present. Married Debbie Shea, oncology nurse, Huntsman Cancer Institute, two sons, Michael and Paul.

**Bob Thompson** has been a watershed scientist and planner at Salt Lake County since 2009. His current assignments include field data collection for pfankuch level 3 stream channel assessments, physical habitat assessments using EMAP, RSRA and EPA rapid bioassessment protocols, creating and maintaining database and GIS data related to field collection, is the project manager for riparian restoration projects on the Jordan River north of Bangerter Highway, at Rotary Park at 12600 S and near 4800 S and acting county geologist. He has a background in teaching and hydrogeology and has been an avid whitewater kayaker for 25 years.

**Suzanne Walther** is an assistant professor in Earth Science at Utah Valley University, where she teaches a variety of geography, geology, and GIS courses. She is a fluvial geomorphologist, whose research investigates human-environment interactions, sediment mobility, and dam impacts. Her work utilizes remote sensing and geographic information system (GIS) methods to study the riverscape for use in environmental management.

**Jessie Walthers**, executive director of the Cottonwood Canyons Foundation, is a native of New England and has taught at the Maine Conservation School and the Hyde School in Woodstock, Connecticut. After moving to Utah in 2001, Jessie has worked with the Utah Museum of Natural History (in its old location!), the Norwegian Outdoor Exploration Center, and the Sundance Preserve. She directs the Cottonwood Canyons Foundation's stewardship and environmental education initiatives with the help of a small staff and over 100 dedicated volunteers.

**Tom Ward** is deputy director of Salt Lake City's Department of Public Utilities. He is a professional engineer with over 20 years' experience specializing in water quality and environmental engineering, planning, design and management of drinking water, storm water and wastewater systems throughout Utah, Idaho, Nevada and Washington. Tom has designed, constructed and managed treatment plants, constructed wetlands, flood control, riparian corridor habitat and recreation enhancement facilities, as well as wastewater reuse and land application systems. His current role includes supporting the City's Water Reclamation Division whose 56 million gallon per day wastewater reclamation facility discharges directly to the Great Salt Lake, as well as the City's Water Quality & Treatment Division which manages the City's drinking water quality, riparian corridors and storm water quality permitted discharge to the Jordan River.

**Dave Whittekiend** is 2nd generation Forest Service and grew up moving from one western town to the next. He received a B.S. in wildlife biology from Colorado State and a M.S. in botany from BYU. Dave's career with the Forest Service started in 1988 as a seasonal range technician on the North Kaibab Ranger District, AZ. Dave's first permanent appointment was a wildlife biologist on the Teasdale Ranger District, Dixie National Forest, UT. From there he went to the Lewis and Clark National Forest, MT, where he worked on the Rocky Mountain Ranger District as the wildlife, timber and minerals staff. While on the Lewis and Clark, Dave also held positions as a team leader for a mineral withdrawal and acting District Ranger on the Kings Hill Ranger District. Dave also served as district ranger on the Soda Springs Ranger District, Caribou-Targhee National Forest, ID. After being a district ranger, Dave worked in the Forest Service Nation Headquarters in Washington D.C. on the forest plan appeals and legislative affairs staffs. Dave is currently the forest supervisor on the Uinta-Wasatch-Cache National Forest. Prior to moving to Utah, he was the forest supervisor of the Mark Twain National Forest in Missouri. Dave lives in Herriman with his wife and four kids (one son and three daughters). He enjoys being outdoors and doing outdoors things such as fly fishing, mountain biking, camping and adventure racing.

# Notes





