

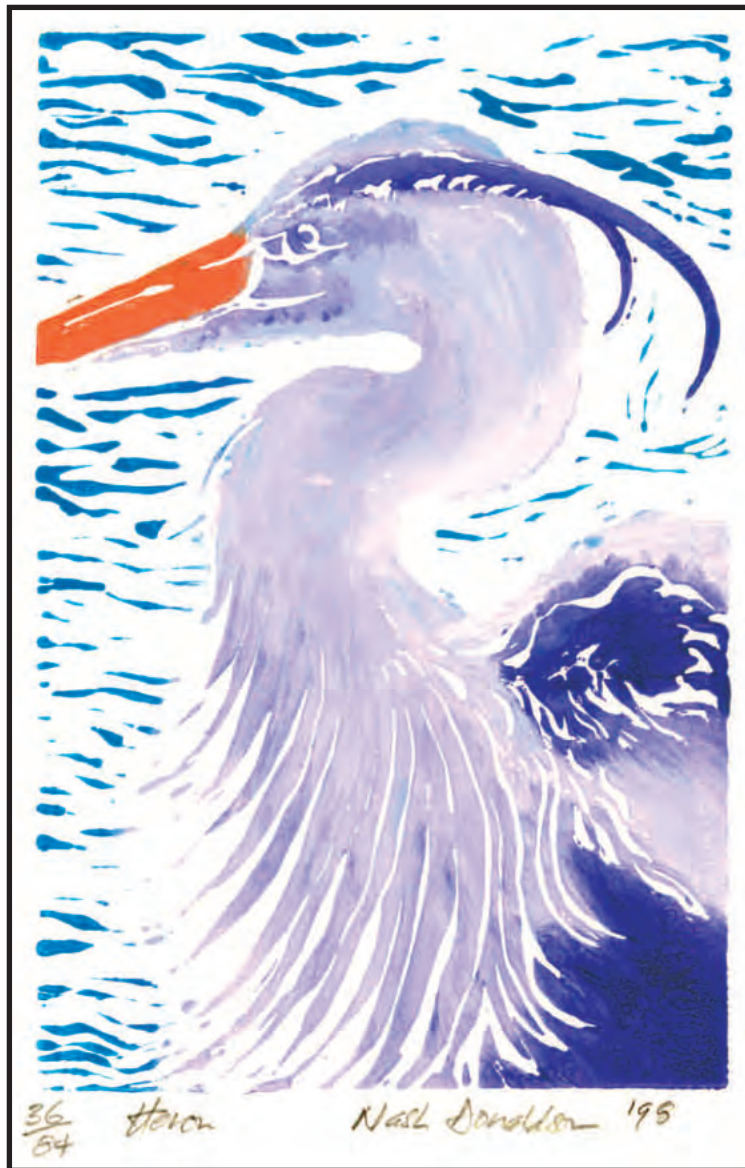
FRIENDS of *Great Salt Lake*

P.O. Box 2655, Salt Lake City, Utah 84110-2655
www.fogsl.org

801-583-5593

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Heron by M. Nash and J. Donaldson

The mission of FRIENDS of Great Salt Lake is to preserve and protect the Great Salt Lake ecosystem and to increase public awareness and appreciation of the lake through education, research, and advocacy.

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EXECUTIVE DIRECTOR'S MESSAGE

A WASTE STREAM OF THREE MILLION GALLONS A DAY FOR THE NEXT 40 YEARS SHOULD BE CAREFULLY SCRUTINIZED

"The permit limits for this discharge will be protective of Great Salt Lake and the waterfowl that depend on that important ecosystem"

- Walt Baker, State Director of the Division of Water Quality

In 1995, Kennecott Utah Copper Corporation (KUCC) and the Jordan Valley Water Conservancy District (JVWCD) forged an agreement with the State of Utah. Under this agreement KUCC and JVWCD are to remediate or "cleanup" two deepwater aquifers (Zone A & B) contaminated by mining activities on the Kennecott property. The contamination includes high concentrations of salts, an acid plume, selenium, and mercury. The clean up, the Southwest Groundwater Remediation Project, is to help provide municipal quality drinking water to various affected areas in the Southwest Salt Lake Valley.

Kennecott is already working to remediate Zone A of the Project, which includes the acid plume. JVWCD is focusing on Zone B. That work included the construction of a 21- mile pipeline from Jordan Valley's reverse osmosis (RO) treatment plant to Gilbert Bay in Great Salt Lake. While initially discharging up to 1.5 million gallons per day (MGD), at build out the facility will generate and discharge up to 3 MGD of byproduct into the Lake.

JVWCD is now seeking a permit to discharge in two places - the 001 Outfall at the end of the pipeline and the 002 Outfall, that goes directly into the Jordan River.

So far, quite simple. But then it gets complicated. There are two kinds of water that JVWCD wants to discharge. One comes from the deepwater aquifer which is full of mining-related contaminants. The other is what's called "lost use" water from the shallow aquifer along the Jordan and has its own special chemical brew.

On December 1st the Utah Division of Water Quality (Division) opened the 60 - day public comment period on this permit. Details are available online at www.deq.utah.gov/Issues/hottopics/swjvgwtp

The public is being asked to evaluate complex effluent limitations, monitoring and reporting requirements, and compliance responsibilities for a permit that will approve a system that will be in place for at least 40

years. The permit will be evaluated and renewed every 5 years. The worry is that the accumulated concentrations from all these contaminants could have significant impacts to wetlands along the Jordan River and Great Salt Lake where natural processes inevitably retain and recycle selenium and mercury.

Much will depend upon meticulous monitoring and reporting requirements, the implementation of a risk assessment protocol, and a rapid response from JVWCD and the Division to prevent impairment of the system. FRIENDS and members of the conservation community are urging the Division to implement an adaptive management approach to this new discharge. Start small, monitor the changes, and assess what steps should be taken next to protect the resource.

If your memory is as good as an elephant's, you will recall that in August 2003, the Division issued a UPDES permit to Jordan Valley authorizing it to discharge a waste stream of reverse osmosis (RO) byproduct from Zone B into the Jordan River and the wetlands surrounding Great Salt Lake. The discharge included selenium, which is known to be toxic to bird reproduction. The public was extremely upset by this proposal. Following a series of public meetings, JVWCD returned the permit. The State then embarked on an 18 month study to determine the first numeric standard for selenium in the open waters of Great Salt Lake. Can you see where this is going?

A bird egg tissue standard of 12.5 mg/kg was the outcome of the process and was adopted by the State in 2008. A variety of alternatives for disposing of the RO waste stream were discussed but due to cost and some logistical challenges, the 21-mile pipeline was selected as the preferred alternative.

The tissue standard has not yet been converted into an effluent or water column standard for the discharge. Apparently it requires some complex translation to achieve this. However the Division would allow JVWCD to discharge

the same concentration of selenium that Kennecott is currently permitted in its effluent into Great Salt Lake. It's unclear why the Division has chosen to do this. Whatever the reason, this deserves a red flag.

Suffice it to say that the scope and magnitude of this project with its potential cumulative impacts on Great Salt Lake and the Jordan River continues to generate concerns and questions like the following:

The Comprehensive Sampling and Analysis Plan is Missing. JWCD is supposed to provide this to the Executive Secretary of the Utah Water Quality Board by Feb. 1.

Without the Plan we can only guess what the scope of monitoring and sampling will be, what metrics will be implemented, and who exactly is accountable for submitting detailed and timely reports to the Division for review. (The draft permit suggests coordination and "cooperation" with KUCC as a neighboring discharger in some sampling and monitoring activities).

FRIENDS believes that under no circumstances should a discharge permit for JWCD be approved without ample time to review and comment on the Plan.

No Selenium Data Have Been Collected Since 2007 - The draft permit allows JWCD to discharge a selenium concentration of .54 ug/L (ppb) through the 001 Outfall - the same as KUCC's 012 Outfall 50' away. This is not without contention from FRIENDS. No data on selenium levels in the lake or in bird tissue have been collected since 2007 when the work on the selenium standard was in progress. During that time, increasing trends in selenium levels in the Lake were observed but monitoring did not continue after the standard was determined. Two very important areas that were not studied in the scope of work were groundwater sources and airborne deposition to the Lake. Dust events from Kennecott's tailings impoundment could be a contributing source of selenium to the Lake, but we don't know that because it was never studied.

In 2009, the US Geological Survey identified a potential area of groundwater discharge of selenium along the south and eastern shore of Gilbert Bay in the vicinity of the Kennecott property. Further study by USGS to quantify and monitor the amount, source and chemical quality of this "missing" selenium load is in progress.

We recommend that the Division does not approve the permit without first reviewing the USGS monitoring work. We also advocate for a lower selenium concentration in the permit and insist on monitoring the open waters of the Lake where loading or accumulation may occur.

How Can the Division Allow for a Mixing Zone that Doesn't Exist? - Since 2007, the Lake level has dropped over 3' in elevation. Currently, there is a 13.5' difference between the 001 Outfall and the open waters of Gilbert Bay. JWCD's selenium discharge is supposed to be diluted by 2:1 with water from Great Salt Lake in a "mixing zone" that extends for 200' beyond the end-of-the-pipe discharge point. Mixing zone models typically come from river systems where flows are constant and a certain area for mixing the contaminants is required. Since the discharge currently flows in an open channel that extends beyond the proposed discharge point to the open waters of the Lake, with no other water flowing into it, it's impossible for any mixing to occur within the channel, let alone within the first 200' from the end of the pipe. (Another red flag here). This condition exposes soils, biota and wildlife to these undiluted contaminants in a "transitional wetland." Many scientists have suggested that this transitional wetland- which in effect constitutes an attractive fresh-water nuisance for birds - should not exist. We agree.

Relying on a mixing zone under these conditions is problematic at best. We know this from our work on the Kennecott UPDES permit for the 012 Outfall. The Division should find a better way to ensure that the selenium concentration is effectively diluted. The uncertainty of this condition is untenable.

Mercury - Currently there is no water quality standard for mercury in Great Salt Lake. We know that 3 species of ducks that use the Lake are in trouble because of high concentrations of methylmercury in their tissue. Experts have raised concerns about the possibility of methylation of the waste stream in the pipeline. The permit would allow JWCD one year to characterize the Zone B aquifer to determine total and methylmercury concentrations. This is a cart before the horse arrangement. We believe the permit should not be approved until this information has been reviewed by the Division and the public.

40 years is a long time. Kennecott is gearing up to extend the life of its mining operation for at least another 40 years. Managing Great Salt Lake and discharges into it will only become more complicated as we continue to grow. We all have a stewardship responsibility for the Lake. Let's do our part by staying involved in these critical decisions. 🐦

In saline,
Lynn

Visit www.fogsl.org for our comments, links and updates.

FRIENDS ORGANIZATIONAL STATEMENT

FRIENDS of Great Salt Lake was founded in 1994. The mission of FRIENDS is to preserve and protect the Great Salt Lake Ecosystem and to increase public awareness and appreciation of the lake through education, research, and advocacy. The long-term vision of FRIENDS is to achieve comprehensive watershed-based restoration and protection for the Great Salt Lake Ecosystem.

FRIENDS has a very active Board of Directors and an Advisory Board consisting of professionals in the scientific, political, literary, education, and broadcast communities. The organization sponsors an array of programs, activities, and materials in pursuit of its mission.

Every two years, FRIENDS hosts the Great Salt Lake Issues Forum to provide a focused discussion about the Lake for policy makers, researchers, planners, industry and other stakeholders. The goal of each Forum is to encourage constructive dialogue about the future of the lake's ecosystem and its resources, and to illuminate the complexities involved in research, management and planning for the lake.

The Friend of the Lake Award, given at each forum, acknowledges a citizen, business or organization working to promote GSL awareness in the community.

In 1997, Bruce Thompson was hired as Education Director to initiate a major regional education project designed to enhance both the knowledge about and care for the future of Great Salt Lake. Bruce wrote and produced a live-narrative slideshow program "The Lake Affect: Living

Together Along the Shores of Something Great." The program is now available on DVD.

In 2000, Project SLICE, a 4th grade curriculum using Great Salt Lake as a system of study was initiated. It consists of 7 units of study, a Speakers Network, Teacher Training Workshop, and Lakeside Learning Field Trips. Currently work is being done to expand the curriculum into other grades.

Emily Gaines, Education and Outreach Director is working to refine the Project SLICE curriculum and expand education outreach into the Great Salt Lake community.

In 2002, the Doyle W. Stephens Scholarship Award was established. The scholarship provides support to undergraduate and graduate students engaged in new or ongoing research that focuses on Great Salt Lake.

In 2006, FRIENDS was the recipient of the Calvin K. Sudweeks Award by the Utah Water Quality Board for outstanding contributions in the water quality field.

In 2002, President Lynn de Freitas, was awarded the outstanding volunteer educator award by the Utah Society for Environmental Education.

In 1998, FRIENDS was awarded the Conservation Achievement Award by the Utah Chapter of the Wildlife Society. 🦋

On the Cover

Heron by M. Nash and J. Donaldson

Each year Joe and Margie create unique block prints that they give as cards to family and friends during the holiday season. The images represent special events or experiences from that year. The heron image was inspired by one of their favorite birds from their numerous outings to National Wildlife Refuges. They collaborate on developing the design. Joe does most of the carving. They trade off hand-painting the block and pressing each image individually so that each print is unique. This is one way they enjoy sharing their experiences and love of the natural world with others.



Sunlit Hills by Charles Uibel

THE DEAD SEA

AN ENVIRONMENTAL DISASTER

The Dead Sea is a hyper-saline terminal lake in the Jordan Rift Valley and is shared by Israel, Jordan and the Palestinians. The lake is located in the lowest depression on Earth (1385 feet below sea level), is the saltiest (34% - about 10 times that of the oceans, 6 times that of Great Salt Lake) and is a small remnant (together with the Sea of Galilee to the north) of a vast lake system that existed during the last ice age named Lake Lisan (~70,000 to 15,000 ago).

The present climate in the Dead Sea area is hyper-arid (2 -4 inches of rain per year). Temperatures during the summer months can reach more than 110° F with an average of 95° F and winter temperatures are mild, around 70° F. The aridity is a result of a rain-shadow effect created by both the north-south oriented Judean Mountains ridge of central Israel and by the low elevations within the Dead Sea valley.

Historic variations in the Dead Sea levels correlate with natural climatic periods of large floods and prolonged droughts, respectively. Since the beginning of the 20th Century the rapid decline (currently 3 - 4 feet per year) is predominantly human-related and not climatically induced. There are two major causes: alteration of the natural water flow into the lake and commercial mining evaporation.

The Jordan River is dammed at the Sea of Galilee outlet, as are the three major tributaries, the Yarmouk, Zarka, and Arnon Rivers. These dams have reduced inflow to the Dead Sea which in turn has increased evaporation (the smaller the surface area of the lake the more water evaporates). The result is a rapid decline in the water level -- more than 100 feet in the last 70 years.

The decreased water inflow and the high evaporation rates mean that the Dead Sea's shallower southern basin has separated from the deeper northern basin. The southern basin is also now almost entirely covered with commercial evaporation pans controlled by feeding canals, pipes, pumps, and numerous barriers and dikes. Each evaporation pan has a different concentration of minerals depending on the chemical composition needed for harvesting. The minerals produced include elemental potash, caustic soda, bromine, sodium-chloride, magnesium and salt.

Environmental damage in the southern basin of the Dead Sea is not limited to the drying of the lakebed. The dikes need constant maintenance and the earth material is locally dredged from nearby ephemeral tributary streams (wadis). These mining pits scar the landscape and are permanent as the sediment-rich flashfloods cannot refill them at the rate they are dredged. The earth mining also disturbs the rare local ecosystem when the sparse arid vegetation disappears and cannot support the local desert fauna that is highly dependent on it.

On the Israeli side of the lake, the Dead Sea Works plans to expand their evaporation ponds further north almost all the way to the northern basin, just below the famous historic site of Masada. This plan is being met by massive resistance from local residents and environmental organizations that fear the northern basin will have the same fate of the southern, now largely industrialized, basin.

Together, the production plants of the Dead Sea Works and its Jordanian counterpart, the Arab Potash Company, emit significant air pollution. This affects the health of the region's residents. One of the largest health tourist resorts, Ein Bokek and Neve Zohar, located on the shore of one of the evaporation pans suffers from the fluctuations in the water levels. As hard salt accumulates on the bottom of the evaporation ponds the brine water levels constantly rise and attack the concrete foundations and adjacent infrastructure of the hotels.

The environmental damage of the lake decline is not limited to the southern basin of the Dead Sea. As the lake recedes, the ephemeral streams that undergo seasonal flashfloods cut into their previous courses and cause damage to roads, bridges and nearby infrastructure since the energy gradient they gain continually increases. Sinkholes that were once a rare feature are now appearing by the thousands both on the Jordanian and Israeli shorelines. These sinkholes are created when freshwater from the surrounding mountains dissolves underground salt layers leaving large subsurface cavities that eventually collapse and form deep holes of different sizes. Consequently, large areas used for tourism and agriculture have been abandoned due to ground instability.



Typic image of Dead Sea development source unknown

In 2006, a comprehensive policy report was submitted to the government of Israel indicating the future fate of the Dead Sea Basin under continuous decline in lake levels. This document relates to the physical aspects, ecology and environment, planning, economical characteristics, legal aspects and public administration. As a result of this document, in 2008 the State of Israel established the Dead Sea Preservation Government Company Ltd. to tackle the major problems in the southern basin of the lake.

The Jordanian government has been advocating for a connecting canal, the “Red-Dead,” between the Red Sea and the Dead Sea. Israel withdrew its support for the project after a feasibility study found the project to be counterproductive and dangerous (the Arava Valley where the canal is planned is a highly active fault zone, a unique natural land corridor, and the effect of water extraction on the Red Sea coldwater reef system is unknown). The Jordanians are now pursuing the \$14 billion project by themselves and are trying to persuade the World Bank to fund this endeavor but it is unlikely to be implemented without the support and consent of Israel.

In the short term, the Dead Sea is in such a dire water deficit that it appears that it is no longer a sustainable-self supporting natural system. It seems that the only viable option is to start releasing very large amounts of freshwater from the Sea of Galilee and the southern Jordan River’s main tributaries to stop the Dead Sea level decline and to revive the degraded southern Jordan River. Since the region is currently experiencing a severe drought and water is as valuable as gold, it is unlikely any decision makers will permit a release of precious freshwater to save a hyper-saline lake.

Since human beings are predominantly responsible for the modern demise of the lake, it is up to the people of the region to restore and rehabilitate the Dead Sea and the rich natural and historic heritage it encompasses. 🐦

Nati Bergman

Further readings:

Dead Sea Preservation Government Company

<http://www.haganot.co.il/>

<http://www1.american.edu/ted/deadsea.htm>

www.iclfertilizers.com/

<http://www.arabpotash.com/>

<http://www.deadsea.co.il>

http://en.wikipedia.org/wiki/Dead_Sea

*Nathaniel (Nati) Bergman is currently doing a PhD dealing with the erosion of glacial till due to landuse changes and climate change in Southern Ontario streams at the University Of Western Ontario, Canada. Before coming to N. America he worked on Dead Sea floods, continuous monitoring of sinkholes and geologic interpretations from boreholes in the southern basin of the Dead Sea.

He can be reached at: bergmannati@hotmail.com

HIGH THEN DRY



Tundra Swans by Gary Crandall

April Fools Day, 1985 was my first day of work with the Utah Division of Wildlife Resources. An appropriate first day for me, as I had left the waterfowl rich haven of the Central Valley of California for the disaster that was unfolding in Utah. Unrelenting rains had caused the Great Salt Lake to rise to 4209' above sea level that year, and the Division had completely retreated from efforts to battle rising water levels on state waterfowl management areas. Farmington Bay, Ogden Bay, Howard Slough and Harold Crane were essentially lost.

My first aerial survey of the state revealed tsunami-like images of mass flooding: inundated hunting clubs and impoundments, wave-scoured dike tops, and tens of thousands of acres of water too deep to reveal the marsh vegetation that still carpeted the bottom. At Farmington Bay WMA, the manager's house had been sold and moved off site and the staff reassigned. The lake eventually peaked at nearly 4212', flooding most of the fresh water marshes along its eastern shore.

Waterbirds of all species reacted to the flooding. Many migrants over-flew the GSL or engaged in bizarre behavior if they stayed. Canada geese that typically used the same areas year to year nested in trees. Over 100 pairs of geese nested on the abandoned stockpile of materials from the Farmington landslide that was deposited at Farmington Bay WMA to help riprap eroding dikes. Few nests were successful, and the pile is now named "Goose Egg Island" from all the scattered eggs. Other nesting species abandoned Utah altogether. Production of waterfowl and shorebirds fell by over 90%.

That year the waterfowl hunt reflected the flooding as well. Most duck clubs were out of business and coveted memberships sold for a song. The Bear River Refuge and State WMA's were oceans of open water with nothing to entice either waterfowl or hunters. Hunter numbers declined by 60% from earlier years, when hunters and others enjoyed nearly 400,000 acres of emergent marsh and a diversity of species. Mid-winter management surveys recorded thousands of birds on the GSL instead of hundreds of thousands.

As quickly as the lake rose, however, it began to retreat. By 1989, the level had fallen to 4202' and most state waterfowl management areas were back in business. Aerial images showed dry cracked soils littered with thousands of tires that were ineffectively placed to control dike erosion on many duck clubs. As managers and wetland ecologists debated the best approach to rebuilding the marsh, natural processes took hold. Dormant seed banks responded instantly to inflows of fresh water. As fast as water control was restored, marsh vegetation returned and so did the birds. By 1992, waterfowl areas were again producing ducks and holding hundreds of thousands of migrating birds each Fall and Spring.

Today, GSL has continued its record decline and is within 2 feet of an all time low – 4191' Changes are occurring in the distribution of waterfowl that I believe are related directly to the declining lake level. Tens of thousands of waterfowl that used to loaf on the south end of Farmington Bay during Fall have now moved north to the Antelope Island causeway where surface



American Coots by Gary Crandall

water remains expansive. Bear River Bay along Promontory, once deep in nature and important to goose molting, now goes dry during summer. Duck use explodes, however, when fresh water covers the area in the Fall. On a recent aerial survey, hundreds of thousands of ducks were observed in the area.

Dramatic changes in the vegetative communities also have responded to changing GSL elevations. Inundated landscapes at peak water levels blossomed into diverse and productive wetland communities as the lake receded. Continued drought, however, has led to aging wetlands less diverse and productive, and invasive species like phragmites dominate.

The dynamics of salinity, water depth, and ice formation around GSL are also in play. The shallow, fresh areas below Farmington Bay and Ogden Bay WMAs seem to freeze earlier than in the past and dependent species appear to leave the GSL earlier than during higher lake levels.

Over my 25 year career I have witnessed ecological processes that are important in maintaining a healthy wetland system, including heartbreaking natural cycles of flooding and drought. As managers, we must learn from these experiences and allow the lake to continue

its natural course. This includes allowing fluctuating water levels, preservation of areas that function at both high and low lake levels, and recognition of the role of GSL in a dynamic network of habitats that collectively support healthy nesting and migratory bird populations. Preserving the capacity of GSL and other wetland systems to function throughout the west will be key in maintaining this dynamic. If climate change progresses as predicted, preserving enough inflow to GSL to drive these natural cycles will be challenging but absolutely essential. 🐾

Tom Aldrich
Migratory Game Bird Program Coordinator
Utah Division of Wildlife Resources

THE GREAT SALT LAKE YACHT CLUB

IMPACTS FROM A LOW LAKE

The Great Salt Lake Yacht Club was organized in May of 1877, and consisted of four sailboats and their crews. It is the 3rd oldest yacht club in the west; only the San Francisco (1869) and Santa Barbara (1872) yacht clubs are older.

I myself began sailing on the Great Salt Lake twenty-five years ago. Without question, sailing on the Lake is the most rewarding and challenging sailing in the area. Our Catalina 30 comfortably accommodates a weekend cruise where one can experience the beauty and solitude of the Lake, far from shore in the open water or in a quite anchorage with the most beautiful and unique sunsets in the world. Yacht Club Members and other sailors on the Lake appreciate this uniqueness like no others.

The first phrases in our club's purposes include promoting and developing the recreational use of the Great Salt Lake while preserving ecology. This has never been more critical to our Yacht Club than it is today. With the Lake at near historic low water levels, our ability to recreate and use the marina facilities on the Lake has been severely compromised. Boat owners are renting slips on an annual basis but are only being able to access the Lake a few short months from May to August.

The Lake, suffering from drought and diversion of upstream water, is also losing water to industrial mining. For example, Great Salt Lake Minerals extracts potassium sulfate by pumping vast quantities of water from the Lake into thousands of acres of shallow evaporation ponds. Such ponds artificially expand the Lakes surface area resulting in more rapid, abnormal evaporation of Lake water. Our Yacht Club is a member of the Coalition to Keep the Lake Great and we are actively looking to influence the State of Utah, Department of Natural Resources and other governmental agencies in the protection of the Lake's environment and restoration of minimum operational Lake Levels.

Low water levels have introduced a new safety concern. Storm tides can drop Lake level in the south bay by well over a foot. Strong south winds push water north towards the railroad causeway some 40 miles away. So much water is sucked out of the Marina that boats are sitting on their keels on the bottom, teetering and tearing at their dock lines. Storm conditions can expose hazards to sailors on the Lake and possibly render them unable to return to the Marina until conditions subside.

We have all heard about "Lake Effect Snow"; every weather forecaster in the region refers to the likelihood of lake effect when cold fronts pass over the warmer water of the GSL. A Salt Lake Tribune November 13, 2010, article announced an ongoing study at the University of Utah, funded by the National Science Foundation, has estimated this effect to account for 20% of precipitation. Consider what would be the effect on the approximately \$1 billion per year Utah ski industry and our economy if our watershed in the mountains received 20% less snow. Our Greatest Snow on Earth would be reduced to ho-hum snow and the industry and our local economy would pay a heavy price.

The Great Salt Lake Yacht Club currently has about 150 members. We all share a common love of sailing and appreciation of the Great Salt Lake; it's a family. Like me, my friends and fellow club members and sailors would be sorely disappointed if we could no longer sail our boats on the Great Salt Lake.

Additionally, all of us would take a significant financial hit to remove and relocate our boats to deeper waters. Members have invested significantly in their boats and relocating some of these boats to deeper waters could cost upwards of \$10,000 apiece. If current water levels drop by much more, many of the larger boats will have to come out of the Lake. Since the early 2000's, we have already lost most of the largest, deep draft boats, their owners moving them to the coast or other deep water lakes out of state. Yacht Club membership has dropped significantly as well. We fear that the club could lose membership to a level that would compromise its viability.

The perception that water reaching the Lake is wasted must be reversed and the Lake level needs to be managed to return and maintain its level at the historical average. Right now GSLYC members and other sailors in the marina cannot utilize the marina due to shallow water. The State needs to appropriate funds and take immediate steps to restore the Marina to a navigable condition by dredging the mouth and dock area.

The GSLYC is committed to fulfill its purposes and will work hard to that end. 🍷

Jerry Harwood,
Commodore, Great Salt Lake Yacht Club

REFLECTIONS FROM A FOUNDING FATHER

PROTECTING GREAT SALT LAKE

My life has unfolded along an unexpected yet rich path. One thing I've noticed is that this path circles back to its most significant places and the life experiences they inspired. The Great Salt Lake is one of those places.

During a recent trip back to Utah from my current home in northern New Mexico, I reconnected with both the Great Salt Lake and FRIENDS (FoGSL). The trip provided a couple of hours to visit the Great Salt Lake's south shore and also attend FoGSL's October fundraiser. Both experiences brought back a flood of great memories and an opportunity to reflect.

I was one of the organization's original board members (1994-1998). In those early days, we focused our efforts on catalyzing a greater awareness amongst Wasatch Front residents that there was something over our shoulders pretty amazing and worthy of a closer look.

Our efforts seemed to fill a void and quickly gained momentum. A programming mix of monthly lectures, field trips, and lake "circumspections" grew to include a biennial issues forum, research scholarship, teachers' curricula, and lakeside environmental education program. A folksy four page, black-and-white newsletter with pencil sketches grew into a thoughtful and attractive full-color publication that garnered regional attention.

Most importantly, a community of leaders and partners dedicated to protecting the Great Salt Lake developed and congealed. The formation and nurturing of this community was essential because the job was too big for any one organization to take on alone. FRIENDS and others facilitated and kept alive the contemplative discussion of and strategizing to address the contemporary issues affecting the Lake ecosystem.

This new community increasingly stood up for the Lake through advocacy as well as education. With its partners, FRIENDS made the case for better addressing the health of the Lake on critical issues, including pollution from MagCorp, plans for the Legacy Highway, and development of the Great Salt Lake Comprehensive Management Plan. FoGSL has continued to grow and serve in this role over the years, more recently initiating discussions about the need for a conservation pool of water for the Lake, raising

awareness about how the proposed expansion of Great Salt Lake Minerals poses system wide threats to the Lake, and why the development of the Northwest Quadrant would bring sprawl to the south shore of Great Salt Lake.

My time around the Great Salt Lake and with FRIENDS shaped me profoundly as I grew through my thirties. I developed a very personal connection with the Lake through the exploration and study of its wetlands, playas, plants, and critters. I learned how to help build community and be an advocate, and enjoyed befriending fans of the Lake's saline serenity in the process. And I was so very fortunate to go on countless Great Salt Lake outings to Antelope and Stansbury Islands, Bear River, Farmington Bay, the Inland Sea Shorebird Reserve, Spiral Jetty, and more. I would return from these excursions rejuvenated, inspired, and yearning for the next adventure to this briny biotic wonderland.

It is an indicator to me of how fast life flies by that FRIENDS is entering its 17th year. Yet if the history of Great Salt Lake and Lake Bonneville before it was measured by a day, FoGSL has existed only within the last minute of that history. But during that minute, and the preceding minutes of unprecedented human expansion in northern Utah, we've witnessed large scale alteration of Great Salt Lake's hydrology and ecology.

When viewed through this timescale, FRIENDS came along not a minute too soon. I'd like to express sincere gratitude to FoGSL and its partners for continued timeliness and making a difference for the Great Salt Lake. 🐦

Howard Gross lived in Utah from 1992-2003 and now lives in New Mexico.

GREAT SALT LAKE EDUCATION

PARTNERSHIPS STRENGTHEN EDUCATIONAL IMPACTS



4th grade at work by Jeff Clay

As a small organization with limited funding, FRIENDS is able to maximize the effectiveness of its lake education efforts by seeking community partners with similar interests. By pooling resources and expertise, these partnerships generate educational impacts far greater than either organization could achieve on its own. In the past, FoGSL's education partnerships have included groups such as the Utah Museum of Natural History, Great Salt Lake Institute, and Living Planet Aquarium, to name a few.

FoGSL was recently presented with a wonderful opportunity to partner with Weber State University's Community Involvement Center (CIC). The CIC promotes civic participation by combining academic learning and community service. FoGSL was fortunate enough to be selected as a community service partner by Dr. Julie Rich, a professor within the Geology department.

At the start of the partnership last spring, Emily Gaines, FoGSL's Education & Outreach Director, presented the students in Julie's "Geology of Utah" course with a range of possible service projects. The WSU students gravitated towards environmental education projects. Since FoGSL's formal education programs have historically focused on the fourth grade, the WSU students felt that it was important to develop lessons for older children.

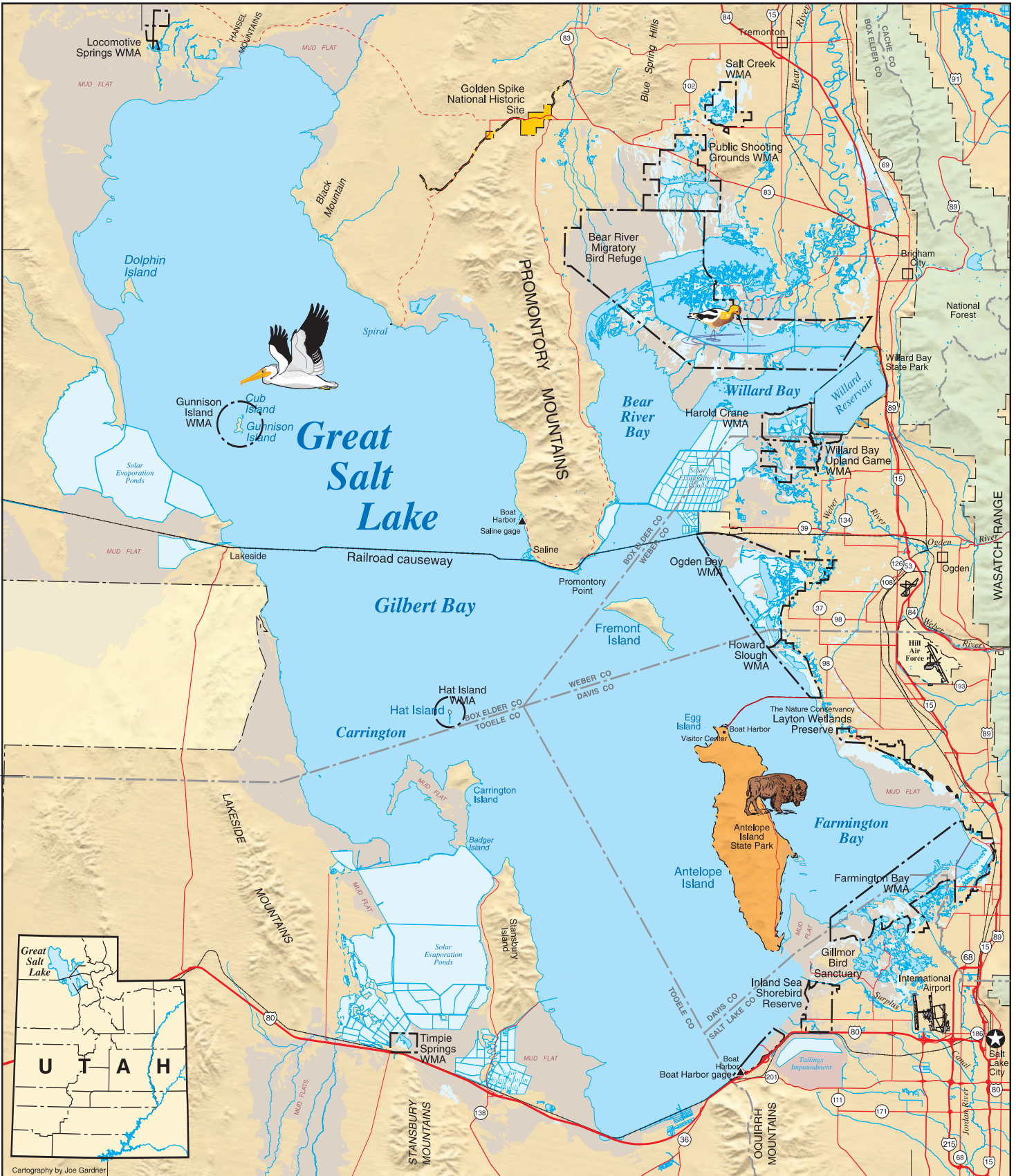
The WSU students, working under the auspices and guidance of FoGSL, developed innovative ways to connect lake learning to the 7th grade social studies core curriculum. They created a number of lesson plans designed to bring an awareness of the unique lake ecosystem to young students and help them understand how the Great Salt Lake is linked to our environment. Thanks to the WSU students' hard work and dedication, these lessons will soon be available to the public at www.fogsl.org.

Due to FoGSL's small size and limited resources, these lessons and curriculum materials could not have been created without this special partnership with WSU. At the conclusion of the project partnership, FoGSL had wonderful new curriculum materials and new relationships with the WSU community. In return, the WSU students enhanced their knowledge of the Great Salt Lake and the importance of protecting and preserving the ecosystem. These students demonstrated their commitment to Great Salt Lake by concluding their semester with an Earth Day activity of removing invasive weeds along the lake shore.

Although the project and partnership were multifaceted and very involved, the WSU students received an outstanding education in the classroom as well as outside of it. For further information on Weber State University's Community Involvement Center and outreach program, please email CIC@weber.edu or visit <http://www.weber.edu/communityinvolvement>. 🌿

By Julie Rich and Emily Gaines

GREAT SALT LAKE AT A GLANCE



Courtesy of USGS



DR. EPHYDRA - WE WELCOME YOUR QUESTIONS VIA EMAIL OR PHONE

E•phy'•dra, a noun; a genus of two species of brine flies that live on the bottom of the Great Salt Lake as larvae and pupae, and along the shores of the Lake as adults.

Brought to you by the Science Committee to help explain the science surrounding Great Salt Lake. We welcome your questions via email or phone. Contact Lynn de Freitas at ldefreitas@earthlink.net

Great Salt Lake: Why are Levels of Methyl Mercury So High?

“Lake of paradoxes, in a country where water is life itself and land has little value without it; Great Salt Lake is an ironical joke of nature—water that is itself more desert than a desert.”

—Dale Morgan

Great Salt Lake (GSL) is a natural wonder that has some of the most ancient forms of life, is a safe-haven for millions of birds including the worlds’ largest staging population of Wilson’s Phalarope and is host to billions of brine shrimp and brine flies which account for a large portion of the migratory birds’ diet. However, it is also heavily polluted with mercury (Hg) (Naftz et al. 2008).

The greatest concern with the elevated mercury concentrations in GSL is that up to 31-60% is in the form of methyl mercury (MeHg). Since MeHg bioaccumulates in the food chain the greatest risk of exposure is to organisms, like the Phalarope that consume brine shrimp and brine fly larvae living in or near MeHg contaminated water. Methylated mercury is a potent neurotoxin (toxic to the central nervous system) up to 1000 times more lethal than its elemental state and is elevated in bird breast tissue samples and eggs collected throughout the GSL ecosystem.

MeHg is a byproduct of anoxic methanogenesis, iron reduction, and sulfate reduction carried out by bacteria in the sediment; consequently most forms of Hg that accumulate in aquatic sediments are prone to methylation in low oxygen environments. Of the three, sulfate reduction is generally the primary suspect for methylation in most environments. Normally, high salinity slows down or even prevents sulfate reduction and the formation of MeHg; however, this appears not to be the case in GSL. Although GSL is a hypersaline environ-

ment, MeHg levels are among the highest ever encountered by the (US Geological Survey) USGS testing lab.

Our research at the Center for Integrated Biosystems at Utah State University addresses the question of why the levels of MeHg are so high in GSL. We hypothesize that the high MeHg in GSL is due to a high rate of sulfate reduction. Our goals are first, to quantify sulfate-reducing bacteria in lake sediments and determine how much mercury they methylate, and second find out if MeHg becomes trapped in lake sediments. From that information, we can develop models that will help to predict MeHg production and release. By establishing which fraction (clay, organic matter, pore water, etc.) traps MeHg, we will better understand how much MeHg is available to the food chain. Because the GSL is such a complex and valuable ecosystem, the MeHg cycle—specifically the source of MeHg within the lake—must be thoroughly understood before any discussion of remediation can successfully take place. 🐛

Danielle M. Criddle,
USU Dept. of Plants, Soils and Climate, Logan, UT



LEGACY NATURE PRESERVE UPDATE

Located in adjacent to the Legacy Parkway Davis County, the Legacy Nature Preserve (LNP) is a unique area protected for wildlife use. As mitigation for the Legacy Parkway, the Utah Department of Transportation (UDOT) is required to successfully establish the 2,100-acre LNP. Success criteria are set forth in the LNP's permit under Section 404 of the Clean Water Act and include reducing weed cover to 20% or less, maintaining wetlands (about 900 acres) in good condition, and creating 12 acres of groundwater slope wetlands. Our adaptive management plan and accompanying resource management plans expand on success criteria and establish habitat goals intended to help the LNP fulfill its mission to provide quality wildlife habitats. The adaptive management strategy (AMS) we use on the LNP is based on identification of current conditions, development of management actions, and monitoring the response of bird and plant life to those actions.

Vegetation management was intensive across the LNP when initiated in 2007. Treatments have gradually been reduced and are now at maintenance levels in many areas. The primary vegetation management actions we use are mechanical (pulling, mowing), cultural (targeted livestock grazing), and chemical treatments. Specific and careful application of each of these methods has been a key to achieving the desired effects on vegetation structure and composition. Follow up restoration of areas after treatment has also been another key to improving habitat conditions on the ground. Over time weed cover has been reduced from over 25% to less than 10% across the site.

Water levels within the Jordan River floodplain portion of the LNP are adjusted to mimic natural fluctuations of flooding and draw-down that provide habitat diversity for wildlife, especially shorebirds and waterbirds. The results of monitoring indicate that the increase in water extent and changes in vegetation structure have increased priority bird use in many parts of the LNP. Inundation in the Jordan River floodplain has increased to nearly 270 acres in the spring and groundwater slope wetlands creation has exceeded 12 acres. Overall bird use has increased tenfold during peak migration times and over 100 species have been identified.

During the adaptive management phase we have implemented a volunteer program for habitat restoration and other cleanup activities. In 2010, approximately 1,000 volunteer hours were spent pulling weeds, transplanting wetland plugs into newly inundated areas, and spreading native seed across the landscape. Over 50 volunteers participated in the International Coastal Cleanup, where

over 1,000 pounds of garbage and debris were removed from the Jordan River along the western border of the LNP. The Utah Division of Wildlife Resources Dedicated Hunter Program Volunteers also participated in a variety of cleanup and habitat improvement projects. Although hunting is not allowed on the LNP, these Dedicated Hunter Volunteers helped improve habitat for nesting waterfowl and other birds in what has become an important refuge and resting area for these and other guilds.

The Legacy Nature Preserve Science Advisory Committee (SAC) was formed in 2006 pursuant to the stipulations of the Legacy Settlement Agreement. The SAC meets twice annually to review activities and progress, discuss and evaluate research activities and plans on the LNP, and to coordinate with other pertinent activities in the surrounding areas. SAC members include representatives from resource and regulatory agencies, and universities. The most recent SAC meeting was held on November 3, 2010. Agenda items included review of 2010 LNP management actions and monitoring results, the Legacy Avian Noise Study, and the Jordan River TMDL. The Legacy Avian Noise Study was initiated to help evaluate the potential effects of highway noise on birds. The fifth and final year of sampling for this study was completed in July 2010. Data analysis is currently underway, with a final report anticipated early in 2011. The experimental design, developed jointly with State and Federal resource agencies, included sampling on the LNP and six other wildlife preserves in the general area. Over 90 avian species (4000 to 5000 individuals per season) have been identified, generating a very valuable and unique avian population dataset. Nest surveys for avocets and stilts have shown a steady increase at the LNP in both number of nests and their success over the years, largely as the result of improved habitat.

Once LNP success criteria are satisfied, UDOT may transfer long-term management to a suitable third party. While adaptive management will continue in 2011, we are preparing for long-term management by identifying and developing steps needed for a successful transition and coordinating management responsibilities with interested candidates. For more information about the LNP, please visit www.legacypreserve.utah.gov.

Mike Perkins, HDR Inc.,
Tom Twedt, BIO-WEST,
Eric McCulley, SWCA Environmental Consultants, Inc.

DISCOVERING OUR LAKE

Running with Bison (and Antelope)



Image courtesy of Gregg Norrande

Tired of running on a treadmill all winter? Legs sore from pounding the pavement? Try Antelope Island for a rejuvenating trail running escape.

Several times a year, my trail running buddies and I head out to the island for a change of pace. We do so in winter when we're tired of running the Shoreline Trail because other trails are knee deep in snow, or in spring when trails in the foothills are a soggy mess. Or just when we feel like enjoying the beauty and serenity of the island and the surrounding lake.

Although we've run on Antelope Island dozens of times, each seems to be a unique adventure. One morning last spring it was so calm that Farmington Bay was like a polished mirror, with snowcapped mountains reflected perfectly on the water. Other times, we have to bow our heads as blowing snow whips into our faces. We've run the island when it's hot enough for shorts and a t-shirt (and a lot of sunscreen), or bundled in tights, multiple layers and wind-proof mittens.

Sometimes the sky is blue, the air is clear, and visibility across the lake is perfect. Other times we run through a shrouded mist, with vague impressions of the island's craggy peaks as our only "view". Either way is equally inspiring.

And yes, we have run with the bison and the antelope (and even an occasional coyote). One needs to be cautious with bison, of course. They may seem calm as they lumber across the trail, and usually pay scant attention to people, but they can be quick to startle. Getting gored by an angry bull would surely put a damper on your training schedule! Several times, though, while we jogged by at a safe distance, they've looked up and broken into their unique canter. Any runner would be amazed at how quickly 1500 pounds of bison can accelerate.

But for sheer grace and blinding speed, almost nothing compares to the island's herds of pronghorn antelope. It's one of those joys that occur only rarely, and if you're looking down at the rocky trail in an effort to avoid an embarrassing fall, you may well miss it. Just as you



Image courtesy of Gregg Norrander

crest a ridge, a blur of speed flashes across your path. They are gone almost before your foggy brain registers the sight, but the image of the line of fleet, lean antelope remains implanted in your memory.

Mostly we run Antelope Island for the solitude. But sometimes, you feel like having a party. Every year, on a Saturday in late March, hundreds of trail runners converge for the Antelope Island Buffalo Run, organized by local rocket engineer and trail running regular Jim Skaggs and his amazing volunteers. Participants range from casual joggers and walkers to trail running elite, but all test themselves against 25K, 50K, or 50-mile courses. Next year, some will tackle the first 100-mile version of the race. If running with bison for between 15 - 100 miles isn't enough fun, the party continues at the finish line, where organizers serve a mean buffalo stew, to which all racers contribute by bringing a can of ... whatever.

Some might bristle at hundreds of feet trampling the island in one day, but Park officials have been delighted by the event's low impact. If there is one way to get the

otherwise affable Jim Skaggs mad, it is to leave just one little gel packet tab on the trail. Some runners even return to the start with extra trash left over by other park users. For more information about the race and its strict "no impact" policy, go to <http://www.buffalorun.org/>.

I asked Jim why he takes so much time out of his busy schedule to put on this event. He said: "I love being a volunteer on the island's trail patrol. Running out here is such a unique experience, unlike anywhere else, that I just had to share it with my trail and ultrarunning friends. The state has a real treasure here that I hope is protected for generations to come." . 🐾

For a trail map: www.stateparks.utah.gov/img/maps/aispprintable.jpg.

Bob Adler is an avid runner and member of the FRIENDS Advisory Board

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FRIENDS of Great Salt Lake
P.O. Box 2655
Salt Lake City, UT 84110-2655
801-583-5593
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matt@celadonstudios.com

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XMission

Submission Deadlines: Sept. 16 (Fall), Dec. 16 (Winter), Mar. 16 (Spring), and June 16 (Summer). Submit articles and images for consideration to Lynn de Freitas ldefreitas@earthlink.net or call 801-583-5593.



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Lake Fact:

What was the lake elevation
in the North Arm when
Spiral Jetty was constructed?

Answer: 4195'



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Goats on the Legacy Nature Preserve by E. McCulley