A new administration with new priorities has brought an old topic back into the headlines: the Keystone XL pipeline.

It was over seven years ago that the first round of Keystone XL pipeline protests swept throughout Nebraska and beyond. With the heightened attention that the revival of the pipeline discussion has created, I would like to reiterate a point I made several years ago: no matter the outcome of the proposed Keystone XL pipeline, there will continue to be issues that strain and put our water supply at risk.

More succinctly: the fate of our aquifer does not depend on one pipeline.

Since we are once again debating the pipeline and its potential threat to groundwater, let’s look at the other threats I identified in an article published in The Aquifer at the height of the controversy: “Where Have you Been for the Past 25 Years.” (Winter 2012)

Nitrate Contamination

As discussed in the 2012 article, the Nebraska Department of Environmental Quality reported that in 2009, over 32 percent of groundwater wells tested across the state exceeded drinking water standards for nitrate. Today, the report shows that over 42 percent of wells sampled exceeded the Maximum Contaminant Level (MCL) for nitrate. What does this mean for our communities? It means hundreds of thousands, even millions, of dollars in costs to ensure its drinking water is safe for human consumption. It is going to take enormous efforts to get past these issues, but best management practices that effectively diminish the nutrient load are being widely adopted by producers. This is one step in the right direction. Homeowners in urban setting can also do their part in reducing nutrient loading by following recommended label rates of application for lawn and garden fertilizers.

Naturally-occurring Contaminants

There is also naturally occurring phenomena which can pose risks to groundwater supplies. These include elements such as arsenic and uranium, which can leach onto our groundwater. We also experience natural disasters which can impact the quantity and quality of groundwater. In the past seven years we have seen the extremes of weather, swinging from extreme drought Habt to devastating flooding.3

Energy Production

Also mentioned in the 2012 article was production of energy – with a focus on emerging technologies including hydraulic fracturing. As discussed in the article, the Niobrara shale formation, located in the northeastern Colorado,
Hydrogeologist Jim Goeke Joins Groundwater Foundation Board

Jim Goeke said he always knew he wanted to be a scientist, but when asked why he chose hydrogeology, his answer was "Thirst." Fall football practices and games throughout high school and college made him appreciate the countless bottles of water needed to sustain him.

Years later, Jim would become one of the foremost experts on Nebraska's groundwater. He was part of the founding of The Groundwater Foundation in 1985, and last week was elected to the Foundation’s board of directors.

“The Groundwater Foundation is thrilled to have Jim on our board,” said Groundwater Foundation President Jane Griffin. “As a hydrogeologist, His vast groundwater knowledge, expertise, and experience will be invaluable to the Foundation’s mission.”

Jim joined the University of Nebraska in 1970, after earning a Bachelors Degree from the University of Wisconsin and Masters Degree from Colorado State University. As a University of Nebraska professor and proud member of the University’s Conservation and Survey Division (CSD), Jim was responsible for the CSD/U.S. Geological Survey test hole drilling program to delineate the Ogallala Aquifer. Over 1,100 test holes later, he has an intimate familiarity with the Ogallala formation and its water riches.

According to his biography from the University's School of Natural Resources, Jim's main research interests dealt with groundwater and groundwater management, particularly under conditions of scarcity. He worked to gather data to model unconfined aquifers in the central Platte region and stream-aquifer research in the Republican River Valley. He served as the University's liaison to the Nebraska Well Drillers Association, and worked with USGS on the High Plains Regional Aquifer System Analysis (RASA) and the High Plains National Water Quality Assessment (NAWQA).

Jim retired from the University in 2001 and became a professor emeritus. Jim has long been active in education and outreach, given countless presentations about Nebraska's groundwater to schools and community groups, and has a long history of involvement with The Groundwater Foundation.

In 2001, Jim was awarded the Maurice Kremer Groundwater Achievement Award from The Groundwater Foundation, adding to his many accolades.

Study Reveals Much Groundwater Loss in California’s Central Valley

A new study by researchers from UCLA and the University of Houston reveals significant groundwater loss in California’s Central Valley during the recent drought and sparks questions of sustainability for the important agricultural area.

Researchers tracked net groundwater consumption in the Central Valley from 2002-2016, which included two droughts, one from 2007-2009 and the more severe drought from 2012 to 2016. The Central Valley is more than 18,000 square miles from the coast to the Sierra Nevada Mountains and is one of the largest agricultural hubs in the United States, providing more than half of the U.S. fruit, vegetable and nut crops.

During the two drought periods, a total of 16.5 cubic kilometers and 40 cubic kilometers of water were lost, respectively, according to the study. The more recent drought accounted for more than 10 cubic kilometers of water lost per year. Researchers attributed this to reduced precipitation and snow melt, a change in the type of crops being cultivated and hotter temperatures.

“For perspective, the amount of material associated with the 1980 eruption of Mount St. Helens was about one cubic kilometer,” said Dennis Lettenmaier, UCLA professor of geography who led the study. “So, we’re talking about 40 times that amount in the recent drought.”

During droughts Central Valley farmers are forced to use wells to replace water that would typically come from the Colorado River basin and the Sierra Nevada mountains. Adding to the severity of the groundwater depletion, the 2012–2016 drought coincided with Central Valley farmers transitioning from row crops to more high-value, thirsty crops like almonds, pistachios and walnuts, which are grown in groves. Unlike row crops, tree crops cannot be left fallow during dry years without jeopardizing the trees, and future crops.

The increase in groundwater loss occurred even with a reduction in the amount of irrigated land, which decreased 7 percent from 2007-2009 compared to the 2012–2016 drought. Higher temperatures during the more recent drought period and the transition from row to tree crops, accounted for most of the increase in groundwater loss.
between the two droughts, and more than offset the effects of a reduction in irrigated land, Lettenmaier said.

Groundwater usage for crop irrigation in the Central Valley is a well-documented and hot-button issue in California. There are an estimated 100,000 or more private wells in the area, some dating back to the 1930s, and many are unmonitored by state or federal agencies.

Using groundwater to irrigate crops has environmental and economic implications, Lettenmaier said. Subsidence is a concern, because as the water table lowers, the soil compacts. And a lower water table increases pumping costs for farmers.

In California's complicated water rights system, some of which is managed by the federal government, groundwater usage has been largely unregulated. But in 2014, California introduced legislation that requires local land planners and farmers to create (or join an existing) groundwater sustainability organization by the end of this year. They have until 2022 to come up with plans that will stabilize groundwater basins by 2040.

"It's fair to assume that there's going to be another drought, and fair to assume that there will be usage of groundwater in that drought too; the wells are already there," Lettenmaier said. "Now that this most recent drought is in the rearview mirror, there are still questions about how much natural recovery we can expect in groundwater and how water will be managed in the Central Valley."

The study accounted for evapotranspiration, or water released into the air through plant transpiration and soil evaporation, as well as precipitation, and surface water flowing into and out of the Central Valley.

Researchers used two methods to track groundwater levels, traditional water balance estimates—which take into account surface water inflow like rainfall and snow melt, soil moisture capacity and evapotranspiration — and data from NASA's twin satellite system called GRACE (Gravity Recovery and Climate Experiment).

"For this study, GRACE served as a unique tool that provided information on water volume changes directly from space, and corroborated the water balance estimates," said Hyongki Lee, a co-author of the study and a professor of civil and environmental engineering at the University of Houston.

GRACE estimates align with the water balance estimates, with some variance. GRACE data estimates that groundwater loss from 2012-2016 was 11.2 cubic kilometers per year, compared to water balance estimates of 10 cubic kilometers per year. While the water balance data showed some recovery of groundwater reserves in non-drought years, GRACE data does not reflect that.

"Although both water balance-based and GRACE-based groundwater volume estimates are subject to errors, the relatively small area of the Central Valley in the eyes of GRACE might also be responsible for that recovery discrepancy," Lee said.

Researchers hope future studies will address actual recovery between droughts and whether recovery from the most recent drought is on track to replenish the system.☼

### Increasing Aridity and Land-use Overlap Have Potential to Cause Conflict

Climate change combined with overlapping high-intensity land uses are likely to create conditions detrimental to the recreation economy, wildlife habitat, water availability and other resources in hyper-arid landscapes, or drylands.

Drylands are of concern because broad-scale changes in these systems have the potential to affect 36 percent of the world’s human population.

The findings are based on an analysis of trends and spatial data for the Colorado Plateau, a drylands region that covers parts of Arizona, Utah, Colorado and New Mexico, by researchers from Northern Arizona University and the U.S. Geological Survey. The research team examined the combined effects of climate change and human land use—agriculture, recreation, energy, mining and population growth—on a range of ecosystem functions and landscape attributes.

“Our approach offers a relatively simple method for scenario development that could be applied to a wide range of change agents, ecosystem services and regions," said lead author Stella Copeland, NAU Merriam-Powell Center post-doctoral scholar.

The study examined four scenarios to estimate how climate change and overlapping land uses may influence ecosystem functions and landscape attributes. Although outcomes varied by scenario and characteristic, the recreation economy had the highest impacts for all scenarios; followed by vegetation and wildlife habitat and cultural and spiritual values; water availability; soil productivity; and cropland productivity.

The findings suggest that the recreation economy is vulnerable to negative impacts associated with the high degree of spatial overlap between areas of high recreation intensity, aridification, and petroleum and renewable energy development.

“These results illustrate remarkably rapid growth in both recreation and energy development on the Colorado Plateau over the past few decades,” said John Bradford, a USGS research ecologist and co-author of the study. “Higher intensity land use and warming is likely to lead to increased conflict and added complexity for resource managers.”☼
parts of Wyoming, Nebraska and Kansas, was a spot of interest for many companies. In fact, many companies were busy leasing land for potential future drilling.

So, what has happened over the past few years? All exploration has basically come to a grinding halt. There are a few reasons for this, but primarily because of a collapse in natural gas prices. Nonetheless, in an effort to be proactive on this issue, the Nebraska Oil and Gas Conservation Commission conducted a specific set of rule revisions, which included policies requiring disclosure of procedures for any fracking in our state.

**What’s the Solution?**

**Community Preparedness**

Communities need to be prepared with emergency plans in place in order to mitigate the impacts of natural disasters and other potential contamination events.

Did you know over 22,000 miles of pipelines crossing the High Plains Aquifer already exist? Many of these pipes are decades old. They were built before safety precautions and regulations were in place. These pipelines are aging, and as a result, vulnerable to breaking down and leaking.

Preparedness and planning can help communities be vigilant in protecting their drinking water supplies. Adopting monitoring systems can assist in preventing major problems, such as the City of Seward, Nebraska did when faced with a pipeline crossing their wellfield.

**What’s the Solution?**

**We Each Do Our Part**

Effective policy is part of the solution. The other, and perhaps more important, part of the solution is each of us.

We are the ones putting the demands on our groundwater supply for our nourishment, shelter, and the comforts of a modern society. By making wise choices we can collectively diminish the demand and negative impacts on our groundwater supply:

- Follow label instructions when applying fertilizer to your yard – there’s no need to put on extra!
- Sweep up any fertilizer that lands on surrounding pavement so it isn’t washed down storm drains.
- Use native plants and grasses in your yard – they naturally require fewer inputs (water and fertilizer) and are adapted to your region’s climate.
- Install a moisture sensor on your sprinkler system so you only water when the plant truly needs it.
- Get involved in groundwater protection and education as a Groundwater Guardian.
- Make sure your community’s groundwater supplies are protected through a state-approved wellhead protection plan.
- Recruit green spaces in your community to be Green Sites.
- Make sure your kids are learning about groundwater in school.

The fate of the aquifer depends on each of us. Do your part by adopting the best management practices that you, your family, your business and your community can!

As I said in 2012, groundwater is our unsung hero – sustaining life and livelihood. It is most often out of sight, out of mind. We need to keep groundwater in the forefront of our conversations and in the forefront of the decisions that we’re making. While we recognize it is not the only consideration and topic to be discussed, we have to ensure it has a place at the table.

Let’s show groundwater our appreciation. Let’s look for actions we each can take to be part of the solution, and not look to blame elsewhere. Let’s focus on what each of us can do. The fate of the aquifer depends on us.

**References**


The Keystone pipeline was constructed three-quarters of a mile upgradient of the City of Seward’s south wellfield. Because a leak from the pipeline could potentially be transported into the city’s south well field, the community took action, revising their wellhead protection plan and installing a monitoring system for the wellfield. The system, which is monitored by the U.S. Geological Survey, verifies the direction of groundwater flow, estimates the depth of the aquifer, samples wells in the vicinity of the well field for nutrients and volatile organic compounds, and conducts passive soil sampling. The technology developed for this project is designed to provide early detection of leaks and potentially can be used in other areas where drinking water could be at risk.
Since 2013, The Groundwater Foundation (GF) and the Girl Scouts Spirit of Nebraska Council have teamed up to help passionate young scientists earn their Let's Keep It Clean! patches and learn about groundwater and environmental stewardship. The Let's Keep It Clean! patch booklets include a number of activities from the GF’s resource library, including making water cycle bangles, experimenting with runoff and recharge, and making a center-pivot irrigation model. Many of these activities overlap with certain journeys the Girl Scouts must complete in order to earn their Bronze, Silver, and Gold Awards.

Troop 20605 co-leader, Dana Hartung, took advantage of this overlap and encouraged her Brownies to pursue hydrology, something she’s always been deeply connected with. Dana grew up on a farm and learned early on that all parts of the environment interacted with each other. With her own daughter, Dana wanted to make sure that despite living in the city of Lincoln, Nebraska, environmental stewardship was a significant part of her daughter’s education. What Dana found, however, was that many of her daughter’s friends were totally unaware of the water cycle and the dangers of pollution. When her daughter’s troop leader, Stephanie Hill, asked Dana to come on as a co-leader, she knew this was her opportunity to get these girls thinking about water on local and global scales.

When Dana attended the GF’s 30th Anniversary Conference to find out more about groundwater education in the Lincoln area, she attended a pre-conference workshop that was co-led by the GF and older Girl Scouts. She learned how to use the Awesome Aquifer Kit and was introduced to several other educational games and downloadable apps that could easily be adjusted to a young Brownie troop. The seven girls have since been able to explore Nebraska’s groundwater and complete their WOW! Wonders Of Water journey through a number of interdisciplinary hands-on activities. They discovered the mathematical significance of drinking water by comparing models of the total volume of water in the world to the volume of water they can use (1%). They created artful bracelets with beads that correlated to the different steps in the water cycle. They practiced the scientific method by investigating where their daily water comes from and toured a water treatment plant to find out where it goes when they’re done using it. At the beginning and end of each school year, they celebrate with a water discovery troop meeting outside, but even when the weather’s cold, they are able to keep track of their water use with the GF’s Water1der app.

With the girls’ growing knowledge of local groundwater issues, Dana knows the next step is to introduce them to water on the global scale. She wants the girls to acknowledge the privilege of having freshwater available at every tap, so she has begun to ask them where in the world people might not have water. Dana plans to start in other parts of the US, teaching them about the Navajo people’s inability to regularly access clean water. Eventually, she hopes the troop will make the connection to water rights and conservation in other countries. The biggest struggle for the girls now is to find the confidence to ask questions about what they’re learning, but Dana is impressed with how far they’ve come. With each chance to review, more and more answers are confident and correct and the girls have gotten excited about the prospect of continuing their hydrogeology education.

Dana and her troop are some of the biggest supporters of the continued cooperation between the GF and the Girl Scouts. The soon-to-be Juniors will begin working on their Let’s Keep It Clean! Junior patch after their bridging ceremony and Dana hopes that her daughter will be inspired to do a project about groundwater protection to earn her Bronze Award. “Girl Scouts learn to do so much for the environment like not litter, plant trees, and recycle,” Dana says. “I’m excited that now there’s a path for them to learn about water, our most precious resource.”

For more information about the Let’s Keep It Clean Patch program, visit http://www.groundwater.org/kids/getinvolved/girlscouts/.

www.groundwater.org | Volume 31 Number 4
Developing Science Literacy Through Environmental Education

by the WELS2 Project Team

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Around the globe, humans face an array of contemporary challenges associated with food, energy, and water systems. To prepare future generations of problem-solvers equipped to address these challenges, education must go beyond merely disseminating information. The Environmental Protection Agency (EPA), for example, has identified important components of environmental education that include an emphasis on awareness, knowledge and understanding, attitudes, skills, and participation in environmental challenges. When focused on these challenging issues of today, science literacy can involve:

- Explaining, describing, predicting natural phenomena
- Considering multiple viewpoints and different stakeholders invested in the system
- Identifying issues, biases, or limitations within research
- Accounting for various mechanisms and their effects within a system
- Evaluating the validity of data collection methods
- Creating and evaluating arguments around environmental topics
- And a myriad of other science-oriented tasks and practices

This knowledge and the associated skills define scientific literacy about interactions between humans and the environment. Supporting audiences to become more scientifically literate requires cultivating a culture and perspective that values critical thinking, problem-solving, and informed decision-making.

For example, decisions about water resources are complicated and involve human and environmental concerns. A scientifically-literate person is one who’s prepared to ask questions such as: Who/what benefits from resource allocation? Who/what might be hurt by these decisions? What evidence do we have to support these claims and how did we obtain that evidence? How will this impact the water availability for others? Have we considered the natural and economic factors will be influenced? And these are only a few aspects to consider. While issues like this are complicated, frameworks like the ones developed at the University of Nebraska help untangle them by providing guidance such as where to start, who to ask for help, and how to educate ourselves.

Another way these key components of environmental education are highlighted and science literacy is supported is through the adaptation of state and national standards that acknowledge the role of ‘science practice’ as a way of doing and knowing science and requesting these practices be taught in the classroom. Teachers can support students through meaningful and directed educational experiences by providing opportunities to develop knowledge about food, energy, and water issues (e.g. water resource management) and scientific practices (e.g. scientific modeling).

One aspect of environmental education that can prove challenging for learners of all ages centers on the complexity of hydrological phenomena.

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The University of Nebraska Lincoln’s framework for Science Literacy. UNL applies a theoretically-grounded perspective on science literacy to foster a scientifically literate society capable of making effective decisions grounded in STEM-informed analyses of complex, real-world challenges associated with food, fuel, water, landscape, and people issues.
Complicated environmental issues develop around balancing humans’ use of groundwater against depletion and recharge rates. Supporting and fostering critical thinkers who can find solutions for these multifaceted issues will take dedicated educators who are well versed in science practices and environmental education.

A program targeted to support these dedicated teachers to provide quality classroom instruction is the WELS2 project. Based at UNL, this project is a collaboration between the UNL Science Literacy Program, Daugherty Water for Food Global Institute, and The Groundwater Foundation.

The WELS2 project (Water Education Leaders for Secondary Science) is committed to providing high school and middle school teachers in Nebraska with the training, supplemental educational materials, and experiences around hydrological phenomena, to support their food, energy, and water education efforts in the classroom. Through this professional development program, teachers can earn up to 9 hours of graduate course credit through the College of Agricultural Sciences and Natural Resources at the University of Nebraska-Lincoln, as well as a stipend, to support their ongoing professional learning. WELS2 introduces teachers to various resources including computer-based water modeling tools, pedagogical strategies for encouraging students’ model-based reasoning about water, and strategies for grounding these experiences in real-world, issues-based contexts. Teachers will learn to use these resources to develop their professional skill sets, as well as how to use them in their classrooms to enhance their students’ learning about water systems. Participating teachers use part of this experience to collaborate with educational specialists and scientists and tailor resources suited to their students’ needs. This collaboration is an important facet of the project which highlights the expertise of the participating teachers to assess and develop materials specifically for their use. If you are interested in joining this program or would like to learn more, please inquire at http://go.unl.edu/wels2.

Environmental education is an important part of supporting and developing science literacy in audiences of all ages. Educators who wish to help students develop these tools for critical thinking, reasoning, and problem-solving need to be supported and provided opportunities to do so. By partnering with institutions like the UNL Science Literacy Program, Daugherty Water for Food Global Institute, and The Groundwater Foundation, educators can leverage additional tools and resources delving deeper into environmental challenges and supporting their students in building critical thinking, problem-solving, and decision-making skills.

WHAT IS SCIENCE LITERACY?
An enhanced capacity, both at the individual and collective levels, to make effective decisions grounded in STEM-informed analyses of complex, real-world challenges.

WHAT DOES THIS MEAN?
By supporting students’ to learn science, they will naturally employ this knowledge as a tool to analyze and make effective decision about challenging real-world issues.

To find out more about the WELS2 project, or to get involved, visit http://go.unl.edu/wels2 or contact Cory Forbes at cory.forbes@unl.edu.
In the summer of 2010, Los Angeles lost about 100 gallons of water per person per day to evaporation, mostly from overwatering of lawns and trees.

Lawns accounted for 70 percent of the water loss, while trees accounted for 30 percent, according to a study published in May 2017 in the journal *Water Resources Research*. The research was funded by the National Science Foundation (NSF) and conducted by Diane Pataki and Elizaveta Litvak of the University of Utah.

The results, based on data collected before Los Angeles mandated watering restrictions in 2014, show a pattern of systemic overwatering of the city’s lawns, and a surprising water efficiency of its tree cover. The researchers also found a correlation between water loss and household income.

The water loss that Pataki and Litvak measured is called evapotranspiration (ET), the evaporation of water from the soil and the transpiration, or release of water vapor, from plants. ET rates depend on several factors, including plant type, temperature, humidity and the amount of water in the soil.

According to the scientists’ measurements, Los Angeles’ soils were an abundant source of water during the drought, largely a result of lawn overwatering. Imagine placing a soaking wet towel out to dry on a hot summer day: it’s a thoroughly wet surface, and should evaporate quickly. Water loss from an over-irrigated lawn is similar because transpiration from the grass pumps water from the soil to the atmosphere.

“California’s recent drought highlights the need for urban water conservation,” says Tom Torgersen, program director in the Division of Earth Sciences in NSF’s Geosciences Directorate, which funded the research. NSF’s directorates for Biological Sciences and Social, Behavioral and Economic Sciences also funded the research.

Torgersen says that for Los Angeles, the greatest ET was due to turf grass and seed-producing trees. Palm trees made very small contributions.

“Both provide an alleviation of the urban heat island effect and reduce the need for air conditioning,” Torgersen says. “However, the benefit is not evenly shared. The higher the median income, the greater the local ET, with cooler temperatures in wealthier areas and higher temperatures in poorer sections of the city.”

To measure ET from lawns, Litvak devised a shoebox-size chamber that measured rapid changes of the temperature and humidity above the grass.

Pataki, Litvak and their colleagues traveled around Los Angeles in the summer of 2010 and the winter of 2011 taking measurements to develop a mathematical model of ET rates from lawns under different conditions.

They tested the hypothesis that wealthier neighborhoods had more plant cover and cooler temperatures than poorer areas.

ET rates in the wealthiest neighborhoods, they found, were roughly twice those of poorer neighborhoods. That’s probably due to a variety of factors, Pataki and Litvak say, including the larger lot sizes of more expensive properties.

Trees emerged as the water-saving heroes of the study, using far less water than grassy lawns.

Trees have a much lower leaf surface area and don’t directly irrigate their leaves, so they are less prone to evaporation. Also, trees regulate their transpiration rate in response to the surrounding humidity. Under dry conditions, trees will rein in transpiration so they can retain water.

“It’s surprising that we can maintain the tree canopy of L.A. with relatively little water,” Pataki says. “There’s this assumption that we need abundant irrigation to support trees. But we can drastically reduce water use and still have trees.”

This spring, Los Angeles’ watering restrictions were lifted after California’s very wet winter.

Pataki says it’s too early to tell whether Los Angeles residents’ watering patterns and landscaping choices will return to pre-drought excesses.

“Whether the drought changed people’s landscape preferences in a lasting way, that’s something we still need to find out,” she says.
In September of 1996, I participated in a program sponsored by the local Chamber of Commerce called Leadership Marshfield. To graduate from the program, participants were required to form teams and select a project that would have a significant impact on their community. In my position at Marshfield Utilities, I worked closely with the water department so I was very interested in a project that would involve water. Another Marshfield Utilities employee, Dave Wasserburger, also participated in the program and the two of us were able to gain enough interest to form an environmental team. That team graduating from Leadership Marshfield in 1997 included Terry Knoll, Cathy Lotzer, Chris Raasch, Arden Rindfleisch, and Dave Wasserburger.

Introduction to the Groundwater Foundation

In October of 1996, my former manager at Marshfield Utilities, James Trierweiler, came across a brochure from The Groundwater Foundation advertising an environmental education program called Groundwater Guardian. The organization was meeting in Oakbrook, Illinois in November of 1996 to celebrate communities receiving Groundwater Guardian designation.

Jim asked if I was interested in attending to learn more about the program. From the brochure, it looked like a great project for us to suggest to our Leadership Marshfield environmental team. I attended the conference and fell in love with the Groundwater Guardian program. At our next Leadership meeting, I shared information about the program with our team and everyone agreed that it was a perfect fit for us to work on as a project.

The Work Begins

Our team began work in early 1997 applying for entry to the program, recruiting additional team members, and completing ROAs (Result Oriented Activities) within our community. One of our first activities was the Spencer Water Festival in May of 1997. Later that fall, Tom Drendel and I attended the conference in Oakbrook, but this time to accept the first Groundwater Guardian Designation for Marshfield.

In our first years of Groundwater Guardian participation, our focus was educating our community about the importance of protecting our precious groundwater. We explained that Marshfield’s water supply was vulnerable because we sit on a sole source aquifer, which is shallow and easily susceptible to surface contamination. ROAs those first few years were aimed at elementary school children. We felt it was important for children to learn early in their lives about the water cycle and the resource that serves their community.

Other activities led by the group have included teacher workshops, wellhead protection videos, groundwater model presentations, fair exhibits, TV shows, rain gardens, pharmaceutical take-back programs, Green Site sponsorship, community green expos, and the Girl Scouts Let’s Keep It Clean patch program.

Of all our activities, we are the most proud of our Rx Round-Up Pharmaceutical Take Back Program. We began in May of 2006 with a series of one-day collections. In 2009, we worked with the Marshfield Police Department to house a permanent collection site in their lobby. Since that time, we have collected well over 10,000 pounds of pharmaceuticals. No small accomplishment!

On March 24, 2017, the Marshfield Groundwater Guardian group held an event to celebrate the organization’s 20 years and acknowledge local leaders for their work with the program. Awards were presented that evening to Milladore Groundwater Guardian Team, Good Neighbor Award; Marshfield Police Department, Partner Award; Norb Salamonski, Volunteer Award; Jeff and Treva Tisdell, Caring Couple Award; Marshfield Utilities, Champion Award; and Cathy Lotzer, Leadership Award.

The Groundwater Guardian team is very proud of all we’ve accomplished the past 20 years. However, we know that there is still much work to be done in our community. We recognize that our groundwater resource will always need a “voice” and our team will continue to be that voice for Marshfield.
Be in Boise!
Boise, Idaho Will Host the 2017 Groundwater Foundation National Conference October 24-26

Idaho's capital city has a lot to offer! Not only is Boise one of the original Groundwater Guardian pilot communities (and has been designated every year since 1994!), but it is home to natural beauty, a focus on sustainability, and unique attractions.

Come early or stay late in Boise and check out these area features and attractions:

**Greenbelt/Boise River**
The Boise River Greenbelt stretches 25 miles along the Boise River providing a place for fishing, biking, roller blading, jogging, or a leisurely stroll. Bicycles are available for rent at a variety of bike shops.

[www.cityofboise.org/parks](http://www.cityofboise.org/parks)

**Basque Museum and Cultural Center**
Just one block from the conference hotel (The Grove Hotel), this unique attraction provides a look into the heritage of the Basque communities of Idaho. Tour the Cyrus Jacobs-Uberuaga Boarding House, one of few remaining in the west.

[www.basquemuseum.com](http://www.basquemuseum.com)

**Southwest Wine Region**
The history of Idaho wines dates back to 1864 when the first grapes were planted. A perfect combination of soil, climate, and water, Idaho is home to more than 50 wineries to explore, many near to Boise.

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

**Idaho State Capitol**
In the heart of downtown, less than a 10 minute walk from The Grove Hotel, Idaho's State Capitol is one of the state's most treasured buildings. It's the only capitol in the U.S. heated by geothermal water. The building is open 24/7.

[www.capitolcommission.idaho.gov](http://www.capitolcommission.idaho.gov)

**First Thursday**
Stick around after the conference ends and stroll through the unique shops and galleries in downtown while enjoying in-store entertainment and special events from 5:00 - 9:00 p.m.

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

Find out more about what to do in Boise at [www.boise.org](http://www.boise.org).

Find out more about the 2017 Groundwater Foundation National Conference at [www.groundwater.org/conference](http://www.groundwater.org/conference). Early bird registration will open soon!

Images courtesy of Boise CVB.