

THE MEADOWS CENTER FOR WATER AND THE ENVIRONMENT

Annual Report 2018-2019



THE MEADOWS CENTER
FOR WATER AND THE ENVIRONMENT
TEXAS STATE UNIVERSITY

MEMBER THE TEXAS STATE UNIVERSITY SYSTEM

 www.MeadowsWater.org



OUR MISSION

Inspiring research, innovation and leadership that ensures clean, abundant water for the environment and all humanity.

OUR VISION

A world where all people understand and embrace the value of water and environmental stewardship.

OUR FOUR PILLARS

The Meadows Center fulfills its mission by integrating activities across four pillars of action in powerful ways. Our work in each of these pillars begins at Spring Lake – one of the largest artesian springs in the world – and ripples outward across Texas and beyond.



LEADERSHIP



RESEARCH



EDUCATION



STEWARDSHIP

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A LETTER FROM OUR INTERIM EXECUTIVE DIRECTOR

Dear Friends,

This letter comes at a time of key transition for our organization. In March, I was named the Interim Executive Director of the Meadows Center to build on the successful 17-year tenure of outgoing Executive Director, Dr. Andrew Sansom. Emily Warren also began a new position as the Water Program Officer for the Cynthia & George Mitchell Foundation after serving as our Associate Director for over fifteen years.

As the successor to the foundation of excellence that Dr. Sansom and Mrs. Warren paved, I am incredibly humbled and honored to continue their legacy and lead the center into its next chapter.

With the many changes that occurred, one thing has always stayed consistent – our commitment to developing and promoting programs and techniques that ensure sustainable water resources for human needs, ecosystem health and economic development.

The incredible work done at the Meadows Center provides the knowledge and multi-disciplinary research necessary to allow decision-makers to tackle the tough decisions facing our natural resources in Texas and in communities around the world.

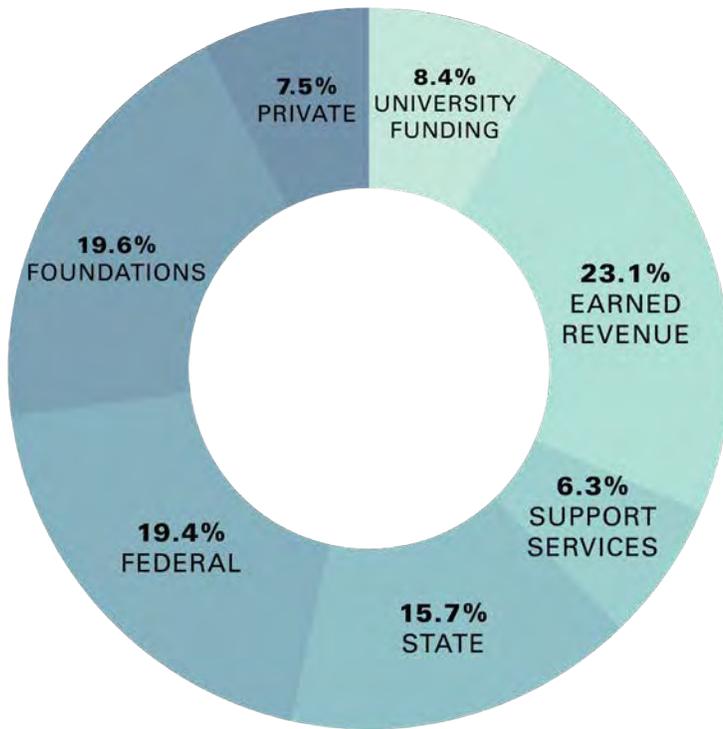
I am very proud to share that our flagship citizen science program, Texas Stream Team, received a Texas Environmental Excellence Award from the Texas Commission on Environmental Quality in May. This program is just one example of how we bring together a mix of diverse community partners and stakeholders to make improvements to the environment.

As you read this annual report, we hope it will remind you of our recent successes and energize you for the future of our organization. With your support, along with the hard work and dedication of our expert staff and faculty, the Meadows Center looks forward to another year of building a bright and flowing future for our water resources.

Your friend in water,

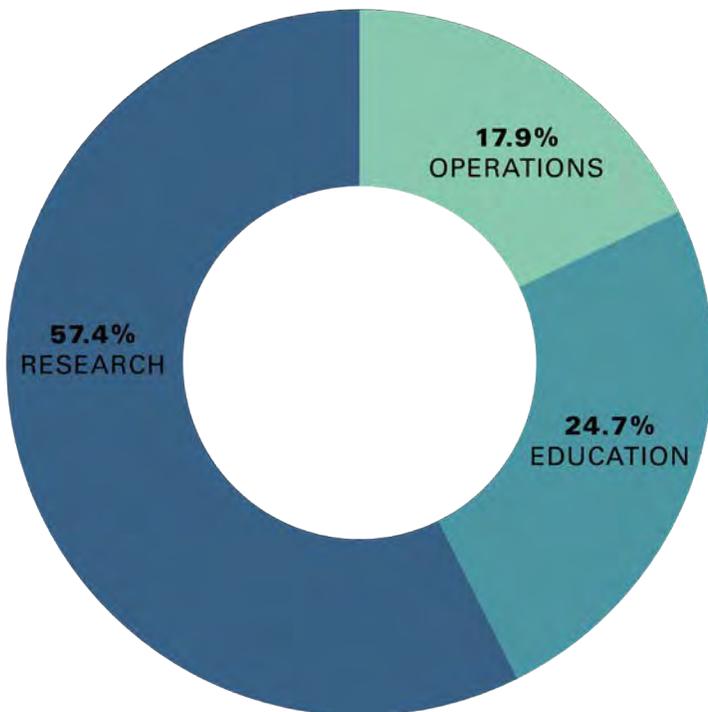
Robert E. Mace, Ph.D., P.G.

OUR FINANCIALS



REVENUE

EARNED REVENUE	\$846,513
FOUNDATIONS	\$718,565
FEDERAL	\$711,065
STATE	\$306,570
UNIVERSITY FUNDING	\$576,434
PRIVATE PHILANTHROPY	\$273,666
SUPPORT SERVICES	\$229,861
TOTAL	\$3,662,674



EXPENSES

RESEARCH	\$1,856,065
EDUCATION	\$799,683
OPERATIONS	\$580,571
TOTAL	\$3,236,319

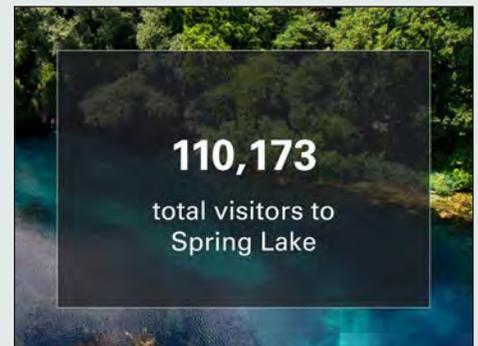
OUR YEAR IN NUMBERS



\$1,816,281
research dollars awarded
to our faculty & staff



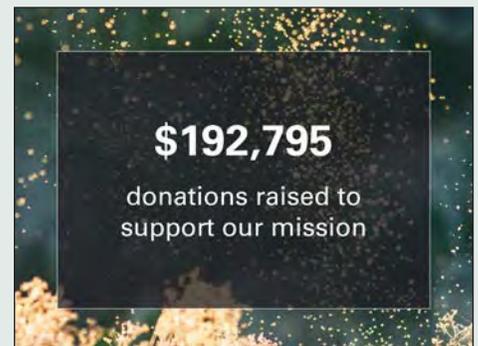
132
University students
supported by research &
education projects



110,173
total visitors to
Spring Lake



33,372
school children & university
students engaged in
outdoor learning



\$192,795
donations raised to
support our mission



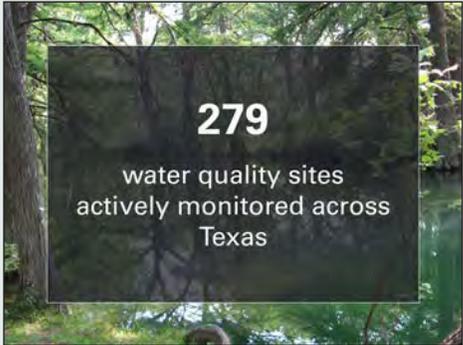
590
citizen scientists trained in
water quality monitoring
through Texas Stream Team



9,117 m²
of non-native vegetation
removed from Spring Lake
& the Upper San Marcos
River



8,135
native species planted in
Spring Lake and the Upper
San Marcos River



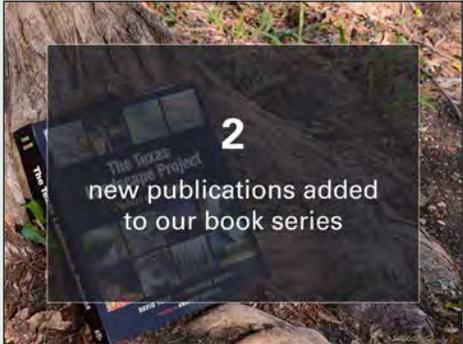
279
water quality sites
actively monitored across
Texas



232
new volunteer divers
trained to help manage
Spring Lake



3,415
hours spent sampling
water quality



2
new publications added
to our book series

ADVANCES TO OUR STRATEGIC GOALS

The Meadows Center has achieved great things this year thanks to our dedicated staff and network of supporters. We led the way to finding solutions for complex water and environmental challenges in Texas and beyond. We also made progress towards the five goals outlined in our 2017 –2023 Strategic Plan. There is much progress to celebrate!

Strengthen research program and the infrastructure platform that supports Texas State’s research community.

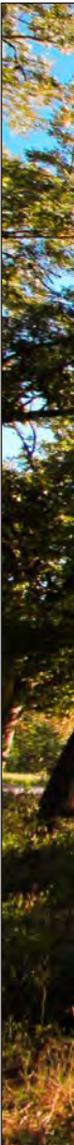
- Awarded 22 research grants, totaling more than \$1.8 million in research dollars for Texas State University.
- Received approval from the U.S. Environmental Protection Agency and the Texas Commission on Environmental Quality to implement the Upper San Marcos Watershed Protection Plan.
- Employed five graduate research assistants to support the Meadows Center’s grant-related projects.
- Approximately 10,000 people reached through educational speaking engagements in Texas and beyond.
- More than 250 articles, abstracts, reports and papers published by faculty and staff about the Meadows Center’s water-related news and research.

Implement the next phase of restoration and stewardship enhancement projects at Spring Lake.

- Completed restoration work on glass-bottom boat 1963, the third of five historic boats to receive a new fiberglass hull.
- Recruited and trained 232 new Aqua Corps volunteer divers to conduct restoration work in Spring Lake.
- Completed an emergency stabilization project for Spring Lake Dam, addressing damage from the October 2015 flood and returning the dam to its pre-disaster condition.

Contribute to the learning and enrichment of Texas State students.

- Employed 132 Texas State students to support the Meadows Center’s education and research programs.
- Engaged 7,295 university students on a glass-bottom boat tour, teaching them about the importance of water conservation.
- Dr. Rob Dussler, Director of Spring Lake Operations and Chief Education Officer, was appointed as a lecturer for the Department of Health and Human Performance at Texas State.
- Hosted more than 20 events on campus and at Spring Lake focused on water education.
- Led a team of Texas State biology students to conduct habitat restoration work as part of the Edwards Aquifer Habitat Conservation Plan.
- Awarded Aaron Raper, applied geography graduate student at Texas State, the Graduate Fellowship Endowment to work on research projects at our center as a Graduate Assistant.
- Awarded the Don and Reba Blaschke Scholarship for the Protection of the San Marcos River to Eryl Austin-Bingamon, Texas State biology undergraduate student.
- Supported Nestlé Waters North America in coordination of a \$10,000 “Every Drop Counts” Earth Science Scholarship to Texas State University doctoral student, Dawn Houston.



Strengthen and expand work on conservation leadership to address the grand challenges facing water resources in Texas and beyond.

- Provided field trips for free or at a reduced cost to seventh grade students in Hays County, teaching them about the importance of our natural resource through Texas Essential Knowledge and Skills (TEKS)-aligned curriculum at Spring Lake.
- Deployed the Central Texas Feral Hog Task Force in Hays, Caldwell and Guadalupe County to track and abate the extensive ecological and economic damage associated with invasive feral hogs.
- Spearheaded design of first One Water School in Texas for a new primary school in Wimberley to reduce its water footprint.
- Continued partnership with the Texas Water Resources Institute and the Texas Water Journal to publish Texas+Water, a monthly newsletter that provides information about Texas water.

Strengthen and broaden the leadership and management capacity at the Meadows Center to ensure its long-term success.

- Added four new Fellows to advise and support the Meadows Center's research programs and initiatives. The new Fellows include Dr. Kelly Albus, Dr. Mario Garza, Sharlene Leurig and Vanessa Puig-Williams.
- Hired Collin Garoutte and Christopher Riggins as Grant Specialists to strengthen efforts related to the Edwards Aquifer Habitat Conservation Plan.
- Hired Aspen Navarro as Program Coordinator of Watershed Services to assist communities in implementing watershed protection plans and support Texas Stream Team.





PROGRAM HIGHLIGHTS

Of the numerous projects and initiatives that the Meadows Center directed in fiscal year 2019, the following select achievements from across our four pillars showcase the scope and diversity of work we undertake with partners in pursuit of our mission.



RESEARCH HIGHLIGHTS

Faculty, staff and students at the Meadows Center conduct applied research to address real-world problems. Our researchers provide multi-disciplinary expertise to advance science-based solutions for the most pressing water resource challenges facing Texas and the world beyond.



How Much Water is in the Guadalupe River Basin?



© Tricia Zeigler

Over the past several years, the Meadows Center’s “*How Much Water is in the Hill Country?*” research efforts have focused on developing baseline groundwater-surface water interaction and water quality data for Onion Creek, and the Blanco and Pedernales Rivers to gain a clearer understanding of the complex hydrogeology of our Hill Country rivers, aquifers and springs.

The results of our findings to date have helped quantify how much of the surface flows of the rivers come directly from groundwater and vice versa. These findings have direct relevance to many communities that rely on Hill Country streams and rivers as the source of their drinking water and livelihood as well as aquatic organisms living in the river. Thanks to the generous support of the Cynthia & George Mitchell Foundation, this year we expanded our research to the Guadalupe River Basin, from its headwaters to tide waters.

The first phase of investigation into the Guadalupe River included a desktop study. Findings indicate that surface water/groundwater interactions are dominated by the flow contribution of the Plateau Edwards headwaters spring system, Comal Springs, San Marcos Springs, Hueco Springs, Pleasant Valley Springs and Jacob’s Well. An analysis of stream gage data indicate decreasing discharge trends since 2000.

The preliminary report identified several data gaps that were further studied in phase two. This next phase found that baseflow has decreased in the Guadalupe River. The climate data was then added with baseflow data, which showed increasing temperature and decreasing precipitation trends in the representative counties that support the analysis. Impacts of rapid population growth and dynamic changes in land cover/use cannot be denied in this regard as they are putting pressure on both the ground and surface water.



<http://bit.ly/31R9Lpt>



RESEARCH

Assessing Water Use and Conservation Potential for Highland Park

With funding from the Meadows Foundation and the Town of Highland Park (Highland Park), the Meadows Center completed a nine-month project in June 2019 that explored water use and conservation potential for Highland Park, with the goal of developing tailored recommendations that reduce per capita water use within the town. The project was led by Dr. Tim Loftus, Meadows Endowed Chair in Water Conservation and Chief Conservation Officer, and Jaime P. Murata, Texas State University graduate student in applied geography.

The project team found numerous opportunities and potential to achieve measurable progress in water conservation for Highland Park. With key investments made in advanced meter technology and data management software, Highland Park is positioned well to become a model community of water-use conservation and management. The final recommendations from the project team include the following:

- In order to benefit fully from the promise of a water conservation program, Highland Park should hire a new conservation coordinator whose focus will be to develop and manage a new water conservation program.
- Highland Park should phase out use of potable water on their town-owned properties by making a commitment to showcasing native and regionally-appropriate (i.e. drought tolerant) plants and using either rainwater or reclaimed water when watering is necessary.
- Current Highland Park water rates and the tiered-rate structure should be re-imagined to both pay for and incentivize water-use conservation.
- Highland Park must actively engage with the Highland Park Independent School District and other willing collaborators in order to ensure that K-12 school-aged residents adopt a water conservation ethic to carry forward in life.
- Highland Park should invest in data development about average lot size, landscaped area per lot, and turf grass per lot.
- Reducing outdoor watering should be emphasized in a new water-conservation program.



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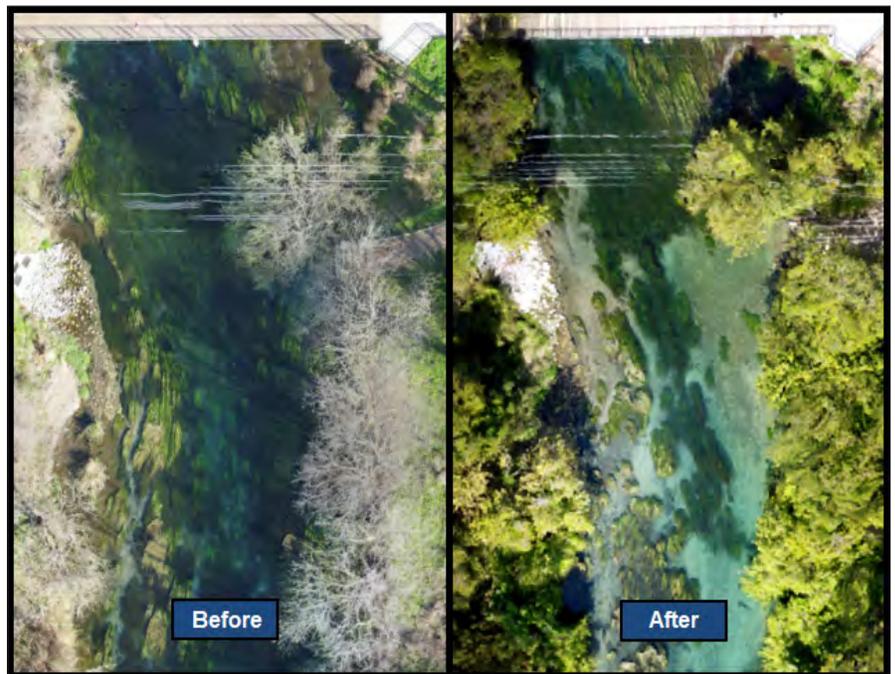
Edwards Aquifer Habitat Conservation Plan Updates

The Edwards Aquifer Habitat Conservation Plan is a cooperative effort to protect groundwater resources of the southern portion of the Edwards Aquifer both for people in the region and the endangered species that depend on the aquifer for survival.

Since 2013, the Meadows Center's Biology Field Crew has played an active role in the implementation of the conservation measures outlined in the habitat conservation plan to protect the springflow and habitat of the San Marcos Springs and San Marcos River. The following highlights were achieved by our biology field crew in partnership with the City of San Marcos in 2019.

Texas wild-rice Enhancement and Restoration: In 2019, aerial coverage of Texas wild-rice, a federally listed endangered species endemic to the San Marcos River, was expanded by approximately 1,351 square meters through maintenance of existing plants and new plantings. Since 2013, Texas wild-rice has expanded an estimated 7,046 square meters, or 158 percent, through planting and natural expansion.

Reduction of Non-Native Species: Our Biology Field Crew removed a total of 9,117 square meters of non-native vegetation from Spring Lake and the San Marcos River. *Hydrilla verticillata* and *Hygrophila polysperma* were the primary focus for non-native removal efforts in 2019. However, increased efforts were also placed on removing or clearing floating vegetation that accumulated on native submerged aquatic vegetation stands.



» Aerial image of before and after removal of Hydrilla from lower City Park in San Marcos.



Introducing Two New Members to Our Field Crew

Our Biology Field Crew provides internship opportunities for Texas State University students to gain hands-on experience in biology-related research, allowing them to apply knowledge learned in the classroom to real-world experience. Two of our field crew students, Collin Garoutte and Christopher Riggins, were hired on this year as full-time staff members.



Working at the Meadows Center has allowed me to gain and develop specialized knowledge of the San Marcos River system, while simultaneously being in a position where I can assist current students to do the same: enabling them to graduate with the experience that many employers in this field are looking for fresh out of college.

COLLIN GAROUTTE
GRANT SPECIALIST



I enjoy having the opportunity to help mentor current students who are following a similar path as I did. The best thing about working as a Grant Specialist on the HCP is that I get to work in a unique aquatic environment, making a direct impact on the health and sustainability of an ecosystem that includes multiple endangered species.

CHRISTOPHER RIGGINS
GRANT SPECIALIST

Mace Making His Mark on San Marcos Ecosystem

Our very own Dr. Robert Mace was appointed as secretary to the Edwards Aquifer Habitat Conservation Plan Implementing Committee in July 2018. The committee oversees progress towards the habitat conservation plan's goals and ensures compliance. In May 2019 the Implementing Committee approved Resolution No. 05-19-001, which effectively validated the transition from Phase I (Years 2013 – 2020) to Phase II (Years 2020 – 2028) of the habitat conservation plan and confirmed the conservation measures that will be implemented through 2028.

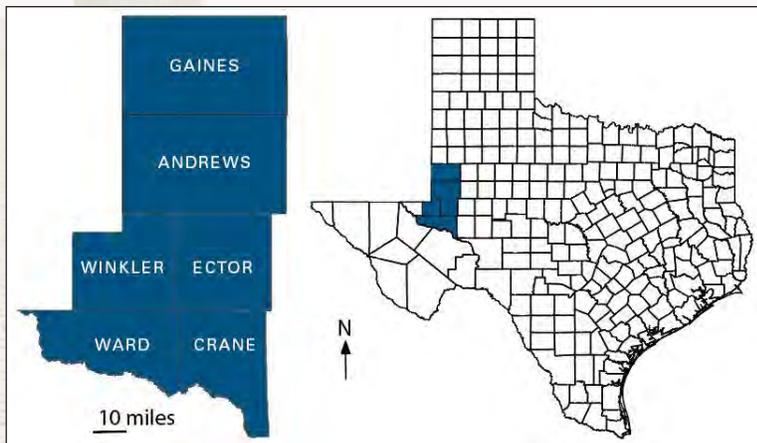
» **PHOTO:** Edwards Aquifer Habitat Conservation Plan Implementing Committee signing Resolution No. 05-19-001. Pictured (left to right): Robert Mace (Implementing Committee Secretary), Mark Enders (Implementing Committee Chair), Scott Storment (Program Manager), Darcy Frownfelter (Implementing Committee Parliamentarian and General Counsel).

How Much Water Does Frac Sand Mining Use?

Hydraulic fracturing (fracking) a well requires sand and water—water to over-pressure the formation to its breaking point and sand to prop the resulting array of fractures open once the pressure is released. However, the mining of sand for fracking also requires water, and more and more sand is being mined in Texas locally to major oil and gas plays.

With funding from the Texas Comptroller of Public Accounts, the Meadows Center investigated the potential effects of frac sand facilities on the groundwater resources in the Monahans-Mescalero Sand Ecosystem in Andrews, Crane, Ector, Gaines, Ward, and Winkler counties in West Texas.

Limited local information suggests that frac sand facilities in the study area consume **between 60 and 250 gallons of water per ton**—the exact amount depending on how sand is transported, how clean the sand is and the water efficiency of a facility. And with frac sand facilities in the study area having an annual capacity of **56.8 million tons**, a substantial amount of water might be pumped from local aquifers. Numerical modeling suggests that aquifer levels can be expected to decline locally in the Pecos Valley Aquifer and regionally in the Dockum Aquifer.



» Study area located in Andrews, Crane, Ector, Loving, Ward and Winkler counties.



» Approximate extent of the Monahans-Mescalero Sand Ecosystem in Texas and New Mexico (from Leavitt and Fitzgerald 2013).



<http://bit.ly/2JybiJn>

Groundwater Pumping and the Springs of the Blanco River

The Blanco River watershed spans five counties in the Texas Hill Country and supplies water to some of the fastest growing regions in Texas. The River is both fed by and feeds the Trinity and Edwards Aquifers, blurring the line between groundwater and surface water. It is also a source of water to iconic springs such as Pleasant Valley Springs, Jacobs Well Spring and San Marcos Springs.

There are several impending threats to the health of the Blanco River and the aquifers it overlies, including a growing population with increased demands on water resources, rapid residential and commercial development bringing increased impervious cover to the watershed and changing weather patterns. **How might this increased pumping and drought affect springs and baseflow in the Blanco River and its tributaries?**

Working with Southwest Research Institute and various stakeholders and funders, the Meadows Center led an effort to develop the Blanco River Aquifer Tool for Water and Understanding Resiliency and Sustainability Trends (BRATWURST). The first phase for the project involved developing a conceptual model that describes how the Blanco River watershed interacts with the underlying Trinity and Edwards Aquifer. A conceptual model is our best idea

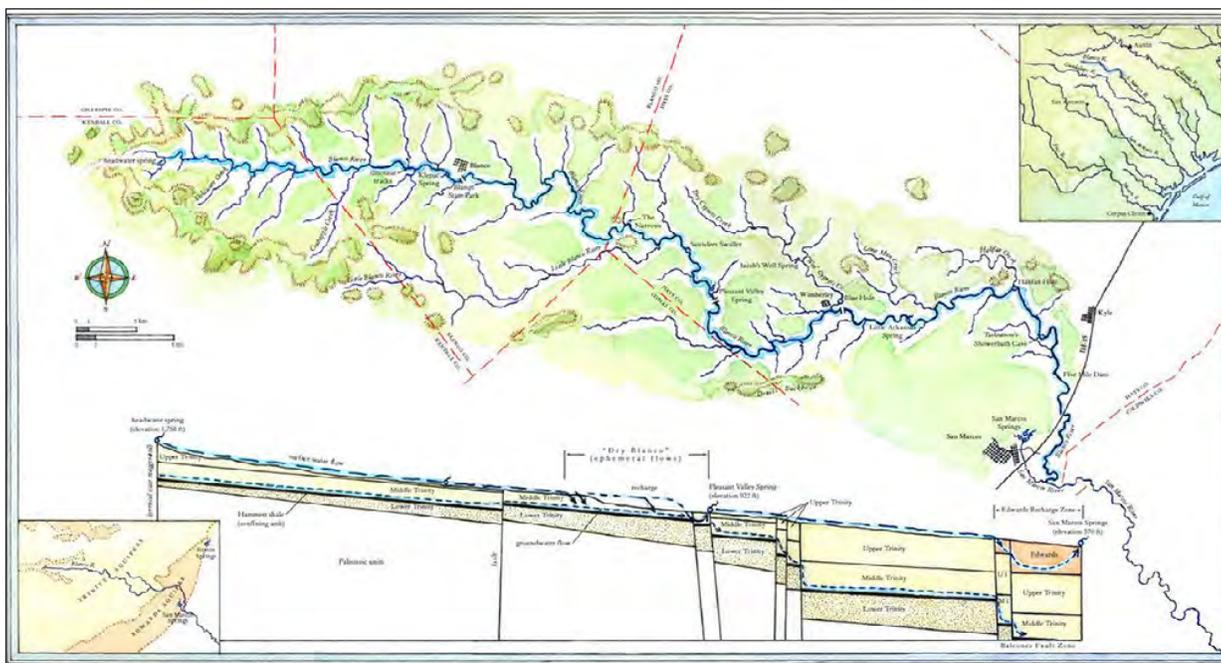
of how an aquifer works and the associated supporting information, including geology, depths, groundwater levels, pumping amounts, climatology, river and spring flows and aquifer properties.

The conceptual model will serve as the blueprint for a comprehensive surface-water/groundwater numerical model, which will be developed in Phase 2 of the project. Once developed, the numerical model will be a valuable tool that policymakers and groundwater conservation districts can use to effectively manage water resources and plan for increased water demand. The tool will provide a means for examining and optimizing water management practices in respect to expected increases in groundwater pumping and changes in long-term average weather, or climate.

Funding for the Blanco River Aquifer Assessment Tool project was provided by the Edwards Aquifer Authority, Rushing River Foundation, Greater Houston Community Foundation, Needmore River Ranch LLC, Electro Purification, Barton Springs Edwards Aquifer Conservation District, Counterweight Davit Foundation, Tito's Handmade Vodka, the Way Family Foundation, Blanco-Pedernales Groundwater Conservation District and Hays-Trinity Groundwater Conservation District.



<http://bit.ly/36pHcSm>



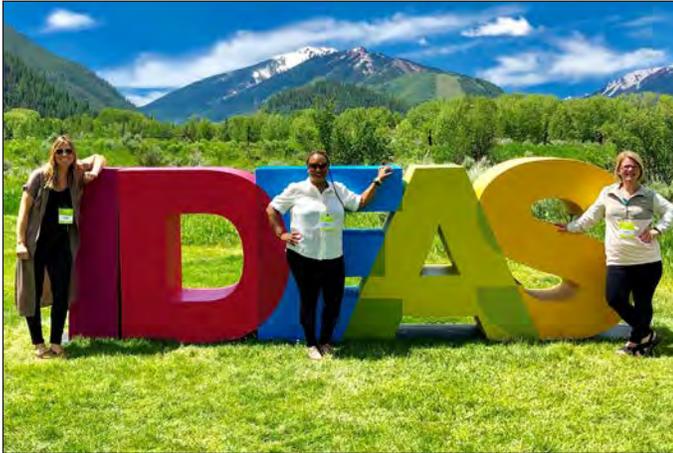
» Blanco River watershed with a generalized vertical geologic cross section. Drawing by Molly O'Halloran.



LEADERSHIP HIGHLIGHTS

The Meadows Center is a leader in water and environmental management and policy topics in Texas, the U.S. and abroad. We convene stakeholders to address critical water and natural resource concerns and the grand

Partnering with Nestlé Waters North America to Build a Water Resilient Future



» Jenna Walker (left), Deputy Director of Watershed Services, at Aspen Ideas Festival.



» Every Drop Counts Scholarship Award Ceremony at Spring Lake.

Partnerships are at the very heart of our mission to ensure clean, abundant water for the environment and all humanity. Recognizing that the private sector has a critical role to play in bridging the gap to address Texas' water challenges, the Meadows Center embarked on an exciting and innovative new partnership with Nestlé Waters North America.

The following accomplishments achieved by the partnership this year include:

- Nestlé Waters North America was a sponsoring organization of our Water Grand Challenges initiative, which involves invitation-only forums with public and private sector water thought-leaders to discuss best practices in water management, technology and policy to encourage the adoption of the most resilient water management practices by the state's water decision-makers.
- We assisted Nestlé Waters North America in securing the Alliance for Water Stewardship Standard certification for their South Houston and Pasadena sites, demonstrating the efficiency of their water stewardship.
- Jenna Walker, our Deputy Director of Watershed Services, represented Nestlé Waters North America as one of 200 Aspen Ideas Festival Scholars at the Aspen Ideas Festival in June. She connected with hundreds of festival attendees and fellow scholars from around the globe on behalf of the Meadows Center and the Nestlé Waters North America partnership.
- We supported Nestlé Waters North America in coordinating a \$10,000 scholarship to Texas State Aquatics and Conservation Biology doctoral student, Dawn Houston, effectively supporting her research and investing in the future of conservation. The award will assist Dawn in her avian conservation studies to shed light on the important role that Texas river systems have on migratory birds moving through our state.



LEADERSHIP

Water Grand Challenges Initiative

This year we partnered with the Cynthia & George Mitchell Foundation, the Meadows Foundation and Nestlé Waters North America to continue the Water Grand Challenges initiative, bringing together an influential and diverse group of stakeholders to grapple with urgent issues outside the normal envelope of water policy makers.

Stakeholders have identified six long-term Water Grand Challenges for Texas, which include (1) meeting the needs of 50 million Texans by 2070; (2) ensuring flows to sustain healthy ecosystems; (3) sustainably managing surface water and groundwater resources; (4) ensuring adequate investment in water, infrastructure, and conservation to meet demands; (5) fostering public awareness of water issues to advance conservation and investment in sustainable water management; and (6) protecting water quality to meet human and environmental needs.

These challenges constitute an ambitious set of long-term goals that can be advanced through short-term actions. Making progress on the six long-term water challenge goals requires patience, strategy and a multi-faceted approach. To advance our goals this year, our efforts focused on convening the stakeholder group to develop theories of change for each challenge and identifying long-term goals as well as quantifiable next steps to advance on each challenge.

The stakeholder group is not only a way to receive input from a diverse group of water interests, but also a tool to build relationships between members, communicate strategies and expand the audience. We will know that our strategy is working when these topics remain items of discussion and ultimately lead to actions and policy decisions to advance them.



» Water Grand Challenges stakeholder meeting.

Cultivating the Next Generation of Conservation Leaders

Blaschke Scholarship for the Protection of the San Marcos River

In 2002, Kurt Waldhauser established the Don and Reba Blaschke Scholarship for the Protection of the San Marcos River to honor his parents' dedication and life-long commitment to environmental protection. The scholarship is awarded annually by the Meadows Center to a student that demonstrates a significant service to protect and preserve the San Marcos River and its surrounding environment as unique resources of San Marcos and Texas State University.

Eryl Austin-Bingamon, Texas State University undergraduate student, was selected as the 2019 recipient. Eryl has volunteered with our Texas Stream Team since her freshman year of college and currently serves as the President of Bobcat Stream Team, the affiliated student organization. Eryl will graduate in December 2020 with a Bachelor of Science degree in Aquatic Biology and minor in Geography.

Nothing feels more personally fulfilling to me than doing my part to protect a resource so tangibly valuable to me and the community around me. I plan to continue spending my undergraduate years serving the San Marcos River and I hope to use my career to help sustain and protect aquatic resources all over Texas.

ERYL AUSTIN-BINGAMON



» Dr. Mace presenting Eryl Austin-Bingamon with scholarship certificate at award ceremony held at Spring Lake.

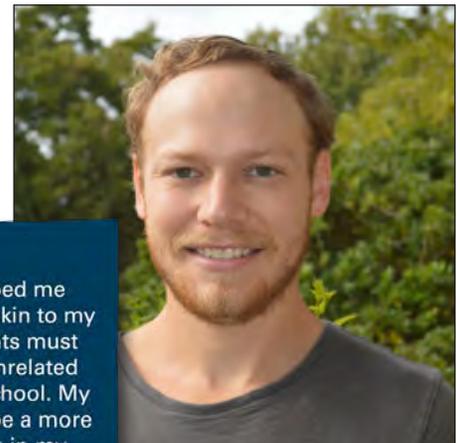
Meadows Graduate Fellowship Endowment

With generous support from the Meadows Foundation, a permanent Graduate Fellowship Endowment was established in 2015 to provide research assistantships at the Meadows Center to Texas State graduate students pursuing a degree related to water or the environment.

Aaron Raper, Applied Geography and Environmental Studies graduate student, was selected as this year's research assistant. His work has focused on collecting water quality measures across rural areas of differing landscapes near wetlands to compare potential ecosystem services. Collection of this data is being utilized as both a research topic for his graduate degree and to supplement a current project between the Meadows Center and the Texas Parks and Wildlife Department.

The Meadows Center has helped me develop real-world experiences akin to my schoolwork. Often times students must work somewhere completely unrelated to their degree while finishing school. My experience here has helped shape a more comprehensive understanding in my education at Texas State University.

AARON RAPER
GRADUATE RESEARCH ASSISTANT



Mace Honored With 2019 Rainmaker Award

Our Interim Executive Director, Dr. Robert Mace, was selected as the 6th recipient of the Texas Rainmaker Award in May 2019. The award is given by the Texas Water Foundation to leaders who have made exceptional contributions and long-lasting impacts to promote sustainable water policies in Texas.

Dr. Mace has not only contributed to our water future through his work at the Texas Water Development Board, but has shaped it by serving as one of the most respected water scientists in complicated policy discussions.

SARAH SCHLESSINGER

EXECUTIVE DIRECTOR, TEXAS WATER FOUNDATION



Texas Stream Team Wins Excellence Award

In May 2019, Texas Stream Team was honored with a Texas Environmental Excellence Award from the Texas Commission on Environmental Quality for bringing together numerous partners and thousands of citizen scientists to monitor and protect water quality across Texas.

Texas Stream Team was recognized in the Civic/Community category for its efforts to raise awareness and develop environmental stewards. The team was also recognized for the value of the data collected and recorded online. This helps regional leaders and advocates to assess their local water quality, and when necessary, allows them to develop remediation strategies and conservation efforts.



<http://bit.ly/2MUJ8KO>



© Woody Welch

LEADERSHIP

Evaluating a Jacob's Well Groundwater Management Zone in Hays County

The Meadows Center, in collaboration with the Hays Trinity Groundwater Conservation District (the District), published a report that evaluated a potential groundwater management zone to preserve flows to Jacob's Well in the Wimberley Valley region.

Jacob's Well, a karst spring originating in the Middle Trinity Aquifer, is the primary source of base flow to Cypress Creek, which flows through the towns of Woodcreek and Wimberley and into the Blanco River. Cypress Creek and Jacob's Well provide important ecological, hydrological and economic benefits to Wimberley, Woodcreek and the surrounding areas.

The report was completed by a scientific technical committee of groundwater scientists and a stakeholder advisory committee formed by the District. Our Interim Executive Director, Dr. Robert Mace, and Director of Watershed Services, Nick Dornak, served on the stakeholder advisory committee; Meadows Center Fellow, Doug Wierman served on the scientific committee.

Ultimately, the report recommended two potential groundwater management zones, a Jacob's Well Groundwater Management Zone and a Regional Recharge Area Groundwater Management Zone, along with recommendations of management strategies that would ensure Jacob's Well continues to flow, even during drought or heavy usage conditions.

These findings led to the District's proposal of Rule 15, which expands permitting requirements for non-exempt wells and added mandatory drought curtailments for all permit holders located within the Jacob's Well Groundwater Management Zone.



<http://bit.ly/2YwFDMY>

Water Data Needs To be FAIR!

Texans have immediate access to transportation and weather information but are unable to answer fundamental questions about water in a timely way. Access to timely water data is needed to address flooding, drought and water-management decisions. Unfortunately, water information is complex and housed by a variety of public agencies with varying levels of data accessibility. With mobile devices, data mining, artificial intelligence and synergistic applications, there's a real need for water data in Texas to be FAIR: Findable, Accessible, Interoperable, and Reusable.

With funding from the Cynthia and George Mitchell Foundation, the Meadows Center is working with Texas A&M University-San Antonio, the Texas Water Development Board and various stakeholders to develop a water data hub to make water data FAIRer in Texas.

This work has resulted in an inventory of water data for Texas and the identification and development of use cases on surface water/groundwater interactions and a drought dashboard. It has also supported the advancement of a water data hub, with legislative support, built on a flood dashboard use case.

Providing Texans with a Trusted, Unbiased Source of Water News

Launched in March 2018, Texas+Water is a monthly newsletter published by the Meadows Center, the Texas Water Journal and the Texas Water Resources Institute at Texas A&M University that provides timely information on the spectrum of Texas water issues including science, policy, and law. Our partnership, a mix of communicators and water experts, aim to build a better understanding and awareness of the water challenges Texas is facing by providing news and analysis in an easily accessible platform.

Thanks to the generous support from the Cynthia and George Mitchell Foundation, Texas+Water completed a strategic development process in 2019 that created formal guidelines and a vision for the future to continue Texas+Water's evolution to be the go-to source for decision makers and the public to find water-related news.

Brand Refresh: The partnership used the momentum from our strategic development efforts to rebrand Texas+Water, which led to the creation of a new logo, website interface and newsletter design. The new brand aesthetics not only present a more professional appearance for the publication, but also better represents our publication's identity and values.

Texas+Water Advisory Council: To bolster support and awareness of Texas+Water, the partnership formed a five-member Texas+Water Advisory Council. The council will not only help amplify the publication's reach but will also serve as strategic advisors and advocates for Texas+Water.



www.TexasPlusWater.org



According to survey results from 117 respondents, 87.5% of subscribers rate Texas+Water as very good or good.



TESTIMONIALS:

"Texas+Water is an excellent source. Our faculty use it in their classes. I believe that this is the most important issue in our state."

"Excellent publication. The wider the distribution, the better. Very good representation of the hot topics in Texas. I really enjoy that the editors seem to focus on the stories that nobody else is talking about but should be."

Mobilizing the Texas Environmental Flows Initiative



© Jerod Foster

The bays and estuaries of Texas provide irreplaceable habitat for a huge variety of fish and wildlife, while also generating billions in economic value for the state. The ecological health of these coastal systems depends in large part on adequate freshwater inflows from contributing streams and rivers. However, Texas bays and estuaries are increasingly at risk as the state's population grows and upstream water demands increase.

Recognizing the need to demonstrate environmental water transactions as an effective tool for achieving conservation outcomes in bays and estuaries, the Texas Environmental Flows Initiative was created in 2014. The three-year pilot — a collaborative effort of Ducks Unlimited, Harte Research Institute at Texas A&M Corpus Christi, the Meadows Center, National Wildlife Federation and The Nature Conservancy — brought more than \$3 million in funding toward the development of the legal and scientific frameworks necessary to implement water transactions for the benefit of three priority bays in the Gulf of Mexico: Galveston Bay, Matagorda Bay and San Antonio Bay.

The initiative generated new knowledge and tools that were put to effective use in pursuit of a completed water transaction to benefit an important bay, estuary or wetland along the Texas Coast. Significant progress was made on two major water transactions that remain under development. The initiative's success also includes a better understanding of, and support for, water transactions as a tool for meeting identified flow objectives around the state.

As the Texas Environmental Flows Initiative concludes, ongoing engagement by the initiative's members, as well as the work of a newly established organization, Texas Water Trade, will provide the energy and expertise needed to expand the use of water transactions throughout priority bays, estuaries, rivers, streams and wetlands.

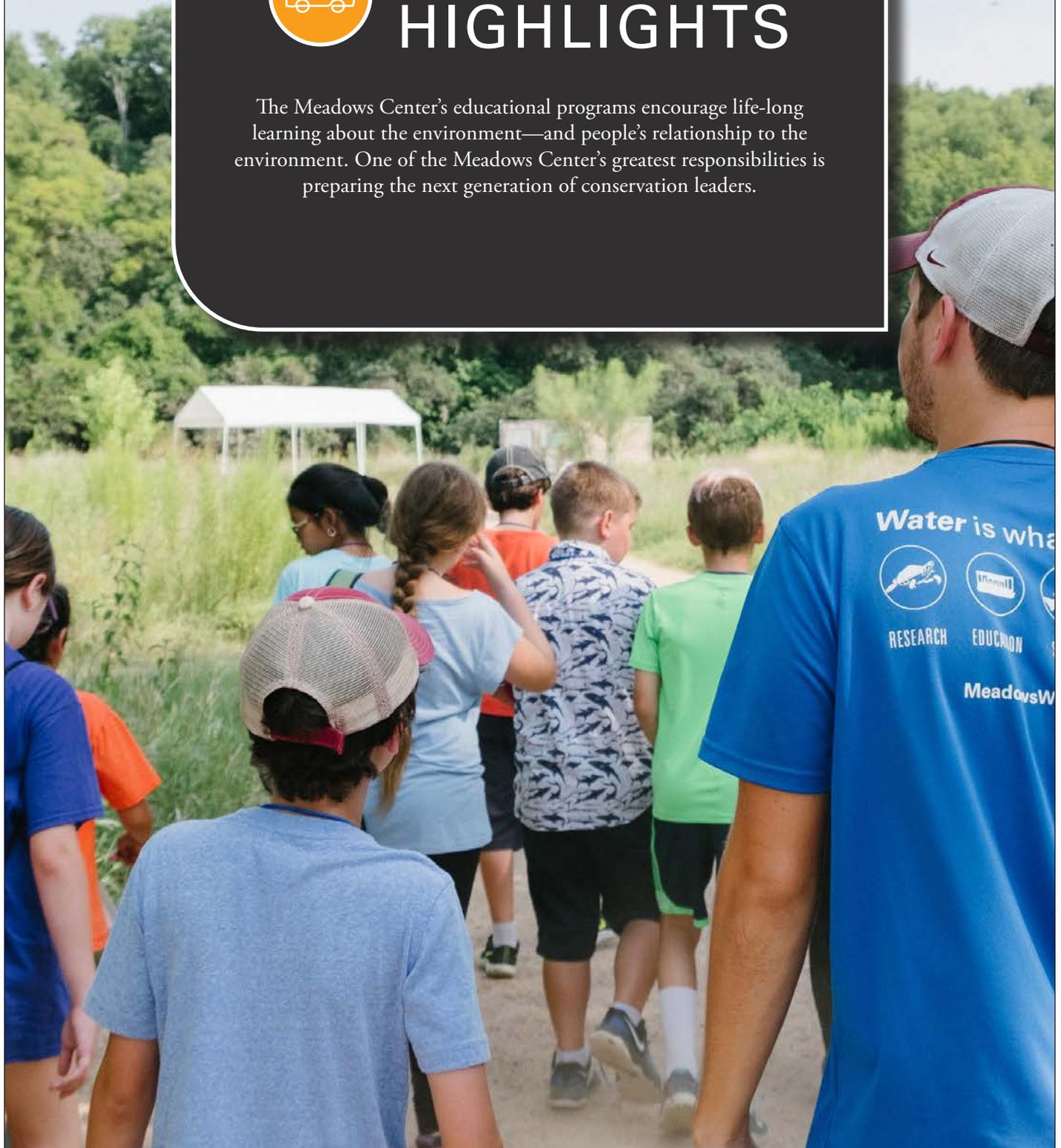


<http://bit.ly/2pnlWe3>



EDUCATION HIGHLIGHTS

The Meadows Center's educational programs encourage life-long learning about the environment—and people's relationship to the environment. One of the Meadows Center's greatest responsibilities is preparing the next generation of conservation leaders.





EDUCATION

Launching the Splash into Science Snorkel Program at Spring Lake

Spring Lake is renowned for being one of the most biologically diverse aquatic ecosystems in the country. While many visitors view Spring Lake's artesian springs and teeming aquatic life on a glass-bottom boat, one can now get a closer look by enrolling in our new Splash into Science Snorkel Program. The immersive snorkel program aims to connect guests to the wonders of our local ecosystem and our relationship with the environment through low-impact, educational fun.

With crystal-clear water and exceptional visibility, snorkeling in Spring Lake is a chance to see Texas water at its best. Through the 45-minute guided course, participants will learn about the unique history and habitat of Spring Lake, while getting an up-close view of a wide variety of fish, turtles and aquatic plants. Funding for the Splash into Science Snorkel Program was provided by the Burdine Johnson Foundation.



[Snorkel.MeadowsWater.org](https://www.Snorkel.MeadowsWater.org)

Celebrating the Return of Newly Renovated Glass-Bottom Boat #1963



» Ribbon cutting ceremony for glass-bottom boat 1963. (left to right) Dr. Andrew Sansom, Founder of the Meadows Center; Chikage Windler, Chief Meteorologist at CBS Austin; Jason Mock, President of SM Chamber of Commerce; Walter Elias, SM Chamber of Commerce Board Member

In February, the San Marcos Chamber of Commerce helped us celebrate the return of newly restored glass-bottom boat 1963 with a ribbon cutting ceremony at Spring Lake. Our historic fleet includes five boats, with the oldest built in 1945 and the newest built in 1978. Boat 1963 is the first hard-top boat to be renovated with a new hull.

In 2014, we began the process of redesigning and replacing the wooden framed hulls with a fiberglass composite hull, which is stronger and more water-resistant. Boat 1953 and

Boat 1945 were the first to receive a new hull. Over the next two years, we will continue to pull one boat each year until the entire fleet has been restored with a new fiberglass composite hull.

To support the historic fleet of glass-bottom boats at any level, consider making a tax-deductible donation to the Meadows Center's Glass-bottom Boat Endowment Fund online at <http://bit.ly/2WpfMqV>.



» Newly restored glass-bottom boat 1963 at Spring Lake.

All of these boats were hand built by many different individuals, so none of them are exactly the same. Restoration on an item like this typically requires a craftsman that can do that; everything is custom.

AARON WALLENDORF
SPRING LAKE MANAGER

Engage young leaders in water and environmental stewardship

Hosting Texas State's First Natural Leaders Summit

In collaboration with the Children and Nature Network and the Children in Nature Collaborative of Austin, we hosted Texas State University's first-ever Natural Leaders Summit on March 30-31 in San Marcos to bring together 26 young leaders who are passionate about ensuring equitable access to nature in their communities.

With funding from the Burdine Johnson Foundation and Texas State's Office of Equity and Access, the free two-day summit provided students with valuable leadership training, peer-to-peer mentoring and the opportunity to discover how the conservation movement relates to Texas State University's Diversity and Inclusion Plan. Students also heard from prominent leaders of diverse backgrounds within the Texas State community to learn about their professional experience and highlight examples of success.



Spring Lake Earth Day Festival 2019

In April 2019, the Meadows Center co-hosted a Spring Lake Earth Day Festival with the Texas State Environmental Services Committee, the Environmental Conservation Organization, the Texas State Department of Campus Recreation and Apogee Presents.

The festival featured a variety of stations celebrating Mother Earth including interactive demonstrations on water and oil pollution, fresh water global distribution, a scavenger hunt, recycling games, making planters and bird feeders as well as many more water and environmental sustainability-related activities.

Apogee Presents provided live music for the festival and the Texas State Department of Human and Health Performance provided recreational activities for guests of all ages to enjoy. The Texas State Environment and Sustainability Committee also announced the Green Cat Challenge Award winners during the festival to recognize the dedicated individuals on-campus that work to be environmentally sustainable in their practice. We plan to make this an annual event and look forward to expanding its reach in 2020!





Texas Rivers Expedition: Adventure Camp for Natural Leaders

This summer we joined forces with El Ranchito to co-host the Texas Rivers Expedition, a traveling adventure camp formerly named the Gulf Coast Expedition. The week-long camp provided an immersive service-learning journey for young conservation leaders who are interested in water issues. During the experience, we highlighted the many ways that water – both physically and conceptually – connects our communities, professions and experiences. Tuition and trip expenses were granted to participants at no-cost, thanks to generous contributions from the Shield Ranch Foundation and the Texas Parks and Wildlife Department.

Campers visited significant sites throughout the Texas Hill Country to explore the journey of water from underground, through artesian springs, to the headwaters and beginnings of a riverway. Along the way, campers engaged and connected with conservation leaders and mentors who are working to protect Texas Rivers and springs.



New Publications From Our River Book Series

The River and the Wall

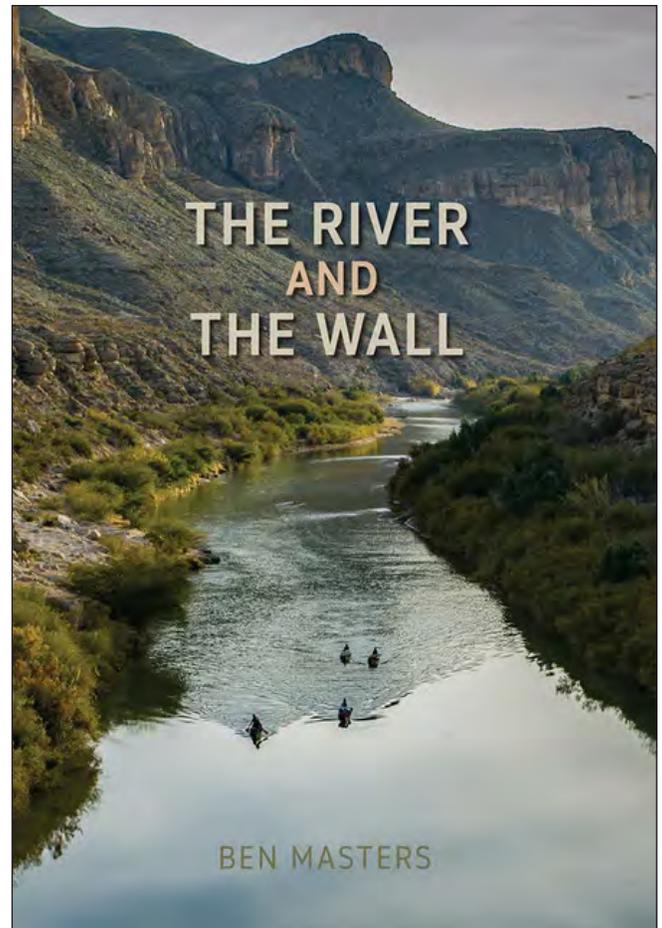
Written by Ben Masters; Foreword by Dr. Andrew Sansom

When a team of five explorers embarked on a 1,200-mile journey down the Rio Grande, the river that marks the southern boundary of Texas and the US-Mexico border, their goal was to experience and capture on film the rugged landscapes of this vast frontier before the controversial construction of a border wall changed this part of the river forever.

The crew—Texas filmmaker Ben Masters, Brazilian immigrant Filipe DeAndrade, Texas conservationist Jay Kleberg, wildlife biologist Heather Mackey, and Guatemalan-American river guide Austin Alvarado—began the trip in El Paso, pedaling mountain bikes through the city's dry riverbed. Their path took them on horseback through the Big Bend, down the Wild and Scenic stretch of the river in canoes, and back to bikes from Laredo to Brownsville. They paddled the last ten miles through a forest of river cane to the Gulf of Mexico.

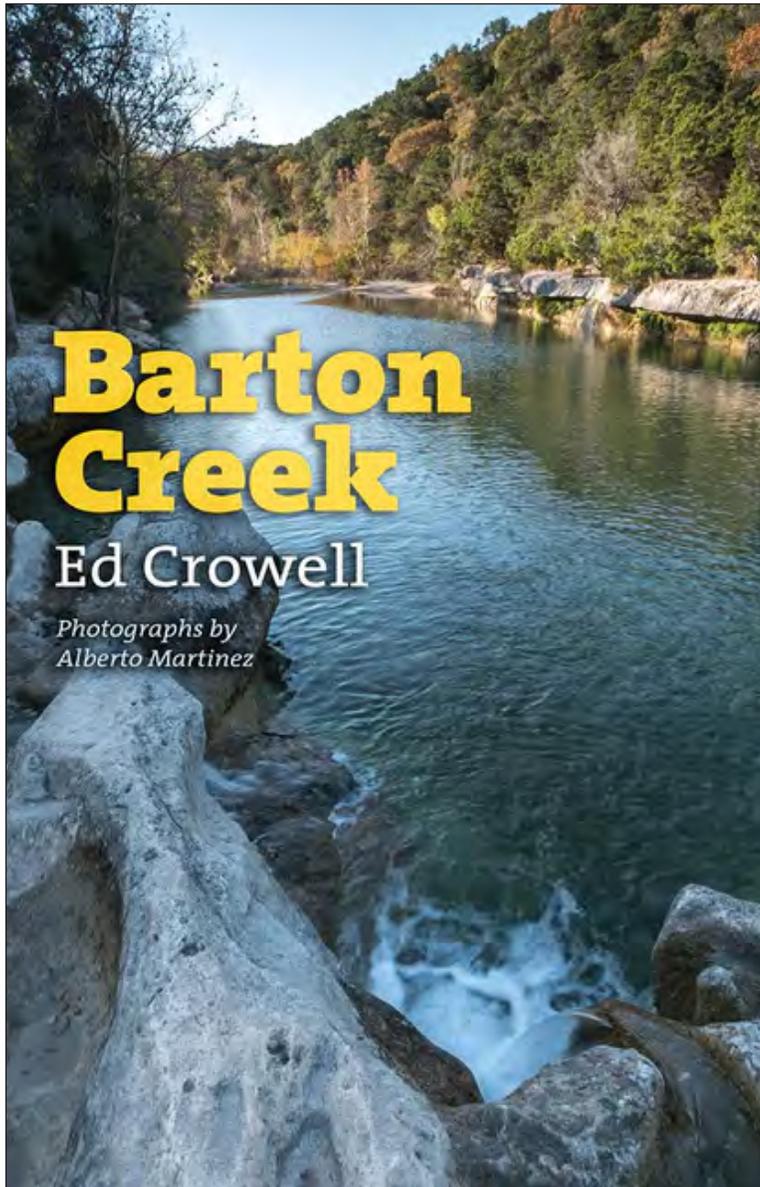
As they made their way to the Gulf, they met and talked with the people who know and live on the river—border patrol, wildlife biologists, ranchers, politicians, farmers, social workers, locals, and travelers. They climbed the wall (in twenty seconds). They encountered rare black bears, bighorn sheep, and birds of all kinds. And they sought to understand the complexities of immigration, the efficacy of a wall, and the impact of its construction on water access, wildlife, and the culture of the borderlands.

The River and the Wall is both a wild adventure on a spectacular river and a sobering commentary on the realities of walling it off.



<http://bit.ly/2NZCuBR>





Barton Creek

Written by Ed Crowell; Photographs by Alberto Martinez; Foreword by Dr. Andrew Sansom

While Barton Springs Pool is an iconic landmark of Austin and many people are familiar with the end of Barton Creek and its seven miles of public greenbelt, less is known about the forty-odd miles beyond that tumble and twist across private lands, eventually feeding the Colorado River. Legendary fights saved Barton Springs in the 1980s and 1990s, when the pool repeatedly was closed because of pollutant runoff from streets, nearby construction, and leaking sewer lines. In 1992, a highly publicized campaign resulted in land protections and stricter water standards.

But will the creek and its springs become fouled again? That possibility arises upstream where tributaries and other creeks flow across mostly rural acreage, attracting new housing and business developments. Not only would city bathers lose access to the pool, but endangered species of salamanders and birds that depend on the Edwards Aquifer and its unique habitats face an uncertain future.

Following the creek from downtown Austin's Barton Springs Pool to its source as a cow-pasture trickle, longtime resident and journalist Ed Crowell explores the creek's contentious political history, its historic and current residents, and the mounting environmental pressures threatening it. Barton Creek highlights the passionate individuals involved in the stream's preservation, from city scientists to local landowners, who want to see the creek running clear and clean for future generations. Striking photography and vivid descriptions will entice readers to fall in love with Barton Creek all over again.



<http://bit.ly/2OgwMPH>

Sneak Peak: Texas Centennial Parks Book

The Meadows Center's Founder, Dr. Andrew Sansom, and William Reaves will co-author a publication that celebrates the 100th Anniversary of the Texas State Park System. The book will include artwork from a distinguished group of Texas artists, showcasing the beauty of 62 State Parks from across the state.

An accompanying art exhibition is scheduled to open at the Bob Bullock Texas State History Museum on January 1, 2023, the 100th Anniversary of the Texas State Park System!

» **PHOTO:** Andrew Sansom and the artists at a Texas Parks and Wildlife Commission Meeting announcing the centennial parks book.



STEWARSHIP HIGHLIGHTS

One of our greatest privileges is the stewardship and management of Spring Lake and its habitat, endangered species, and cultural resources.

The Meadows Center is active in the San Marcos community and beyond and strives to strengthen those ties by connecting stewardship of water and natural resources to quality of life.

Texas Stream Team: Growing a Statewide Network of Citizen Scientists

Our flagship citizen science program, Texas Stream Team, expanded its efforts this year for trainings, data collection, stakeholder engagement and watershed education to continue its mission of understanding and protecting the 191,000 miles of Texas waterways.

Texas Stream Team also introduced two new training programs to help watershed coordinators and stakeholders across the state better understand the health of their local waters.

- **Riparian Evaluation Citizen Scientist Training:** focuses on the nature and function of stream and riparian zones, and the benefits and direct impacts of healthy riparian zones
- **Macroinvertebrate Bioassessment Citizen Scientist Training:** assesses the health of lakes, rivers, streams or estuaries based on the riparian habitat and the aquatic insects that are present to track ecosystem and habitat health over time in waterways that flow to the Texas Coast

 www.JoinStreamTeam.org



 <p>2,718 hours monitoring water quality across Texas</p>	 <p>590 new volunteers trained by Texas Stream Team</p>
 <p>279 active sites monitored across Texas waterways</p>	 <p>1,806 monitoring events conducted in 2019</p>



To guide new and existing monitors after they have received official certification, Texas Stream Team also produced instructional videos this year that cover parameters taught in Standard Core and Advanced Water Quality Citizen Scientist Trainings.

 <http://bit.ly/34mS29Z>



STEWARDSHIP

Assembling the Central Texas Feral Hog Task Force

Feral hogs are among the most destructive invasive species in the United States today. They impact water quality in our creeks and rivers, as well as cause financial loss to agricultural production.

Texas is home to an estimated 3 million feral hogs. Lacking sweat glands, hogs seek out shelter along Texas creeks and rivers, which can result in contamination of waterways. Hog rooting and feeding behaviors also impact agricultural production across the State, where they do some \$400 million in damages annually.

In fiscal year 2019, we continued our partnership with Texas A&M University AgriLife Extension, local stakeholder groups and the counties of Hays, Caldwell and Guadalupe to implement the Central Texas Feral Hog Task Force (task force).

Since 2018, the task force has deployed 40 corral traps, maintained three wireless “smart” traps, conducted monthly bounty programs, host three workshops and three webinars. In 2019, Task Force partners removed 4,607 invasive feral hogs from the Central Texas landscape, staving off an estimated \$2,303,500 in property and ecological damages, an return of \$55.33 for every dollar spent!



www.FeralHogTaskForce.com

Shoal Creek Watershed Action Plan

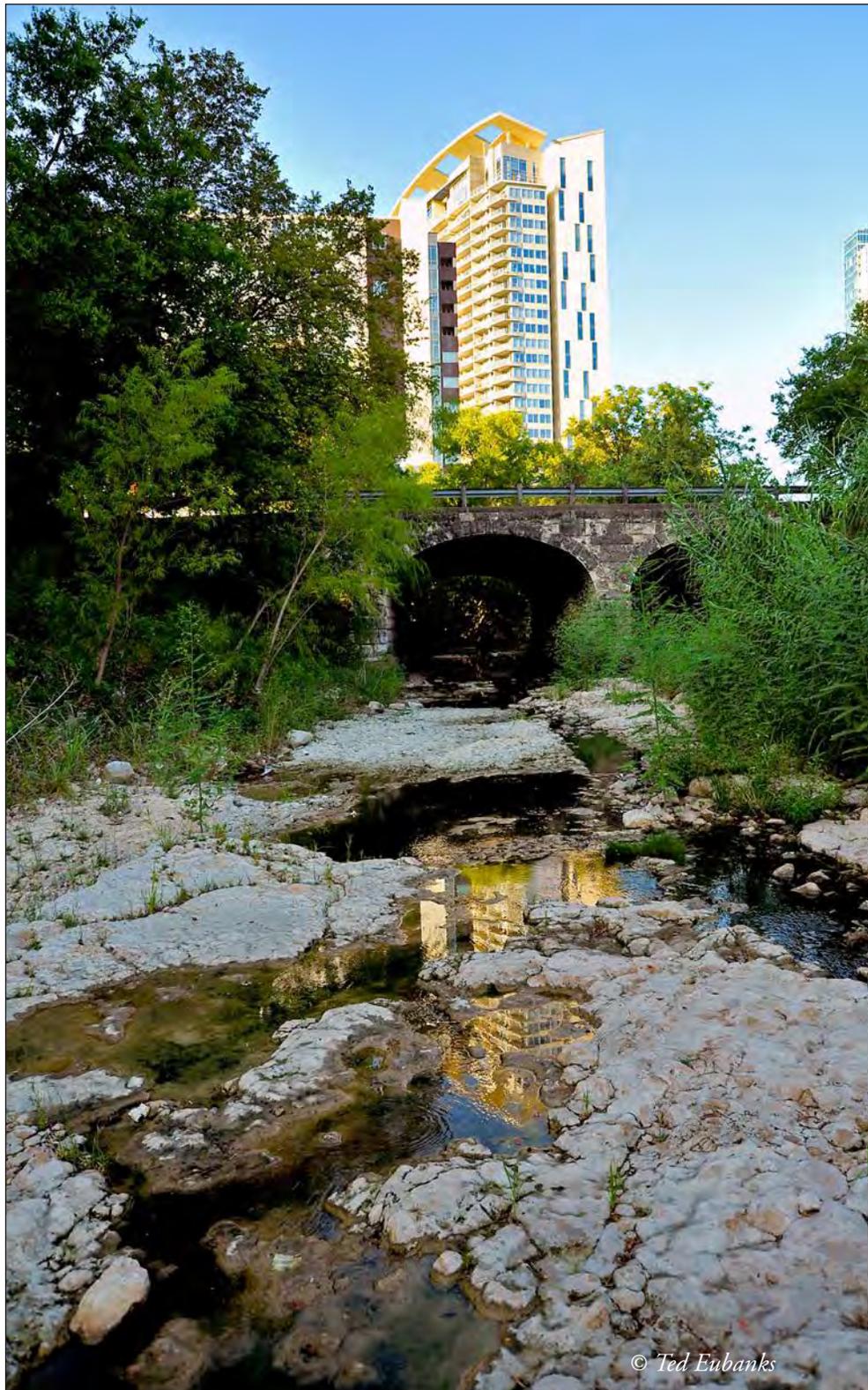
With funding from the Texas Commission on Environmental Quality, the Meadows Center, the Shoal Creek Conservancy, the City of Austin Watershed Protection Department and Douchet & Associates launched a multi-year partnership in 2017 to develop Shoal Creek's first Watershed Action Plan.

Shoal Creek is a highly urbanized watershed that spans 13 square miles from downtown Austin to the Domain. The watershed suffers from numerous and interconnected water-related challenges, including devastating flood events, poor water quality, erosion, loss of native habitat, and reduced spring flow.

Efforts this year focused on data collection and community engagement. The data collection phase resulted in the creation of the Shoal Creek Watershed Characterization Report, which identified water quality trends, sources of pollution and target areas for the development of solutions. The community engagement phase began in early 2018 with the creation of technical and stakeholder committees that meet monthly to define shared goals for Shoal Creek and develop a clear path for implementation.

The partnership also initiated a multi-year education campaign, #Stewards4Shoal, to generate support for a healthier future for Shoal Creek. The Meadows Center worked closely with the Shoal Creek Conservancy to develop a series of video public service announcements that were designed to encourage local action to conserve Shoal Creek.

In Spring 2020, the partnership will submit the Watershed Action Plan to the Texas Commission on Environmental Quality and the US Environmental Protection Agency for state and federal approval.



© Ted Eubanks



www.shoalcreekconservancy.org/watershedplan/



» A mock-up of Wimberley's "one water" school.

STEWARDSHIP

Designing the First One Water School in Texas

The small Texas towns of Wimberley and Woodcreek are making big waves in the One Water world after the Wimberley Independent School District announced their plans to build the first One Water school in Texas. When it opens in Fall 2020, the primary school campus will utilize a variety of One Water strategies to reduce groundwater usage by 90 percent when compared to traditional construction standards.

One Water is a water planning and management approach that rethinks how water moves through and is used in a community; it brings stakeholders like developers, community leaders, urban planners, water managers and engineers together with the goal of utilizing water as thoughtfully and efficiently as possible.

Our Watershed Services team and the Wimberley Valley Watershed Association spearheaded the One Water project, meeting regularly with officials from the Wimberley Independent School District and other local entities involved in planning the school's design to assure the new primary school achieves the mission of the Cypress Creek Watershed Protection Plan to protect and conserve water quality and quantity in Cypress Creek.

The school's One Water design acknowledges the importance of protecting Wimberley's sensitive water resources, such as Jacob's Well, Blue Hole and the Trinity Aquifer, by promoting and managing all the water as a single resource that is sustainable and reusable. Here are a few ways the 85,000 square-foot campus will incorporate One Water strategies to reduce its water footprint:

- Rainwater and AC condensate collection will be used to flush toilets and provide irrigation for landscape and school gardens
- Water saving fixtures to reduce water usage
- Green Stormwater Infrastructure to slow down runoff, recharge groundwater and reduce non-point source pollution
- On-site treatment and reuse system that will allow gray/black water produced by the school to be beneficially reused through a subsurface drip irrigation system
- Educational features include clear pipes and signage installed into the architecture of the school to create an immersive, educational experience

The new school will not only benefit the environment, but will also save money for the Wimberley Independent School District in the long-term. The district projects that it will save around \$800,000 over 30 years in utilities, as less water is being used to operate the school. But most importantly, the water smart school will serve as a model for communities throughout the Texas Hill Country as well as a teaching tool to students about the value of water conservation.

Upper San Marcos Watershed Protection Plan Accepted By EPA

Every two years, as a condition of the federal Clean Water Act, the Texas Commission on Environmental Quality releases a report on water quality across the state and names a number of bodies of water as impaired, meaning that the level of pollution is higher than regulations allow.

In 2010, for the first time, the San Marcos River made that list for exceeding total dissolved solids water quality standards. The level of contaminants was relatively low and the river is no longer considered impaired, but the Texas Commission on Environmental Quality's listing led the Meadows Center to begin a collaborative, stakeholder-driven process to build a watershed protection plan (WPP) for the Upper San Marcos Watershed to address water quality and quantity issues in the watershed.

In October 2018, the plan was approved by TCEQ and U.S. Environmental Protection Agency. The Upper San Marcos WPP is designed to ensure the future health of the San Marcos watershed by addressing biodiversity, population growth, recreational use and changing water quality. The plan outlines strategies to mitigate non-point source pollutants, protect spring flow and improve water quality in the watershed.

In its first year of implementation, our activities have focused on coordinating efforts with partners, employing on-the-ground best management practices, protecting undeveloped land necessary for recharge and mitigating storm-flow in urban areas.



Aspen Navarro Joins Watershed Services Team As Program Coordinator

We welcomed Aspen Navarro to our team as the Program Coordinator for Watershed Services in July 2019. Navarro began her career at the Meadows Center in 2015 as a student worker with the Biology Field Lab, then as an Environmental Interpreter for Spring Lake Education and most recently as a Graduate Research Assistant for Watershed Services.

Navarro will lead implementation efforts for the Upper San Marcos River Watershed Protection Plan and will also serve as the new Statewide Program Coordinator for Texas Stream Team.

She is currently pursuing a Master of Science in Sustainability Studies at Texas State and is set to graduate May 2020.

Throughout my four years here, I have been fortunate to learn and work with incredible individuals who support our mission and environmental passions. We have continued to expand our scope and expertise, and I am excited to be a part of an organization that strives to take on new challenges and growth opportunities.

ASPEN NAVARRO
PROGRAM COORDINATOR, WATERSHED SERVICES

OUR MEADOWS CENTER TEAM



ROBERT MACE, PH.D., P.G.
Interim Executive Director



ANDREW SANSOM, PH.D.
Founder



THOMAS HARDY, PH.D.
Chief Science Officer



TIMOTHY LOFTUS, PH.D.
Chief Conservation Officer



ROB DUSSLER, PH.D.
Director of Spring Lake Operations



NICK DORNAK, M.S.
Director of Watershed Services



CARRIE THOMPSON, M.P.A.
Director of Operations



SANDRA ARISMELENDEZ, PH.D.
Water Quality Monitoring Coordinator



CLAUDIA CAMPOS, B.S.
Grant Secretary



COLLIN GAROUTTE
Research Associate



SHARLA GUTIERREZ
Business Manager



SUSAN HANKINS, B.S.
Admin & Event Coordinator



TOM HEARD, M.S.
Research Associate



CALEB HENDERSON, B.A.
Dive Coordinator

Meet the amazing people behind the scenes here at the Meadows Center. We are fortunate to have a talented group of faculty and staff who are dedicated to making a difference in the water industry.



ANNA HUFF, B.S.
Communications Manager



MEAGAN LOBBAN, B.S.
Education Manager



SAM MASSEY
Glass-Bottom Boats Manager



ERICA JANE MEIER, M.S.
Administrative Assistant II



ASPEN NAVARRO, B.S.
Program Coordinator



LAURA PARCHMAN, B.A.
GIS and Data Management Associate



CHRISTOPHER RIGGINS, B.S.
Research Associate



RYAN SPENCER, M.A.GEO.
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SYNTHIA TUMA, B.A.
Procurement Specialist



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Deputy Director of Spring Lake Operations



JENNA WALKER, M.A.GEO.
Deputy Director of Watershed Services



AARON WALLENDORF, B.S.
Lake Manager

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Adjunct Professor, University of North Texas



MIKE ABBOTT, PH.D.
Fellow of the Meadows Center



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Principal, GroundswellTX



MARIO GARZA, PH.D.
Founder, Indigenous Cultures Institute



FREDERICK HANSELMANN, PH.D.
Director, Underwater Archaeology Program



TOM HEGEMIER, P.E., D.WRE
Senior Project Manager, Doucet and Associates



CHRIS HORRELL, PH.D.
Research Associate



SHARLENE LEURIG
Chief Executive Officer, Texas Water Trade



MEREDITH MILLER, M.S.
Director, William R. Sinkin Eco Centro



VANESSA PUIG-WILLIAMS
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Protection Association



WARREN PULICH, JR., PH.D.
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