Watershed Conservation

Texas Watersheds

Conservation news from headwaters to coast

SPRING 2015 NEWSLETTER

TEXAS PARKS & WILDLIFE

In this issue

History of Dams on the Upper San Marcos River

KEN SAUNDERS AND KARIM AZIZ, TPWD RIVER STUDIES PROGRAM

When we think of dams in the state of Texas, one typically thinks of dams on the state's major rivers and the large reservoirs they impound. In fact, most of the 7,500 dams in Texas are located on smaller rivers and streams. These dams were an integral part of the state's historical economic development, providing power to drive mechanical mills and providing water for cattle and agricultural irrigation.

Many of these dams still remain, although many do not serve the purpose for which they were originally intended. While the waters these dams impound are often still used to provide irrigation they also often block the migration of fish, alter the way sediments are transported, and can lead to unstable watershed conditions. According to American Rivers, a Washington, D.C. based public interest group, 1,150 dams have been removed across the country since 1912.

The San Marcos River emanates from multiple springs within the City of San Marcos, Texas. These springs are the second largest in Texas, have never stopped flowing, and have historically exhibited the most constant discharge of any spring system in the southwestern United States. There are eight species listed as endangered or

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Remnants of Cape's Dam and Weir, July 2014

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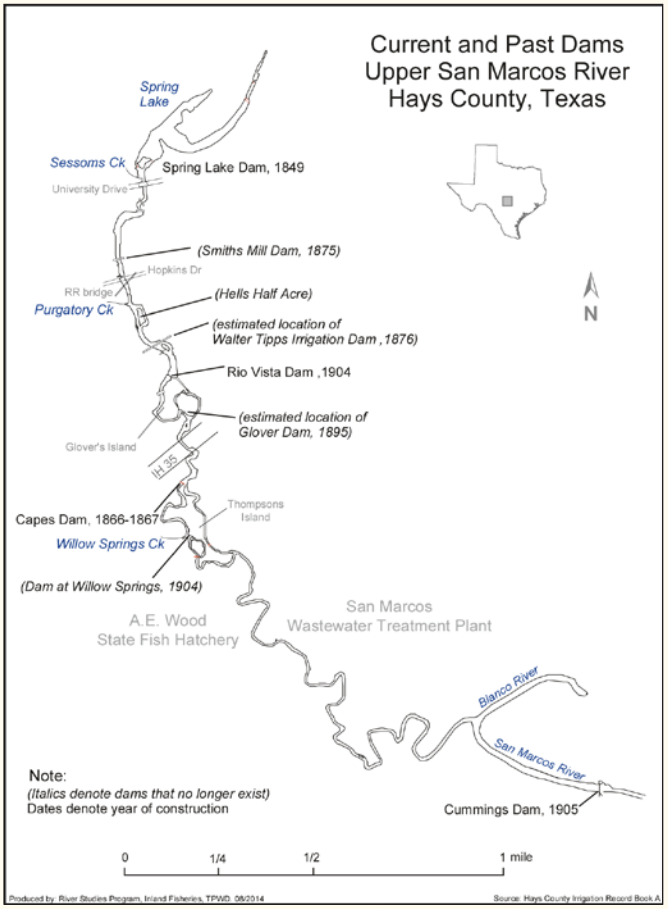
History of Dams on the Upper San Marcos River



Location of the eight dams on the upper San Marcos River.

threatened in the upper four miles of the San Marcos River. Unbeknownst to most people, the upper San Marcos was once extensively impounded. Beginning in the mid- to late 1800s, eight dams were constructed for purposes including agricultural irrigation, power to run saw and grist mills, domestic water supply, and production of electricity. Of the eight dams, four remain (see map above). We describe the eight dams to give readers a historical perspective of the upper San Marcos River.

The following descriptions rely mostly on the publication *Hays County Irrigation Record, Book A*. The book not only described the location, size, capacity, and intended use for these dams, but also included hand-drawn maps describing the length to which waters would be impounded, position relative to land tracts, and other historical information.

Descriptions are presented in order from upstream to downstream and not chronologically. The map to the left illustrates the location of each dam and its year of construction. It should be noted that the major contributing tributaries of the upper San Marcos River, namely Sink and Purgatory creeks, also have five flood control dams on them that affect the hydrology and sediment transport of the river by reducing scouring flows during flood events (below).

Upper San Marcos River Watershed (approximately 95 square miles). Five flood control reservoirs are located on the two major creeks leading into the upper San Marcos River.

SPRING LAKE DAM (1849)

The springs and land around what is today called Spring Lake were originally granted to J.M. Veramundi in 1840. Over the years ownership changed various times culminating in the purchase of the Aquarena Springs theme park by Texas State University in 1994. Spring Lake Dam was built about the year 1849 by General Edward Burleson to power a saw and grist mill. The original irrigation record for this dam was recorded September 6, 1895, making it the oldest record for appropriated water from the San Marcos River. After purchase by the San Marcos Utility Company in late 1895 the dam was rebuilt and used for electric power generation, milling, irrigation, and municipal water supply. Major repairs were made in the last decade to prevent its collapse. The dam impounds water up to the head springs and for a significant distance up Sink Spring hollow, or what is currently referred to as The Slough. The maximum holding capacity of Spring Lake reservoir is about 13,000,000 cubic feet and it covers approximately 30 acres.

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SMITH'S MILL DAM (1875)

This dam was owned by Ed G.L. Green. The irrigation record was recorded September 9, 1895. Construction of the dam was initiated in 1875. The reservoir behind the dam had a capacity of approximately 1,000,000 cubic feet of water and covered approximately 3 surface acres. This dam was likely associated with a "bath" house that offered male and female bath houses and a large swimming area.

WALTER TIPPS IRRIGATION DAM (1876)

Walter Tipps recorded a water right in Hays County September 10, 1895, though the dam was constructed in 1876 to provide irrigation for agriculture through the use of a large irrigation ditch known as Fromme's Ditch. The ditch was constructed at the confluence of Purgatory Creek and the San Marcos River. The ditch constitutes today's main volumetric flow channel and created an island then known as Hell's Half Acre, which today is commonly known as Snake Island. It is reported that Hell's Half Acre was farmed for beans. The head gate of Fromme's Ditch was situated on the west side of the San Marcos River at the west end of the dam. The ditch was 514 feet long, 10 feet wide, 3 feet deep, and had a carrying capacity of 200 cubic feet per second. The dam had a maximum holding capacity of about 100,000 cubic feet. The impoundment behind the dam had a surface area of one acre.

RIO VISTA DAM (1904)

The original dam was owned by W.D. Malone and P.T. Bost and was known then as the Malone-Bost Dam. The dam was constructed to provide irrigation for about 246 acres of agricultural lands, produce electricity, and for personal use. Water was diverted through a mill race originally known as the Malone and Bost Canal. The original water right was issued on August 15, 1904. Construction of the canal was initiated soon thereafter. Once completed it ranged from 1 to 15 feet deep and 14 feet wide. The canal had a carrying capacity of 125 cubic feet per second. The reservoir behind the dam had a holding capacity of approximately 20 million gallons and was about 3,000 feet long, 60 feet wide, and 12 feet deep, covering about 4.25 acres. Remnants of the canal and headgate structure remain on what is known as Glover's Island, a part of the City of San Marcos park system. This dam was reconstructed by the City of San Marcos in 2006 and is currently used as a water feature for water recreationists.

GLOVER'S DAM (1895)

The irrigation record for this dam was filed December 6, 1895, and it was constructed shortly thereafter by Mattie Glover. No remnants of the dam remain, although the channel is modified at the site, suggesting the dam had an effect on the river's hydrology. The dam included a canal known as Frank Glover Ditch. The head gate for the canal was located on the west side of the San Marcos River at the west end of the dam. The canal was 8 feet wide, 3 feet deep, and had a carrying capacity of 300 cubic feet per second. The maximum holding capacity of the dam was 1,000,000 cubic feet and the surface area of impounded waters was 10 acres.

CAPE'S DAM (1866-1867)

The original dam was built in 1866 or 1867 and was known as the "Thompson McKie and Davis Mill Dam." Its original purpose was for milling and for the ginning of cotton. The irrigation record was filed September 9, 1895. A ditch was constructed by William A. Thompson on what was known as "Thompson's Mill Tract" for milling and the irrigation of approximately five acres. The original size of ditch was 10 feet wide and 3 feet deep, with a capacity of about 33 cubic feet per second. The diversion powered a cotton gin. The water right, dated September 8, 1895, is the second oldest on the San Marcos River, issued only five days after the Spring Lake water right.

In conversation with a member of the Thompson family (Mrs. Rich) more history of this dam came to light. In 1850, Mr. William Thompson purchased 2,700 acres along El Camino Real and set up a cotton gin turned by oxen and mules. Soon he realized more power was needed. Grist stones from the Canary Islands were ordered and excavation of Thompson's ditch was initiated. Mrs. Rich reported the original ditch was 30 feet wide at its head, tapered to 20 feet at the gin, and carried a 0.04% grade. The original headgate was wood and the original dam was constructed with cypress caissons (baskets) filled with rubble size stones from the Blanco River. Caissons were laid side by side and stacked atop each other to make the core of the dam. The final product was a flow-through dam which did not significantly alter the flow of the river from the natural channel. In 1852 the grist stones arrived and the gin became operational.

The mill/gin ran almost continuously until World War II. Initial milling was old cedar from the escarpment slopes on General Burleson's land at Spring Lake. American elm and cypress were also milled. In 1890 Mr. Thompson poured the first concrete at the dam and replaced the wood head gate with concrete supports which are still in place today. Near the Cape Road crossing of Thompson's ditch was a sluice that regulated water to the head gate. Waters that passed through were allowed to return to the natural channel where the Till family ran a smaller mill. This mill is likely the Mattie Glover Dam at Willow Springs Creek described below.

Mr. Thompson also used reservoir waters to irrigate a large orchard and family garden. Hollowed out cypress logs were used to carry water to these irrigation areas.

J.M. Cape filed another irrigation request for the impounded water from this dam on May 19, 1905. The purpose was for milling and ginning as well as irrigation. Mr. Cape noted that by this time his family had maintained the dam and used water for milling and ginning for nearly 40 years. The reservoir extended 2,640 linear feet upstream with an average width of 100 feet. The dam's maximum holding capacity was recorded as about 2,500,000 cubic feet of water covering approximately six acres. Water was to be pumped from the reservoir at a rate of nine cubic feet per second as needed.

MATTIE GLOVER DAM AT WILLOW SPRINGS CREEK (1904)

This dam was constructed for irrigation of 170 acres and for milling purposes. Remnants of the gates and diversion pumps remain on the west bank at the confluence of Willow Springs Creek and the San Marcos River. Original Hays County Irrigation records locate the dam on the Juan De Veramundi League #1 and #2 section, 1.5 miles downstream of the town of San Marcos on the west bank at the southwest corner of the aforementioned J. Veramundi League #2. The dam had a capacity of 360,000 cubic feet and a surface area of 180,000 square feet (4 acres). The irrigation record was filed October 8, 1904 and recorded October 12, 1904.

CUMMINGS DAM (1905-1910)

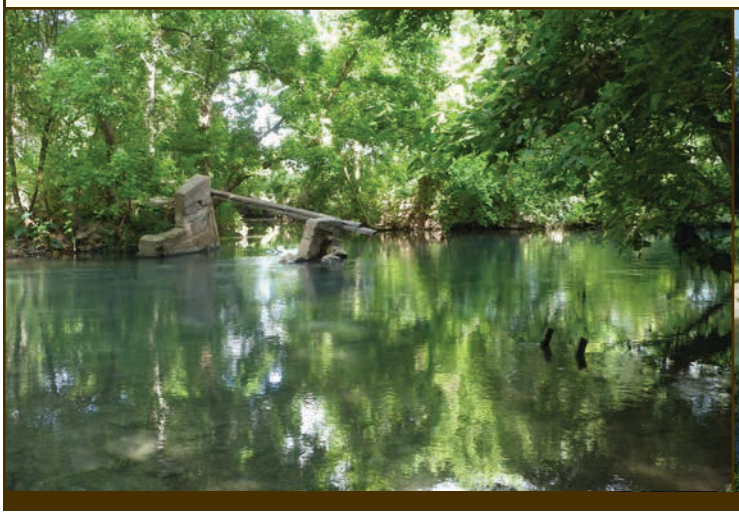
Mr. J.A. Bachman and Z.P. Jourdan filed a request to appropriate waters from the San Marcos and Blanco rivers for milling and irrigation on June 21, 1905, and a dam was completed circa 1910. It was proposed to irrigate 10,000 acres using a ditch or canal called simply "number 1." Its head gate was to be located in the Blanco River approximately one mile upstream of the confluence of the two rivers. The canal was to be 3 feet deep and 10 feet wide, with a carrying capacity of 250 cubic feet per second. The reservoir's capacity was to be approximately 15,000,000 cubic feet of water covering about 50 acres and 1,500,000 surface feet. The lake was to extend approximately two miles upstream into each river impounding all waters in the San Marcos River between the Thompson Mill Tract Gin and the dam. This dam remains intact and is the largest dam on the upper San Marcos River.

Mr. Ernest Cummings indicated in conversation that the dam and water right were sold to a Mr. Albord shortly after its completion. In or about 1921 it was again sold to Texas Power and Light. During the 1930s it was purchased by the Lower Colorado River Authority. Finally, in 1952 it was purchased by the Cummings family giving it its current name.

THE FLOOD OF 1998

The flood of October 1998 affected all these dams. USGS recorded up to 30 inches of rainfall just south of the City of San Marcos with peak discharge reaching 106,000 cubic feet per second for the Blanco River in Kyle and 21,500 cubic feet per second for the San Marcos River in San Marcos. As a result of this flood, work was begun to stabilize Spring Lake Dam. Rio Vista was reinforced and built up with additional features to support recreation such as additional chutes and bank stabilization. Cape's Dam was breached and a weir dam was constructed immediately upstream to maintain water depth for a persistent stand of Texas wild rice, an endangered aquatic plant. As of this writing, Cape's Dam has suffered further damage and is in disrepair. The weir dam is still in place, but the dam is under consideration for removal. Cummings dam, while not severely affected by the 1998 flood, suffered a breach which resulted in the dewatering of Cummings Lake. The dam was repaired and the lake reformed.

Mattie Glover Dam



Cummings Dam, July 2014

Early Results of Blanco River Guadalupe Bass Reintroduction Efforts Encouraging

STEPHAN MAGNELIA AND GORDON LINAM, TPWD RIVER STUDIES PROGRAM

In the Summer 2012 issue, we reported on a Guadalupe bass restoration project initiated on the Blanco River in 2011. As a result of severe drought, the river had been reduced to a series of enduring pools.

See article at: http://tpwd.texas.gov/publications/pwdpubs/media/pwd_br_t3200_003_8_12.pdf

The objective was to remove smallmouth bass and their hybrids from a 15-mile reach of river between Blanco State Park and The Narrows (a natural physical barrier limiting upstream movement of fishes) and reintroduce pure Guadalupe bass. Project collaborators included staffs from: TPWD Watershed Conservation, Hatcheries, and Fisheries Management; Texas Nature Conservancy; The Meadows Center for Water and the Environment; and the Texas State University Aquatic Biology Department.

Stocking of smallmouth bass in the 1970s and 1980s in the Blanco River and other Hill Country streams had unintended consequences. While smallmouth bass were well suited to the rocky stream habitat of the Texas Hill Country, they also hybridized with endemic Guadalupe bass. Soon it was difficult to tell one species from the other and extinction of Guadalupe bass became a real possibility. Smallmouth bass stockings were discontinued, but in many streams restoration of genetically pure Guadalupe bass populations was thought to be nearly impossible. A previous study by Texas State University that documented the genetic integrity of Guadalupe Bass throughout their range found no pure Guadalupe bass in the Blanco River.

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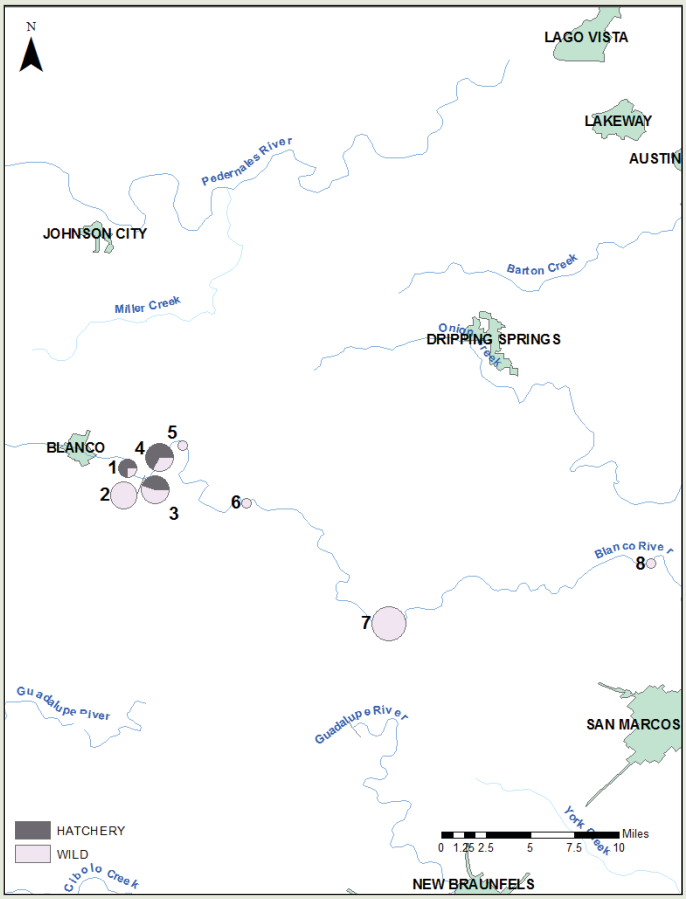
Map of the Blanco River from headwaters to its confluence with the San Marcos River near San Marcos, TX. The river from Blanco State Park to The Narrows, a natural barrier to upstream fish passage, was selected for smallmouth and Guadalupe bass hybrid removal. No smallmouth bass or hybrids were collected from the State Park to the headwaters of the river.

Pure Guadalupe bass adult collected in summer 2014. This is likely a hatchery fish stocked in spring 2012. Photo courtesy of Rachael Ranft (Texas Nature Conservancy).

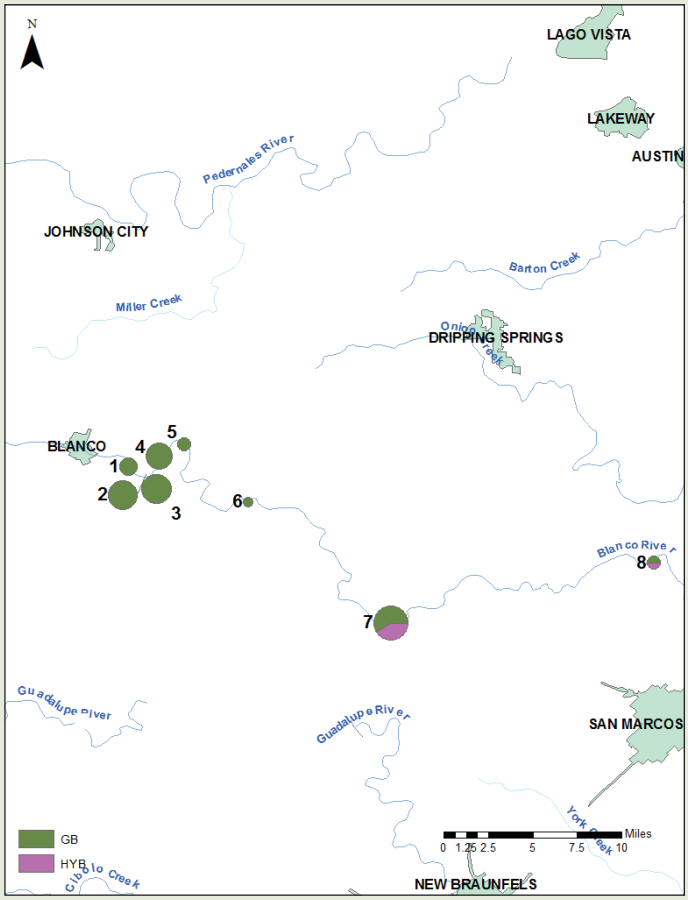
In 2011 about 40 enduring pools in the targeted reach of the Blanco River were identified and a relatively small number (n = 26) of smallmouth bass and hybrids were removed. Large numbers of other species of fish taking refuge in the pools were collected and released, which was a positive sign that the seining and electrofishing techniques used were effectively removing smallmouth bass. Rains returned to most of Texas in spring 2012 and the Blanco River once again began flowing, connecting the once isolated pools. In spring 2012 and 2013, 322,000 pure Guadalupe bass produced by the TPWD A.E. Wood State Fish Hatchery in San Marcos were stocked throughout the Blanco River.

Fish sampling was conducted in August 2014. Fingerlings stocked in 2012 should have been sexually mature by 2014 and we hoped to find young-of-the-year Guadalupe bass that were spawned during the spring. Ninety-nine fish identified in the field as pure Guadalupe bass or hybrids were collected for genetic analysis. These were collected inside and outside of the restoration area. Results indicate the project has thus far been a success, as only pure Guadalupe bass were collected in the 15-mile area targeted for restoration. Natural reproduction is taking place as wild fish contributed to the population of pure Guadalupe bass, not only in the restoration area but also downstream beyond The Narrows, the lower extent of the targeted restoration area. Wild fingerlings probably represent the best chance for reducing genetic introgression in the entire river over the long-term. The restoration area and the river upstream to the headwaters, which has yet to be stocked, could potentially serve as a perpetual source of pure Guadalupe bass stock for downstream areas.

Early results from this project are encouraging. While the drought of 2011 is something we likely want to forget, it did bring a rare opportunity for removing a non-native species. Without the drought this removal effort would not have been considered.



Proportion of Guadalupe bass (GB) and hybrid (HYB) genotypes recovered at each sample site (total n = 99). Pie graphs are scaled to sample size. Sites 1 through 6 were in the area where smallmouth bass were removed from enduring pools. Figure courtesy of Dijar Lutz-Carrillo, A.E. Wood State Fish Hatchery Analytical Services Lab.



Proportion of hatchery and wild Guadalupe bass recovered at each of 8 sampled sites. Sites 1 through 6 were in the area where smallmouth bass were removed from enduring pools. Pie graphs are scaled to sample size. Only Guadalupe bass subjected to parentage analyses were considered (total n = 46). Figure courtesy of Dijar Lutz-Carrillo, A.E. Wood State Fish Hatchery Analytical Services Lab.

The Urban Water Cycle Tour

NORA SCHELL, CITY OF WACO – LAKE WACO WETLANDS PROGRAM COORDINATOR

"Where does your drinking water come from?" The North Bosque River is the section of our watershed that flows into Lake Waco. Most of our citizens know that Lake Waco is a place to fish and to swim, but most don't know that it's our drinking water source.

Knowing where your water comes from helps in understanding what is in your water. After 10 years of working for the City of Waco Water Utilities Department at the Lake Waco Wetlands, and facilitating hundreds of field trips for several schools, organizations, and the general public, I started to realize that the answer to this question is relatively unknown to many people (i.e., citizens in our community). And it became even more evident soon after our newest water treatment facility became operational. Media attention was drawn to it and people started to read and learn more about the urban water cycle process. More importantly, people started to ask questions.

The idea of the "Urban Water Cycle Tour" came about during this time because school groups started asking for tours of this newest facility, the Dissolved Air-Flotation Plant (DAF). As the Water Utilities Dept. staff we saw the need of providing a tour of the whole water treatment process. Focusing on just one step of the process would not give the "Urban Water Cycle" justice, so a field trip plan was devised.

The Lake Waco Dam

www.swf-wc.usace.army.mil/waco/

Park rangers with the U.S. Army Corps of Engineers provide a walking tour of the Lake Waco Dam, focusing on the lake's history and how the dam works, including a visit into the inside of the intake vault.

Dissolved Air-Flotation Plant (DAF)

www.waco-texas.com/cms-water/

Completed in 2011, it is one of five in the United States that is used for pre-treatment of drinking water. The DAF can treat 90 million gallons of water, removing algae and improving water taste and odor by using ozone disinfection.

Mount Carmel Water Treatment Facility

www.waco-texas.com/cms-water/

Waco has two water treatment facilities, including Riverside WTP. These facilities further disinfect and chlorinate over 60 million gallons of drinking water per day. The Water Quality Lab, located at Mount Carmel WTP, continuously analyzes water samples from our watershed to ensure healthy and safe water at all times.

Waco Metropolitan Area Regional Sewerage System (WMARSS)

www.wmarss.com

Designed to treat over 40 million gallons of waste water per day, using micro-organisms in a biological treatment process.

CONTINUED ON PAGE 8

The Urban Water Cycle Tour, continued

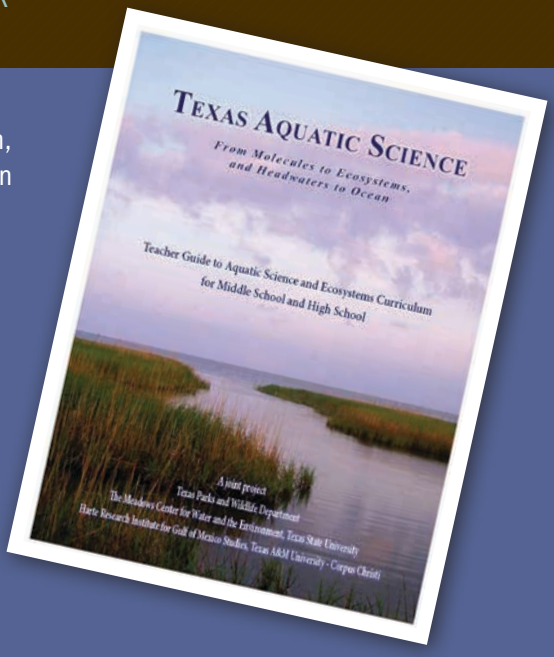
Baylor University's Center for Reservoir and Aquatic Systems Research (CRASR) and the Lake Waco Wetlands were awarded the "Sustainability in the Swamp" grant through the Louisiana Environmental Education Commission in February 2014. CRASR and the City of Waco have partnered in the past to provide educational programs that introduce local educators to area resources in water conservation and wetland habitats. The "Sustainability in the Swamp" workshop directly enhanced this goal by providing 15 area teachers with additional program ideas that they in turn could use in their classrooms. The grant was also used to support field trips to both the Lake Waco Wetland and the Urban Water Cycle Tour by the teachers who participated in the workshop. A total of 477 students in grades 4 through 12 came on 15 field trips ranging in length from 1.5 to 6 hours in the spring of 2014.

For additional information on Baylor University's Center for Reservoir and Aquatic Systems Research, please contact the Environmental Education Specialist at (254) 710-2358 or melissa_mullins@baylor.edu.

For more information on the "Urban Water Cycle Tour" and the Lake Waco Wetlands, please contact the City of Waco Lake Waco Wetlands Program Coordinator at (254) 848-9654 or noras@ci.waco.tx.us.

New Texas Aquatic Science Curriculum Now Available

JOHNNIE E. SMITH, TPWD CONSERVATION EDUCATION MANAGER



Texas Aquatic Science is a new curriculum offered by Outreach and Education, part of the Communications Division of Texas Parks and Wildlife, and is written for middle school and high school students. Lessons are designed to help teachers make students aware of the importance of water to life, aquatic ecosystems, and what we must do to conserve water and aquatic life.

Texas Aquatic Science is a comprehensive aquatic science curriculum, from molecules to ecosystems, and headwaters to ocean. The curriculum consists of an online student textbook, a teacher guide, specially produced videos, and supplementary materials. All materials are aligned with Texas state curriculum standards, the Texas Essential Knowledge and Skills for sixth through eighth grade, and for Aquatic Science and Environmental Science courses for high school.

Access both the student and teacher guides at **www.tpwd.texas.gov/publications/learning/aquaticscience/index.phtml**.

New for 2015, the student textbook will be available in print through Texas A&M Press. Texas Aquatic Science is a cooperative education project sponsored by Texas Parks and Wildlife, The Harte Research Institute for Gulf of Mexico Studies at Texas A&M University–Corpus Christi, and The Meadows Center for Water and the Environment at Texas State University. It was modeled after the Missouri Department of Conservation's (MDC) curriculum, Conserving Missouri's Aquatic Ecosystems. Support was provided by the Ewing Halsell Foundation, San Antonio and the Sport Fish Restoration Program of the U.S. Fish and Wildlife Service.

Upper San Marcos River Protection Efforts

MARY VAN ZANT AND TRAVIS TIDWELL
THE MEADOWS CENTER FOR WATER AND THE ENVIRONMENT

Texas Stream Team on the San Marcos River

Data collection is a vital component to any successful Watershed Protection Plan in order to establish baseline conditions, predict future changes via modeling, and to measure the impacts of the efforts taken to protect the watershed. The San Marcos Watershed Initiative relies on Texas Stream Team for a good portion of its water quality data.

Texas Stream Team is a collaboration of the Environmental Protection Agency, the Texas Commission on Environmental Quality, and The Meadows Center for Water and the Environment at Texas State University to support a network of citizen scientists and partnering organizations across Texas that are committed to water stewardship.

CONTINUED ON PAGE 11

The Upper San Marcos River

The upper San Marcos River watershed is located in Hays County, TX and includes the San Marcos River and its major tributaries: Sink Creek, Sessom Creek, Purgatory Creek, and Willow Springs Creek. Artesian spring water from the Edwards Aquifer emerges into Spring Lake through hundreds of spring openings, creating one of the most productive spring-fed systems in Texas, and forming the headwaters of the upper San Marcos River. The upper portion of the river flows through part of Texas State University and a number of public parks, managed by the City of San Marcos, before passing under Interstate Highway 35. It then meanders by a fish hatchery, a wastewater treatment plant, and several tracts of private land in a largely undeveloped area before combining with the Blanco River.

The watershed is mostly limited to Hays County, with small portions of the west-south-west portion of the Purgatory Creek subwatershed crossing into Comal County. A small northern section of the Sink Creek subwatershed is located within the boundary of the City of Wimberley. The majority of the watershed is rural and located over the Edwards Plateau. The main stem of the river, however, is in the urban center of the City of San Marcos, on the Gulf Coastal Plain. The springs flow out of the Balcones Fault Line, which separates the Edwards Plateau and the Gulf Coastal Plain. The upper San Marcos River watershed is approximate 60,585 square acres.

The lake and river are home to several endangered species, including the Texas blind salamander, fountain darter, San Marcos salamander, San Marcos gambusia, and Texas wild rice. Locals celebrate the unique Texas wild rice, found only in the

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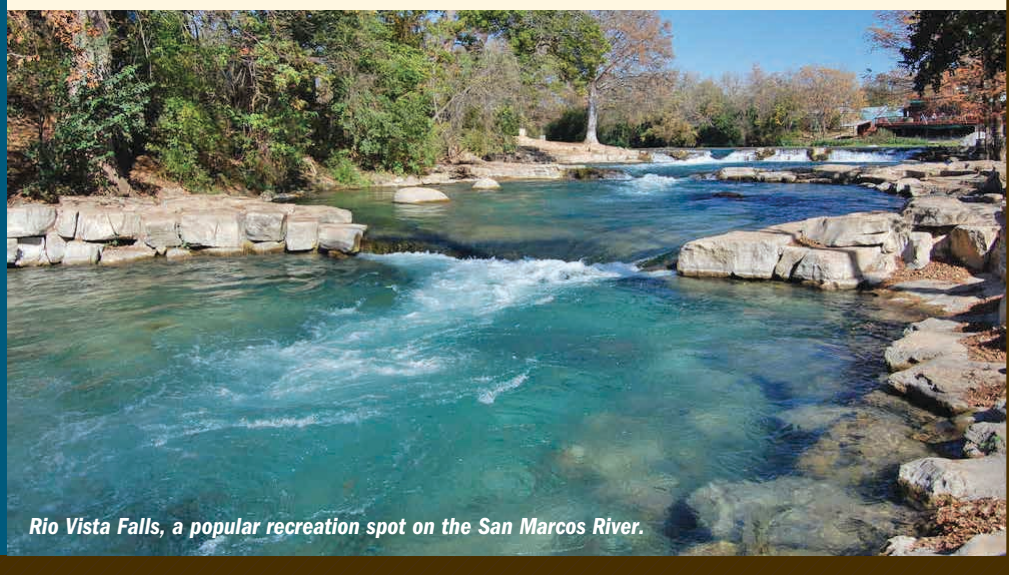

Rio Vista Falls, a popular recreation spot on the San Marcos River.

first 3 miles of the river, with events such as the annual Texas Wild Rice Festival. Due to the river's high biodiversity and the presence of a number of endemic and endangered species, the USFWS has designated the San Marcos Springs and Spring Lake as critical habitat. The Guadalupe roundnose minnow and the bigclaw river shrimp also occur in the headwaters and have been identified by the Texas Comprehensive Wildlife Conservation Strategy as species of "high priority" for conservation.

From archeological studies of the area, there is evidence that it has been continuously inhabited for over 11,000 years. Based on its rich cultural record, Spring Lake and the San Marcos River continue to hold a great deal of significance to contemporary populations. This includes not only modern-day San Marcos residents, but also descendent Native American communities, some of whom consider the springs to be sacred.

In the 20th Century, Spring Lake was home to a theme park known as Aquarena Springs, with an underwater submarine mermaid show, a swimming pig named Ralph, and glass bottom boats. Texas State University purchased the theme park in 1991, and has retained the glass bottom boats as an educational nature tourism attraction which continues to operate on Spring Lake. Today, the river is known for its high clarity and relatively constant flow rates and temperatures. It is a very popular location for water recreation activities including swimming, tubing, boating, canoeing, kayaking, golfing, snorkeling, SCUBA diving, and fishing. The river attracts hundreds of thousands of visitors annually, generating substantial revenues from tourism and recreation.

Threats to the River

According to U.S. Census data, the population of San Marcos increased by 29% and the population of Hays County grew by a remarkable 61% between 2000 and 2010. Both San Marcos and Hays County grew at a faster rate than state (21%) or national averages (9.7%). Projected growth rates indicate that the population near the San Marcos River will continue to grow at a rapid rate over the next 20 years. The population of the entire Edwards Aquifer region is expected to increase by 63%, to nearly 1.3 million people over the next 50 years. Given these population growth projections, the land use demands within the upper San Marcos River will be much more significant and the demand for Edwards Aquifer water resources also will be exceptionally high.

Along with impacts from population growth, the region has been affected by drought conditions in recent years. The years 2009 and 2011 had below average rainfall, with 2011 being one of the driest years on record. The drought of 2011 dried up intermittent creeks and rivers, and drastically diminished reservoirs, the effects of which are still present. The City of San Marcos has remained under water use restrictions nearly continuously since 2011. Flows have been variable (often below average), and low flow conditions degrade water quality conditions.

The San Marcos Springs and Sink Creek flows make up Spring Lake. The brown flood waters from the Halloween 2013 Flood can be seen here, creating a distinct line where they meets the turquoise spring water from the Edwards Aquifer.

The endangered species in the lake and river are sensitive to variances in water quality and rely on suitable flows for survival, including constant cool temperatures made possible through spring flows into the upper reaches of the system. Other threats to these species include habitat destruction from development (sedimentation and pollution from construction, reduced riparian areas, and increased river traffic), invasive species that alter the ecosystem, and water pollution.

Water Quality in the River

The Texas Commission on Environmental Quality (TCEQ) has set the standard total dissolved solids (TDS) concentration for the upper San Marcos River as 400 mg/L. In 2010, the upper San Marcos River Segment 1814 was listed as impaired for TDS and added to the state's 303(d) List (the list of water bodies which do not meet a specific water quality parameter's standard for the water body's designated use). As part of the Texas Stream Team, citizen scientists have been collecting water quality samples for the upper San Marcos River under an approved TCEQ Quality Assurance Project Plan since 1995. A recent analysis of TDS concentrations on the upper San Marcos examined 1,683 specific conductivity measurements by Texas Stream Team Citizen Scientists from 1995 to 2013. A mean TDS value of 399 mg/L was calculated and showed no significant increase or decrease in concentrations over time. Texas Stream Team's data is not intended for official assessment purposes, but the analysis does support the notion that TDS concentrations of the upper San Marcos River are hovering at, or above, the state's designated standard and that these concentrations have remained steady for some time. Furthermore, the San Marcos system has shown an inverse relationship between peak discharge from rain events and TDS, which indicates that the rainfall runoff is low in TDS and dilutes that which may come from the spring water.

Watershed Protection Plan

The San Marcos Watershed Initiative (SMWI) began when local stakeholders partnered with The Meadows Center for Water and the Environment to better understand water quality in Spring Lake and Sink Creek. With guidance from the TCEQ and the Meadows Center a stakeholder committee is utilizing

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Texas Stream Team on the San Marcos River

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Trained volunteers conduct water quality monitoring at assigned sites on their local lakes, rivers, streams, and estuaries across the state. The information collected by citizen scientists is submitted to a database containing 23 years' worth of data on hundreds of sampling sites maintained by The Meadows Center.

The Stream Team group responsible for water quality monitoring on the San Marcos River is "The San Marcos River Rangers," who have been monitoring the San Marcos River on 19 sites since 1995. Rachel Sanborn, the leader of the River Rangers, has been involved with Texas Stream Team for almost 20 years. "I think volunteering in this capacity strengthens the idea of local responsibility for local resources," said Rachel, when discussing the benefits of joining Texas Stream Team.

"Rather than relying on outside forces such as TCEQ to note and find problems, this is a much more proactive type of involvement. I stress that data collection is our best defense against the inevitable development by clearly demonstrating what the water quality has been, and what standard must be maintained."

Texas Stream Team relies on its partner organizations across the state to support local Stream Teams by purchasing monitoring equipment and supplies, creating monitoring plans, and organizing trainings. The San Marcos River Rangers are supported by The San Marcos River Foundation, a non-profit organization dedicated to protecting the flow, purity, and natural beauty of the San Marcos River. "The Stream Team's volunteers are the perfect way to collect data. All of the volunteers let us know when they see anything unusual that needs to be checked out while they are out doing their water testing. The long term records of any changes in water quality will be useful for generations to come," said Dianne Wassenich, the Executive Director of SMRF.

Many of the San Marcos River Rangers are Texas State University Students who volunteer with Texas Stream Team to gain experience and technical skills. Texas Stream Team supports the goals of many students who pursue a career in water resource management or environmental science. Some of these students move on to start their own Stream Teams after graduation and others continue to collect data on the San Marcos long after they have graduated. Whatever the case, the data collected by these Texas Stream Team Citizen Scientists will help to ensure that the San Marcos River stays just as beautiful for future Texans.

Texas State University student Thomas Howard monitoring water quality of the San Marcos River with the student group RINSE (River Inspired Student Effort), a partner of Texas Stream Team's newly launched Paddling Program.

ETCETERA

Upper San Marcos River Protection Efforts

CONTINUED FROM PAGE 10

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HAVE AN ARTICLE YOU'D LIKE TO SUBMIT?

If you would like to submit an article or announcement concerning watershed-related activities, initiatives, or workshops* for the next issue, please email the editor at: ryan.mcgillicuddy@tpwd.texas.gov

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the results of the Spring Lake Study to develop a Watershed Protection Plan (WPP) for the upper San Marcos River. Goals of the WPP are to investigate causes of the TDS impairment and identify any other non-point source pollution concerns in the watershed. The vision of the San Marcos Watershed Initiative is "a healthy watershed that supports a clean, clear, and flowing San Marcos River for the future as it was in the past."

Stakeholders involved in developing the WPP include diverse representatives of the community. Stakeholder interests include: agriculture, archaeology, culture, development, and local business, coupled with representatives from the city, county, university, local non-governmental organizations, river authority, and experts in water quality, water conservation, education and outreach, and other relevant topics.

There are several parallel efforts focusing on other aspects of the river that are being combined with WPP efforts. As the City of San Marcos approaches a population of 50,000 both the city and Texas State University are required to develop a Multiple Separate Storm Sewer System (MS4) program to manage stormwater. The city is also coordinating its current water quality protection plan activities with the WPP. Efforts to protect the endangered species include the Edwards Aquifer Habitat Conservation Plan (HCP), which requires various conservation, restoration, and protection measures such as invasive species removal, riparian protection, recreation entry points, sediment management, and educational outreach.

This effort presents the opportunity to explore ways to manage impacts to surface water resources through a voluntary, stakeholder-driven WPP for the upper San Marcos River watershed. The WPP will address the listed impairment (5c) for TDS, and will serve as a proactive mechanism to address E. coli, nutrients, sediment, pollutants identified by stakeholders, and impacts of future population growth. This project began in the winter of 2012-13. A Watershed Characterization has been compiled and pollution causes and sources have been identified. The next task in the project timeline is to identify best management practices to address existing and expected future nonpoint source pollutants. A comprehensive WPP will be completed and submitted to TCEQ and the Environmental Protection Agency in October, 2015.

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