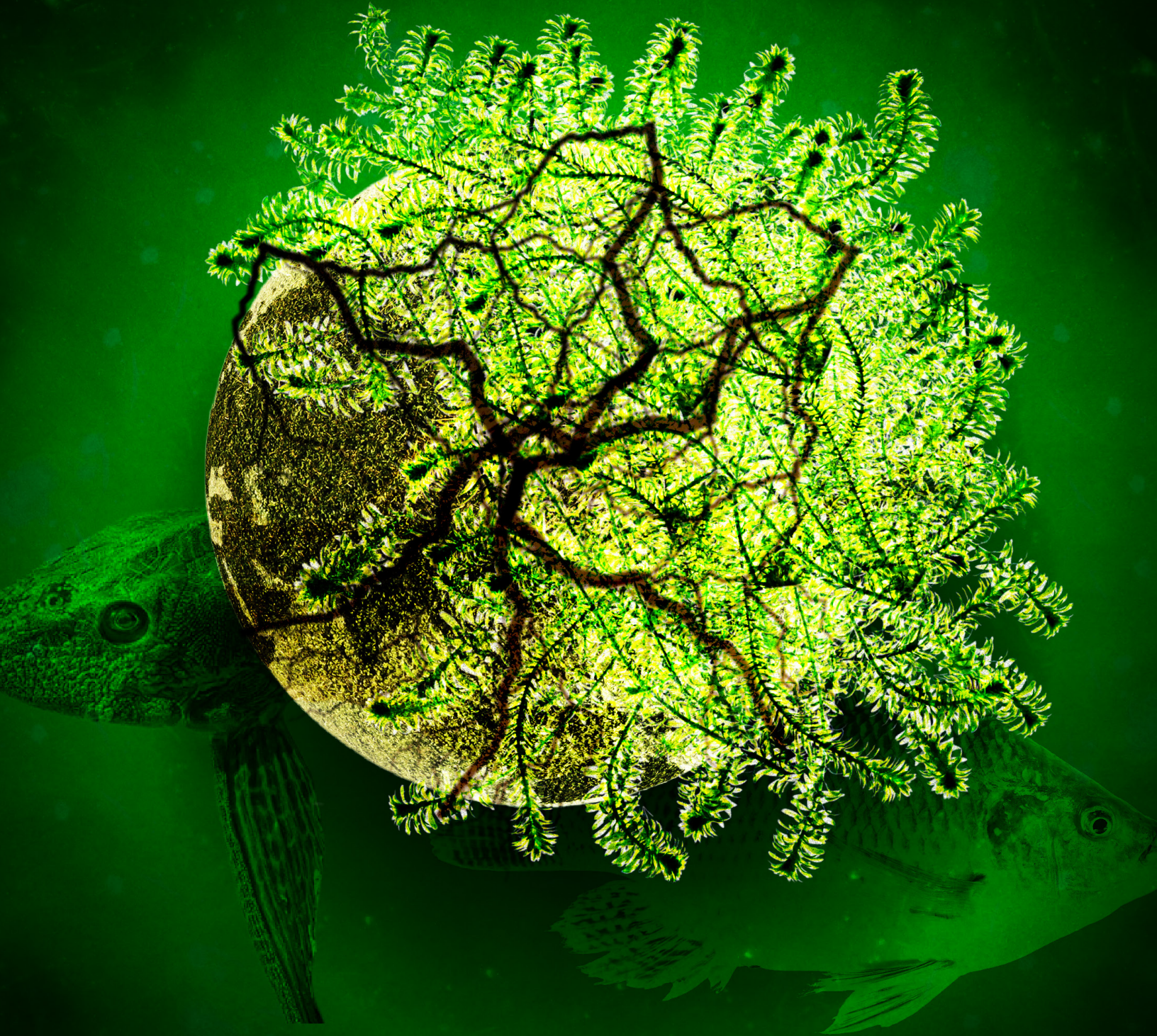


NEWS DROP

M A G A Z I N E

AUTUMN 2021



I N V A S I O N

OF THE WATER BODY SNATCHERS

*In
Loving
Memory*

*Forever in Our
Hearts*

- Deana Watson



AUTUMN 2021

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Edwards Aquifer Authority
900 E Quincy St
San Antonio, TX 78215

HOPE



“Hope” is the thing with feathers -
That perches in the soul -
And sings the tune without the words -
And never stops - at all -

And sweetest - in the Gale - is heard -
And sore must be the storm -
That could abash the little Bird
That kept so many warm -

I've heard it in the chilliest land -
And on the strangest Sea -
Yet - never - in Extremity,
It asked a crumb - of me.



Roland Ruiz
EAA General Manager

Dear Friends,

As we journey down our path into the “Next Generation” of our mission, I am drawn to the poem, “Hope” is the thing with feathers - (314), by Emily Dickinson.

A study of Ms. Dickinson reveals that she lived mostly a secluded life in the middle part of the 19th century. It's an experience with which we can perhaps identify more easily now as a consequence of the COVID world thrust upon us these past 18 months or so.

As it did for a poet of a past generation, hope -- however frail it may appear to be, even as a little bird -- sustains our dream, and inspires our work.

We manage, enhance, and protect the Edwards Aquifer system, not for ourselves, but for those who one day will look back and be glad we did. We hope.



AUTOMATED METER READING (AMR) PROGRAM

The Edwards Aquifer Authority (EAA) developed our Automated Meter Reading (AMR) program to assist well owners in meeting their obligation to report groundwater use to the EAA. As specified in the EAA Act, and described in EAA's rules, all well owners who operate under a groundwater withdrawal permit issued by the EAA must file an Annual Groundwater Use Report each calendar year. To facilitate annual use reporting, EAA staff prepare reporting forms to collect monthly and year-end meter readings and mails the reporting forms to well owners in December as the year ends. Well Owners must file their reports by January 31st of each year, listing monthly and year-end meter readings, along with a calculation of annual use for the preceding calendar year.

In addition, during periods of declared Critical Period Management (CPM), permit holders who are permitted to withdraw more than 3 acre-feet annually, must file Monthly Groundwater Use Reports. These monthly forms were also mailed to affected permit holders, requiring monthly beginning and ending meter readings and calculated usage. These monthly reporting forms were due to the EAA within 10 business days after each month experiencing CPM conditions. Parts of the EAA region experienced CPM conditions in 10 of the past 13 years since EAA groundwater permits were finalized in 2007. The result has been that well owners received multiple mailings and filed a lot of reporting forms in order to meet the requirements in EAA's rules.

AUTOMATED METER READING (AMR) PROGRAM

Groundwater use reporting is one of the most important obligations well owners have in the overall management and conservation strategies outlined by the EAA Act. Because reporting annual use is so important, EAA staff dedicates much time and resources to collect this important information.

Meter readings are critical in how we administer the permitting program and identify permits that are over-pumped. Failing to file a year-end report usually involves EAA meter team visiting the well to obtain the meter readings ourselves. When this happens, the well owner is required to settle this possible violation of EAA rules, and if they don't settle, are subject to possible enforcement and assessment of an administrative penalty by the EAA Board of Directors.

BECAUSE REPORTING ANNUAL USE IS SO IMPORTANT, EAA STAFF DEDICATES MUCH TIME AND RESOURCES TO COLLECT THIS IMPORTANT INFORMATION.

Over the years, EAA staff have introduced additional ways for permit holders to report their meter readings. Currently, in addition to filing the EAA's Annual Use Report through the mail, owners can log on the EAA website and generate and file an electronic reporting form.

More recently, EAA developed our Meter Matters Smartphone Application ("meter app") to make this process even easier by allowing well owners to submit meter readings directly from their wells using their smartphone camera. But EAA staff envisioned a reporting technique that would not require the well owners' efforts at all.

Would it be possible to automate the meter reading process by electronically generating and storing information at the well and transmitting meter information directly to our office?



PHOTO ABOVE: Early efforts to develop a communications system for AMR followed the same idea as the EAA Rain Gauge Network. This photo shows an AMR radio relay station in north Uvalde County co-located with an EAA monitoring well and rain gauge station (the smaller tower on the right).

The radio relay station is powered by solar panels and a small wind generator. This radio relay tower communicated with over a dozen remote AMR stations in the area and sent the data (through an additional relay station) to a receiver and internet gateway at the Sabinal Water Tower. From there the data was transmitted via web to the EAA office.

The introduction of cellular communication made these stations no longer necessary.

If we have that information, the permit holder would no longer need to file an annual use report with the EAA. With this simple premise, the EAA's AMR program was born; and AMR entered the EAA lexicon.

It all began innocently enough during a September 2008 meeting of the EAA's Permits/ Enforcement Committee. EAA staff were discussing the need to begin replacing the water well flow meters on Irrigation wells that are owned and maintained by the EAA.

As a provision in the EAA Act, the EAA was required to purchase, install, and maintain the flow meters on permitted wells designated for Irrigation use, while the Act required owners of municipal and industrial permits to install and maintain their own meters. Since it was almost 10 years since the initial installation of these irrigation meters, it was time to begin replacing them.

As part of the discussion, EAA staff introduced the possibility of developing an 'automated meter reading' program at irrigation wells that would operate somewhat like the EAA's regional rain gauge network functioned.

As envisioned, we could develop a way to generate an electronic meter reading from these mechanical meters and transmit that data back to the EAA. Our rain gauge network did that in reporting rainfall, how hard could it be to do basically the same thing with meters?

Intrigued by the possibility, the EAA Board of Directors adopted Resolution and Order No. 12-08-608 at their December 9, 2008, meeting which created a volunteer automated meter reading program ("VAMR").

The Order approved the canvassing of irrigation permit holders to volunteer to participate



PHOTO ABOVE: EAA Staff (Joseph Sterzenback) holds up the LTE cellular modem (left) from T-Mobile Communications and a MicroRTU+ Programmable Logic Controller, or PLC, from Visionary Electronics (right). The programming in the PLC converts the electronic pulses from the ring sensor into electronic meter readings and stores the data while the cellular modem transmits the information four times per day to the EAA's SCADA server where the AMR data is accessed by EAA staff.

in the VAMR where EAA would pay all costs for installation and equipment. Participation would eliminate the need for the permit holder to file usage reports with the EAA.

AUTOMATED METER READING (AMR) PROGRAM

It was necessary to start with irrigation wells since all the meters owned and maintained by the EAA were of the same manufacturer. In this way, early development and engineering of AMR components were made to the same meter standards.

Thus, kicked off a grand experiment that would become EAA's AMR program. In the almost 13 years since that initial discussion, EAA staff developed a functioning integration of hardware and software which operates today at over 120 remote stations. How this was accomplished is a story of having high expectations, experiencing key disappointments, maintaining a dogged determination, keeping a strong collaborative spirit, steadily improving technologies, to finally experiencing success.

The EAA rain gauge network – the genesis of an AMR idea

At the time, the genesis of AMR possibilities was in the success of the EAA Rain Gauge network.

When AMR was proposed, the rain gauge network consisted of over 70 remote solar-powered gauging stations scattered throughout the Hill Country (mostly in the Contributing and Recharge Zones of the Edwards Aquifer system) that mechanically collected and electronically measured rainfall.

This system sent the electronic rainfall information over a VHF radio network to various collection points and internet gateway site, which was then accessed by a central server located at the EAA office.

As envisioned, we could develop a similar system for our mechanical flow meters by developing an electronic meter reading and then using a radio/internet network to bring this information back to the EAA.

The developmental challenges for AMR as we saw them generally revolved around four key areas: how to generate electronic signals from a mechanical meter and convert to a meter

reading accurately, how to log and store these electronic meter readings for at least 18 months, how to transmit the meter readings to the office four times daily, and how to share this daily information with the participating well owner.

As we began to develop these ideas before our 2008 proposals to the board, engineering these solutions were on our electronics technicians and IT professionals who operated the rain gauge network.

To understand the mindset going into this initial development period, our electronics technicians, working with selected vendors, practically custom-built our mechanical rain gauges.

To keep costs low, they used off-the-shelf components and electronics to design our rain gauge stations. Always with an eye on budget limitations, we understood our investments in mechanical meters and in the relatively low cost of radio communication

as electronic meters and other forms of communication were prohibitively expensive at the time.

AMR Muscle – Electric Power, the Sensor Ring and Flow Meters

When EAA staff were first required to install flow meters at irrigation wells beginning in 1998, it was necessary to install mechanical meters since these were economical, durable, and did not require external power.

This was necessary as most well locations at these irrigation sites did not have electric power available. A mechanical flow meter works by measuring the speed of flowing water running through the pipe that causes a propeller to rotate. The volumetric flow rate of the water is proportional to the rotational speed of the prop.

That rotation is geared to a mechanical register that measures the amount of water passing through the meter. The register works like the odometer on your car, and

subtracting successive readings indicated the amount of water used. Since we were already invested, our first real challenge was how to get an electronic signal from these existing mechanical meters.

From our experience with rain gauges, solar panels and batteries would power the electronics of this new AMR system. We considered this would be the easy part (only later did we begin to see limitations).

And in taking apart and performing basic repairs on the meter registers, EAA's meter team observed the moving parts that made the meter work. We noted how the spinning shaft coming up from the propeller assembly comes into the register housing to operate the register and flow rate needle.

EAA meter and electronics staff, working closely with Technology Kitchen to design and then with Ember Industries to manufacture, developed a 'sensor ring' to attach

to the inside of the meter housing. The sensor in this ring would detect small magnets attached to the meter shaft which operated the flow rate needle.

During water flow, when the propeller and shaft are rotating, an electronic pulse would be generated when the magnets mounted on the shaft passed across a sensor mounted on the ring.

That way, the faster water flows through the pipe, the faster the prop spins, and the faster the shaft spins, the faster the pulses are generated. As we began to tinker with the meter housing and work on the programming to convert these pulses into meter readings, we also worked very closely with the meter manufacturer.

We informed them of what we were doing and why we needed such unusual technical information; we didn't want to void warranties and needed rotational specifications for the variously sized meters to aid in our conversion programming.

AUTOMATED METER READING (AMR) PROGRAM

It turned out that the meter manufacture was equally intrigued; they requested details of our designs and later developed their own version of our sensor ring configuration that they installed on a new line of meter products.

Our first big disappointment came when we tried to introduce a new mechanical meter to support AMR soon after our 2008 proposals to the board.

As part of that overall meter replacement program, we solicited proposals and selected a new meter manufacturer (not to be named here) which we hoped would supply a more cost-effective meter for replacements and could also integrate into the AMR program. As it turned out, the new meter failed at the task.

Within the first few months of installation, the new meters were failing due to lower quality parts, especially with the meter registers, and the vendor support we needed to develop our programming proved unsatisfactory.

After almost a year of constant struggles, we had to abandon the new vendor and meters, and return to our original meter and vendor.

This proved to be a wise choice, as our McCrometer meters and vendor support proved to be a strong partner in our irrigation meter O&M requirements, and in our AMR rollout. EAA continues our strong relationship with McCrometer, and we are testing several McCrometer electronic meters and communication options at a few of our AMR sites today.

As mentioned, the sensor ring assembly was the brainchild of our electronics technicians. EAA staff worked with electronic engineering and manufacturing partners to develop and produce this component which we continue to install in our McCrometer meters. McCrometer provided all the technical specification needed to aid in programming from the electronic pulses, and likely developed new products from our ideas to market for themselves in the process.

AMR Brain – Programmable Logic Controllers (PLCs)

Along with the development of the hardware (sensor ring) to install in our existing meters, a parallel challenge was to develop the programming necessary to convert the pulses generated by the sensor into meter readings that would exactly mimic the mechanical register on the meter.

The platform for this programming is the Programmable Logic Controller, or PLC. PLCs are small industrial computers used to control different electro-mechanical processes and are generally rugged, fast, easy to operate and considered easy to program.

As I came to learn, a PLC is a complex little device that is generally custom made for the specific applications intended, so our challenge was to find the best PLC for the job. And once again, a bit of not delivering on promises and much trial and error plagued our early developments.

Perhaps it was a little bit of implementing a new application, and a vendor raising our expectations about their capabilities, the early efforts were very frustrating.

As with lots of things about this time, it was working, but just not right. Here again, we learned that you don't always get what you hope for with new products or vendors.

It was also during this time; we began to realize the power requirements we needed to run the various electronic components of the new AMR system.

The overall power consumption of the PLC and the communication radios would be a critical factor to success.

Sometimes during short winter days and prolonged cloud cover, the solar panel and batteries were strained to provide the necessary power.

Power consumption would prove to be a nagging problem. We seemed to be on a constant search for lower power demands or

bigger batteries (and in the meantime, prayed for more winter sunshine).

Ultimately, after disappointment and failing with earlier board manufacturers, we found a capable vendor with Visionary Electronics, and their rugged little PLC, the MicroRTU+.

EAA staff continues our relationship with Visionary as we look to develop more efficient PLCs with better capabilities and lower power requirements.

At this point, it seemed we solved our first two big challenges. While we began fielding AMR prototypes at VAMR participants beginning in 2009, the meter and PLC issues plagued our progress for the next several years.

It is important to realize developing AMR became an 'additional duty' for much of the meter staff as they were busy enough with current duties. Mainly, our two dedicated electronics technicians focused on solving the many technical problems being encountered.

However, by 2014 with the meter and PLC issues mostly resolved, it was time to expand in earnest into the field, where the power issues would once again become apparent.

MAINLY, OUR TWO DEDICATED ELECTRONICS TECHNICIANS FOCUSED ON SOLVING THE MANY TECHNICAL PROBLEMS BEING ENCOUNTERED.

AMR Speaks – From Radios to Cellular

As originally envisioned, the AMR network would communicate by radio. The rain gauge network had various remote stations (called "remote terminal units" or "RTUs") that would communicate by radio signal to base stations (called "data concentrator units" or "DCUs") generally located on hills with large radio antennas.

The DCUs then connect to an internet gateway that sends the data over the internet to our rain gauge

AUTOMATED METER READING (AMR) PROGRAM

server at the EAA. While we hoped that parts of the rain gauge communications network could be utilized for AMR, most of the rain gauge RTUs and DCUs were located too far away from most of the AMR sites, since most of these irrigation wells are in the artesian zone of the aquifer system.

So, it was determined early that due to these large physical separations, the limited range of the radios, and the type of data to be transmitted, the DCUs used by the rain gauges would be of little use to our AMR network.

As we began to identify VAMR participants to bring into a limited pilot program, a priority for initial selection was to be within the range of our key internet gateway in Sabinal (located at the Sabinal water tower).

By 2015, EAA began our pilot program with 60 volunteers.

We now had fielded AMR stations that were operating as envisioned, and where electronic pulses from the sensor ring were converted to meter readings stored in the PLCs.

The stations in communication were polled four times a day, and meter readings were transmitted by radio signal to the regional relay tower and on to the internet gateway.

From there, the information was sent over the internet to the AMR SCADA server at the EAA. However, some of the stations were outside of radio range from the relay tower, so EAA staff had to visit these sites periodically and download the stored data onto laptop computers to bring back to the office.

Notwithstanding these ongoing issues, EAA staff was able to provide annual use reports from AMR to our 60 VAMR participants for the first time in January 2017, providing meter readings for the 2016 pumping year.

As we began to contemplate reaching out to more distant wells, it required the installation of additional 'repeater' stations, generally within the 'line of sight' requirements for our ISM radios, to bring the information to the relay towers. As power issues continued to plague our

progress, getting radio signals from the far reaches of our potential volunteers looked to provide our next insurmountable challenge. Then, an old idea took on a bold new look.

A bit to the south of EAA's boundaries, the Eagle Ford Shale would bring an unprecedented oil boom to those nearby counties. Cellular phone companies were surging into the area to supply services to the myriad of electronic and communication requirements in the oil industry.

As cellular services expanded into previously blacked out portions of our jurisdictional areas, and with the recent declines in drilling activities, cellular service providers were willing to offer a cost-competitive option for our AMR communications network.

The cellular option would prove to be the solution to several long-standing problems. First, it didn't have the range and coverage restrictions of our radios; and second, it needed much less power to operate. When the cellular option became viable,

we no longer needed a network of relay towers and internet gateways. Solar panels were becoming more powerful and cheaper to purchase.

And T-Mobile Communication provided cost competitive rates for their wireless services with respect to the costs of maintaining our proposed radio network.

This solution proved to be the last technical hurdle in rolling out the AMR program as it operates today.

AMR Reaches Out – EAA Smartphone Meter App

As a final challenge, we needed a way for our volunteer participants to view, in real time, the meter readings being collected from our AMR system. In time, we envisioned a website that volunteers might be able to access with special credentials to see their AMR data.

Simultaneously, in another part of our meter department, we began developing a new tool for all well owner to report meter readings – the EAA Meter Matters Smartphone App.

The Meter Matters App was developed to allow any well owner required to file meter readings (permitted and limited production well owners) to use their smartphone so submit meter readings to the EAA.

With the successful rollout of the meter app in 2017, we quickly realized this would be an excellent platform to allow VAMR participants to access their AMR data.

Working with our App developer, we had integrated a module to allow this to happen in early 2019.

AMR Success and Expansion

So it was at a July 9, 2019, Technical Briefing to our Board of Directors that EAA staff was able to display and present the results of our work and to report to the board that we had fulfilled the expectations outlined in Resolution and Order No. 12-08-608.

We were now operating a fully functional and growing AMR network of volunteer irrigation permit holders at over 120 stations.

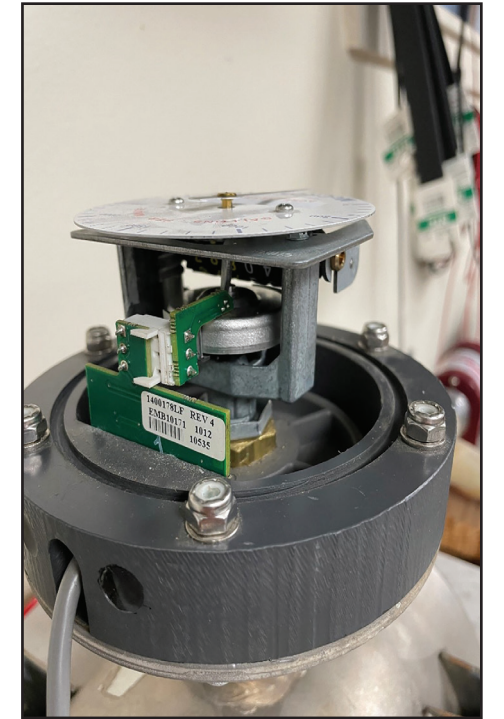


PHOTO ABOVE: The Sensor Ring assembly, envisioned by EAA Staff to convert the mechanical spinning of the meter register shaft into electronic pulses that can be programmed into an electronic meter reading.

EAA contractors Technology Kitchen engineered the device and Ember Industries manufactures the assembly. EAA staff then attaches the ring to the meter housing.

The green sensor shaft attached to the ring sits over the spinning register plate which contains small magnets for the flow rate needle. As the magnets pass across the sensor, electronic pulses are generated, to be converted into meter readings by the PLC. The added assembly in no way affects the normal operation of the meter.

AUTOMATED METER READING (AMR) PROGRAM

During that briefing, EAA staff proposed and was allowed to consider a pilot program to extend participation in AMR to municipal and industrial (or "M&I") permit holders.

As mentioned earlier, M&I permit holders are required under the EAA Act to install and maintain their own meters, therefore the EAA meter team encounters many different meter sizes and manufacturers.

Since the installation of a sensor ring and associated programming needs precise meter specifications, integrating M&I meters into AMR posed additional challenges.

Since one of the key aspects of participating in AMR is that it should not incur any additional costs to the participant, we are looking for volunteer M&I permit holders who are already operating McCrometer meters or other meters that are compatible with our AMR hardware. In early 2021, EAA staff approached a small rural water supply company in Medina County about participating in AMR.

On August 1, 2021, EAA entered into an agreement with Medina River West Water Supply Corporation (MRWWSC) to operate our first AMR stations for a municipal permit holder. MRWWSC pumps about 117 acre-feet from two wells from the aquifer and supplies water to about 387 customers.

Currently operating a compatible meter is not a requirement to participate in AMR. However, when agreeing to participate, the well owner allows EAA staff to obtain at our cost and install the initial compatible meter, if the owner then maintains and replaces with compatible meters to continue participation in AMR.

That way, there is no initial cost for M&I permit holders to enroll in the program.

One consideration M&I owners need to make in considering AMR is the increased need for EAA staff to access the meter and maintain the AMR equipment.

In all cases, EAA staff schedules appointments

for any access needs when convenient to the owner.

The future for AMR seems bright. EAA currently has over 1,680 meters active in our records, over 700 are irrigation meters.

Groundwater use reporting is still a really big deal, and not having to file monthly or yearly use reports is a significant benefit to AMR participants.

Due to the additional costs involved in AMR, this service is currently being provided to owners who pump more significant amounts of groundwater each year.

In this respect, we are eagerly seeking additional volunteers for AMR.

Finally, technological improvements in computing and electronic components will only make operating a network like this more reliable at less cost per station.

The quality of data and the amount of information collected should strengthen future data analysis and aquifer modeling efforts.



PHOTO LEFT: EAA Staff (Matthew Cota and Joseph Sterzenback) at an AMR site at the McFadin Farm in Uvalde County.

The photo shows an AMR enclosure with solar panel and battery providing power to the PLC board and the LTE cellular modem.

Joseph has been with the EAA since 1999 where he was hired to help maintain the EAA Rain Gauge Network and has been involved in AMR development since its inception.

Matt was hired in 2020 and brings a new face and fresh ideas to the AMR program.

AMR data can provide greater resolution of pumping trends and additional perspectives on regional use that annual meter readings can provide.

As a science-based organization, the more information we can provide to policy makers, the more informed will be the decision that serve to better manage, enhance, and protect the Edward Aquifer System. ■



PROTECT

YOUR GROUNDWATER DAY

Protecting groundwater is an important part of keeping the aquifer clean and pristine, and The Groundwater Foundation and the National Groundwater Association (NGWA) recognize **September 7th** as Protect Your Groundwater Day.

This day serves as a reminder for water well owners to conduct maintenance, and schedule inspections with certified water well contractors to ensure their water well system is operating properly.

According to Wellowner.org, The Groundwater Foundation and the NGWA encourages everyday households and water well owners to ACT — acknowledge, consider, take action.

1. Acknowledge the causes of preventable groundwater contamination

Everyone

Most household water use occurs in a few areas around the home so be

aware of the surroundings of these locations

If you own a water well

- Wellheads should be a safe distance from potential contamination
- Septic system malfunctions can pollute groundwater
- Poorly constructed or maintained wells can facilitate contamination
- Improperly abandoned wells can lead to groundwater contamination

2. Consider which apply to you

Everyone

- What specific hazardous substances are in and around your home?
- Where do you and your family use the most water?
- If you own a water well
- Is your wellhead a safe distance from possible contamination? Is your well/septic system due for an inspection?

• Are there any abandoned wells on your property?

3. Take action to prevent groundwater contamination

Everyone

When it comes to hazardous household substances:

- Store them properly in a secure place
- Use them according to the manufacturer's recommendations
- Dispose of them safely

If you own a water well

- Move possible contamination sources a safe distance from the wellhead
- Get current on your septic system inspection and cleaning
- Get your annual water well system inspection
- Properly decommission any abandoned wells using a professional

When a Well Isn't Well After All

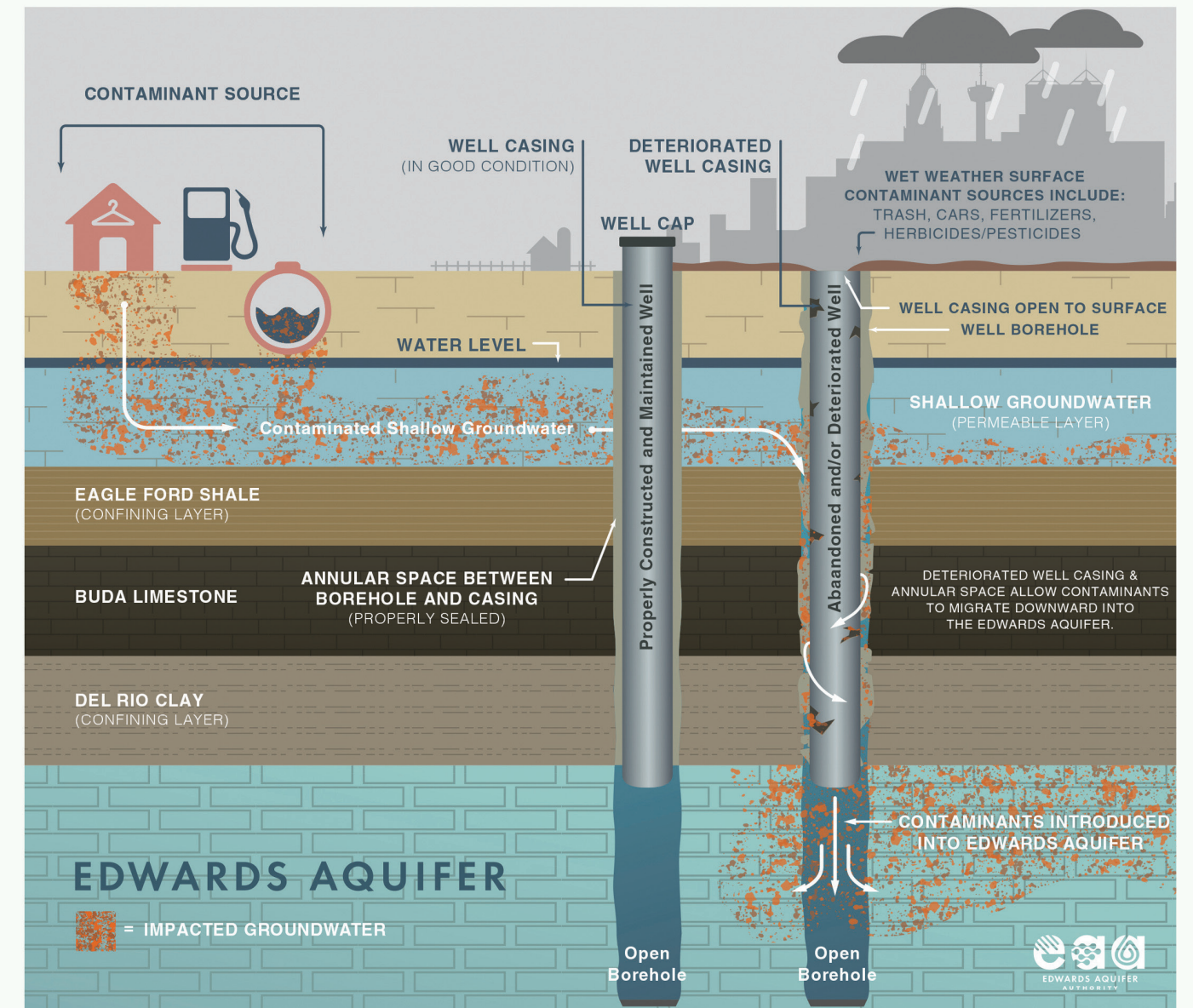


Illustration: "Potential for Edwards Aquifer Groundwater Contamination; Abandoned and/or Deteriorated Wells."

For more information related specifically to the Edwards Aquifer Well Protection Program, please visit: <https://www.edwardsaquifer.org/business-center/wells/>

Citation:
Protect Your Groundwater Day - September 7, 2021. (2021, August 1). Wellowner.Org.
<https://wellowner.org/2021/08/protect-your-groundwater-day-september-7-2021/>



THE EAA FIELD RESEARCH PARK

CELEBRATES National Public Lands Day

Saturday, September 25, 2021

8:30 AM - 2:00 PM

23400 Cibolo Vista (off Evans Road)

San Antonio, TX 78261

Breakfast and lunch will be provided

EAA Field Research Park Celebrates National Public Lands Day

On **September 25th** the EAA's Field Research Park (FRP) will open its gates to celebrate National Public Lands Day with a field day event held for public participation.

The featured project will be planting on a berm and landscaping (planting seeds/native grasses, composting, mulching, and planting live root grasses).

Registration for the event will close Friday, September 24th, so don't miss your chance to participate in the first public event for the EAA FRP!

Register today at:

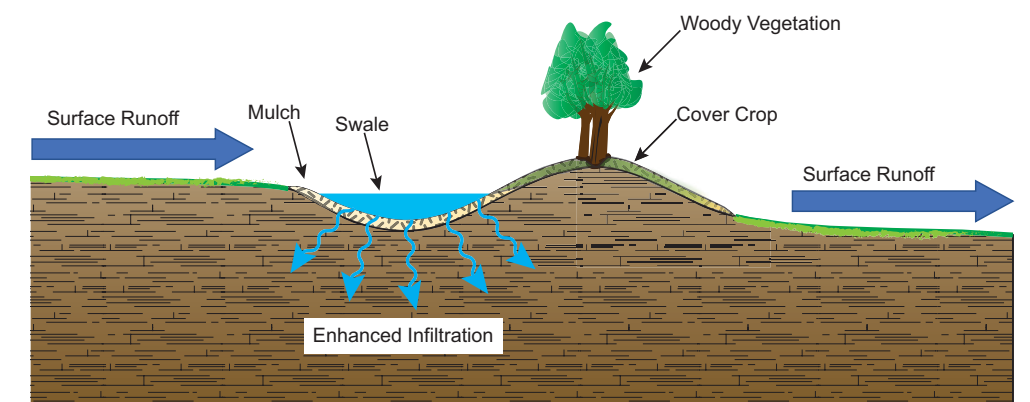
<https://bit.ly/EAAFRPCleanUpEvent>



Berm and Swale System

The FRP features sustainable land management and field research activities, designed to both improve our understanding of the Edwards Aquifer system and provide opportunity for improved sustainability for aquifer related water resources.

One of the primary land management strategies at the FRP is the berm and swale system.



The intent of the berm and swale is to slow surface runoff, resulting in the expected outcome of improving both filtration and infiltration of that surface runoff. Therefore, improving groundwater quality and quantity. As these practices are implemented at the demonstration scale, EAA staff will be developing methodologies to assess the effectiveness of each practice over the coming years. ■



Teach the world about podcasts on September 30

International
PODCAST Day



The Recharge Zone Podcast
C E L E B R A T E S
International Podcast Day

International Podcast Day™ is celebrated on **September 30th** and is an international day held to recognize the power of podcasts around the world.

On September 30th, we encourage you to check out some new podcasts, and be sure to listen/follow our podcast, The Recharge Zone Podcast, dedicate to all things Edwards Aquifer related.

Get involved by sharing your favorite podcasts or podcast episodes on social media. Don't forget to add **#InternationalPodcastDay** to your posts too!

Citation:
International Podcast Day. (2015)
<https://internationalpodcastday.com/>



LET THERE BE LIGHTS



EDUCATION OUTREACH CENTER UPDATES

It's been another exciting few months at the Education Outreach Center. Things are happening quickly, and each new development brings us closer to our completion date, which we estimate to be Spring 2022. All this excitement stirs the butterflies in our bellies!

Speaking of butterflies, we are happy to announce we have successfully planted a native plant garden. The project was completed in July with the much-appreciated help from the San Antonio River Authority's Garden Club. There were over 20 volunteers involved in digging, planting, moving mulch and installing the irrigation system.

AWARD WINNING Rain Catcher A W A R D

The garden has received the Rain Catcher Award from the Texas Water Development Board (TWDB), for its ability to harvest rainfall and its use in public education, making the EOC an award-winning center even before officially opening!



PHOTO ABOVE: After EAA staff and Volunteers plant the Demonstration Garden at the EOC.

PHOTO RIGHT (CIRCLE): SARA Volunteers and EAA staff build a garden.

With plentiful rain events in June and July, the rain tanks have been near full all summer.

The garden now has over 100 plants, shrubs and flowers native to Texas such as the Gregg Mistflower that is a favorite of the Monarch butterflies that migrate through Texas on their way to Mexico; several have been spotted in the garden fueling up for the trip south.

As we are writing this issue, workers are busily taking measurements for the fence that will help keep the hungry deer from snacking on the native plant garden, but will still allow access to pollinators like bees, hummingbirds, and butterflies.

Lately the quiet at the EOC has been broken by the sound of rambunctious, laughing children at Morgan's Wonderland Camp. It's easy to imagine what this place will be like in the near future.

**THE SOUND OF
CURIOUS CHILDREN
BRINGS EVERYTHING
TOGETHER; THE EOC
WILL BE A FUN AND
WELCOMING SPACE
FOR EVERYONE.**

The EOC continues to provide tours to special guests. On June 26, we had a visit from Duane Landes of Exhibit Concepts Incorporated (ECI).

ECI is the company that is helping us with the building of all the displays and exhibits. Duane made the trek all the way from Ohio to check out the progress at the EOC and to take some final measurements.

It was nice to meet him in person after months of online meetings. As always, visitors from the north are surprised by our mild temperatures that can quickly fluctuate between hot and cold extremes.

LET THERE BE LIGHTS

There's a lot of busywork to be done as we prepare for the installation of the Aquariums! Final plans for electrical panels, water pumps and floor drains need to be settled.

The EOC will house not one, but four tanks that will feature some of the creatures that live in the Edwards Aquifer, including the Texas Blind Salamander, Fountain Darters and a few that are not native to Texas.

Additional tanks will be dedicated to breeding the black worms, amphipods and daphnia that will provide food for the aquifer dwelling critters on site.

Let there be lights! The lighting system has arrived and will be installed very soon. By the time next quarter's issue of News Drop is available, the overhead lights will be casting their glow on the polished concrete floors giving us a small preview of what the atmosphere will be like once we're officially open.

The dimmable track lights will provide the backdrop for the coming 3-D theatre and will light up the exhibits and photos which will adorn the walls of the EOC.

With the building coming together it is time to turn our attention to the story of the Edwards Aquifer and how that is represented on the walls of the EOC.

The Communications and Development team has been busy going through 25 years of photos, maps, and graphics to pull together the panels that will guide visitors through the history of the Edwards Aquifer Authority and that of the region's unique water resource.

With the addition of new staff member Eduardo Flores as Creative Manager, the EOC is sure to get a vivid and engaging retrospective while planting a seed of curiosity and wonder for future artists and scientists.



PHOTO ABOVE: Intern April Myers guides students through video about how caves are formed.

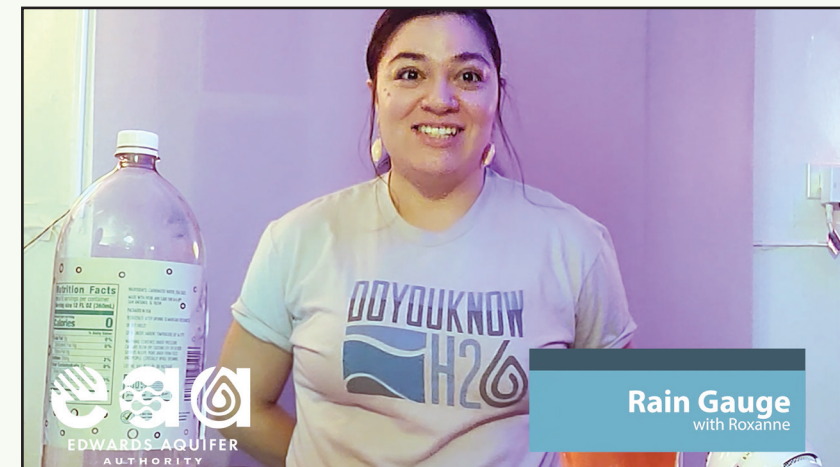


PHOTO ABOVE: Intern Roxanne Eguia shows students how to make a rain gauge.



PHOTO ABOVE: Interns create educational videos in the Karst Learning Lab.

LET THERE BE
LIGHTS

Our interns have been busy too. Roxanne Eguia and April Myers have been making educational videos.

Roxanne's video features an activity for a make-your-own rain gauge using items that can be found in any household.

April's video describes how caves are made and talks about a few of the animals that live in the Edwards Aquifer.

The videos will be appearing on our website in the next few weeks, so be sure to look out for them if you want to do some fun science-based activities with your classroom or even with the kids at home.

Our summer internship has ended, and we wish Roxanne much success in her last semester at university and congratulate April on graduating cum laude.

WITH SUMMER ENDING AND THE NEW SCHOOL YEAR BEGINNING, WE'RE ANXIOUSLY AWAITING THE ARRIVAL OF OUR FALL INTERNS AND ALL THE LEARNING EXPERIENCE THAT EACH NEW SEMESTER BRINGS.

We wish everyone a safe and productive school year!



PHOTO ABOVE: Pollinators visit the EOC Demonstration Garden.



PHOTO ABOVE: A rain barrel stands alone before the EOC Demonstration Garden is planted.

INVASION

OF THE

WATER BODY SNATCHERS

Non-native plants, animals taking their toll on ecosystems

Film buffs regard *Invasion of the Body Snatchers* from the 1950s as a classic sci-fi movie. It depicts alien plant spores falling from space and growing into large seed pods.

The scary complication is that each pod becomes capable of producing a visually identical replacement of a human being. Interestingly, there were two endings written for that movie.

One left the viewer wondering what happens to the townspeople. The other included a happier resolution to the invaders taking over the town.

While there isn't any body snatching going on in 2021, there is an intrusion of water bodies by non-native plants and animals happening around the country. In fact, it's been occurring for decades and the ending for this story is still being written.

INVASION

OF THE
WATER BODY SNATCHERS



PHOTO ABOVE: Armored catfish.

THE TEXAS PARKS AND WILDLIFE DEPARTMENT (TPWD) NOT ONLY CALLS THESE ENCROACHING SPECIES “INVASIVE,” BUT ALSO ESTIMATES THAT THE ECONOMIC COST TO THE U.S. IS APPROXIMATELY \$219 BILLION EACH YEAR, WITH GLOBAL IMPACTS ESTIMATED AT MORE THAN \$4 TRILLION.

According to TPWD, non-native aquatic invasive species negatively affect fish and wildlife, fishing, boating, and hunting opportunities, water infrastructure, and even waterfront property values.

They acknowledge this is a critical problem that must continue to be addressed over the long term. The significance of those impacts is not lost on Edwards Aquifer Habitat Conservation Plan (EAHCP) team members.



PHOTO RIGHT: Hydrilla removal.

“There is definitely no shortage of invasive species in the Comal, Guadalupe and San Marcos river basins, and their impacts are profound on these ecosystems,” said Mark Enders, Watershed Program Manager for the City of New Braunfels. “What we’ve come to learn is that many of the riparian non-native species originated from Asia and were brought to the United States because they are ornamental and look nice.

The non-native fish species have proliferated through the aquarium trade and other means such as aquaculture.

We think this was done very innocently decades ago by people not knowing the giant problem they would be causing in the future.

INVASION

OF THE

WATER BODY SNATCHERS



PHOTO ABOVE: Arundo on Old Channel (pre removal).



PHOTO ABOVE: Tree treating.



PHOTO ABOVE: Hydrilla removal.



PHOTO ABOVE: Tilapia removal.

But, the bottom line is that future is now and we are fighting an uphill battle against non-native species overrunning native species and causing harm to endangered species and their habitats."

Many plants and animal species not native to an area cannot survive due to a drastic change in climate or other ecosystem conditions drastically different than from their original locations in the world.

However, South Texas has warm climate and the Edwards Aquifer provides a consistent water temperature year-round.

So those two elements make this area good growing locations for non-native riparian trees like Chinese tallow and Ligustrum and non-native elephant ear plants.

INVASION

OF THE
WATER BODY SNATCHERS

NON-NATIVE AQUATIC PLANTS LIKE HYDRILLA AND HYGROPHILA HAD PROLIFERATED NOT LONG AGO TO A POINT OF TAKING OVER LARGE SWATHS OF LANDA LAKE IN NEW BRAUNFELS AND SPRING LAKE IN SAN MARCOS.

NON-NATIVE ARMORED SUCKER-MOUTH CATFISH FROM SOUTH AMERICA AND TILAPIA FROM TROPICAL AFRICA ALSO FOUND CONDITIONS IN THE EDWARDS AQUIFER REGION IDEAL FOR THRIVING.

"Before the EAHCP partners began addressing this issue in the 2013-14 timeframe, the problem with non-natives in New Braunfels and San Marcos was still escalating," said Melani Howard, EAHCP Program Manager for the City of San Marcos. "So, we developed programs to begin the removal of non-natives and restoration of native species. The main problem with non-natives is they crowd out native plant and animal habitats and that is detrimental to the endangered species we are charged with protecting. In other words, they compete for food sources and disrupt spawning areas. So in time, populations of the endangered species decline. Additionally, some non-native snails can emit parasites which can be harmful to endangered fountain darters. Some good news is that we've made great strides in tackling the invasive species problem over the past seven or eight years. But, we continue to spend a good portion of our EAHCP budgets as well as our respective city budgets on invasive removal programs."



PHOTO ABOVE: Armored catfish.

One major concern for the many professionals charged with environmental protection is that as they are working at removing non-natives, commercial establishments are continuing to sell invasive species.

Howard noted that trailing purple lantana and tree of heaven plants can be easily found in plant nurseries and big box stores around San Marcos.

She explained that there were areas of the Sessom Creek watershed, one of the five upper San Marcos River tributaries which empties into the headwaters of the San Marcos River, covered with the purple lantana and had to be removed.

And, horticulturists and developers are still recommending these types of non-native plants for landscapes.

The United States does have laws which limit the types of plants and animals that can be imported into the country.

ADDITIONALLY, STATE AGENCIES LIKE THE TEXAS PARKS AND WILDLIFE DEPARTMENT GOVERN THAT TYPE OF ACTIVITY AND WORK TO EDUCATE THE PUBLIC ON HOW NON-NATIVE SPECIES CAN BE TRANSPORTED FROM ONE REGION TO ANOTHER.

FOR EXAMPLE, AT MANY TEXAS BOAT RAMPS, YOU WILL SEE SIGNS ABOUT PREVENTING "HITCHHIKER" SPECIES LIKE THE INFAMOUS ZEBRA MUSSELS FROM SPREADING BY CLEANING BOATS AND OTHER GEAR AFTER EACH USE.

"In addition to traditional public outreach methods such as brochures, signs, websites and social media, we are trying a new method of reducing invasive species by visiting with individual homeowners we see that have invasive plants or trees in their yards," Howard explained. "We are even offering to remove the invasive species and replace it with a native one. This is a pilot project we're trying in a few small watersheds, but it is another attempt to reduce non-native plants in this area. As far as aquariums go, the Discovery Center in San Marcos will gladly take aquarium fish from people if they can't take care of them any longer. We would rather have them than seeing the owner dump the aquarium in the river."

While Enders and Howard both seemed fairly resigned to the fact that eradication of non-native plants and animals is probably not possible, they were not content with settling into maintenance mode forever. "With our federal permit coming up for renewal in 2028, this should be a time for doing some investigation of new ideas to expand our protections of native species," Howard said.

"Maybe there are ways we can enhance what we're doing that will get us closer to the ultimate elimination of non-natives.

For example, we've had great success with removing elephant ears, so I feel we should at least strive for non-native eradication while being realistic that doing so is an extremely tall order." ■

PHOTO BELOW Tree removal.



Everyone loves those home makeover shows where a visionary decorator and demolition-loving partner take a quaint old home and turn it into a Better Homes and Gardens cover story. Well, if there was such a show for watersheds, the Sessom Creek watershed in San Marcos would definitely be featured. The only downside to this story is that the "big reveal" won't take place for about two years or more.

"The complete overhaul, so to speak, of the Sessom Creek watershed has been a long time coming. But, we're just about to get underway with the first phases of construction and we couldn't be happier about that," said Melani Howard, who is the Edwards Aquifer Habitat Conservation Plan (EAHCP) manager for the City of San Marcos. "This is a relatively small watershed, but it empties directly into the

headwaters of the San Marcos Springs where endangered species and their critical habitat are located. I think a lot of people now know what types of pollutants urban stormwater runoff can gather and deliver to an ecosystem. And that was something we had to change as it relates to the Sessom Creek watershed." Overall, the Sessom Creek watershed covers about 60 acres of land.

A WATERSHED

MOMENT

Restoration of the Sessom Creek Watershed Nearing Construction

While that is a relatively small watershed for a major tributary, it encompasses parts of Texas State University, major thoroughfares, apartment complexes and densely populated neighborhoods. Sessom Creek runs through heart of the basin and becomes essentially a concrete ditch just before it empties into the San Marcos River.

Over time, the riparian vegetation associated with most parts of the creek was overrun with non-native, invasive plants and trees, and essentially turned the area into an opaque thicket. That was the first issue that needed attention as part of the watershed's restoration. The second hurdle to overcome was the presence of old sewer lines that transected Sessom

Creek. The City of San Marcos took on this portion of the project which includes the replacement of approximately 1,800 linear feet of 12-inch sanitary sewer lines. Additionally, the project will provide stabilization of the Sessom creek banks to minimize sediment from entering the San Marcos River, and will also repair two separate drainage outfalls along

A WATERSHED MOMENT



PHOTO ABOVE: Invasive cat claw vine.

Sessom Drive and Sessom Creek. "Going back to about 2015, the EAHCP was focused on significantly reducing erosion rate that fed significant amounts of sediment from Sessom Creek into the San Marcos River," Howard noted. "We discovered that the City of San Marcos was gearing up to do a major sewer line capital project there and so the two entities started

talking about how to work together to more efficiently achieve our goals. Those discussions turned into what we now call the Sessom Creek Project, Phases 1 and 2." There is an exposed 50-year-old sewer line that runs across Sessom Creek in several locations. Originally, that 16-inch pipe (not sure what size the pipe is) was not visible,

however, erosion uncovered the aging line over time and created a water quality threat to both Sessom Creek and the San Marcos River. Removing that old line and boring underneath the creek to install the new one is the initial focus. In Phase 2, the City will be rehabbing failing portions of Canyon Drive which runs along the creek as well as accomplishing some major

drainage infrastructure improvements there. Due to the high percentage of impervious cover (roads, rooftops, driveways) in the watershed, water flows at a high velocity during a rainstorm. That heavy torrent increases the amount of sediment being carried to the home of endangered species in the San Marcos River. The increased sediment load decreases available habitat for the species and makes protecting them all the more difficult.

The invasive trees that grew along Sessom Creek reduced sunlight thus reducing understory plant establishment. Lack of dense native riparian vegetation results in increased soil erosion, bank instability, and vulnerability to impacts of flooding. In turn, the creek channel got deeper and disconnected with the original floodplain. Additionally, the more urbanized development around the creek with growing impervious cover such as streets and parking

lots have increased the amount of water flowing into the creek. The EAHCP's answer to the fast-moving water was to utilize "natural stream design" to reconstruct major sections of the creek. This process uses grade and gully controls to create riffles and pools in the streambed. Large boulders and rocks will be the main components used to reshape the meanders of the creek and reduce flowing water velocities. This type of stream

restoration is not only less costly than using truckloads of concrete, but slows water down which increases infiltration into the groundwater and is better for the overall ecology of the watershed.

"The primary goal here is to slow down and spread out the water during rain storms and this natural channel design will help us accomplish that goal," Howard explained. "It is not often in urban situations where you have enough space to reconnect a creek with its floodplain, but we will be able to do that in Sessom Creek." If you had to relate the demolition portion of a home makeover

to the Sessom Creek project, you most certainly would point to the vast removal of non-native trees and plants in the watershed.

"We contracted with a private company to handle the major removal and mulching of non-native trees in about 14 acres near the creek. And we're happy to report that enormous job has just concluded," Howard said. "But, we can't forget our volunteers who have gathered once a month for the past three years to take out other non-native plants as well." I clearly remember that group's year-and-a-half effort to take out about an

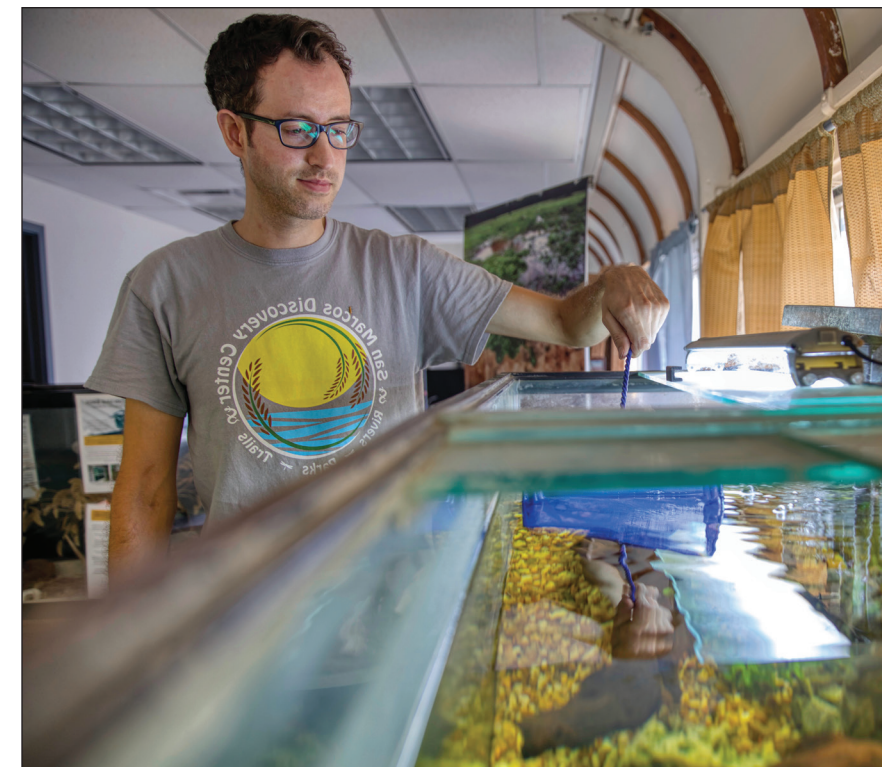
acre and a half of bamboo. You just have to tip your hat to that type of dedication.

This whole effort is going to take about two years or so to complete. And, then you're looking at many more years for the native plants to grow in. To add to the aesthetic improvements, the City of San Marcos will be adding walking paths, benches and such along the creek.

One of our project coordinators, Jim Boenig, who is with the Edwards Aquifer Authority, put it best. "The greatest thing about this project is, once it is completed, it won't look like a new project."



PHOTO ABOVE: The "pleco" is a common aquarium trade fish due to its ability to eat algae. The downside to these non-native fish from South and Central America is that they will quickly outgrow a standard aquarium. It then becomes a hazard to native fish and plants if dumped into a South Texas stream.



THE RESTORED AREAS WILL LOOK VERY NATURAL. THE NEW SESSOM CREEK WILL BE PLEASING NOT ONLY TO THE PEOPLE WHO ARE HERE, BUT TO THE ENDANGERED SPECIES LIVING IN THE SAN MARCOS RIVER AS WELL,
- Concluded Boenig. ■

PHOTO LEFT: The Discovery Center in San Marcos will take unwanted aquarium fish to prevent non-native fish and plants from being dumped in local creeks and rivers. Here, Eric Weeks, Discovery Center Coordinator, is placing fish dropped off at the Discovery Center in one of their tanks.



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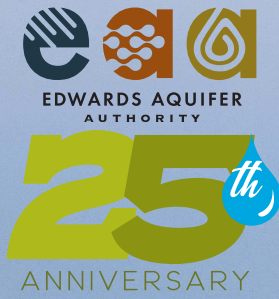
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