



# Year in Review ~ 2016

## CAMINOS DE AGUA

### **Mailing Address**

11 S. Green St.  
Unit 1508  
Chicago, IL 60607

### **Mexico Office**

Allende #5, Colonia Insurgentes  
San Miguel de Allende, Gto, México  
CP: 37712

[info@caminosdeagua.org](mailto:info@caminosdeagua.org)

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

# Thank you to all the helping hands in 2016

## **Caminos de Agua Team**

Dylan Terrell  
Jennifer Ungemach  
Saúl Juárez  
Casilda Barajas  
Jeff Rottler  
Nico Vargas  
Fili Baltazar Vargas  
Ismael Rodríguez Bolaños  
Carmelo Gonzalez Ramirez  
Aaron Krupp  
Billy Thurston  
Chantal Kronenburg  
Elena Diek  
Sarah Mitchell  
**And all our Families**

## **Board of Directors**

George Terrell  
Joshua Samson  
Rob Lerner  
Agustin Madrigal  
Muriel Logan  
Carlos Santacruz

## **Funders & Donors**

Natural Health Research  
Foundation  
272 Individual Donors  
The Global Giving Campaign  
Dr. Joe Mercola  
Benevity  
Guggenheim Partners  
UU Church – San Miguel de  
Allende  
JWH Initiative  
Wageningen University  
University College of London

## **Community Leaders**

Padre Juan Carlos Zesati  
Lucha Villafuerte  
Carmen Castro  
Padre Cesar

## **Local Partners & Organizations**

United Communities for Life and  
Water (CUVA)  
Pozo Ademado Community  
Center (SECOPA)  
El Maíz Más Pequeño, A.C. &  
Henry Miller  
Adelante por La Colorada, A.C.  
The Lavender Project  
The San Cayetano Community  
Center  
Vía Orgánica, A.C.  
CERECALY Center & Rodrigo and  
Violeta  
Citizens Observatory for Water &  
Sanitation  
Occupy San Miguel  
Midday Rotary Club San Miguel  
de Allende  
The Center for Global Justice  
The San Miguel Writers'  
Conference  
ITESI – San Felipe  
CECyTE High School  
COTAS Rio Laja  
All of the Volunteers from the  
Urban Water Quality  
Monitoring Program

## **Academic Partners**

Dr. Joshua Kearns  
NC State University

Dr. Jaime Hoogesteger  
Wageningen University  
Dr. Ilan Adler  
University College of  
London  
Dr. Peter Knappett  
Texas A&M University  
Dr. Yanmei Li  
University of Guanajuato  
Dr. Melissa Lenczweski  
Northern Illinois  
University

## **Rural Communities**

Vergel de Guadalupe  
La Onza  
Llano Verde  
Arenal de Arriba  
Arenal de Abajo  
La Escoba  
San Antonio de Lourdes  
Los Platanos  
Rancho Nuevo (SLP)  
La Norita del Refugio  
Exhacienda de Jesus  
San Cayetano  
Las Liebres  
Pozo Ademado  
Villa Nueva  
Las Adjuntas del Monte  
Los Lopez  
San Antonio de la Joya  
El Salitre  
La Aurora  
Don Juan  
Rancho Nuevo – Villa de  
Guadalupe  
Montecillo de Nieto

Cruz del Palmar  
Atotonilco  
Agustín González  
Boca de la Cañada  
San Miguel de Viejo  
La Colorada  
Juan Gonzalez  
La Cienega  
Sosnabar  
Soledad Nueva  
Ojo de Agua de Trancas  
Las Yervas

## **National Partners**

CEDEMI, A.C. and Katia Corroy  
CATAS, A.C. and Bruno Morales  
Isla Urban and David Vargas  
Cantaro Azul  
INANA (Veracruz)

## **International Organizations & Partners**

Engineers Without Borders-UK  
Engineers Without Borders – UCL  
& Wafa, Efosa, Ayisha,  
And Ivonne  
Aqueous Solutions  
IRRI Mexico  
Organic Consumers Association  
Missions for Life & Matt Morrison  
The Willamette River Initiative  
The Pun Pun Institute in Thailand  
Watershed Management Group &  
Joaquin Murrieta-Saldivar  
The International Biochar  
Initiative

## **Very Special Thanks**

Steve Rye  
Don Patterson  
Ronnie Cummins  
Rose Welch  
Rosanna Álvarez  
John Perkins  
Marti McGinnis  
Selene Trapp  
Susan Page  
Gaya Massink  
Pilar Quintanilla  
Janet Jarman  
Elisabeth Malkin  
The New York Times  
Humberto Manduley  
Natalie Long  
Mario Hernandez  
Cameron Plese  
Fernando Rosales  
Rachel Kaster-Lopez & Jorge  
Lopez  
Jim Hallock

## **Local Businesses**

Casa Colectiva  
Eric Ramirez  
La Lonja  
Think TIM & Elliot Shand  
Chez Papa  
Don Ciro  
Don Pedro

Dear Friends of Caminos de Agua,

In preparing this year-end report, I struggled to decide what to highlight and whom to thank. The lists kept growing and growing, and I was struck by a comment made recently by one of our board members – Rob Lerner – who asked:

*“How do we get this much work done on such a small budget?!”*

Indeed, this truly was a watershed year for the organization. With our new name and narrowed focus, our work had a **greater impact on safe, healthy, and sustainable water supplies**, and I am more proud than ever of our accomplishments.

In this report you will read about:

- Groundbreaking developments in our water treatment program,
- Expanding our water monitoring to include **tens of thousands of new people** in the region,
- Creating tangible impact on water quality and access for **thousands of people through our rainwater harvesting and ceramic water filter programs**,
- And so much more.

But to answer Rob’s original question on the *how* – the answer, quite clearly, is *collaboration and passion*.

We brought on five sensational and talented volunteers and interns from around the globe who, despite being unpaid, literally work around the clock. We hired new staff whose passion exudes from every project. We have a dedicated board of directors who provide counsel, technical support, financial reporting, and legal guidance, as well as take on full projects – a highlight this year being Muriel Logan’s coordination of our Urban Water Quality Monitoring Campaign.

We collaborate with renowned and impassioned researchers – like Dr. Josh Kearns – who work with us on the ground– offering up their expertise and vast experience for little more than a bed to sleep on.

We partner with dedicated community organizers who run themselves ragged building the social and intellectual foundation in the rural communities we serve – making our jobs infinitely easier.

This year, we worked in 35 rural communities whose residents provided well over **10,000 hours of volunteer labor!**

And, we have individual donors and funders – like the **Natural Health Research Foundation** – who trust us, believe in our work, and support us year after year in a way that allows us the freedom to focus on the work at hand.

The Caminos team and I spent the last staff meeting listing our major collaborators this past year. The process was exciting, nostalgic, and humbling as we remembered all of those who have contributed so deeply to this work.

I would like to sincerely and honestly thank everyone listed on the previous page. At the risk of sounding cliché, our work is truly not possible without all of you.

On behalf of the entire Caminos de Agua Team, thank you for making 2016 our most impactful year to date!

Saludos from San Miguel,



Dylan Terrell  
Caminos de Agua, Executive Director



## | Our Mission

Promoting healthier more prosperous lives through practical sustainable solutions along the pathways water travels through our lives and the planet.

## | Our Vision

Camino de Agua believes that all people should live in a clean and ecologically healthy environment with access to safe and healthy drinking water, nutritious and affordable food, and secure shelter. We work in partnership with local communities and other diverse actors to innovate and implement open sources solutions for our region in the Independence Watershed but that can also be adapted throughout the world without restriction or license.







# Content

## 2016 by the Numbers

## Water Quality Monitoring

## Rainwater Harvesting

- Large-Scale Rainwater Harvesting Systems in Rural Villages

- Community Profile: San Antonio de Lourdes

- Small-Scale & Urban Rainwater Harvesting Systems

- Educational Materials & Tech Development

## Ceramic Water Filters

## Biochar for Water Treatment

- Wood-based Biochar Treatment Systems

- Functionalized Biochars for Arsenic & Fluoride Removal

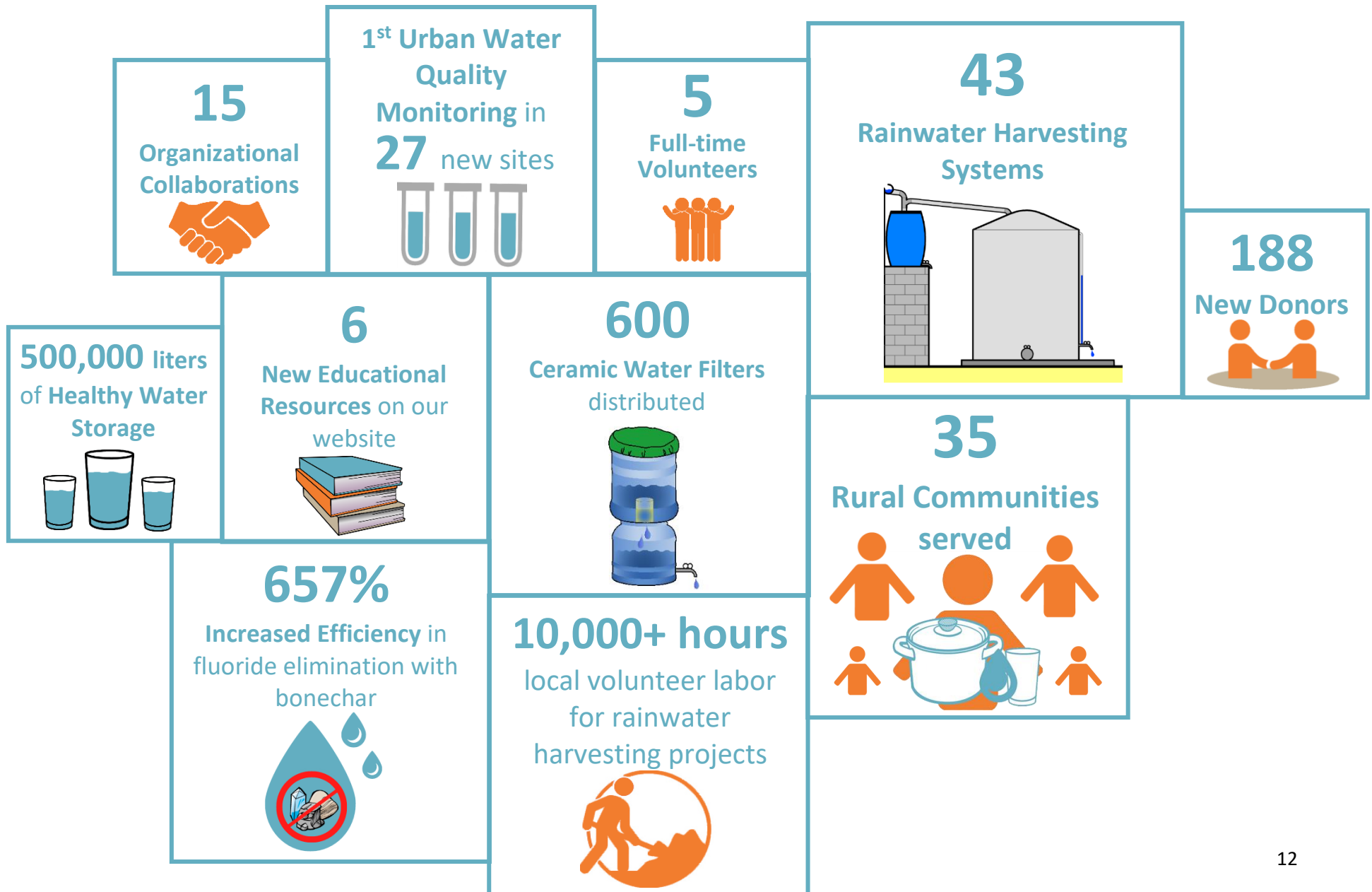
## International Trainings

# 2016 by the Numbers

*“Creating low costs, high-impact solutions for challenges in safe,  
healthy and sustainable water issues”*



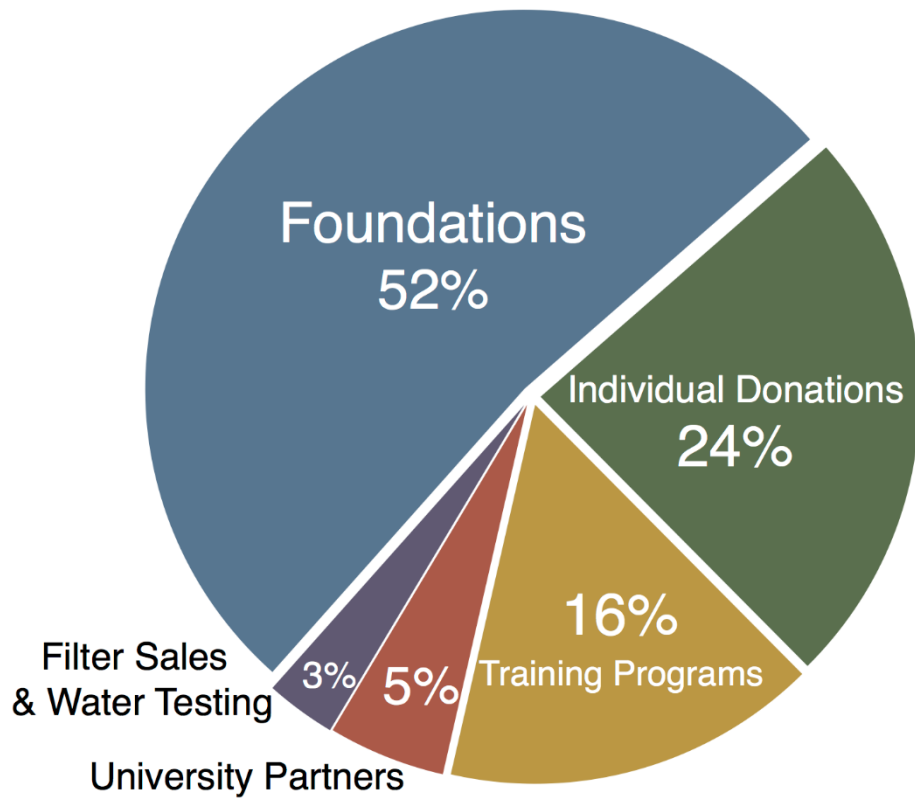
# 2016 by the Numbers



# 2016 by the Numbers

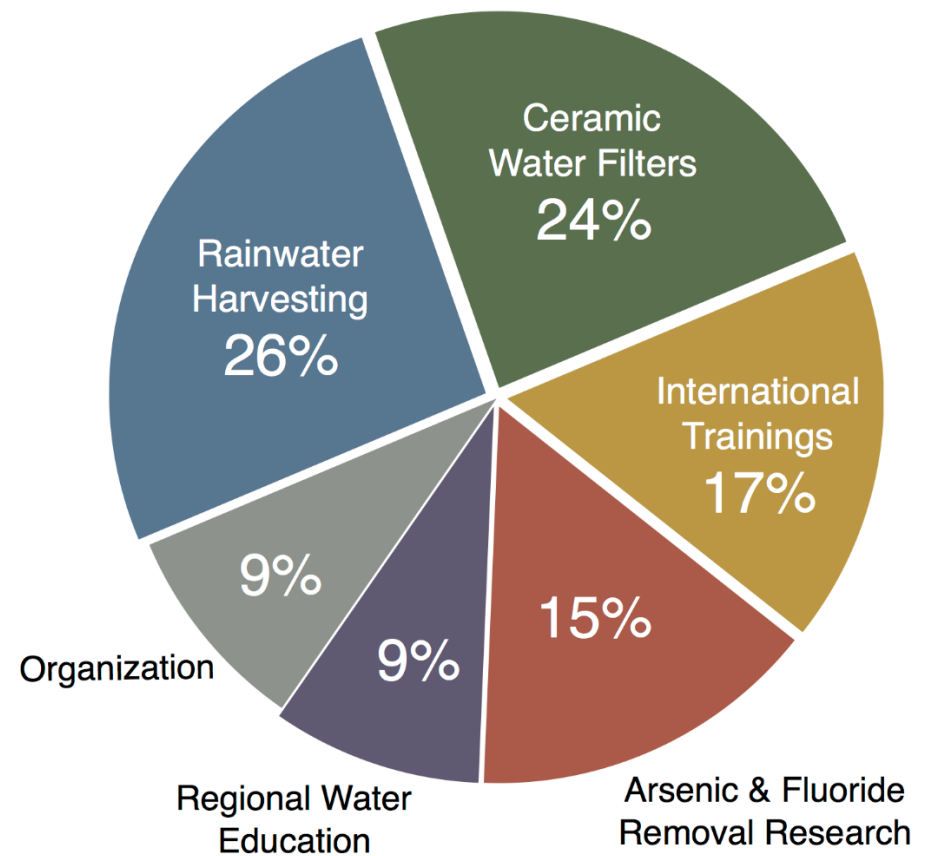
## Income\*

\$122,005



## Expenses\*

\$100,219



\* These numbers will be updated upon close of the 2016 financial year.

# Water Quality Monitoring

*“Alarming levels of arsenic and fluoride contamination  
in urban San Miguel de Allende”*



# Water Quality Monitoring

In 2016 we expanded our water quality monitoring campaign to include urban areas of San Miguel de Allende. In conjunction with Texas A&M University and the University of Guanajuato, we performed **hundreds of tests in 27 different sites throughout the urban center**. The urban monitoring program is coordinated by Caminos de Agua Board member Muriel Logan, with Engineers Without Borders-UK placement Billy Thurston providing technical support and coordination. The testing revealed **elevated arsenic and/or fluoride**, well above national and international standards, in **more than 60%** of the samples. Some of the highest levels of arsenic in the region were found in the urban center.

These contamination issues affect a broad population in San Miguel – many of whom who drink straight from the tap or use common household filtration systems that do not actually eliminate arsenic or fluoride. Awareness is the key. In 2016, we prioritized new educational materials (see page 25) and urban rainwater harvesting systems (see page 24) to provide solutions to this growing crisis.

We engaged with directors and managers of nearly every municipal department to present our current findings. These meetings were arranged thanks to our growing collaboration with *El Maíz Más Pequeño* – a local NGO focused on education and climate change – and the *Citizens' Observatory for Water and Sanitation*. These meetings were designed to create the framework for future direct action by the municipal government. We utilized local radio and other news outlets, local workshops and presentations to share our critical findings as well as solutions.

Our water quality monitoring maps – available for free on our website – illustrate our continually updated urban data as well as our monitoring from 70+ rural communities. Take a look at our water quality maps and check your own arsenic and fluoride levels if you live in the region.

[\(http://caminosdeagua.org/water-quality-monitoring/\)](http://caminosdeagua.org/water-quality-monitoring/)



Urban Rainwater Harvesting System with Ceramic Water Filter at  
Vía Orgánica







# Rainwater Harvesting

Large-Scale Rainwater Harvesting Systems in Rural Villages

Community Profile: San Antonio de Lourdes

Small-Scale & Urban Rainwater Harvesting Systems

Educational Materials and Tech Developments

*“Rainwater harvesting represents an inexpensive, easy to use,  
and sustainable water solution for local communities”*



# Large-Scale Rainwater Harvesting Systems in Rural Villages

In 2016 Caminos de Agua created more than a **half a million (500,000) new liters of healthy water storage** through our large-scale, community-led rainwater harvesting installations.

## Special thanks to our partners providing financial and/or logistical support

Donors from the GlobalGiving Campaign \* Engineers Without Borders – University College of London \* Wageningen University and Dr. Jaime Hoogesteger \* United Communities for Life and Water (CUVA in Spanish) and community organizer Lucha Villafuerte \* The San Cayetano Community Center and Padre Juan Carlos Zesati \* The Pozo Ademado Community Center (SECOPA in Spanish) and community organizer Carmen Castro

**These rainwater harvesting installations would not be possible without 10,000+ hours of volunteer labor contributed by community members.**

Caminos de Agua staff Saúl Juárez led several week-long trainings in rural villages throughout the region. In total we built **41 large-scale, 12,200-liter (~3,200-gallon) capacity systems and one 7,500-liter (~2,000-gallon) system in homes and schools in 17 villages.**

Our collaboration with Engineers Without Borders – University College of London rehabbed 10 existing systems in 9 rural community schools. Engineers Without Borders-UK volunteer, Billy Thurston, provided technical support and oversight.

All rainwater systems include our certified ceramic water filters to safeguard against bacteria and pathogens. Our impact increases by providing multiple filter systems per rainwater harvesting system thanks to organizations like Missions for Life, who sponsors water filter systems in the region. Our final project this year provided six households in four communities with large-scale rainwater systems; the 30 filter systems provided to neighbors increased the overall impact five-fold. Through these large-scale rainwater harvesting projects, we provided **more than 150 water filter systems to classrooms and family homes, with the ability to produce more than 6.5 million liters (~1.7 million gallons) of safe drinking water** over their lifetime.

Thanks to our GlobalGiving donors, we will begin construction on **25 large-scale, 12,200-liter systems** in early 2017. A training and system installation in a rural high school in partnership with the nonprofit organization *El Maíz Más Pequeño* is also programmed. This project will pilot our new bicycle water pump (see page 25).

# Community Profile: San Antonio de Lourdes

San Antonio de Lourdes is a small rural village (population ~300). The community sees a large rate of migration – mostly men – due to a lack of services and job opportunities. The ratio of men to women in San Antonio de Lourdes is currently 4.94 to 10.00, making it the third lowest of nearly 500 rural villages in the region.

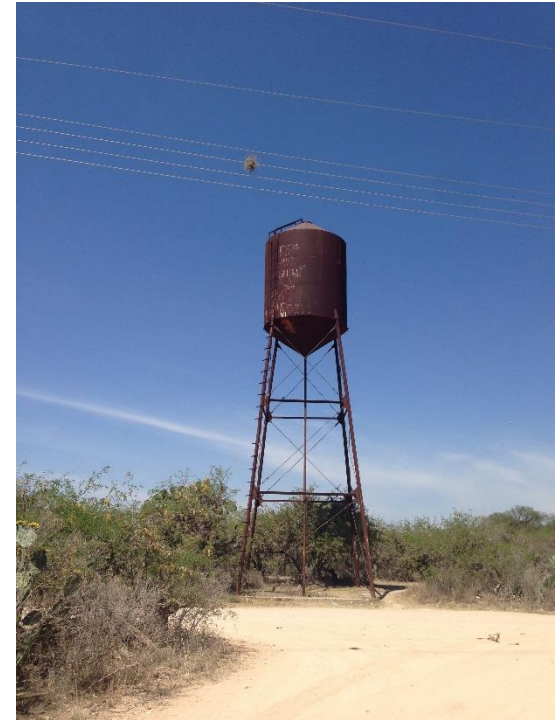
The village's water well went dry seven years ago – due to groundwater overexploitation from surrounding agricultural producers – and the community has been without water since. Most families have bought large 1,000 – 3,000 liter *tinacos* (water storage tanks), which were filled by government trucks regularly. However, the service was suspended. Today, families pool money and water is brought in on personal pick-up trucks. There is no piped water service currently available to the community.



*Dry water well*



*Transportation of water*



*The community's water tower - empty for years*

The communities' two main water sources are among the most contaminated in the region, with arsenic and fluoride levels at 6 and 10 times World Health Organization limits respectively. This water is acutely toxic and not apt for human consumption. Children and adolescents suffer from severe dental fluorosis (browning/blackening of the teeth) throughout the village and interviews indicate many may also be suffering from development disabilities now widely associated with fluoride toxicity.

# Community Profile: San Antonio de Lourdes

What does no water mean for the community elementary school and kindergarten?

*“We were working in the kindergarten in May of 2016, and I went to the bathroom to wash my hands – which were covered in PVC glue. I was told that the kindergarten bathroom had not had any water for the prior 3 weeks, making sanitation and hygiene a major issue for the kids.”*

---- Dylan Terrell, Caminos de Agua Executive Director ----

In partnership with the *United Communities for Life and Water Coalition*, Caminos de Agua installed **14 rainwater harvesting systems** – accompanied by dozens of ceramic water filters for biological treatment. The great part of funding for this project came from Engineers Without Borders – University College of London and the GlobalGiving Campaign. Most of the systems were built in community homes and are shared among several neighbors. Community systems were also installed in the kindergarten, elementary school, and the village church.



Rainwater Harvesting Training with local communities, regional organizations, and EWB - UCL volunteers



Working together

# Small-Scale & Urban Rainwater Harvesting Systems

Camino de Agua's rainwater harvesting work in the past focused on larger rainwater harvesting installations in rural communities. 2016 brought a focus on rainwater harvesting in diverse settings and conditions.

## New Focus on Small-Scale Rainwater Harvesting System

We piloted our small-scale educational strategies and materials in Los Lopez, a semi-rural community, located just five minutes from urban San Miguel. Los Lopez suffers from excessive levels of arsenic and fluoride but has abundant water access. Local families only need sufficient rainwater to subsidize their cooking and drinking needs. The workshop focused on strategies to build up storage capacity over time – spreading out the investment over months or years. The 55 participants installed three 2,500-liter plastic cisterns to illustrate how systems can be expanded over time. The workshop also covered how to dilute contaminated well water (further reducing the amount of rainwater storage needed), how to calculate drinking and cooking needs, and rainwater treatment options.



*The rainwater harvesting system will provide 211 elementary school students sufficient drinking water for the entire school-year.*

## Urban Rainwater Harvesting System

Our first workshop focused on urban rainwater harvesting was held at Vía Orgánica – a popular restaurant, store, and education center with an urban rooftop garden space. With just one small 500L storage tank - installed in the rooftop garden for the workshop - one can harvest sufficient rainwater to provide drinking water for two people year-round and up to 15 people during the rainy season (May – October)! These small-scale rainwater harvesting systems are perfect for urban populations as they take up little space; and when accompanied with biological treatment, they make one of the best drinking water sources available (see page 16 for a pictures of this system).



# Educational Materials & Tech Development

## Educational Materials

This was a year of innovation for our rainwater harvesting work. We developed teaching strategies and educational materials that can be used with different audiences and conditions. The new educational materials developed by Communication Fellow Chantal Kronenburg were instrumental in improving our educational methodology. Elena Diek, intern from The Technical Collage Cologne (Germany), provided all of the technical drawings and illustrations for these materials. These materials easily illustrate to families and students how to calculate both their consumption needs as well as their rainwater harvesting capacity based on more than 40 regional climate/rainfall options (depending on where you live). These educational resources will continue to be adapted, improved, and expanded in 2017; Chantal and Elena are already working on a full-scale rainwater harvesting manual.



*New educational materials in use*



*First bicycle pump prototype –  
pumping 3 meters high*

## Tech Development

We are developing new technologies that can be coupled with rainwater harvesting. One research focus is on solutions that require no electricity as it is unreliable and expensive in many villages. In conjunction with University College of London (UCL), we began piloting a passive-solar pump which uses no solar panels nor electrical wiring. We will expand this work with two pilots slated to begin in early 2017. Our Research Coordinator – Aaron Krupp – developed a low-cost, zero energy, bicycle pump. These water pump technologies improve the functionality of the rainwater harvesting systems by easily transporting water from storage cisterns directly into water filter systems with no electrical input. 2016 also brought design improvements to our first-flush systems; we researched and implemented systems with new materials and build options depending on the rainwater harvesting system.

# Ceramic Water Filters

*“Our ceramic water filters remove 99.9999% of the pathogens and bacteria”*





FILTRO CERÁMICO DE AGUA

**CAMINOS de AGUA**

Para más información:  
[www.caminosdeagua.org](http://www.caminosdeagua.org)  
+52 562 253 1500 Fecha de compra:

Nombre del Beneficiario de la donación y el nombre de la Institución:  
Código: **123 3004**

# Ceramic Water Filters

Along with the more than 150 ceramic water filter systems provided in our rainwater harvesting projects, we distributed nearly **450 additional systems and filters** through sales, sponsorships, and organizational partnerships. In total, we have installed **more than 1,600 ceramic water filter systems** since 2012.

## Partnerships in Ceramic Water Filter Distribution

**Missions for Life**



Distribution of 60+ ceramic water filters

**Fundación de Apoyo Infantil**



Addition of filter systems with their rainwater harvesting projects

**Adelante Juntos para la Colorada**



48 filter systems in 2016; 153 systems since 2015

### New Educational Videos

Four new educational videos (Ceramic Filter Use & System Installation) are available on our website. These videos create the possibility for us to easily ship our filters and allow partners to build and distribute their own systems. Check out the new informational videos here: <http://caminosdeagua.org/ceramic-water-filters/>. New educational videos on system construction are also available in Spanish: <http://caminosdeaguamexico.org/filtracion-ceramica/>

We met with numerous local organizations in Chiapas – Mexico’s southern-most state – earlier this year, where we believe our filters can have a major impact. We began direct partnerships with CATAS and CEDEMI, two social organizations working in rural villages and communities. To date, we have shipped 120 filters and Saúl Juárez will visit the projects to provide technical support in January 2017.

In 2017, we plan to expand to at least two more regions throughout Mexico.

# Biochar for Water Treatment

Wood-based Biochar Treatment Systems

Functionalized Biochars for Arsenic & Fluoride Removal

*“There is an urgent, global need for a low-cost filter  
which removes arsenic and fluoride”*



# Wood-based Biochar Treatment Systems

## Background

Executive Director Dylan Terrell travelled to Thailand in early 2016 for a 10-day workshop on biochar treatment systems led by Dr. Josh Kearns, a visiting researcher at NC State University and Director of Science at *Aqueous Solutions*. Dr. Kearns is an expert in biochar adsorption for water treatment and has spent nearly a decade designing, installing, and monitoring low-cost treatment systems throughout Southeast Asia. This encounter sparked an exciting research collaboration in biochar.

## Wood-based biochar treatment systems

Based on Dr. Kearns' designs and research, we began producing wood-based biochar in February. Biochar can improve the taste, odor, and color of water while also removing synthetic organic chemical contaminants, which are common in agricultural and pharmaceutical runoff or from industrial waste. While we do not currently have known organic chemical leaching in our water supplies, there is a persistent problem of over-chlorination in rural villages, which biochar addresses easily. Local water authorities install chlorination systems to treat water in these rural villages, but residents dislike the taste so much that it leads to less water consumption.



*Biochar treatment system at the elementary school in Vergel de Guadalupe*

In May of 2016, we installed our first biochar treatment system in the rural community of Vergel de Guadalupe at the elementary school. The system **treats 300 liters/day and is accompanied by five ceramic water filters in each classroom, which serve 500+ students at the school.** Reports from the community indicate a major increase of water consumption due to improved taste of the water.

Inspired by the success in Vergel de Guadalupe, we offered a 2-day intensive course in August focused on both biochar and ceramic water filtration. The course was held at the CERECALY Community Center located in the rural community of Las Yervas. Participants learned theory, built a gasifier kiln, produced and processed biochar filter media, and built and installed a 300-liter/day treatment system. The 20+ students learned how to assemble several different models of our ceramic water filter system.





# Functionalized Biochars for Arsenic & Fluoride Removal

The most exciting and groundbreaking developments this year came from our research and development into specialized biochars – specifically bone-based biochar for fluoride removal.

The arsenic and fluoride issues that plague our regional water sources are a major global health concern facing 300 million people, conservatively, around the world. There are no low-cost, appropriate systems that currently exist for these contaminants.

With Dr. Josh Kearns overseeing our research design and protocols, we designed and built innovative, full-scale prototypes of bone-biochar filtration systems. These systems are constantly filtering real community water and being monitored by our tech development team, led by Research Coordinator Aaron Krupp. The current systems are being run by Engineers Without Borders-UK placement, Sarah Mitchell. Sarah will begin monitoring four full-size prototypes concurrently in 2017, providing massive amounts of data on how these systems and specialized biochars will perform under real-world conditions.

Improved production processes of our bone-biochar under ideal conditions, combined with Kearns' pioneering system design has **increased the efficiency of our fluoride removal by more than 600%** from just one year ago. We plan to install prototypes and monitor pilots in real community homes next year. We will also create and test new chars to address both arsenic and fluoride concerns simultaneously.

Look for a report detailing these exiting new results in early 2017.



*Camino's team members Billy and Nico making bone biochar in a low-tech gasifier*

# International Trainings

*“Educating people has a core role in our work”*





ENGINEERING  
CHANGE TOGETHER  
www.ewb-uk.org

# International Trainings

In July 2016, Caminos de Agua, in partnership with IRRI-Mexico, hosted the third annual *Sustainable Technologies in Action* course. To date, we have received 49 participants from around the world in our 12-day course. For three years, we have also been proud to receive the Engineers Without Borders-UK Design Challenge winners. Caminos de Agua dedicates time and energy to this course as an investment in our future. There is a great need for passionate skilled professionals in diverse fields, working daily to find sustainable solutions around the globe. We believe that the course cultivates heart, critical thinking, and creativity for those looking to work in professions that tackle environmental problems. In 2016, students saw over a dozen eco-technologies showcased in a course that combines theory and practical site visits. IRRI Mexico coordinates the course components in Mexico City, and Caminos de Agua hosts the components in San Miguel de Allende. In 2016, a highlight was the site visit to the community rainwater harvesting project installation in San Antonio de Lourdes (see page 22) , executed in conjunction with Engineers without Borders- University College of London where 10 rainwater harvesting systems were installed in a zone with no water access.

This course hones skills of self-awareness, critical thinking, and inspires action.

**Be inspired.  
Be challenged.  
Join us in 2017 for  
the fourth edition.**





