



Year in Review ~ 2016

CAMINOS DE AGUA

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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.





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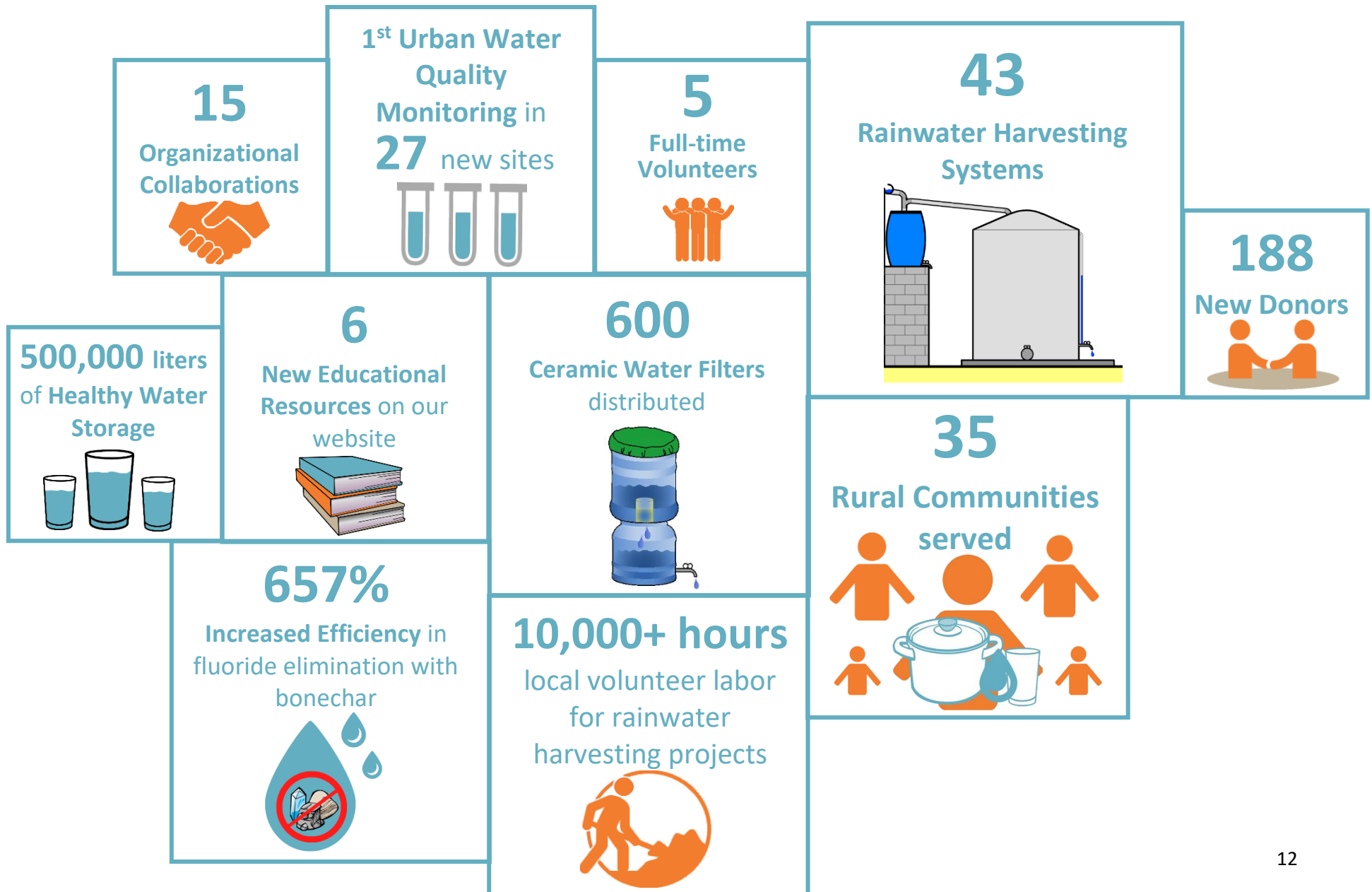
International Trainings

2016 by the Numbers

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



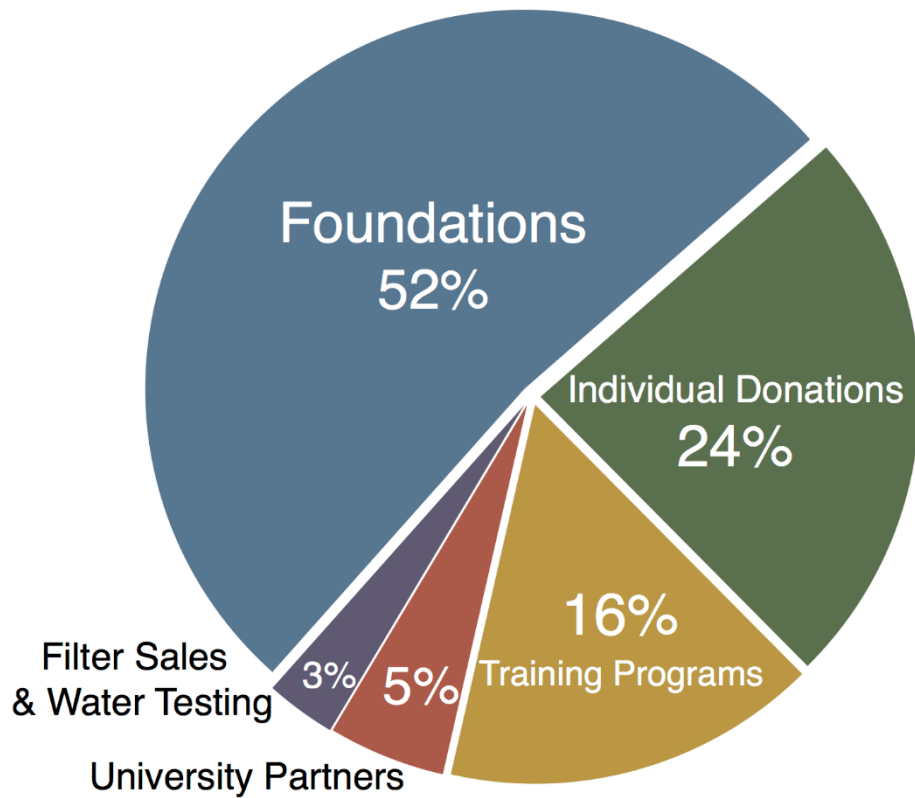
2016 by the Numbers



2016 by the Numbers

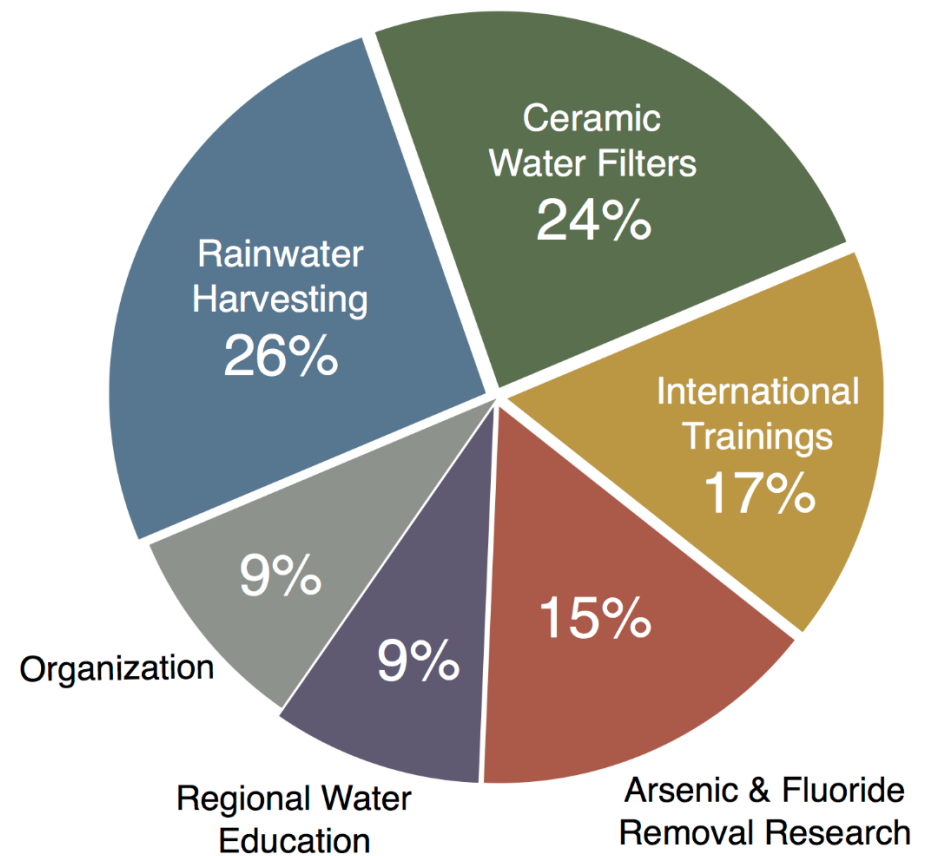
Income*

\$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 (SECOA 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.

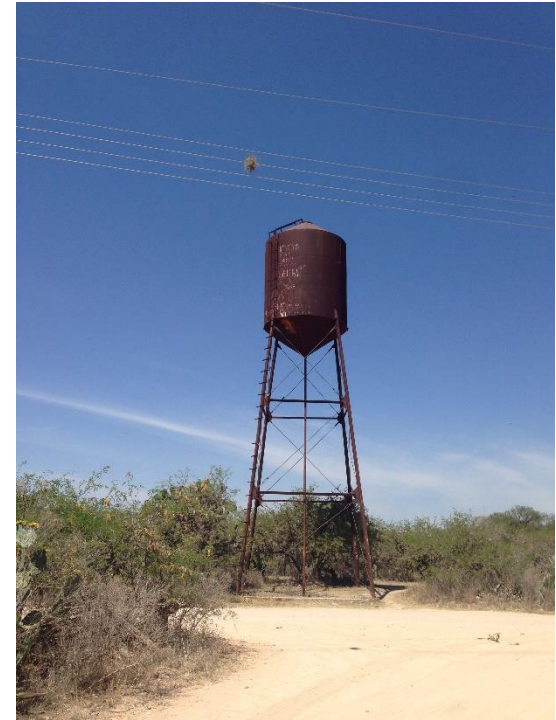
The village's water well went dry seven years ago – due to groundwater overexploitation from surrounding agricultural producers – and the community has been without water since. Most families have bought large 1,000 – 3,000 liter *tinacos* (water storage tanks), which were filled by government trucks 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
+52 562 253 2534 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”





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.**





