



AguaClara

■ ■ ■ Introduction to AguaClara

Thank you for taking an interest in AguaClara at Cornell University.

One in four people worldwide lack access to affordable clean water. Many illnesses such as E.Coli, giardia, cholera and diarrhea-causing pathogens are transmitted through contaminated water used for washing, bathing, drinking and preparing food. AguaClara envisions improved quality of life throughout the Global South through provision of centralized water treatment solutions that can reduce instance of waterborne illnesses as well as catalyze self-sufficiency within communities.

AguaClara is an engineering project team in the School of Civil and Environmental Engineering that develops sustainable water treatment technology. The AguaClara design is unique in that it is gravity-powered, electricity-free, built from locally-sourced materials, and scalable to fit the needs and size of a range of communities. We currently have eight plants operating in seven Honduran communities, totaling near 30,000 residents.

AguaClara water treatment plants treat surface waters to remove turbidity and pathogens, consistently producing drinking water that meets applicable US EPA standards. In collaboration with a non-governmental organization down in Honduras, AguaClara currently has eight operating treatment plants in various locations in Honduras, with a real-time online monitoring system in place.

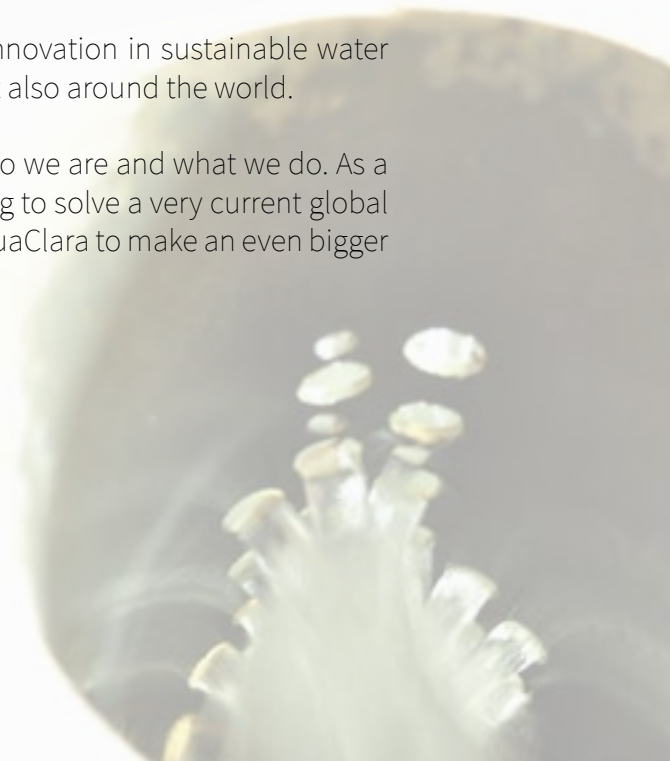
The team is comprised of fifty undergraduate and graduate students who work in sub-teams throughout the academic year and summer term to continue research and design of treatment plant components that address inefficiencies and problems in the current system.

Sponsorship is a vital aspect of the project's continued innovation in sustainable water treatment and success, not online in the lab at Cornell, but also around the world.

The following pages provide further information about who we are and what we do. As a team, we are proud of the work we do and how it is helping to solve a very current global issue. We hope that you will support our efforts to allow AguaClara to make an even bigger difference.

Sincerely,

Julia Morris
2013-2014 Team Leader



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■ AguaClara

■ Who We Are

AguaClara is an engineering team based at Cornell University focusing on the development of sustainable water treatment technologies. AguaClara was created in 2005 by Professor Monroe Weber-Shirk to address the global water crisis. AguaClara's mission is to create high-reliability, low-cost water treatment technologies scalable to fit the needs and size of any community. Our plants currently focus on small scale water treatment systems that can be fully maintained by their local community. AguaClara plants are powered by gravity rather than electricity, significantly reducing their performance costs.

Our plants are created with the intent of community ownership, democratic governance, and easily-managed technology. Through this integrated model of technology development and sustainable governance, AguaClara plants have proven extremely successful. All seven AguaClara facilities are owned and operated by their respective communities and continue to provide safe drinking water. This is particularly noteworthy in Honduras where most conventional water treatment plants cannot consistently meet drinking water standards. Several towns with AguaClara facilities are experiencing reverse migration due to their superior water quality.

The AguaClara program provides undergraduate and graduate students the opportunity to enhance their education with hands-on experience working on projects with real life applications. In 2012, the National Academy of Engineering recognized AguaClara as an exemplary program that "infuses real world experience into engineering education."

AguaClara hopes to continue to achieve our vision of providing safe water to millions of people through our technology. This will be made possible through the growth of our partner networks and increased funding so that AguaClara becomes the international standard for centralized water treatment.



Our Philosophy

“combining knowledge of local circumstances with modern science and technology is a crucial prerequisite for developing more efficient, sustainable infrastructure.”

Elinor Ostrom, Nobel Laureate

The AguaClara design philosophy was developed to ensure the long-run sustainability of the facilities we engineer. AguaClara employs the practice of open-source design. Open-source design allows AguaClara research to be shared freely, published rather than patented and empowering rather than controlled. AguaClara is committed to providing design tools at very low costs and making our designs easily accessible, in hopes that our Implementation Partners will be able to use the designs to leverage increased funding for improved drink water infrastructure in their local communities.

AguaClara plants are created to be both afforded and beneficial to the communities in which they serve. Our plants can be easily maintained and foster a strong sense of ownership by the local community members. AguaClara’s mission is to create low-cost, high efficiency water treatment facilities which improve water quality without complex operational systems.



- Impact
- Our Influence on Communities

“AguaClara is about reliably providing that glass of cold, clear water.”

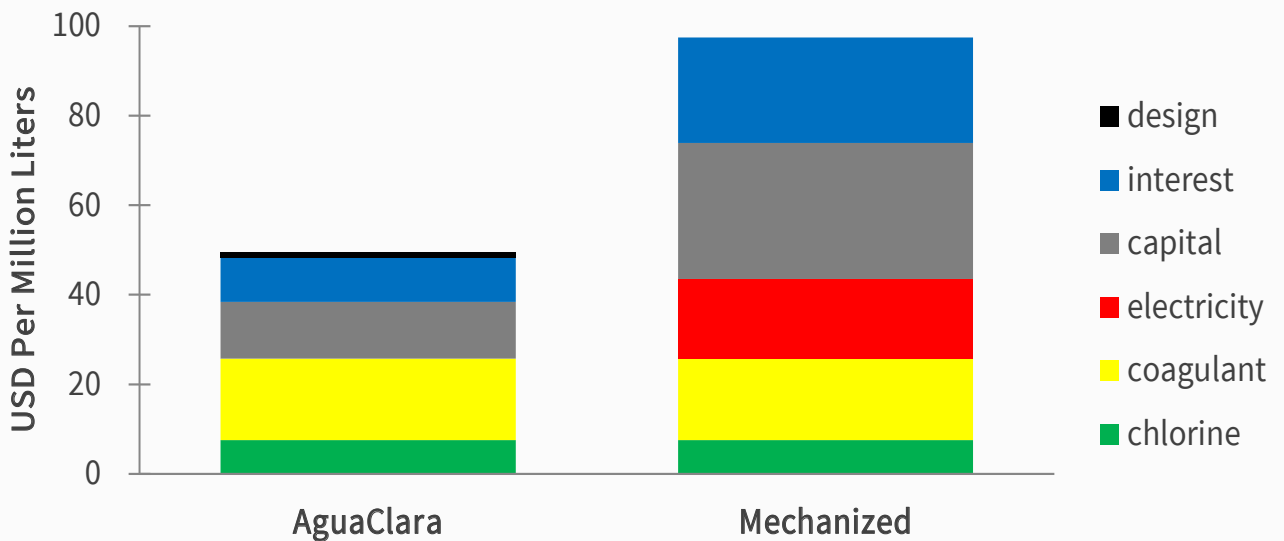
-Monroe Weber-Shirk, AguaClara Founder



Location	Partner	Inaguration Date	Population Served
Ojojona, HON	AAP	Janurary 2007	2000
Tamara, HON	APP	June 2008	3500
Marcala, HON	IRWA	July 2008	9000
Cuatro Comunidades, HON	APP	March 2009	2000
Agalteca, HON	APP	June 2010	2160
Marcala Expansion, HON	APP/ACRA	May 2011	6000
Alauca, El Paraiso, HON	APP	Feburary 2012	3600
Atima, Santa Barbara, HON	APP	May 2012	4000

Facts and Figures

low cost	high quality	reliable service
<p>The cost of an AguaClara Plant providing 10 L/s for a community of 5000 is ~\$110,000</p> <p>The capital cost of building an AguaClara plant is less than half that of a conventional mechanized plant</p>	<p>Daily service to over 30,000 people in 8 communities Our plants are affordable for the community and operator-friendly</p> <p>Community-based water service organizations equipped with AguaClara technology have increased revenue and savings by over 100% by providing treated water service, allowing them to be financially sustainable.</p>	<p>AguaClara treatment plants deliver water quality that exceeds World Health Organization health guidelines (turbidity below 5 NTU, chlorine residual from 0.3-1.0 mg/L, and zero bacterial contamination) without electricity or machinery.</p>



Calculations based on a 25 year life for both AguaClara and mechanized plants

accountability

Performance data for all of our plants is updated daily and can be found at aguaclara.cornell.edu/projects/data.

Research & Tech

AguaClara Plants

AguaClara began with the general objective to design a gravity-powered and electricity-free water treatment system. Doing this ensures minimal costs of operating the plant, and with cooperation within the community being served, it is a self-sustaining water program. Over the past seven years, our research objectives have moved towards fine-tuning existing components and incorporating new technology into the design tool, as well as exchanging information with our partner organizations to modify the design as needed.

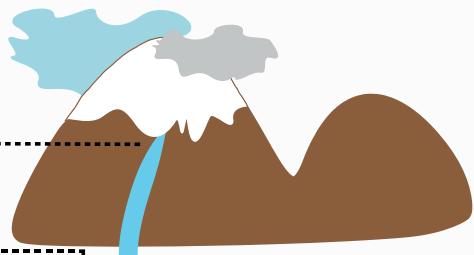
Currently, our AguaClara plant design serves a range of 1,000 to 9,000 people. As more plants are built with our technology, our research will expand towards discovering new ways to implement our technology for larger and smaller populations to meet the needs of a wider range of communities around the world. Current research also includes design elements such as foam filtration for smaller plants, a low-flow stacked rapid sand filtration system, and a ram pump.

The first AguaClara plant was built in Honduras in 2007 and seven more operating plants have been built since. The AguaClara team has worked from year to year with feedback from current plants to remedy any flaws in the design and to optimize the overall system. We hope to partner with more organizations around the world to provide communities with water treatment technology that not only works, but also ensures consistent, long-term access to clean water.



AguaClara technology is unique in that it is zero-percent dependent on electricity and requires minimal elevation drop in comparison to other conventional water treatment technology. The materials used to construct the plant are readily available in the communities that we serve and any chemicals piggyback existing supply chains. In addition to creating self-sustaining technology, our designs are scalable and open-source and designs are available online.

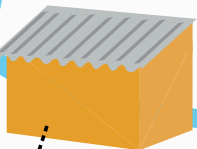
Water flows down towards the plant



entrance



Water enters the plant and large objects are caught in a trash rack



coagulant dose



A chemical is added to the water to allow suspended particles to cluster together

flocculator

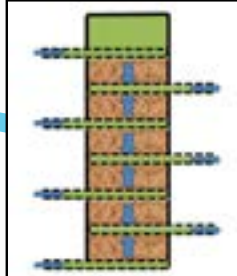


Particles bonded with coagulant gather into "flocs". The many turns in this part of the plant facilitates particle collision



sedimentation tank

Heavier, flocculated particles settle out of the mixture



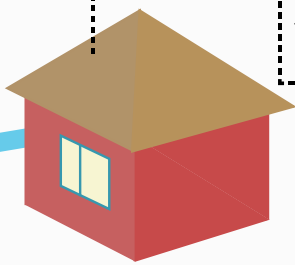
filtration

The stacked sand system filters out any remaining particles before chlorination. This filter accommodates low-flow plants.

chlorination

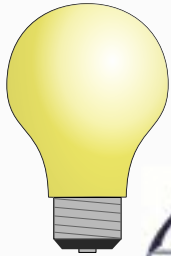
A dose of chlorine eliminates any disease-spreading organisms remaining in the water.

Clean, usable water exits the plant and travels to the plant's patrons



Timeline

AguaClara: Then & Now



2005

AguaClara is founded by Monroe Weber-Shirk in partnership with Agua Para el Pueblo, a non-profit organization based in Honduras.

AguaClara's second treatment plant was completed in June of 2008 in Tamara, Honduras. This plant was built to serve a community of 3,500 people.

June 2008



July 2008

Construction on another AguaClara plant in Marcala, Honduras completed in 2008. This plant served 9,000 versus Tamara's 3,500 people.



January 2007

The very first AguaClara plant is completed in Ojojona, Honduras.

March 2009



Our plant design was used to build a facility for Cuatro Comunidades, serving the communities of Los Bayos, Rio Frio, Aldea Bonito, and Las Jaguas. This plant had shallower tanks, to facilitate maintenance of the plants.

IDEAS

PLAN

The chemical dose controller research team was awarded \$75,000 from the Environmental Protection Agency's People, Prosperity and the Planet (P3) Challenge at the National Sustainable Design Expo.

April 2010



AguaClara and its network of partners named Intel Environmental Tech Award Laureates at The Tech Awards through the Tech Museum based in San Jose.

October 2011



June 2010

Less than a year after construction began, the Agalteca, Honduras plant was complete. This plant included a modified design to address the issue of excess sludge in the sedimentation tank by including an inlet pipe.

AguaClara's unique stacked rapid sand filter design was inaugurated at the Tamara plant, producing some of the cleanest water possible.

January 2012



NING

IMPLEMENTATION

Opportunities undergraduate students



ENGRI 1131 Water Treatment Design

Students build a fully functional, automated, drinking water plant, preparing them to join the AguaClara team in the future.

CEE 2550 Sustainable Water Supply Project

Students are placed into design, research, and public relations teams, where they participate in conducting research, building working models, designing prototypes, creating educational materials for technology transfer, and more.

CEE 4540 Small-Scale Sustainable Water Supplies

Students work on teams to design and analyze sustainable supply and treatment systems.

CEE 4550

This course is the main AguaClara project course, where students work with larger leadership roles to research, build, and present their projects.

Undergraduate students also have the opportunity to take a site visit to the Honduras, where they will see, in person, the water treatment plants produced by AguaClara's contributing members. Lastly, students can also apply for the AguaClara summer internship at Cornell University.

“AguaClara is always new, students are always joining and graduating, and building on the work of previous students. It’s not your standard textbook problem solving - it means something and you’re always the first to do something.”

-Alissa Diminich, former AguaClara member

graduate students

CEE 5051/5052

These courses are offered to Masters of Engineering students looking to fulfill design course requirements. Students take on roles similar to CEE 4550 undergraduate students, but additionally, submit a final report at the end of the spring semester to thoroughly describe the process, analysis, and conclusion of their design project.

Publications

Floc Roll-up and its Implications for the Spacing of Inclined Settling Devices- Environmental Engineering Science 2012

A novel fluidic control system for stacked rapid sand filters - Journal of Environmental Engineering 2012

Gravity-Powered Chemical Dose Controller for Sustainable, Municipal-Scale Drinking Water Treatment -Journal of Environmental Engineering 2012

Influence of polyaluminum chloride self-aggregation on flocculation performance - Journal of Environmental Engineering 2012



- Partners
- Agua Para el Pueblo (APP)



AguaClara focuses on improving living conditions through research, education and implementation, and seeks partners whose values align with our own. Through various partnerships, AguaClara is able to design and create gravity-powered water treatment plants with community needs in mind. With the addition of new partnerships, AguaClara will be able to reach more communities, provide potable water for more families and achieve our goals on a more global spectrum. We are looking for potential partners who are interested in reforming the way water treatment systems are designed.

In Honduras, our primary partner is Agua Para el Pueblo (APP), a non-profit founded in 1984. APP supports initiatives and community efforts to improve living conditions through technical work. Together with AguaClara, APP technicians have built eight water treatment plants serving over 30,000 individuals in Honduras. APP emphasizes strengthening social and environmental conditions through active participation and education of community members, mitigation of the poverty level, alleviation of human suffering and collaboration to form a more equitable and sustainable society. APP additionally contributes significantly to financial planning, infrastructure development, social integration and plant maintenance for the communities they serve. AguaClara and APP's successful partnership has created a higher quality of life and significantly lowered water-borne disease rates in the communities they serve.

Looking forward, AguaClara hopes to expand our partnership database to include corporations from other countries. Our goal at AguaClara is for millions of individuals around the world to enjoy safe, potable water using our technology. For further inquiry about partnerships please see attached forms in this sponsorship packet.



What's New?

Highlights from 2012

Announcing a New Open Data Project

Our new SMS-based data reporting program is in its pilot stage in Honduras

Lack of reliable, up-to-date data on critical infrastructure has always been a serious roadblock in the path of development. Anecdotes might make great PR pieces, but ultimately decisions - which program to fund, which technology to employ, which community's technicians need training - are based on data. A dearth of trustworthy data makes planning more difficult and more arbitrary, with unpredictable results.

AguaClara plant operators collect performance data several times per day, but that data is stored in logbooks at the plant site and collected infrequently. This spring we decided to change that and build a real-time data collection service.

Our Goal

1. Create a tool that allows plant operators to remotely report performance data
2. Allow operators to report problems or unusual circumstances in real time

Our Progress

AguaClara plants don't use electricity, so typically they are not connected to the grid [1]. That, and prohibitive cost, exclude the use of computers to collect data. Water for People / Akvo's FLOW system is based on Android phones with data connections, which aren't applicable in our situation. So we went with SMS (text messaging), which is a ubiquitous technology that has been put to innovative use many times in Africa, India, and elsewhere.

The principal is to have operators text key measurements throughout the day to a SMS-enabled server, parse the messages, and make the data available in an easy-to-use, extensible way online. Messages are parsed based on a pre-determined syntax of short hash tags describing which measurement is being sent, which can be left blank or entered in any order:

```
#cod tam #con aguaclara #cau 130 #tac 9.10 #tas 3.10 #taf 0.10 #com hola
```

The message above shows the flow rate in gallons per minute (#cau) and turbidity in NTU entering the plant, after sedimentation, and after filtration (#tac, #tas, #taf) at the Tamara plant (#cod). A message from the operator (#com) reads Hola.

The development of this program has been spearheaded by Chris Kelley, founder of Open Source Water and a PhD student in the Johns Hopkins University Department of Geography and Environmental Engineering.

Data collection began recently for four of the eight AguaClara plants: Tamara, Cuatro Comunidades, Alauca, and Atima. While there are a few bugs still to be worked out, the pilot launch of this program has gone extremely well. Some graphs and a summary of the data are available at opensourcewater.net/aguaclara_plants.html.

Our immediate work on the ground is to work with the plant operators to correct formatting errors in the incoming messages, as well as improve the program's ability to handle them. In the coming months we hope to use the results of the pilot testing to add SMS to the annual budget of each plant. At the same time we intend to package the platform into a simple-to-set-up, easy-to-manage software tool that can be configured to receive, parse, graph, and publish many types of data. Some potential users are health clinics in the communities around AguaClara plants.

This program is in its very early stages, but we are very excited about its potential. If you are excited about it too, and want to get involved, send us an email. To stay in the loop about future developments, subscribe to our RSS and Twitter feeds.

[1] Some plants use electricity for light bulbs. For more information on our gravity-driven treatment system, visit aguaclara.cornell.edu/our_technology.

Support Us



Platinum (\$20,000 and up)

- Company feature on the team website
- Extra Large company logo on the team website
- Full access to the team for recruitment



Gold (\$10,000 and up)

- Large company logo on the team website
- Full access to the team for recruitment



Silver (\$5,000 and up)

- Medium company logo on the team website



Bronze (\$1,000 and up)

- Company logo on the team website





Donation Form

Support AguaClara

If you are interested in making a donation to AguaClara, please fill out the form below and return to the address listed below. Donations go to fund the unique research being conducted at Cornell University, support the annual educational exchange trip to Honduras, and finance AguaClara internships with partner organizations.

Name / Organization: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Phone Number: _____ Fax Number: _____

Email: _____ Website: _____

What is the amount of your gift? _____

(Please make checks payable to Cornell University with AguaClara in the memo field and attach to this form.)

All monetary donations are tax deductible through Cornell University

Donor Signature: _____ Date: _____

Please return this form to:

AguaClara
220 Hollister Hall
Cornell University
Ithaca, NY 14853

Contact us with any questions:

Monroe Weber-Shirk
(607) 216-8445
mw24@cornell.edu
www.aguaclara.cornell.edu

Support Agua Para el Pueblo

If you are interested in making a donation to Agua Para el Pueblo, our partner in Honduras, please fill out the form below and return to the address listed below. APP facilitates the construction of AguaClara plants through project management, site selection, and community training and follow-up.

Name / Organization: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Phone Number: _____ Fax Number: _____

Email: _____ Website: _____

What is the amount of your gift? _____

(Please make checks payable to The Resource Foundation with AguaClara in the memo field and attach.)

The Resource Foundation is a registered 501(c)3 and all donations are tax deductible.

Donor Signature: _____ Date: _____

Please return this form to:

The Resource Foundation
237 West 35th Street, Suite 1203
New York, NY 10001



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