

Picotani's Water Project: Creating Vicuña Habitat and Empowering the Community



By Dale Cantwell

Photo by Robert Els

The *Camahueto* is a unicorn-like animal that is believed to have the power to purify water. According to Andean myth, *Camahueto*s are born into fresh glacial water melted by the sun between the pinnacles of the Andes. They linger in the surface catchments below before the water slips into the rivers, where they surf down to the sea.

The life blood of Picotani is water, and for the last 30 years they have been bled to death by the bureaucrats, miners, and masses of people living in the cities far below.

Picotani is like a *Camahueto* laboring to conserve water, nurture the endangered vicuñas, and keep the grasslands green.

Many millennia ago, before global warming, the glaciers and the winter snows melted slowly as the water found its way into lagoons and *bofedales* before finally escaping into a river on its way to the Pacific Ocean. *Bofedales* are unique to the Peruvian highlands, formed by huge peat sponges that absorb water and release it slowly. Hence the term “slow water.”¹



Alpacas grazing in a wetland of bofedales. Photo by Madeleine Fortmann

The Andes are the longest chain of mountains in the world. They snake down the entire South

American continent, forming Peru's spine. The mountains' skirts are woven with the warp and weft of tropical glaciers and high-altitude grasslands. If you continue past Picotani's 100,000 acres of Altiplano grassland (home to 10,000 vicuñas), you will soon pass micro farms bursting with the world's finest coffee. A little

farther on you descend into the Amazon Rainforest which occupies 40% of Peru's land mass. 850 Quechua men, women, and children form 170 families who live in Picotani, on the world's rooftop at 15,000 feet above sea level. They have a unique view of the world below.



The Altiplano of Peru is too vast to be captured in a single photo. Nestled between Andean peaks, a few hours from the Amazon River valley and highlighted by glaciers at every turn. This rooftop of the world is a biodiversity wonder. Photo by Bruno Franco.

¹ Erica Geis, “Why Peru is reviving a pre-Incan technology for water.” *BBC*, 18 May 2021. <https://www.bbc.com/future/article/20210510-peru-urgent-search-for-slow-water>.

I joined Quechua Benefit in 2009 as a board member. My wife Pamela Ray is a longtime supporter of the nonprofit organization and its work in Peru. She has been an alpaca breeder at our ranch near Boulder, Colorado since the 1990s. Before joining the board of directors, I knew very little about alpacas other than how to clean the pastures as Pamela's unpaid laborer.

Pamela and I went on a Quechua Benefit Peru Tour, and we visited Casa Chapi in the Colca Valley. Mike Safley was raising money to build a school, and we decided to donate to the building fund. I made the mistake of telling Mike I was an engineer, and the next thing I knew, I was designing and building the schoolhouse!

That first construction project led to others, including building the Sister Antonia Kitchen in Ichupampa after a devastating earthquake in 2016 leveled 80% of the town. I fell in love with Picotani on my first visit. Quechua Benefit has been working in the community for many years, providing anemia prevention services and economic empowerment programs.

Three years ago, Picotani's community leaders approached Quechua Benefit about helping them with a water project. As often happens there was a lot about the project that was lost in translation. At first, we assumed it was for the town's drinking water. After a few meetings it finally dawned on us that the community leaders were talking about a project to provide water for their vicuña during the dry season.

This project intrigued me the minute I connected it with the need. Throughout my career I have designed, supervised the construction, and operated many piping systems, from extremely complicated multi-phase, multi-branch systems to long distance pipelines. The

systems I worked with were for water, natural gas, and liquid petroleum products. I've also had experience designing buildings consistent with Peruvian communities' traditional construction systems and working with local labor in rural Peru, which was invaluable when we decided to support the Picotani water project.

The history of the Picotani project is interesting. When it was first brought to my attention many years ago, "lost in translation" was in full force. From what we



Dale with his two sidekicks in Picotani. Photo by Wasim Muklashy

first understood, the project was paid for and completed by the Italian fashion house Loro Piana. The next time we discussed it, we found that Loro Piana had declined to do the project and that Paolo Zegna, scion of another Italian fashion house, had paid for a dam in 2007. Picotani completed the 160-acre reservoir which is 16' deep in 2010. In 2012, Zegna paid for a membrane to line the lagoon bed and a 6" line that ran for nearly 2 miles. In any case, the system was never finished and lay unused for eight years.



This valve lies at the end of the 6" line from the lagoon and is the beginning of the second phase of the Picotani water project designed by Dale. Photo by Robert Els

The project stalled until 2020 when Jose Escalante, a longtime community leader, approached Quechua Benefit. Mike first met Jose in 2000 when the community asked one of our dental missions to come to Picotani and help the kids with their teeth.

When Jose first pitched the need, he took me on a tour over the steep topography of the project from the lagoon to the vicuña habitat they wanted to expand. I immediately recognized the importance of their objective. The one thing I love about Picotani is that they always propose to be our partners. In this instance they needed design assistance sizing and purchasing the pipes and calculating the elevations for gravity flow purposes. They were entirely willing to provide all the installation labor. This turned out to be no small feat; over 4 miles of pipe had to be dug out by hand and new pipe installed. This does not include the construction of 68 surface water catchments that serve as watering holes which are a minimum of 220 yards apart. Each is supplied by a small diameter pipe fed from the main pipes.



Jose Escalante, the community leader in charge of the water project. Photo by Evan Gering



Dale is second from the left standing between two of the Picotani community leaders. Photo by Ana Caroline de Lima

The current phase of the Picotani Water project is a relatively short, small diameter, low pressure (under 100 psi) water system. The biggest challenges are the extreme elevation changes across the system and coming up with a design that is easy to construct out of materials that are readily available to the local community. The hardest part of the project is walking straight up the hill at 15,000 feet elevation. It's embarrassing when the entire work party must wait for you to catch up!

The global importance of this project took me more time to understand. I always knew that water conservation was critical to the health of the planet, but I did not have a context for this idea as it occurred at 15,000 feet above sea level among the peaks of the world's largest mountain range.

Erica Geis, an award-winning journalist who writes on the subject of water and climate change, uses the phrase "slow water" in the title of her upcoming book. She says,

The Andes Mountains are one of six places in the world where complex civilizations emerged, spurred by precipitation so seasonal it was a catalyst for hydrological innovations again and again. People cultivated deep knowledge of water and the underground, deploying strategies that still astonish—and which some still use.

*As the glaciers that once stored water melt, bofedales play an even more important role in holding water for supply in the dry season. Because they stay green year-round, bofedales are also **biodiversity hotspots**, frequented by birds and mammals, including deer, pumas, Andean fox, pampas cats, and vicuña and guanaco, wild ancestors of domesticated alpacas and llamas.²*

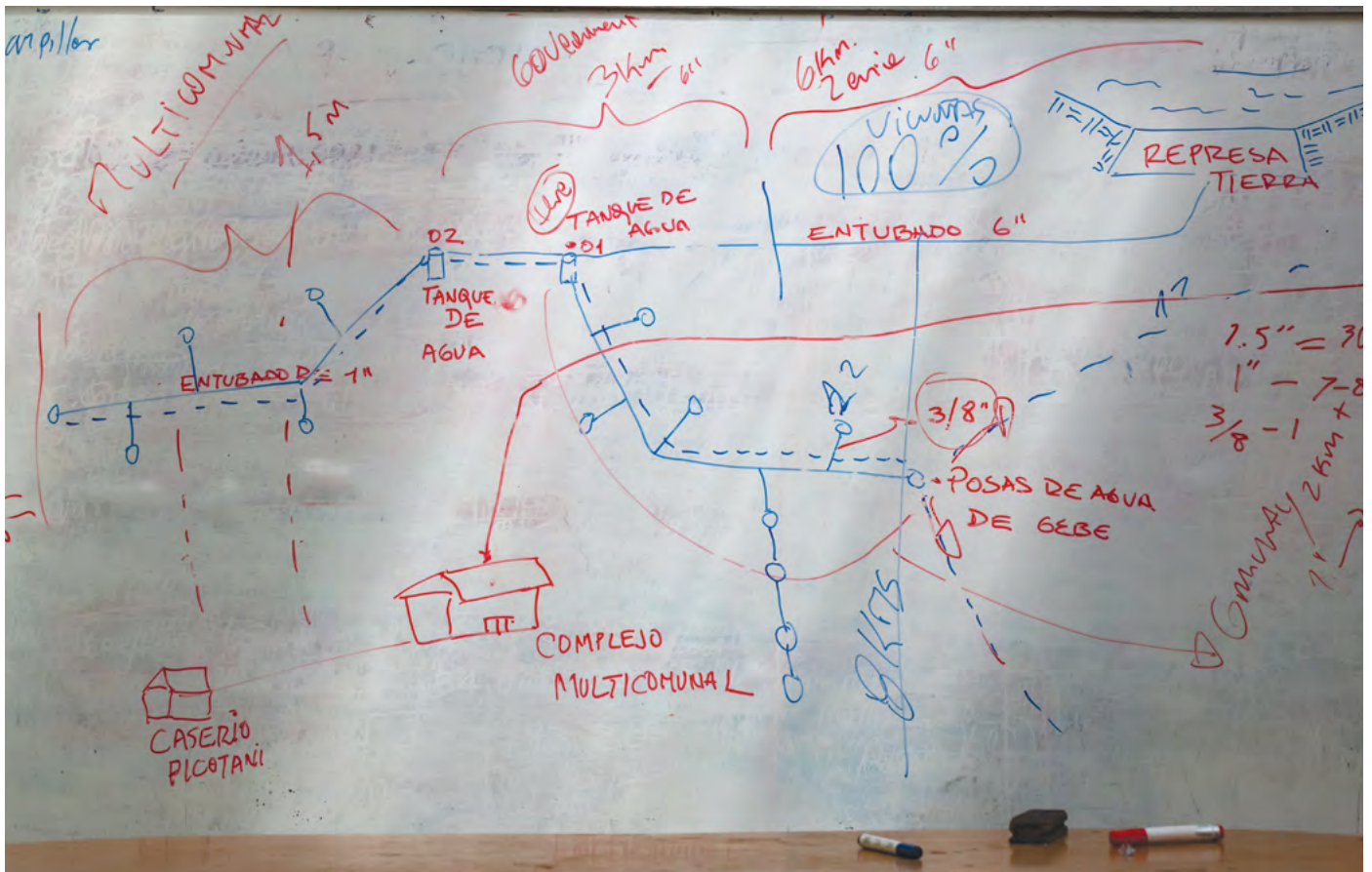
The last paragraph from the Erica Geis article follows and perfectly describes the Picotani water project's full range of attributes which can economically empower the community by providing additional, healthier habitat for its current population of 42,000 alpacas, 10,000 vicuñas, and an additional capacity for thousands more:

As climate change brings water change worldwide, conventional water control structures are increasingly failing. Such human interventions tend to confine water and speed it away, erasing natural phases when water stalls on land... They provide multiple other benefits too, including carbon storage and homes for threatened plants and animals.³

This healthy grassland, holistically grazed and managed by the descendants of the Inca, sequesters 500,000 tons of CO₂ each year. They are a constructive part of the worldwide effort to reach a global warming goal of Net Zero emissions by the year 2050.

² Geis, "Why Peru is reviving."

³ Geis, "Why Peru is reviving."



The white board with the community's diagram of the entire project design. Photo by Robert Els

During my most recent trip to Picotani in December 2021 to plan Quechua Benefit's water project, I met with the community leaders who diagrammed the entire project on a white board, pipe by pipe. Next, we toured the 7,500 acres where Quechua Benefit has provided pipe for the expansion of vicuña habitat. The great thing about diagrams on white boards and step by step tours is that nothing is lost in translation. It just comes down to math, which is a universal language.

I took GPS locations and elevations at the major points along the existing pipeline system and the expansion area. The onsite tour included the community's additional acreage for future expansions. The completed water project will cover Picotani's multi-community vicuña habitat of 7,500 acres. This water project will enable the community to expand their vicuña herd by 2,000 animals. These additional animals will support one of Quechua Benefit's goals: economic empowerment to "Break the Cycle of Poverty."

In addition to the current water project, we are partnering with the community to investigate entirely new vicuña habitat which, when completed, would support up to 2,500 additional vicuñas. To put this into perspective, all these additional vicuñas will produce 1,250 pounds of fleece annually, worth \$225,000. This averages to an additional annual income of \$1,325 for every family in the

entire community. This is like you getting a 25% pay raise in a year.

As we toured, I listened to community members describe what they wanted from the completed system. From the onsite visit and the community meetings, I developed the overall design assumptions and goals. We designed 68 additional surface water catchments that will each provide drinking water for up to 100 vicuñas. I also verified that the reservoir has sufficient capacity for the future needs of the community by using Google Earth, local knowledge, and onsite verification.

Next, I used Google Earth to draw the existing system, checking to make sure the GPS and elevation measurements in the field matched those on the map. It was interesting to note that the satellite view on Google Earth perfectly represented the major features like the reservoir, tanks and many of the existing lines that were visible during our walk.

From the community's input of the existing and future vicuña watering needs, a new system was designed to integrate and improve on the existing unfinished system. I used the Hazen-Williams Friction Loss Equation to determine the pressure at each drinker with the drinker design flowrate of 2 quarts/minute.



The Google Earth image showing pipelines.

Quechua Benefit has purchased 5 miles of 1.5" poly pipe. The community had already installed about 2.5 miles of 1.0" poly pipe.

The Quechua Benefit team will be returning to Picotani in April 2022. The community's completion of the first phase will be ready for inspection at that point. It

will be ready for use just in time for the dry season that begins in June. If my math is sound and the construction crews do a proper installation, we will have a solid platform for any future expansion.

On a personal level it is satisfying to be able to bring a water system that began in 2007 to completion after all these years. The community has already identified an additional 1,000 acres for expansion. With your support and donations, we can make the dream of Picotani's people come true. I will report back to you when I return from Peru in April.



Quechua Benefit purchased 5 miles of pipe for the second phase of the project. Photo by Robert Els

For more information on how you can participate in this project, contact Dale at (303) 902-4503 or email dalecantwell@yahoo.com. Contact Mike at (503) 703-6020 or email mike@alpacas.com. You can also see more about Quechua Benefit at www.quechuabenefit.org.