2010 WEFTA Trip to Peru

Site Visits by Peter Fant and Lou Harrington
March 23 to March 30, 2010

Tacna/Colegio Cristo Rey

On the morning of Wednesday, March 24, 2010, we met with Padre Paco (Director of Colegio Cristo Rey) and Hermano Cardona (Administrator), as well as Pedro and Javier (Hermano Cardona's assistants). They showed us some videos of what was done at the Jesuit high school in Lima with their wastewater reuse project, and then took us around the Colegio Cristo Rey campus to show us where they hope to do something similar but on a smaller scale.

The ultimate goal of Hermano Cardona, on behalf of Colegio Cristo Rey, is to create a system that takes the relatively clean wastewater that flows through Tacna's sewer system late at night and early in the morning, treat it, and reuse it to irrigate garden areas throughout the extensive campus of the school in Tacna. Tacna is located in the Atacama Desert, where annual precipitation is approximately 1/2" per year. Needless to say, the natural landscape that doesn't receive irrigation resembles more a lunar landscape than anything seen in most parts of the world. It essentially consists of sand, gravel and rock, with no vegetation.

Hermano Cardona, Lou and Javier

The school would like to create a model treatment facility that is capable of treating relatively clean wastewater (commonly referred to as 'scalped' wastewater) to a degree that the treated effluent could be used for irrigation of green spaces, including orchards of fruit and nut trees, and other food crops. The school has large open areas, some of which have been planted with olive and pecan trees and irrigated by diverted river water which the school has access to on a very limited basis. Hermano Cardona would like to see the proposed scalped wastewater treatment system replace the need for river water altogether, and represent a treatment and reuse alternative for other communities in the same valley as Tacna, as well as other valleys throughout the region.

Hermano Cardona shared with us the experiences he had in Lima at the Jesuit school 'La Inmaculada'. He began construction of a wastewater diversion, treatment and reuse project there several years ago and the results are plain to see. Roughly 800 cubic meters of scalped wastewater is diverted between 1:00 am and 3:00 am daily from the surrounding neighborhoods, screened and pumped up to elevated lagoons on the hillside, treated by means of a very rudimentary oxidation process, and from there the treated effluent is fed into reuse lines, pressurized simply by gravity and used for irrigation of the ample gardens throughout the

campus. The campus of the school in Lima is much larger than that of the school in Tacna. Before starting the project Hermano Cardona had collected wastewater samples from the City's collection system, sent them to a lab and determined that between 1:00 am and 3:00 am the wastewater was relatively clean and had less potential for receiving harmful chemicals that might be discharged into the system during the day.

The system conceived and constructed in Lima under the direction of Hermano Cardona has received much attention and has been documented and promoted both by the school as well as outside entities. We were shown a very well done video prepared and narrated by Antonio Brack, prior to being named the present Minister of the Environment for Peru, in President Alan Garcia's cabinet.

The proposed system in Tacna would have roughly half the capacity of the system in Lima, or 400 cubic meters per day. Hermano Cardona shared with us the initial concept that included a diversion point which would incorporate a series of screens to filter debris, an underground tank and pumps that would pump the effluent to a treatment area with a capacity of roughly 3,000 cubic meters, and from there up to 30 meter high elevated tank with a capacity of perhaps 100 cubic meters. Pete shared with Hermano Cardona the idea of utilizing a series of variable frequency drive pumps to pressurize the lines instead constructing such a tall, and costly elevated concrete tank. Hermano Cardona was not aware of the technology and indicated that he would be very interested in exploring that further.

Hermano Cardona explaining the school's plans

The climate is so dry and the land so arid, that they can simply disperse the resulting solids/sludge (a byproduct of the proposed treatment system) over the land and it is dried very quickly and later gathered and spread as fertilizer over the garden areas.

The school has a total population of approximately 900, made up of 800 students and 100 teachers and staff. The planned garden areas and orchards will require much more irrigation water than the school itself will ever produce. Therefore, the concept includes the diversion of scalped wastewater from the main sewer trunk line in the street in front of the school between 1:00 am and 5:00 am. The local sanitation utility company has already approved the concept of diverting wastewater from the main trunk line that passes in front of the school, so the only thing holding them back is the construction of the system.

Areas to be irrigated with the treated wastewater

Ultimately, the school leadership would like to construct a treatment and reuse system that can be replicated elsewhere, at varying scales, and used as a sort of pilot project to promote the concept throughout the region. Hermano Cardona envisions having civil engineering students from the university come to the site to learn about what is possible and see with their own eyes such a system functioning. If a relatively compact, decentralized treatment system can be constructed at Colegio Cristo Rey, and replicated elsewhere in the valley and throughout Tacna, it may be possible to provide irrigation water for parks and landscaping along streets that are now quite limited due to the scarce water resource.

FOLLOW-UP

WEFTA will provide information on the variable frequency drive pumping systems that may help avoid the need to construct a huge, elevated storage structure to create the needed pressure in the treated effluent dispersal system.

WEFTA will review the plans for the proposed wastewater treatment and reuse system prepared by others, and provide comments and feedback.

Sama/Inclan

The water from the community water system of Inclan in the Sama Valley, about 20 miles north of Tacna, serving a population of approximately 4,600 people, has recently been found to contain very high levels of arsenic, as well as other constituents such as boron, lead and iron, well above the normally acceptable levels. Evidently all the communities within the Sama Valley watershed have the same water quality issues.

Water system inlet for community of Inclan in the Sama Valley

The village government has been able to raise a significant amount of funds to construct the needed water system improvements, as well as a new wastewater collection and treatment system. It is clear that they have the technical capacity to design and develop the water distribution and wastewater collection systems; however, it was made clear to us at the time of our visit that they lack the expertise in dealing with water treatment technologies and procedures. The engineer assisting the community with development of the design for the proposed improvements, Victor Reyes Anaya, explained that they simply contacted Degremont Technologies, a large multinational water treatment firm, and were provided a preliminary design and budget that resulted in a very expensive alternative.

We toured the water diversion structure and found a system that seems to be working well. The design of the proposed improvements includes the installation of the new treatment system down within the community.

Intake for Inclan water system with high arsenic levels

We were made aware that there are smaller, more isolated communities further up the valley that are drinking this same contaminated water, but with much fewer resources or possibility of finding the resources to treat the water. Profesor Edgar Durand will follow up with contacts he has with these communities, such as Coruca, to see if perhaps they would be interested in assistance with rudimentary treatment systems that could greatly improve the quality of their drinking water. Pete feels that we could probably come up with something much simpler and less complicated (less expensive) than the proposed Degremont system, that perhaps would be less efficient in removing arsenic, but would undoubtedly result in a very significant reduction of arsenic and other unwanted constituents, and provide a much healthier potable water resource for the affected communities.

FOLLOW-UP

It was agreed that perhaps the greatest assistance WEFTA could provide the community of Inclan is with review of the proposed water treatment system and equipment, and with suggestions for alternative technologies. Victor Reyes will submit to WEFTA the preliminary plans for the treatment system as well as the latest water quality analyses which are programmed to be performed in April and May.

We will follow up with representatives of Coruca and other communities further up the canyon on potential treatment systems if we hear from them via Edgar Durand, and once we have a better idea of the water quality issues to be dealt with.

Habitat for Humanity Community in Urubamba

A key WEFTA ally in Urubamba is Linda Ochoa, an ex-Peace Corps volunteer who married a local man several decades ago and raised a family in Urubamba. She has been WEFTA's eyes and ears on the ground for several years and continues to play an important role in seeing projects through and setting up new ones in the region.

After visiting with the local leadership at the Habitat for Humanity community in Urubamba, we toured the wastewater system, including both treatment systems. The locals had been experiencing problems with portions of the system getting clogged with debris, before the cause of the problems was identified and systems put in place to assure that proper maintenance takes place on a regular basis. Since then, both subsystems have been functioning correctly. The current president of the community board was not aware, however, of two key screen chambers that were designed to ease maintenance, and would have helped them avoid the problems they've recently experienced.

Lou with Freddy Puma, President of the Habitat Community Association at lower treatment area

One of the community elders was able to point out where these chambers are located and they indicated that they would devote time to uncovering those boxes and be sure to include the cleaning of those screens in their maintenance procedures.

Señor Leandro, the local engineer that helped with the construction of the original system has suggested that a second chamber be constructed next to the existing one to allow the community to switch flow to the new septic tank, and thereby allowing the sludge in the first tank to dry out and decompose. The first tank, constructed approximately 5 years ago is thought to be about 2/3 full now.

The same engineer will prepare a take off for what materials would be required to construct such a tank, as well as a budget. The engineer will also prepare a list of what is still needed to complete and bring on-line the community water storage tank. Once we receive this information, we'll look into what possibilities exist for funding such work.

The president of the community association, Freddy Puma, explained that the Municipality of Urubamba has come through with delivery of all the accessories associated with the new water storage tank, and that all that is lacking is some additional 2" PVC piping that will allow for a dedicated fill line, since the system pressure is unreliable without such a line. The tank also needs some more finish work to create the impermeable surface within the tank that is required.

Discussing status of the wastewater system with local leaders and other topics at Habitat for Humanity community

FOLLOW-UP

WEFTA will need to prepare and provide the community with a simple operations and maintenance manual that can be used by the locals to properly maintain the system, and can be handed down from one council to the next as the leadership changes. This manual will need to include instructions on how to promote decomposition of the sludge in the tanks once they are taken off-line, as well as eventual removal of the material.

Once we receive the drawings and budget for completing construction of a second septic tank, as well as completing the water storage tank, WEFTA will assist with the search for funding and help coordinate this work.

Yucay

The community of Yucay suffered many losses of homes during the recent floods that took place earlier this year. We drove by the tent community that was put up near the central plaza. Approximately 100 families of the 600 families that make up the community lost their homes in the flood.

Surface water diversion structure in need of modifications, community of Yucay, in the Urubamba River Valley

We met with the mayor of Yucay, Juvenal Duran Espinoza, the first evening we were in Urubamba, and toured the community water system the next morning with the system operator. We found a very well conceived and constructed community water system that included an elaborate intake from the creek coming down from the mountains, and then a system of up-flow and down-flow sand filters to purify the water. The structure was constructed with financing provided by Plan International, SedaCusco (the local utility company) and the Municipality of Yucay.

The system operator indicated that the intake structure was where they've had the most headaches. The original design did not take into account the high volume of sediment that would enter the first tank, and the structure has proven much too difficult to clean out. They currently send a crew of about seven or eight men up the mountain, two to three times per month during the rainy season, to manually shovel out the sediment from the bottom of the tank. The operator asked for ideas on what could be done to improve the system and allow for easier cleaning. Pete suggested that a few relatively simple modifications could be made to the tank that would allow for a much less labor-intensive effort when it comes to removing sediment.

The modifications would include creating a clean-out opening with gate that would match the elevation of the bottom of the concrete tank, and would allow the operator to periodically flush the tank out and let all the built up sediment be sent back into the creek bed. If the proposed improvements are to be made, they would need to be made during the dry season which runs from June to November.

We also visited the site where the raw sewage collected throughout the community of Yucay is dumped directly into the Urubamba River. The river was still so high at the time of our visit that the actual outlet was underwater. We did see one of the outlet points however where we could observe the sewage bubbling up from just below the surface of the river water, and detect the odor of the untreated waste. There was also much debris such as paper and plastic bags stuck on shrubs and tree limbs along the river shore, carried there by the sewer lines.

Sewage outlet for community of Yucay, dumped directly into Urubamba River with no treatment nor filtration of any kind

FOLLOW-UP

Pete, with assistance and involvement from other engineers at SMA, will draw up the improvements that he has in mind for the initial tank at the diversion point where the community has all the problems with excessive sediment build-up, and we'll send the drawings to the system operator for his consideration

The development of a wastewater treatment system for the community of Yucay will no doubt be part of a larger effort throughout the region, with communities up and down the Urubamba River, when it comes to treatment of raw sewage prior to sending it to the river. This is discussed further toward the end of this report.

Chichubamba

We visited with a couple representatives of the community of Chichubamba: Antonio Cornejo, Treasurer, and the wife of Alejandro Huaman, President. The original water system concept entailed construction of a waterline that would take water from the stream to the homes of Chichubamba, but would have to cross property belonging to the community of Chicon. Evidently this community was ultimately not willing to grant passage. Approximately 40 lengths of 4" PVC pipe have been installed, and the remaining 150 lengths are in storage in a well protected structure in the village.

Pete with Linda Ochoa and local board members of Chichubamba Water Association

There is evidently a new regional entity established that will be in charge of assuring access to water to all four communities that make up the entity: Chicon, Pino, Chichubamba and Yanacones. A new source will be developed further up the canyon, nearer the Chicon glacier that will supply water to all four communities. The local leadership in Chichubamba indicated that the pipe material in storage now will be used to bring the drinking water to the 800 families that make up the community of Chichubamba, once the main trunk line is developed and extended to the limits of the village.

FOLLOW-UP

The wife of the president of the board has committed to submitting to WEFTA a copy of the proposed new project via the internet. WEFTA will review the proposal and provide comments and suggestions (if applicable) related to the feasibility of the proposal and perhaps ideas on how to maximize the limited resources available to the community of Chichubamba.

Colegio Santa Rosa de Lima in Urubamba

This regional school serves a population of 698 students that attend classes in two turns, a morning turn and afternoon turn. There are also students that attend classes on Sundays that are unable to attend normal classes during the week. On August 30, 2010 the school will celebrate its 100 year anniversary.

Pete, Lou and Tania, Director of the Santa Rosa de Lima school in Urubamba

With assistance from WEFTA the school has been able to construct new bathroom facilities. As of the date of our visit, the main structure has been completed, and is now awaiting the finish work. We were able to see the toilets that have been donated, as well as the tiles that will be installed on the walls and floors. Both the tiles and the toilets were donated by a contact of Linda Ochoa's. The

Municipality of Urubamba has donated the concrete, blocks and bricks used to construct the base structure. Linda has done an extraordinary job of leveraging the funds originally provided by WEFTA by convincing other parties to donate toward the project.

The Director of the school and other faculty members and parent representatives were present to show us around. We were also pleased to hear of the commitment on the part of the faculty to follow through on the hygiene education component of the project. The school representatives shared with us their dream of helping the students appreciate how the facilities work, and how to use them and maintain them properly. They stressed the need to get the importance of proper hand washing and general hygiene across to their students, and their commitment seemed genuine.

Current water resource awareness campaign going on at the school

FOLLOW-UP

The project is expected to be completed within the next couple months. Thanks to the efforts especially of Linda, it appears that the original budget will be plenty. We indicated to her that any funds left over will be able to be used toward future WASH-in-Schools projects in the region, or other WEFTA projects. She is keeping close track of the expenditures.

Lou committed to assisting the school leadership with the design of a park area within the relatively limited grounds of the school. The area set aside for this purpose is currently in a poor state. The idea will be to create a green area where the students can gather and enjoy a natural setting while eating, reading or simply conversing between classes.

Urubamba Valley Wastewater Treatment

We met with the mayor of Urubamba, Ing. Benicio Rios Ocsa, and had a good discussion with him, as well as the representatives of Yucay, regarding the general condition of wastewater collection and treatment in the Urubamba Valley, or more precisely, the lack thereof. Benicio shared with us the efforts that have been made to date regarding treatment of sewage waste. His frustration was very apparent with regard to the bureaucracy of the large efforts expended so far, as well as the millions of dollars spent on studies with little to show for it.

What is clear is that large wastewater lagoons are almost certainly not going to be feasible in the older, established communities up and down the valley. We talked about the alternative technologies that exist now that would almost certainly meet with much greater acceptance.


Downtown Urubamba at dusk

The local government officials we met with shared with us about a central government program that potentially funds 70% of the costs of an infrastructure project with the local governmental entity only having to come up with

30% of the funds. To date, only one or two municipalities in the region have been able to take advantage of this opportunity because of their inability to understand and complete the environmental clearances required for the projects. With assistance from engineering and scientist resources available to WEFTA, we could assist with this process, and certainly provide technical assistance in the discussion of potential treatment technologies and feasibility of each. Additionally, because of the high profile location of Urubamba, it may be possible to tap into other sources of funds tied to the tourism based economy and to help the local municipalities come up with the 30% matching funds needed. These funds might come from an imposed 'wastewater tax' on international ecotourism companies that provide tours in this area, to large scale developers that will undoubtedly move in to the area when the planned airport expansion project gets underway.

FOLLOW-UP

The Mayor of Urubamba agreed to write a letter requesting technical assistance from WEFTA and then WEFTA would be able to develop a preliminary feasibility study for how to address the issue of treating sewage waste for the larger communities up and down the Urubamba River. It is apparent that the local municipalities, as well as regional, provincial and national entities have access the resources that can be used for constructing such facilities. What is also clear is that there seems to be very limited local expertise when it comes to all the alternative methods available for treatment of sewage.

This is an area where WEFTA could provide a very valuable resource, and help promote treatment alternatives that have a chance of being approved for funding, and ultimately getting constructed. Once we receive an official petition from the Mayor of Urubamba for assistance with developing a study that would identify alternative technologies available for treatment of sewage waste, we will respond with a plan for developing such a study. WEFTA is fortunate to have engineers with a great deal of experience and expertise with just such projects.

USAID office visit in Lima

We met with two USAID representatives in Lima, Miriam Choy and Jaime Chang, on the last day of our trip to Peru. Both have been with USAID-Peru for many years and are very familiar with the water and sanitation outreach work supported by USAID.

After we shared with them the history of WEFTA in Peru, they explained that their program typically deals more with behavioral change than large infrastructure projects. They tend to promote programs that deal more at the household level, and in the creation of sustainable models that will result in better hygiene and general health. They've worked closely with CARE in the past, and have experienced success in 'mother/child health' programs.

Of the relatively new Development Grant Program (DGP) they've selected only two recipients for consideration the first year of the program's existence. Their position is that projects funded via the DGP should emphasize education and sustainability.

After we explained our interest in assisting communities in the Urubamba Valley with development of wastewater treatment systems, Jaime mentioned that it would be important to meet with representatives of the 'Chincheros Authorities' who have already had experience in

obligating local stakeholders to construct at least rudimentary wastewater treatment systems, which in most cases are nothing more than large septic tank/leach field systems, similar to the system WEFTA helped construct at the Habitat community in Urubamba. Such systems tend to be very site-specific and/or building-specific, and don't generally represent any kind of comprehensive approach to dealing with the wastewater issue, especially when it comes to established homes and businesses.

Miriam recommended we contact the Ministry of Commerce and Finance (mef.gov.pe) to see to what degree we could tap into their incentive plan for rural communities to improve wastewater treatment and disposal activities.

We discussed the concept of the circuit rider program, trying to tie that into the notion of 'sustainability' and thereby being something that could perhaps be considered for funding via the DGP. They seemed somewhat open to the idea but less than enthusiastic. It's apparent that we would need to work on the packaging of that concept, but it seems doable.

FOLLOW-UP

WEFTA will follow up on contacts with the Chincheros Authorities as well as Ministry of Commerce and Finance to see to what degree we could combine efforts. We will also continue to develop the concept of a more concerted effort in the region with even the possibility of having a significantly higher profile presence in the Urubamba Valley. It may be that we could prepare a proposal for addressing the issue of development of wastewater treatment systems throughout the region that would significantly improve the environment and health and well-being of the local population. The key will be in the promotion of feasible, fundable wastewater treatment systems that will also be sustainable over the long haul.