# WEFTA Site Visits to the Urubamba Valley of Peru and the Bolivian Altiplano

## January/February 2014

WEFTA Director Lou Harrington, his wife Teresa, and son Sean spent the months of January and February in the Urubamba Valley, just north of the city of Cusco, Peru. The purpose of the trip was twofold: a chance to experience life in Peru as a family and to continue the work of WEFTA in the valley and elsewhere in the area that was begun several years prior. For Lou and Teresa, this was an opportunity to share their love of Peru with their 14-year-old son Sean, including the beautiful culture and warm people, and especially the close friends they had made after spending years there as Jesuit International Volunteers in Peru and later with Habitat for Humanity. In fact Lou was involved in the establishment of the local Habitat for Humanity affiliate in Urubamba about 20 years ago.

WEFTA agreed prior to the trip that Lou would work with the local municipalities in assessing their current situations, specifically regarding the treatment of wastewater, or lack thereof, in preparation for a visit by WEFTA volunteers with expertise in wastewater treatment.

As background to the situation in the valley, the Urubamba River reached a tipping point several years ago when the capacity of the river to assimilate the sewage waste from the villages up and down the river was surpassed, and the river is now significantly degraded by organic and inorganic contaminants. The river that runs through the Sacred Valley of the Incas, and played a central role in the Incan culture, has been reduced to a dumping ground for sewage and trash. If one takes the train to Machu Picchu, one can't help but notice the shores of the river lined with plastic bags and rags, and a steady flow of plastic bottles and other debris flowing down the middle of the river. And that's just what you can see on the surface. What was once a river that the elders of the valley remember swimming and bathing in as youth, and as bountiful fishing grounds, has now become an embarrassing eyesore and source of disgust and disease. Several years ago the government enacted laws forbidding fishing in the river. The fish that you might catch now, if any, are so contaminated that they're unfit for human consumption.

**L – John Lincoln complete his field notes from Huayllabamba while waiting for the bus to Pisac**
**R – Sean Harrington enjoys a visit to Machu Picchu**

In the month of March of 2013, the WEFTA team of John Lincoln, Lou Harrington, Jennifer McDowell, and local volunteer Linda Woodell began working with representatives from the various municipalities of the valley, especially in the two largest urban centers of Urubamba and Calca, and laid the groundwork for the work that would continue this year. What the team noticed was a clear lack of almost any knowledge of fundamental wastewater treatment processes by local municipal engineering staff and even civil engineering consultants that they hired. There was certainly no familiarity with the

various technologies available for wastewater treatment, especially those beyond basic lagoon or septic systems. There was significantly increased interest and desire on the part of the local population, especially the younger generation, to do something about contamination of the river. Therefore, it was clearly important that any treatment facilities had to be done correctly; otherwise there was a high risk of wasting the limited financial resources and dampening the enthusiasm that has grown recently.

During the weeks leading up to the site visits by the WEFTA team, Lou established and developed contacts with the municipalities of Urubamba, Calca, Pisac and Huayllabamba, all along the Urubamba River.

On February 3, John Lincoln and Peter Fant arrived to the valley and the work of evaluating the situation at each community began in earnest. The WEFTA team evaluated a couple examples of initial attempts at dealing with wastewater in the valley. One was the wastewater collection, treatment and disposal system at the Habitat for Humanity community on the outskirts of Urubamba, which was an early WEFTA project, and the other was a similar system for the Pumahuanca community just downstream of the town of Urubamba. Unfortunately such examples of wastewater treatment are rare in the Urubamba Valley, where each of the towns, large and small, have historically dumped their raw untreated wastewater directly into the river, and continue to do so to this day.

The primary goal of the WEFTA team in 2014 was to continue this important partnership between the local leadership and WEFTA to ensure that the local communities make wise decisions, which will ensure the long term viability of the treatment systems constructed at each community.

## Urubamba

The team from WEFTA met with town officials in 2013, as well as a local consulting engineer, Lucho Acuña, whom the city had hired to design the wastewater collection and treatment system along with a completely new potable water system. The 2013 WEFTA team had explained the pros and cons of the different possible treatment technologies and offered assistance to Urubamba officials, as well as to Lucho Acuña, as they developed potential alternative designs. The team that met with the town and their consultant this year was disappointed to find that Lucho had run ahead with the design of a wastewater treatment plant that was based on a technology that none of the WEFTA engineers felt was

an appropriate solution. In fact, they unanimously agreed that the potential for failure of the proposed system was quite high. The system is based on an upflow anaerobic process which would require the construction of two huge, fairly complicated tanks followed by facultative lagoons. One of the concerns was that the concentrations of biological material in the wastewater would actually be too low for such a system to function properly, and another had to do with temperature requirements for the processes to function as required during the colder months of the year. The estimated cost of the treatment plant facility was nearly US$6,000,000! The WEFTA team is convinced that other options are available which would not only be much less expensive to construct, but would actually have much better odds of working. Due to available land constraints, the most appropriate options developed by the WEFTA engineers consisted of either a mechanically aerated lagoon system or an even more compact treatment system based on Integrated Fixed Film and Activated Sludge (IFAS) technology such as that used by the STM-Aerotor™ treatment systems.

L - Ing. Lucho Acuna explaining his design for the Urubamba wastewater collection and treatment system
R – WEFTA team member pose questions to Lucho about the proposed design

Martha Serna, the director of the Infrastructure and Projects Office for the municipality of Urubamba, repeatedly made clear the appreciation the town feels for the input from the WEFTA volunteers. She explained that there is no one at the municipality, among the public works staff or otherwise, that can effectively evaluate such proposals for complicated and expensive infrastructure. In the community's eyes, the observations and commentary provided by WEFTA are essential to the success of the project.

## Calca

The large town of Calca, provincial capital of the province by the same name, has an ever-growing population of well over 10,000 and has never had a wastewater treatment system of any sort; rather, the town's wastewater collection system has always discharged directly to the river.

The WEFTA team that visited with provincial officials from Calca last year (March 2013) met with the engineer who designed the wastewater collection and treatment system for the town of Calca, along with local public works staff, and made some serious observations as to the feasibility of the proposed system. WEFTA submitted a design memo to the town and design engineer, detailing the concerns the team had, but upon returning in 2014 the team was disappointed to find that the design engineer had failed to address any of the issues discussed. However, since last year there was a change in leadership at the town and there was a complete turnover of the public works staff. Initially this seemed like an unfortunate discontinuity in leadership, but after continued talks with the new leadership, it was clear

that this was a case where discontinuity is good! To continue down the path they were on would have resulted in failure and wasted funds … many hundreds of thousands of dollars.

The WEFTA team met with the public works department staff and went over the final design drawings and made several follow-up observations and suggestions with the intention of assisting the town representatives with interpreting the proposed design, and deciding how best to proceed with the development of the treatment plants. All agreed that it most certainly would not behoove the town to continue with the system as designed and that a decision as to the most appropriate technology needed to be revisited. The director of the public works department, Ing. Jose Caviedes, requested that he WEFTA engineers play an active role in such ongoing studies.


**L – Meeting with the public works staff of the provincial capital of Calca**
**R – WEFTA team at the site of the decentralized wastewater treatment systems near Calca**

## Huayllabamba

The town of Huayllabamba has a facultative wastewater lagoon system that failed several years ago and that they wish to rehabilitate and bring back online. The revamped lagoon system will be designed to accommodate not only the wastewater produced by the town of Huayllabamba (population of 1,741), but also that of the neighboring community of Urquillos (population of 899), as well as the large Hotel Aranwa (guest capacity of approximately 230).

The consultant, Gladys Yanque, a biologist from Cusco hired by the town to prepare the design report, indicated that she considered design flows of 3.61 liters/second, and sized the lagoons to allow for 11 days retention time in the facultative lagoons, and 13 days retention time in the polishing lagoons.

The WEFTA team discussed various project specific concerns and design parameters considered, and shared insights with the local public works staff and hired consultant both at the municipal headquarters and at the site of the lagoons. The dynamic of the meeting was really more of a brainstorming session over how to deal with construction of the lagoons and the challenge of dealing with a site directly adjacent to the Urubamba River. The general feeling of the WEFTA engineers was that the town was on the right path in terms of treatment technology and agreed that the greatest challenges had to do more with flood protection of the lagoons due to their proximity to the river and the potential effects of fluctuating groundwater levels on the lagoon system.



**L – Failed lagoons at Huayllabamba**
**M – Discussing issues relating to the Huayllabamba lagoon system**
**R – Pete and John discuss plans for the renovated lagoon system**

## Pisac

The town of Pisac also had a lagoon system, but one that was abandoned several years ago due to litigation. A man claiming to have hereditary rights to the land where the lagoons were constructed filed a lawsuit against Pisac and the town was ordered by the local courts to cease operations at the lagoon site until the suit was settled. Since that time, the town has been sending its raw sewage directly to the river and continues to do so to this day. Town officials indicated that the court had recently issued a favorable decision in support of the town, and they are hopeful that a final decision will be made soon and they will be able to bring the lagoons back online, but with improvements made beforehand. The current population of the town of Pisac is approximately 3,000, and the design population for the rehabilitated lagoons is 4,500, with flows of approximately 200 liters/day.

**Workshop of wastewater treatment technologies with public works staff in Pisac**

The public works director for Pisac, Ing. Jorge Luis Velasco Cabalo, requested that the WEFTA team hold a workshop with the department's staff over the topic of wastewater treatment. A large conference room was set up to allow for this exchange. The presentation ended up being more of an open discussion of wastewater treatment technologies available, where local staff shared with the team their experiences with local wastewater systems and the WEFTA engineers provided some important insights and advice for the public works staff to consider while moving forward with their plans. After the more formal gathering, the team visited both the site of the abandoned lagoons as well as the site of one of the smaller decentralized treatment facilities currently under construction.

The wastewater from Pisac is essentially completely residential. The public works department staff is also working with a few smaller, decentralized treatment systems for outlying communities not able to be served by the town's lagoon-based treatment system. During the presentation by town staff and explanations of the challenges posed at each site, especially one prone to flooding, the WEFTA team proposed a few alternatives for dealing with the flood conditions. One would entail pumping the waste to another, more appropriate site outside of the floodplain, another would be the installation of a package treatment plant on the current site, and the third would include the construction of elevated sand filters on the site basically raising the level of the infiltration gallery above the floodplain.

## Habitat Community of Urubamba

The community septic tank wastewater treatment system that WEFTA assisted with in 2004 worked well for about seven years, but the local officials did not provide the necessary maintenance (i.e. removal of solids from the septic tank in one of the sectors). Therefore, the treatment system began to have problems with clogging of the effluent disposal pits. Since such issues began to arise in 2011, the community has made partial attempts at solids removal, but with no definitive solution. There are currently no septic tank pumping services in the Urubamba Valley. Therefore it was agreed that WEFTA will assist with the purchase of a trash pump capable of pumping out the accumulated solids from the septic tanks. In addition, the Habitat community, with support from the municipality of Urubamba in the form of heavy machinery, will construct sludge drying beds at the two septic tank sites for disposal of the materials pumped from the septic tanks. The contents of the tanks will be deposited on the drying beds during the dry months of the year, and allowed to drain and dry out before being removed for deposit on the surrounding fields. The local leaders agreed to organize the cleaning of the tanks every two years during the dry season, thus creating a sustainable system which should function indefinitely. It was made clear that one of the tasks of the local leadership will be to educate the community members regarding what should and what should not be introduced into the sanitary sewer system.

**L – At the site of the Habitat Urubamba septic tank system**
**R - WEFTA team at the home of Habitat Urubamba community leader Guillermo Atayupanqui**

## Conclusions from Trip

While working with representatives in each community up and down the Urubamba River Valley charged with assuring the provision of safe, potable water to the community members and proper collection, treatment and disposal of sewage waste, it was very clear to the WEFTA volunteers that there is an unacceptable lack of local expertise especially when it comes to treatment of wastewater. Local engineers, whether members of the municipal staff or private consultants, seem to generally understand water treatment and even advanced hydraulics related to water distribution. While these same engineers understand how to properly size and design the layout of gravity sewer systems, sadly the same cannot be said for wastewater treatment. Of all the engineers we met with, there did not seem to be any that had a good, solid understanding of the different treatment options available beyond simple septic systems.

Entire WEFTA team with Calca officials at the site of the proposed wastewater treatment plant

It was very apparent that the WEFTA engineers that visited the valley in February of 2014 brought with them a knowledge base that was utterly lacking in each urban center visited. One of the most encouraging things the team encountered however was eagerness on the part of the public works staff at each town to receive advice from the WEFTA team.

Pete listened to the concerns and ideas presented by the staff at each community, and then provided their insights and ideas on how to better address the needs at each location either by considering a completely different technical approach (the towns of Urubamba and Calca), or by improving on proposed improvements (the towns of Huayllabamba and Pisac).

This support provided by WEFTA is different than the typical 'bricks and mortar' (or 'pipes and glue') support provided by several NGOs. In fact, in the case of each of these communities, the WEFTA representatives never discussed financial assistance from WEFTA whatsoever. But rather the support provided, and eagerly accepted, was in the form of the expertise that the visiting engineers have developed over decades of designing similar systems in the U.S. In this way, the success of WEFTA will not be measured in the total of dollars raised and sent overseas, but perhaps in the form of intellectual capital generously provided by the WEFTA volunteer engineers.

With the insights from the WEFTA engineers, perhaps the wastewater treatment systems to eventually be constructed will less likely become abandoned systems and actually have a good chance at success. The cost of a failed system would be measured in more than dollars; it would have a demoralizing effect on the locals and ultimately be counterproductive to the cause giving fodder to the naysayers and those that would just as soon continue dumping their raw sewage directly into the river. As the cliché goes, failure is not an option!