

# The University of Texas Engineers Without Borders Mexico Project: Jaboncillitos, Coahuila Assessment Trip Project Report

## Introduction

In August of 2006, seven members of the Jaboncillitos, Mexico project team traveled to Jaboncillitos, which is a little town in the northern part of the state of Coahuila. They were enthusiastic to analyze the situation in Jaboncillitos and see how the design concept would change after analyzing the layout of the community and getting to know the people. Their hope is to partner with the town to provide a sustainable engineering water project for the people of Jaboncillitos.

After an enthusiastic start in spring 2006, the Mexico Project Group continues to work towards its goal to provide a water purification and distribution system for the people of Jaboncillitos. The exploratory trip was completed in March 2006 which identified Jaboncillitos as the town in which the first University of Texas Engineers Without Borders project would take place. On the exploratory trip, the community members acknowledged water quantity and quality as their primary need and concern. Upon the return to UT, the Mexico Group chose to work in Jaboncillitos and began planning for their assessment trip. This purpose of this trip would to analytically identify problems and collect sufficient data to complete design work at the University of Texas prior to the implementation of the water system.

The four main tasks for the assessment trip included water testing, elevation surveying, well recharge tests, and a health survey and these were completed during the assessment trip (August 19-23, 2006).

## Water Testing

The *Hach MEL-850 Water Testing Kit* was purchased July 2006, after much fundraising, to perform the necessary water quality tests in Jaboncillitos. Testing was performed at four locations in the town: the mountain spring source and outlet, the hand dug well, and the bore hole. Currently, the bore hole is the town's main source of water. It is an eighty meter deep government dug well on the outskirts of town. The water table is only ten meters deep and the aquifer contains a significant amount of water. All of the



town's drinking, washing, livestock, and agricultural needs are satisfied by this well so this water source was of primary importance in water testing. The mountain spring source was the second most important source to test. Black "rubber" hoses currently run from a rudimentary spring-box at the top of a mountain to the bottom, where the water is

collected. This is located approximately one mile outside of the town. This source is currently not as utilized as the bore hole but is used intermittently. In the past, it was used as the only drinking water source for the town but the rate of water collection is much slower than that of the submersible pump in the bore hole.

All four water samples were tested for sulfides, free and total chlorine, ammonia, pH, total dissolved solids (TDS), phosphates, turbidity, nitrates, and nitrites. The

results of these tests can be seen in Table 1. Bacterial tests were also performed using *Coliquant EZ* tests from Microbiology Laboratories. This bacterial testing method consisted of placing water samples in a petri-dish with Coliquant gel. Visual examination 24-72 hours later was used to determine coliform colony counts. Four bacterial tests were run for each of the four water samples where no E coli. bacteria was found after examination. The dishes indicated that some non-fecal coliforms are present in the hand dug well. Almost zero non-fecal coliforms were found at the bore hole and mountain spring source.

After comparing the water testing results to EPA standards, it was discovered that the water is actually very clean. There is some uncertainty in the bacterial testing results, but the Mexico Group plans to return to Jaboncillitos in January 2007, prior to implementation, to do more water testing to before the system is built. Since the people of Jaboncillitos expressed the desire for purified water, the Mexico Project Group is moving forward with the purification component of the design.



	Spring Top	Spring Bottom	Hand Well	Borehole
Sulfide (mg/L)	0	0.1	0.18	0.02
	-	-	0.21	0.03
Free Chlorine (mg/L)	0	0.12	0.33	0.01
	0.02	0.02	0.36	0.02
Total Chlorine (mg/L)	0	0	0.05	0.05
	0.02	-	0.03	0.06
Ammonia (mg/L)	0	0.18	0.6	0.04
	0.02	0.18	Limit	0.05
pH	8	8.2	7.9	7.5
TDS (ppm)	170	170	915	515
Phosphate (mg/L)	0.07	1.68	1.16	0.18
	0.21	0.22	1.28	-
	0.31	0.26	-	-
Turbidity (FAU)	2	6	51, 62	0, 1
Nitrate (mg/L)	0.06	0.06	0.01	0.03
	0.07	0.07	0.02	0.05
Nitrite (mg/L)	0.013	0.018	0.015	0.012
	0.018	0.018	0.019	0.012

Table 1: Water Testing Parameters on Four Water Sources in Jaboncillitos

## Elevation Surveying



Another important part of the assessment trip was the land surveying. Two EWB members surveyed and took forty points in two days while learning to survey. A basic tripod, leveling rod, and transit were used in the surveying process. The elevation points were shot and recorded in and around the town, allowing for the compilation of a contour map. This survey data is a necessity for determining the feasibility and location of the piping and storage system. It has allowed the group to map out the town and begin design concept for the distribution system.

## Well Recharge Testing

Well recharge tests were performed while on the assessment trip. These tests are very important for understanding how reliable the groundwater aquifer source is.

Three members of the project team, with the help of community members performed several tests on the well to determine its characteristics. The water level was measured to be ten meters below the surface, the bottom of the well eighty meters below the surface, and the depth of the current submersible pump twenty meters below the surface. To determine the hydraulic conductivity of the soil, two large concrete cylinders were dropped below the water level. Next, the water level as a function of time was measured until it returned to its equilibrium point. This measurement was also performed upon the removal of the concrete cylinders to create a second set of data for comparison. To determine the effect of pumping on the well, the existing pump with a known flow rate was used to pump water out of the well while measuring the water level as a function of time. By using the hydraulic conductivity data as well as pumping data we were able to determine that the recharge rate of the well is 50 L/min. Since this recharge rate is significant, the Mexico team was encouraged and relieved to find that the town has an ample, reliable supply of water.



## Health Survey

The health survey is a required component of all Engineers Without Borders projects. It is an extensive and detailed health and daily life questionnaire for the people of the community. Obtaining all the information to fill out this form was also one of the primary objectives of the assessment trip. Much of the information was obtained from our host family but at least one representative from every household of the town was interviewed for some of the questions. The town was found to be in very good health with few major issues. Diabetes, overweight adults, underweight children, heart disease, and parasites were identified as common health issues in Jaboncillitos but not overwhelmingly so. Other questions included ones about daily water usage, trash disposal, average number of children per family, etc.

## Future Plans

The August 2006 assessment trip was a successful one for the EWB Mexico Team. All the necessary data gathering was accomplished in a much shorter time period than originally anticipated due to a great deal of help from the community of Jaboncillitos. The town meetings used to convey our ideas and understand their wishes went very smoothly while necessary information was communicated to the town with very positive

feedback. They understood the reasons for our recommendations and agreed with our plan.

EWB team members were all very excited about new friendships and relationships established with the local people. Our host family was extremely welcoming and the authentic Mexican food was superior. The scenery was also very beautiful this



time of the year; mountains, greenery, and majestic sunsets covered the landscape. Team members like to joke that they went on a vacation for five days rather than an assessment trip to the developing world. Project wise and individually, the team could not have asked for more.

Our goal is that the people of Jaboncillos will have an active and robust water distribution and purification system by the end of the 2006-2007 academic year. Project implementation is planned for March/May of 2007. Concentrated research and system design is currently taking place in the Mexico Project independent study class sponsored by Dr. Ananth Dodabalapur (ECE). Team members are using their engineering education and research skills with help from Engineers Without Borders – Central Texas Professional Chapter and University of Texas professors, hope to soon have a economical and sustainable water system for our friends in the town of Jaboncillos, Mexico.