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# Report on Tufts Engineering trip to Balan, Haiti Summer 2008

July 20-August 8 and Continuing Work

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## **1.0 Introduction**

### **1.1 Purpose**

The purpose of this report is to summarize our recent engineering assessment trip to the community of Balan in Northern Haiti. Four Tufts students traveled to Balan to assess the engineering needs of the community and to determine the feasibility of the Tufts Chapter of Engineers Without Borders (EWB) returning to Balan to start a project.

### **1.2 Scope**

The scope of our trip was to obtain general information, both quantitative and qualitative, about Balan to reach some conclusions regarding a future Engineers Without Borders project in the region. This report will outline the background of the project and trip preparations, the data and observations from the trip, and our recommendations for future engineering work in Balan.

Initially the report was to be divided thematically, to address the different perceived needs that had been explained to the team before we arrived. Once on the ground, we began to focus our attention more geographically and more generally as we realized that the community of Balan is larger than we had expected and has diverse needs across the different neighborhoods.

This report will give some of our recommendations and observations regarding the community, the relationship with the community and the RESPE group, and future work with Tufts EWB and the Tufts School of Engineering. This report is not a detailed plan of action and the recommendations depend heavily on the interest from the group members in Boston, the reaction of both the Boston and Balan RESPE committee, and our advisers at Tufts.

### **1.3 The Team and Organization**

Four students from the Tufts Chapter of Engineers Without Borders carried out the assessment trip. This group included three undergraduates at Tufts and one graduate student at the Fletcher School. This report was finished by this four person team.

This team was sponsored by the IGL (Institute for Global Leadership) an interdisciplinary organization at Tufts focusing on international cross-school programs. The IGL had previously sponsored four liberal arts students to travel to Haiti to form relations with the community, Balan, and begin to form an organization there called RESPE.

Each member of the team had individual focuses for the trip, but we worked together to create recommendations and general perspectives on our work. The team included Stephane Cherduville, Allison Fechter, Sebastian Reeve, and Adam White.

Stephane Cherudville is now a senior at Tufts and he is majoring in civil engineering. On the Haiti project his designated focus was on water quality data gathering, soil data gathering, and irrigation.

Allison Fechter is now a sophomore at Tufts. She is majoring in environmental engineering. Her designated focus was on irrigation and agriculture.

Sebastian Reeve is a second year student at the Fletcher School of Law and Diplomacy at Tufts University. He graduated from Tufts in 2004 with a B.S in Engineering. On the Haiti project he focused on irrigation, agriculture, and energy, as well as assisting with GIS mapping, soil data gathering, and water quality data gathering.

Adam White is a senior in the Tufts Engineering School. He has been a member of numerous Tufts groups, including the EWB chapter at Tufts. In Haiti, he was in charge of the GPS mapping project and GIS follow-up, general planning, and infrastructure assessments.

The entire Haiti travel team was composed of eleven members, including the four engineers. Four other students, all liberal arts students at Tufts and the founders of RESPE, the partner organization, travelled to Balan. The eight students were joined by a professor in community health at Tufts, Linda Martinez; the program coordinator at the IGL, Douglas Glandon; and the president of the Haitian Coalition of Boston, Franklin Delembert.

## **2.0 Pre-Trip Expectations and Hypothesis**

Before departing Boston for Balan, the Tufts EWB group had only limited knowledge of the focus area; this perspective influenced the priorities and expectations of the travel team. We were also working in close cooperation with the RESPE Group. This group is a Tufts organization which is currently under the Institute for Global Leadership, the IGL. The group's mission is to establish a long-term relationship between the community, specifically community leaders in

Balan, with a university, Tufts, and its academic resources. The EWB group was invited to the community by the RESPE group at Tufts, and any continuing work will need to go through the same framework. The EWB travel team worked closely with the RESPE group and has some overlap in team members.

The RESPE team conducted the first field assessment trip in January, and solicited Tufts EWB for this trip. RESPE gave EWB members information from their previous trip to Balan and organized lots of the logistics; however, the information regarding the current state of infrastructure and engineering priorities was minimal, justifying our engineering focused assessment.

Some of the important information that the RESPE team did convey to us, which led to some of our hypothesis and concerns included the following:

- Balan is a large community of approximately 20,000 people. The most recent census had a large margin of error and is already a number of years old so the exact scope of the community is unknown. Regardless, Balan is a large area. The community is also divided into different regions primarily along one main road.
- The community has minimal hard infrastructure but a strong community.
- Irrigation and agriculture are priorities for the community.
- The community is close to Cap Haitian.
- The community and Haitian government have minimal financial resources.
- The roads are in poor condition.

All of this information left a number of unknowns. The purpose of our trip was to confirm this information and qualify it. Because of these unknowns, we travelled purely as an assessment group with the following preconceptions.

- The community may be too large for a Tufts EWB Project.
- The top priorities of the community might not line up with the skills of the Tufts EWB group.
- The community's different neighborhoods might not have the same interests, making a single project difficult.
- The framework for EWB at Tufts may limit a continued relationship.
- The framework of the RESPE group at Tufts and in Balan would have to approve any project.
- The RESPE Balan group may have project conditions that Tufts EWB may not be able to fulfill properly.

With the following concerns and understandings we travelled to Haiti optimistic of what we could research and accomplish in the future, but realistic in our expectations.

## **3.0 Introduction to Project**

### **3.1 Community of Balan**

Balan is a large community. Though an accurate census has not been confirmed, it is likely that the entire Balan region encompasses over or around 20,000 people. The location is about 6 miles from Cap. Haitian as the crow flies, but due to traffic and poor roads the driving time from Cap is about 45 minutes.

Balan covers a relatively large geographic area and the different communities within Balan have varying degrees of connection with the center. For our purposes we relied in part on the general consensus of RESPE Balan members, as well as what was accessible to us in our time in the area.

Most families participate in some sort of agriculture. Along the coast, fishing is a form of livelihood for many, though probably declining. There are small markets that occur a couple times a week in which various items can be bought and sold, some local and some brought in. Much of the surrounding area cannot be accessed by road, and the bumpy dirt road that does serve Balan limits heavy traffic. The road is a commercial artery and social gathering place for the community.

Businesses are generally along the road, houses face the road, wells are put along the road, and much social interaction occurs on or around the main road. Together, Balan is comprised of lots of different neighborhoods including Langlaise, Chapelle, Mont Voisin, Bois Caiman, and Port Francais. These different neighborhoods have varying degrees of connection, both in terms of infrastructure and social relations, to the center of Balan (generally Chapelle).

### **3.2 RESPE Organization**

RESPE was created by four Tufts students through the IGL to help a Haitian Community develop itself. The group was formed up of Sabina Carlson, Patricia Eloizin, Helaina Stein, and Valerie Schenkman. The team first traveled to Balan last December and then again with the EWB team. Also three students from Balan came to Tufts in February for the EPIIC: Global Poverty and Inequality conference.

Through these interactions with the community they jointly, the tufts students and Balan representatives, have worked to form a formal organization. The group has the Haitian branch which has a local structure to understand the entire communities needs and to work effectively there, and the Tufts branch which can help to channel academic or knowledge based resources to

Balan. The executive committees of each communicate together, and both groups regularly update each other.

The overall mission of RESPE is to enable Balan to empower itself. This model means that RESPE: Boston, the Tufts Branch does not dictate or determine projects directly, but connects the community with the organizations or projects they need.

The relationship with EWB is one of a consultant or contractor. RESPE has essentially brought Tufts EWB to Balan as their first partner, to address the engineering needs vocalized in the community. Any action that we as engineers decide we should pursue in Haiti, would be approved by RESPE, the Haitian and Boston branches.

### **3.3 Overall Trip Objectives**

The overall RESPE project had a number of objectives. The engineers were not only responsible for assessing the EWB assessment trip, but also could provide general infrastructure and an engineering perspective to the RESPE team.

Other RESPE team members were working on projects addressing economic labor organizations and microfinance, education difficulties for secondary school, and a full community health assessment. All of these individual reports could prove useful for determining an EWB project or step forward. Additionally the community health data is directly relevant to any future EWB project or application. The Engineering Trip had two main components. First, Adam and Allison with RESPE helped conduct community health focus groups. Additionally they began GPS mapping of Balan and preliminary qualitative and quantitative data gathering of the Balan area. The second component of the trip conducted by all EWB trip members consisted of specific community site visits to gather data and more extensive quantitative data gathering.

## **4.0 Focus Group Sessions**

The first 6 days of the trip were primarily dedicated to health focus groups. Over a period of 4 days the community Health team of the RESPE group organized 15 focus groups at 5 different locations for over 150 people. Two focus groups were held in each region of Balan. The focus group questions prompted discussion of health and wellness and were IRB approved before the trip. The groups were separated by gender and dealt with local health issues. The group also interviewed other important health figures in the community. A full Health report, prepared by the RESPE team, will be available soon.

The engineering team benefited from this research because it helped identify specific concerns (especially in health) of the different communities. Traveling to the focus groups was also a good opportunity for the engineers to get a feel for the geographical layout of the

community. Some of the concerns that the engineers followed up on in different regions were first identified in the focus groups. Also, after the focus groups, we were able to casually discuss engineering specific questions, where we learned about dust from the roads, the need for a hospital, water quality, and a general increase in infrastructure. Some communities even stated established priorities; for example, Port Francais mentioned that their top three priorities are (1) a road, (2) water, and (3) a health clinic.

Other communities made similar suggestions which required engineering expertise. The information drawn from the focus groups was definitely helpful in identifying the most likely sites for an EWB type project.

## **5.0 Engineering Assessment Visits**

### **5.1 Introductions**

The engineering team spent a portion of our time focusing on the needs of specific communities. We visited a number of different regions to find out general information about the communities and their priorities. After identifying three of the most accessible regions, we visited them to meet with community organizers, discuss priorities and take field tests.

We identified the following three areas because they seemed to be the most possible project sites due to their needs, accessibility, size, and organization.

### **5.2 Bois Caiman**

Bois Caiman is the birth site of the Haitian revolution. It is a region comprised of both hills and flat land and one of Balan's main farming regions. Some farming is done on the flat land, but the majority of farms are on the sides of mountains. Five Bois Caiman farmers met with us and showed us their farms. They each have about three fourths to one hectare of land, about two acres. These particular farmers plant tomatoes, cabbage, egg plant, Manioc, and bananas.

The farmers believe that their soil is fertile and that it is the lack of water that is preventing them from successful crop yield. Testing two samples of farm land showed us that their soil is not fertile and lacks important nutrients. Regardless of soil nutrients, the farmer's greatest problem is the lack of water. Their crops only get watered when it rains. No form of irrigation, or

rainwater collection has ever been implemented, although they were aware of two other Haitian communities (St. Raphael and Archaie), which have successful irrigation systems.

The farmers told us they would like a reservoir with gates that allow water to flow to various farms. They showed us a location for a reservoir that is a fairly flat stretch of land on top of a small mountain that could be fed by a nearby water source. They believe this is a good central location for a reservoir and that multiple farmers could benefit from it. The farmers told us they do not have the means or knowledge to build a reservoir or rain water collection containers without outside help, but they are willing to help us with any construction. They also feel that having the ability to borrow money would allow for more successful farming and might give them access to supplies, such as seeds or fertilizers, that they cannot currently afford.

The spring box with running water is probably a 20 minute hike from their proposed reservoir location. This site was located up a small hill and may not be technically possible without a pump. The location is fairly close to a running stream, which should be investigated as a possible source. Collecting rain water near the farms off of roofs is not feasible because there aren't really homes in close vicinity to the farms, though other drainage systems may be possible. Also there may be some potential to channel or dam a stream to create an intermediate reservoir near some farms.

### **5.3 Port Francais**

Port Francais is a community about an hour hike up a mountain north from Balan center. It sits on the side of a mountain between the community of Balan and the north coast of Haiti. The community is accessible from both sides, one path leads down to the center of Balan, while another leads down to the coast, where some residents then take boats to other communities, including the piers in Balan.

In Port Francais we met with community leaders. Priorities of the community included fixing the existing water pipe system that brings water from a source in the mountains to the center of the community. A community leader estimates that the spring box provides water for about 20 percent of the Port Francais community. The same leader said that when the spring box was built the number of children with diarrhea decreased. World Vision constructed the spring box in about eight years ago (2000). The system broke about a year and a half ago, probably in 2006-7. The community has put in a proposal to World Vision to have the system fixed. According to the Executive Administrator at World Vision Balan, the proposal has gone through their office to national World Vision headquarters in Port-au-Prince and it is now up to that decision making body.

FAGCOB, the local organization that World Vision created to pass on responsibility to the local community and phase out, promised that the water system would supply every school. This has not happened, and the cistern built for the system was never completely finished. One community leader from Port Francais estimated that there are a little less than 8000 people in the

community. Other people estimates the community was much smaller. The area is a large mountainous area and we focused our attention in the center, which serves a smaller portion of the population.

There are two other water sources in the community besides the spring box. The first is used for cleaning and washing, but not drinking. The second is located much further from the center of town, but is used for drinking.

Rainwater collection does not occur in the community, except that when it rains some individuals will put out buckets to collect water

Another area of concern was education. According to another community member, without World Vision students would not attend school. There are still general problems with education including insufficient resources for uniforms and tuition. Attendance was estimated to be 563 students in the school system that held students from 3 to 12 years of age. This was thought to be about 80% of the children.

Water remains an important issue for the community. Access to water is important for consumption, bathing, washing, and then irrigating the fields close to water sources. We are interested to see if it would be possible to use a model like Potter's for Peace to locally build water filtration devices to clean water. Unfortunately no potters exist in the Port Francais area at this time, and potters would require a more sustainable fuel source. than charcoal.

Infrastructure of all kinds were interesting to the community members we met with in Port Francais. Though the community is a steep forty minute hike along a path from Balan Center onto a mountain, there was a desire to have a road built. Any road would likely be very expensive and require lots of engineering expertise.

## **5.4 Godin**

Godin is a community about a 30 minute walk from Balan center. It sits just north of Balan's main pier and is also on the Bay D'Acul.

In Godin we met with the pastor, he said he has been in Godin since 2000 and though not a local had a close connection with the area. According to the pastor, before 2000 and his arrival, there was almost nothing there. He said that people were not living very well until he arrived. He told us that he asked the community to turn their back on evil and to face God – since worshipping evil contributes to the misery of the people. They did this and the lives of community members has improved.

According to the pastor one of the main problems in the area is with education. He said that people with no education cannot think for themselves, and therefore cannot analyze to think how

to change their situation. No one in his community has a job that generates income on regular bases. The Pastor also told us that a school was built in the Godin area but they don't have teachers. The community had to bring in teachers from other areas. This situation is due to the lack of education in the area, the pastor said that if people of Balan were prepared, they wouldn't have to get teachers from other communities.

According to the pastor, another problem in Godin is that women have too many children, one household has 3 or 4 families living in a small house. And to make matter even worse, there are no markets in Godin. Therefore women have no selling power.

Before the pastor arrived, people only fished in the area. He had the idea of improving farming because when there were storms in the bay, people could not fish and they would starve. The community got a piece of land and started to farm under his initiative. The pastor also looked for loans or credit without interest for women, because it was hard for the women to pay back the interest.

In terms of water, the priest said there is a water source up the mountain. (a water source that doesn't dry up) He would want to build a reservoir up the valley to better treat water and bring it down. We went and visited the source in question about a 10 to 15 minute steep walk up a hill. He told us that people get sick and that the water contains parasitic worms, but we did not perform accurate tests to confirm this. People notice worms after they collected the water and let it settle in a pot at home. According to the pastor, there used to be two water pumps for water in town, but now only one works. But when we walked around both pumps were operational, and we were told that the broken pump, given originally by American missionaries, had been repaired yesterday. There had been a problem with the main gasket and it had been replaced. The other pump was installed by world vision.

According to the pastor there are about 1,500 people in the community, 85-90% of the population doesn't have a toilet to use. The pastor was doubtful that national electricity, even if brought into Balan, would reach Godin. Aldolf, one of the members of RESPE Balan, said that because the area was not large, if the community had a generator (we assume another generator because there is electricity in the church) and more solar panels, then that could give power to everyone.

According to the pastor, the biggest area of improvement would be education. He asked if we could help with spiritual and financial education. Because the community is both poor and undeveloped, general education is very important. In Godin, the existing school only educates students for the first six years, additional education must be provided in Balan or elsewhere, if at all. Lots of parents begin sending their kids to school, but can not continue to because they do not have enough money. The community needs people educated to stay in the community to help improve it. According to the pastor, about 80% of students go to school. Age range in respect to class year is very spread out. This is often because students start late, such that there are 17 and 18 year olds who will not have completed their 2nd school year, and there are other kids that will complete their 6th year before their 18th birthday. He estimated that there are about 500 students in school in Goudin.

Water remains an important issue for the community. Access to water is important for drinking, cooking, bathing, washing, and irrigating the fields close to water sources. The community lacks many things, including sanitation, better roads (in 2000 not even a bike could access the community), and better fishing equipment. An interesting potential project to us was to construct dry composting latrines in Godin. The public toilets could serve the community in the area and significantly reduce the contamination of ground water.

## **6.0 Other Engineering Visits**

### **6.1 Introduction**

Apart from visiting the more isolated communities in Balan with specific needs, we also had some other educational visits to different priorities in the community, to talk with different experts, and see possible solutions that had been implemented in other communities.

### **6.2 Visit with Agronomist to local farm of Balan (near Center)**

The first location the group visited with the agronomist was a rice farm in Balan. It was a 10 minute walk from the main road. This land was shared by many farmers and families. The farm was irrigated with a man-made stream that drew from a fresh water source.

The agronomist recommended generally for Balan that there should be a focus of things like rice growing in the farmland lowdown, and that up in the mountains farmers focused on faster growing crops like beans and tomatoes.

When asked if Balan currently grows enough food, community members and the agronomist responded that they do not grow enough food. A community member said that they cannot be cost-competitive with rice coming in from Florida.

According to community members, historically the rainy season was more predictable. They blamed deforestation for the lack of predictability in rainfall and a decrease in the amount of rainfall. Asked why deforestation makes the rain less predictable, the community members there and the agronomist responded that trees cause it to rain, and that less trees means less rain. This is something that the Tufts engineers were not familiar and will continue to research.

Crop rotation is not occurring in Balan. According to the agronomist, crop rotation would be a good thing to practice, but it must be *shown* to work. The community needs to see it working and succeed before they implement it. Farmers do leave a section of a field unplanted, often to rest it for some partial annual period (6-9 months). The agronomist told us that allowing a field to rest is a very good practice, and that during this time, it is a good idea to keep live stock on this land, as a natural fertilizer.

Reddish soil means that nothing should be planted because all nutrients have been removed from the soil. If farmers are unable to allow their soil to rest for a partial annual period, they should at least rotate crops between above and below ground vegetables. For instance, if peas or corn are planted one season, a below ground vegetable such as manioc should be planted the next season.

Mentioned by the agronomist was a success story of the teaching of modern farming techniques. CNC 40 was a seed type that was brought by an agronomist from Columbia. It was a good seed that he showed the community how to use and they have used it successfully.

The agronomist also believes that the biggest problem facing Haitian farmers is irrigation. When farmers have no access to water, he recommends planting vegetables that grow fast such as peas, corn, and tomatoes (anything that grows for 2-3 months)

Different plants thrive in different locations. Manioc, sweet potato, corn, and beans thrive on hillsides. Coffee thrives in high altitudes. Also, different plant and root structures can help erosion, a problem in the deforested country; manioc facilitates erosion while sugarcane, coffee, and cocoa prevent erosion.

“Good seeds” are treated before they are purchased. “Bad seeds” may have insects in them. Most farmers can not afford the good, more expensive seeds.

### **6.3 Vern’s Farm**

Allison, Stephane, and Sebastian visited Vern’s farm immediately opposite the turnoff for the road to Balan from the national highway with a Haitian agronomist. Part of a stream has been diverted in the area to carry water to a number of rice paddies on Vern’s fields and the fields of others. According to another farmer who has land in the area, the dyke was constructed by about 20 people working sporadically who continued to increase its size.

The agronomist said that this area had water and had diverted water for irrigation, but their real problem was in farming techniques. They need to improve farming practices including things like seeds, or in this case more specifically, rice type selection for their area and soil. Asked about fish farming in rice paddies, a community member or the agronomist responded that World

Vision had taught a group near Bois Caiman about growing fish in rice paddies but that it wasn't done properly and is therefore not occurring anymore.

According to the agronomist, the sale of fertilizer is especially complicated in Haiti. Every area is supposed to have an agronomist who represents them and goes with the local farmers and vouches for them at a specific site to obtain fertilizer. Farmers need an agronomist to vouch for them because the same fertilizer that is sold in Haiti sells for more than two times as much in the Dominican Republic. In the past, people in Haiti were collecting the fertilizer and rather than using it, selling it in the Dominican Republic.

According to the Agronomist who visited with us, every region in Haiti has their own agronomist. The agronomist we had visited cannot work here because the actual agronomist of the area could bring him to court. The other farmers at Vern's farm said that they did not know they had an agronomist for their area and that they had never seen one. When the agronomist left with us he told some of the community farmers that he would vouch for them to get fertilizer at the affordable rate.

According to the agronomist, there has not been sufficient education and training for farmers. World Vision taught a group about making and using a type of fertilizer to improve yield. However the people World Vision taught cannot read or write, so what was learned could not be passed on to other members of the community.

These farms which are owned by a number of farmers and where a running stream sits right next to it would benefit the most if a technician would come train the farmers on proper land preparation and rice harvesting method.

## **6.4 L'Acul du Nord**

On Sunday August third, the engineers visited the town of L'Acul in the morning. We met with Lisette who is a friend of Jackson, a RESPE Boston committee member. We went with the intention of seeing how a similar sized community as Balan was functioning more successfully and how development and infrastructure building had occurred there.

Lisette met us in the town center and then took us to her house. She was lived abroad in New York for a number of years, and then returned to Haiti for retirement. Her house was probably the most impressive we saw. She had her own generator for electricity and to operate an electric pump in her own well. The town of L'Acul is somewhere in size between 50,000 and 100,000 people, significantly larger than Balan. According to Lisette, the Haitian government built the interlocking stone road that links L'Acul to the national highway.

Other projects to infrastructure developments have been contributed to by Haitian Diaspora from the area. They have a nonprofit organization recognize by the Haitian government called Association Philantropique de L'Acul (APA). In the past they worked on many projects in the area, the most noticeable are currently sponsoring six children with their school expenses, sponsorship to get a bell for the church, and in 1996 they financed the fencing of the cemetery. APA is currently working on getting funding for a youth center where people would acquire computer skills, mentoring, sex education. APA had big concerns about the youth and gangs, how they were becoming more and more prevalent in the community. The youth center would give the young people of L'Acul du Nord another option. Unlike Balan, they have a police station with 10 to 12 policemen according to Lisette, but they only have 1 motorcycle. Therefore they are limited in their ability to respond to crisis in their area.

Water access and cleanliness is also a big concern to APA. We visited a well which was located next to a popular trash deposition site. The well was pretty shallow and had almost no water. Lisette told us because it had rain the two previous days people can now get water from it, but it was dry or nearly dry before the rain. We didn't get any water sample from that well but it had trash and dead leaves floating at the water surface.

World Vision is also located in L'Acul du Nord, but is based in a more rural area. They don't operate in the center of town where we visited. Lisette and her brother told us that World Vision sponsors schooling for children, but they themselves had no information on it.

L'Acul du Nord visibly has a better basic infrastructure then Balan including a main paved road, a sewage system next to the main road, a power grid, a bigger market place, a police station, and there is even a governmental representative "mayor". We didn't have the chance to meet with him, because our visit was organized on short notice.

We walked around the town a bit and looked at the 305 year old church currently undergoing repairs. Lisette also told us that a power line broke about 3 months ago and it still hasn't been fixed.

Based on what we briefly saw, L'Acul du Nord has seen a greater investment and corresponding development than Balan. However there are still many areas for improvement in L'Acul du Nord that community members seemed interested in.

## **7.0 Soil and Water Test Results**

### **7.1 Soil Testing Data**

#### **7.1.1 Soil Testing (analysis/results/outcome)**

The first group of soils tested was from farms in the Bois Caiman region of Balan. The two farms were in the hills above the community center and were a few hundred meters apart.

Sample: Bois Caiman Farm

PH: 6-6+

Phosphorous: Trace-Trace+ (0-50 lb/acre)

Nitrogen: Trace (0-30 lb/acre)

Potassium: low (0-120 lb/acre)

Sample: Manioc farm (6V-5pt 043)

PH: 6-6+

Phosphorous: Trace-Trace+ (0-50 lb/acre)

Nitrogen: Trace (0-30 lb/acre)

Potassium: medium (120-200 lb/acre)

Sample: taken with Agronomist, adjacent to rice patty, Balan farm, Aug 1st

PH: 6-6+

Phosphorous: Trace-Trace+ (0-50 lb/acre)

Nitrogen: Trace (0-30 lb/acre)

Potassium: medium

Sample: Godin farm, farm slightly off of path on the way to the sea, possibly sugar cane farm

PH: 8

Phosphorous: medium (50-100 lb/acre)

Nitrogen: Trace-low (0-30 lb/acre)

Potassium: 12 medium-high

### **7.1.2 Soil Testing Results**

Soil Chemistry:

We tested for what are known as "primary nutrients". These are the three nutrients that are most typically lacking from soil because they are the most necessary for plant growth. These are the nutrients that help with photosynthesis, the building of protein, and general plant health. All three of these nutrients can be added to the soil by fertilizers. All four soil samples had relatively neutral Ph, which is good because nutrients prefer soil with a neutral Ph. Without fairly neutral soil, most plants are unable to extract nutrients. Unfortunately, this positive attribute is not of much use to the farmers when the soil is leached of nutrients from poor farming techniques, and over-use of the soil.

## **7.2 Water testing (analysis/results/outcome)**

### Round 1:

Initially 2 kits were brought down that were used to test for coliform colonies in the water supply for the church and for the well immediately outside the church. Both tests came back positive for coliform presence.

Both tests used five test tubes to estimate how seriously the water was contaminated. The water is contaminated if the water turns from red (the color of the initial indicator tablet) to yellow with bubbles between 1-2 days.

For both tests we first tested the the pH of the water to make sure it was approximately 7 and thus the normal indicators would show contamination.

If one of the test tubes turns yellow and bubbly then the water is contaminated. If two (double check that) or more turn yellow and bubbly then the water is seriously contaminated.

For the test on the water at the presbytery where we are staying we took water from the faucet in the dining room. In this test 1 of the tubes quickly turned yellow while the others slowly turned orange and remained less bubbly. We were unsure if yellow indicates a contamination or is more related to other factors.

For the test on the well all five of the test tubes turned yellow and bubbly within the expected time frame suggesting a serious contamination.

### Round 2:

The first 1 mL water tests were taken from water sources in the Bois Caiman region. There were technical problems with the first round of water tests that caused our results to be undeterminable. The incubator that was brought down did not work. There is also the possibility that the 3mL testing pads were damaged from exposure to temperatures above the recommended amount.

### Round 3:

The third round of water samples taken on August 2. These samples also suffered from the same technical errors as previous petrafilm samples. We left these samples in sunlight to compensate for the incubator. Despite the imperfect conditions, one test showed strong coliform presence in the bucket draw well at the market. Some coliform was found in one well in Mont Voisin but none in the other locations tested. Because of the improper testing technique we never assumed a lack of coliform to mean that a water source was clean. The sources that were able to grow colonies despite the difficulties, can be assumed to have had a presence of bacteria, but it would not be possible to quantify it.

Round 4:

Water samples were taken from different wells on the main road from the bay to the national highway on August 4, 2008. Due to continuing problems with the incubator and electricity issues, we were not able to use the incubator and instead again let the coliform grow out in the open. 24 hours later our tests came back all negative. Wells that had previously shown positive traces of coliform showed no evidence of coliform this time around. This is an indicator that our tests were not successful.

Many community members told us that they believe a lot of people get sick from drinking the water in Balan. In a general sense we cannot conclude or come up with a definitive answer on the cleanliness of the water. More tests and analysis would have to be carried out to better determine the overall condition of water resources in Balan.

## **8.0 GPS Mapping**

### **8.1 Introduction**

When Balan was initially described to us, the engineering team, the actual size and layout was not known. The first trip to Balan did not gather data to help understand Balan spatially. Additionally no good online imagery or maps could be found that showed the entire region.

Any longterm project involved with the infrastructure or community would benefit from or need a map, and so we decided to make a GPS map one of the priorities of our field work. Regardless of our results or future plans a map of Balan could benefit the community or any future plans, and it would be a tangible outcome as part of a very abstract assessment.

### **8.2 Purpose**

The GPS mapping served a number of purposes. The maps first helped to understand Balan geographically, they can function as tools for future projects, they are a tangible and appreciated product for the community, and they are an effective presentation tool.

Spatially understanding Balan is very important when quantitative census data is limited. By mapping the main roads, town centers, landmarks, ports and other points of interest, we will be able to divide the community into clearer regions, and better comprehend the actual and perceived distances. This data can go hand and hand with some of the social mapping work that RESPE facilitated, and in actually guiding others around the community using more precise geographic concepts.

Also, by combining the maps with elevation data for the globe, it will be possible to understand some of the watershed and also in seeing the relative elevations of the different regions and paths.

The maps also will be very helpful in any future projects. We can use these maps for navigating guiding teams to water sources, landmarks and sites from before. Lots of the observations and tests can be integrated into layers on the map so that more data can be extracted. These maps will also be helpful in knowing distances of roads and other related spatial information.

Just as the team will benefit from the map, Balan will also receive their first map of their home. This product will first be a very tangible return to the community, showing them that we have been working and continuing on the project.

This map will also be a very useful tool for the community in understanding themselves spatially, and better viewing their resources and problems. The map can serve as a rallying point for the RESPE Haiti team, and a symbol for uniting all of the neighborhoods of Balan. The map will also help them to understand the actual distances between themselves and may even counteract some of the distance related obstacles perceived in not knowing where others live, or understanding exactly how far away they actually are. Any future data sets or tests can be appended to this map, or use it for reference.

The maps will also serve as very clear presentations tools, that will allow others to quickly understand certain elements about our project. We can point out our observations clearly and more regionally, such as highlighting the locations of churches or focus groups. we can also explain the scale of the community and the mountains, or show specific priorities.

### **8.3 Methodology**

To map Balan, we used three GPS units and ArcGIS software. We used one Garmin 76 Unit and two Garmin V units, though we primarily relied on the 76 unit because of its improved accuracy. We took these units with us to Haiti.

In Haiti, we traveled with multiple units and backed up all of the data each night on a laptop and through e-mails. In the field we used data sheets to log waypoint numbers, and descriptions of the waypoint.

We mapped a number of the main roads over the first few days. Generally, we took GPS points in the middle of each road about 500 ft apart from each other or on intersections or important turns. As we visited other regions of Balan we added other features, such as focus group sites, pumps, ports, trails, streams, Baz, churches, schools and test results. All of these individual points were clearly labeled.

Once a majority of the community had been well mapped, we added a second series of points with a local guide named Calix, or Locale, who helped to identify names or more hidden local features. This trip added more churches, pumps, the market, intersections, NGO resources, and soccer fields.

Usually data points would be taken near the front entrance or the center of the feature, though we mapped all four corners of the soccer fields we visited.

Each night the features were loaded into an excel file and then plotted in ArcGIS to check for missing data or possible errors, and then to back up the data.

Now, back in Boston, with all of this data, Adam will be sorting the data into different layers and including the available and relevant information. These layers will highlight specific features, such as churches or middle schools, or roads and distinguish between different types.

Doug, who was brought in for the focus groups, is helping to create icons, so one version of the map can be rendered to create a very visual representation to return to Balan that is not as data heavy. Other versions highlighting specific features will also be created, and the community will receive a version of every map.

The map data can also be put into Google Earth, which is an effective and efficient way to show the ground we covered and the 3D representation.

## **9.0 Energy analysis**

Electricity was not stressed as a paramount concern for all the communities we visited and community members we spoke to. If preempted community members would say they would like electricity, but it was never one of the first things brought up.

Solar energy is already being used by some facilities in the area. The main use of solar power seemed to be to charge cell phones. Solar power seems like the best way to alleviate the limited electricity needs of the community for now. If paired with a generator, most household could enjoy 6 to 10 hours of power when night falls.

The National electricity company (EDH) has no power grid extending to Balan. The grid runs through the national high way which is about 1.5 miles from where we were located. It would be interesting to research and see if EDH would cover that extra 1 to 2 mile of road to Balan center, so that instead of having solar panel paired with generators for electricity people of the community could rely on EDH for part of their electric needs.

Wind power seems unlikely for the region for a number of factors, primarily cost and inaccessibility. Given the trade winds of the Caribbean and the proximity to the ocean, it would

seem possible to use wind power on some of the hill tops in the surrounding area. This would be a high cost project that would probably have limited returns for the community. This type of infrastructure development is neither what the community is looking for, nor what makes sense for the engineering group to devote their resources to.

## **10.0 Education component - Training**

The educational component is something we think we can move forward the fastest with and that can be part of any follow up trip to the region. From our research and our meetings with the agronomist, we learned that the farmers are reluctant to practice crop rotation, are not utilizing the best farming techniques, and practicing their current methods inefficiently. Rice farmers for example, who already have an irrigated piece of land are not getting the maximum yield from their crop, and some are even losing their crop due to a lack of know-how. It is known that better types of rice seeds can be harvest in the region, but the main problem is that the farmers don't have the educational resources to research them and the logistical resources to get those seeds in Balan. The agronomist also mentioned that people who had cattle were unwilling to spend money and get care for their cattle, but if they did they would get almost twice as much when selling them. Generally there is a problem with farmers employing long-term solutions to problems because of added risks and costs in the short-term.

## **11.0 Recommendations**

To the question, should an EWB project go ahead in Balan, the answer would depend most significantly on EWB and the interest of the student members in such a project and in working in Balan, Haiti. From the trip some significant concerns remain as to security and to the scope and scale of an applicable project. However little question remains as to the general need and want of the community; It seems high.

From our research the two most fundamental things sought by the community were education and financial support. Education both at a general level to all children and young adults, and in the form of training for specific skills, such as in agriculture, technology, or other. Our work might have been easier if when we arrived in Balan we would see a specific and contained problem that would lead to a project that fit the EWB model and that would adhere to the type of projects that EWB has pursued in the past. Instead, what we found were mostly general areas that were lacking and broad wants, often related to over-arching infrastructure or lack of education. The community in many senses is healthy and vibrant, but there is a general desire to develop further and a call for support in doing that.

Projects that could be considered for EWB are:

1. Rain water collection and/or the building of cisterns or reservoirs in Bois Caiman or Port Francais
2. Irrigation reservoirs in Bois Caiman
3. Fixing the existing broken spring box at Port Francais installed by World Vision- though World Vision will hopefully fix this first.
4. Potable water project for community, possibly in the form of Potters for Peace
5. Establishment of more infrastructure such as road improvement
6. Working with Public health students to establish/build a clinic of sorts
7. Latrine Systems around the community or in specific areas

Other areas that were not addressed specifically as needs for the community but that we determined might be both applicable and important are:

1. Fish farming in the bay de L'Acuil, next to Balan
2. Some sort of trash collection and recycle or reusing program

In terms of the fish farming, speaking with fisherman and looking at their catch they report that they continue to get smaller and smaller fish and less of them. According to the fisherman, the bay is less healthy than it used to be. Some of the fisherman's answers are to get the proper boats for deep sea fishing and to learn how to deep sea fish, but this introduces new problems of sustainability and environmental degradation. The establishment of a fish farm in the area could prove to be a sustainable project for the community of Balan and an important food source. Downsides of a project of this nature include high initial investment costs and making environmental problems in the Bay even worse.

Currently there is rampant littering in the community, though this is probably true throughout Haiti. There is no system or practice to manage garbage, and recycling occurs to some extent in the wonderful way that an empty plastic bottle has some use for something else once it is discarded by the first time user. Unfortunately not all trash is used again and much of it piles up in stream beds and rivers, and along roadways and paths.

Though Balan has shown every evidence of being a very safe community, it does require passing through Cap Haitian to get there. There have been some rumors that kidnappings that were just occurring in the Port-au-Prince area are now occurring in Cap Haitian as well. There may be no truth to such claims, but regardless the security situation for Haiti, and specifically Cap Haitian, should be paid special attention to.

No project should be undertaken in Balan unless there is sufficient interest among several students to work in such a setting and on such problems. Tufts EWB must also be willing to fully support students in conducting research and working in the north of Haiti.

Because the area is so large, it would be difficult to determine a hands-on project that would be able to reach the whole community within the scope of the Tufts engineering group.

Some solutions might exist for large scale engineering fundraising or solutions in training, engineering marketing or market based technologies (such as potters for peace) that would require less technical expertise. Other projects might take a continued planning over and have a longer timeline and wider skill-set than past EWB Tufts projects

Likely any or all of the focused areas, Bois Caiman, Port Francais, or Godin, along with Balan as a whole, could sustain successful Tufts EWB projects and we should design a strategy to address one specific project at first while maintaining the community relations with the other Balan Neighborhoods, (by smaller training programs or similar gestures) while laying the groundwork for a following trip to a different project.

Each trip could benefit by having different components, potentially one trip in the future could continue working on one of the large scale more macro engineering projects, while working on starting a new specific construction project, doing follow up tests and maintenance on the previous project and conducting measurements and planning for a future trip and project.

All of the neighborhoods are within a 45-60 minute walk from the Presbytery which has good accommodation.

## **12.0 Ongoing questions**

We are still continuing to ask questions about how to move forward, and what the community truly wants. Through continuing discussion, it is seeming that our most ideal projects may require different skills than EWB usually uses, and more time than community can wait, or the relationship can last.

We continually asked ourselves what the community wanted, what we could give them, what the timeline for any project might look like, and what we can do quickly. At the moment, the best project for EWB and Balan may be a project that mutually benefits the groups in the short term, but prepares the longterm groundwork for a future project. This project may also make an effort to educate younger Tufts engineers about Haiti, the community, to develop a stronger relationship, more interest and a more experienced project time, and new creative ideas for the project.

We are also asking questions about the purpose of the project, the perceived purpose, and the roles of EWB. A trip with EWB is clearly a learning experience for the students who travel, but should this purpose preclude that of the community? How can we balance these two needs? In the short term? over time?

As we work to answer those more systematic questions, we are also thinking of the questions that could make or break the project. If no students wish to travel to Haiti, or the community doesn't fully support our project idea, then we must ask if we should change it or if we should

give it up. If the situation in northern Haiti become more volatile, the risks might be too great to conduct a project in the area.

For all of these questions we must proceed cautiously, honestly, and cleverly. The complications and layers of a potential project in this region and with this community increase the number of pros and cons and make the feasibility determination that much more complex. Despite the difficulties, the questions that we are beginning to answer is how to proceed, and what project begins to answer these questions. Beginning to look ahead, we think the pragmatic way forward may be to tackle a smaller problem, while strengthening the foundation for a larger future EWB project in Balan.

## **13.0 Conclusions**

Overall we will continue to meet with EWB students and advisors, the RESPE peers, and people who understand the issues to help us answer these questions and move forward. The situation is complex. The relationships between all of the different players only entrenches the complexity of the problems themselves.

It is clear that we could do almost anything if we do it well to help the community, but we must work hard to find a way to effectively address some of the needs of the community, the Tufts EWB community, as well as work within our limits as a student organization. In the past, Tufts EWB has worked on short term projects where only a few smaller steps or trips lead to a complete project. To have real impact in Balan, the role of EWB at Tufts may need to evolve into something more interdisciplinary and broad, or perhaps more formalized, while still holding on to the core values of EWB.

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