

# Document 523

## Alternatives Analysis Report

Chapter: **EWB-USA University of Mississippi**

Country: **Togo, Africa**

Community: **Akoumape**

Project: **South Togo Water Project**

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ENGINEERS WITHOUT BORDERS USA  
[www.ewb-usa.org](http://www.ewb-usa.org)

## Alternatives Analysis Report Part 1 – Administrative Information

### 1.0 Contact Information *(correspondence regarding report reviews will be sent to the listed President, Project Leads, Mentors and Faculty Advisors)*

	Name	Email	Phone	Chapter Name or Organization Name
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<b>In-country Local Government Contact</b>	Kokou Leguede			

## 2.0 Travel History

<b>Dates of Travel</b>	<b>Assessment or Implementation</b>	<b>Description of Trip</b>
August 2012	Assessment	First assessment trip to Togo; assessed possible water and structural projects
August 2013	Implementation	Phase 1 Implementation of Hedome school building
January 2014	Implementation	Phase 2 Implementation of Hedome school building
August 2014	Assessment	Assessment of Akoumape water supply project

**3.0 Project Discipline(s): Check the specific project discipline(s) addressed in this report. Check all that apply.**

**Water Supply**

- Source Development
- Water Storage
- Water Distribution
- Water Treatment
- Water Pump

**Sanitation**

- Latrine
- Gray Water System
- Black Water System

**Structures**

- Bridge
- Building

**Civil Works**

- Roads
- Drainage
- Dams

**Energy**

- Fuel
- Electricity

**Agriculture**

- Irrigation Pump
- Irrigation Line
- Water Storage
- Soil Improvement
- Fish Farm
- Crop Processing Equipment

**Information Systems**

- Computer Service

**4.0 Project Location**

*Akoumape Village in the Maritime Region, VO (Vogan) Prefect, 40 km northeast of the capital city, Lomé, Togo*

**Latitude:** 1°28.2E

**Longitude:** 6°22.7N

## Alternatives Analysis Report Part 2 – Technical Information

### 1.0 Executive Summary

This report is for the EWB-USA University of Mississippi chapter South Togo Water Project. Three student members and one professional mentor of EWB-USA University of Mississippi traveled to Togo, West Africa from August 3, 2014 through August 12, 2014 to conduct a water supply assessment near the village of Akoumape in Togo, West Africa. This project has been named the South Togo Water Project. Dr. Cristiane Queiroz Surbeck of the University of Mississippi acted as Responsible Engineer In Charge (REIC), and the group was accompanied by three members of the Cleveland, TN Bradley Sunrise Rotary Club.

The goal of this project was to conduct assessment to implement a water project in the community of Akoumape. This assessment trip has the scope of communicating with the community, getting quotations for drilling and well installation, obtaining pricing for materials, and researching other water projects that have been implemented in the region. Furthermore, preliminary monitoring was conducted of the community of Hedome since the implementation of the first three classrooms of a school building.

For this project, Mission B.I.G., headed by Rev. Kokou Loko shall serve as the community entity and will set up a water board to oversee community involvement. The Prefect of Vo (the regional government encompassing several villages), Mr. Kokou Leguede, is a very supportive representative of the local government; EWB-USA University of Mississippi shall provide the design and technical support. Substantial project funding will be provided by Rotary International.

The program started in 2012 with an assessment trip to the Vogan region of Togo (which encompasses the sub-region of Vo and all of the villages visited), facilitated by Mission B.I.G. This assessment trip resulted in an agreement to build a school in the community of Hedome. The school then became the first project for the program, and a school was built during two implementation trips, in August 2013 and January 2014. The August 2014 assessment trip referenced in this report will be the start of a new project, in partnership with a Rotary Club, which has funding available for a project in this region. Further, some preliminary monitoring activities for the first implemented school project were conducted during this assessment trip.

The alternative designs evaluated for this project are: (1) surface water body as a water source; (2) a shallow well as a water source; and (3) a deep well as a water source.

To compare the three alternatives, we considered the feasibility of each source to provide clean, sufficient water for a period of many years.

The preferred alternative is to use a deep well as a water source (alternative 3). Only the deep well described will provide sufficient clean water. With substantial funding from Rotary International, the construction of this well is feasible.

### 2.0 Program Background

The relationship between EWB-University of Mississippi and the Vogan Prefect of Togo has been building for many years. Medical mission teams from Mississippi have been going to the Vogan Prefect of Togo since 2004 through a relationship between pastors Gary Richardson of Oxford, Mississippi and Kokou Loko of Togo (the two friends went to graduate school together in New

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Orleans, Louisiana). In 2008, Kokou Loko visited Oxford and the University of Mississippi Engineering to deepen the relationship between his non-profit organization, Mission B.I.G. (Baptiste Indigène de la Grace) and those in Mississippi willing to help. As a result, Ms. Marni Kendricks, Assistant Dean of the School of Engineering, joined one of the medical missions to Togo in 2008 with the purpose of assessing the location to build a hospital. There was no funding for a full hospital, but shortly after this trip, in 2009, the EWB-University of Mississippi chapter was formed.

After considering several potential projects around the world, the chapter, together with an external advisory board, decided that the best chance of project success would be with a community in Togo, where EWB members already had a relationship with Rev. Kokou Loko. The chapter's application for a new project was approved by EWB-USA in December 2011, and the chapter performed its first assessment trip during August 2012. During this first assessment trip, the chapter was introduced to Hedome Village, after several days of interviews. This rather industrious group of individuals and leaders (as evidenced by a recent road construction project within the village) requested help with something they felt was necessary for improving their lives - education of their children. Although they had many needs, this was what they identified as their greatest concern. They had previously built a school for their more than 300 children; however, due to poor construction, a storm caused some of its walls to collapse. Therefore, the project was focused on the design and construction of a school building.

The chapter began construction in August 2013, and continued through a second trip in January 2014 to finish three classrooms of the school including a roof. With the completion of the school, we not only were planning a monitoring trip to check on the school but also looking for what our next project would be. Rev. Kokou Loko had by this time gotten the funds to start the construction of a full hospital on land owned by Mission B.I.G. The hospital has a need for a continuous clean water supply. Building a water well to supply water for the community of Akoumape along with the hospital became our next goal. The only issue at this point was having the funds to build such a water well in this area. The chapter joined forces with Bradley Sunrise Rotary, who also knew Rev. Kokou Loko, for funding of the water well. The recent assessment trip that took place August 2014 consisted of three Rotarians and four EWB-University of Mississippi members. During our recent assessment trip we monitored the school and took note of any changes. The school is in good condition and is being used. We also visited the hospital grounds and surveyed the land surrounding to determine the best location for the water well. The design of the water well is now in action and implementation trips will be the next step for this project.

### **3.0 Project Description**

Mission B.I.G. has begun a very progressive development project in the region of Akoumape, Vogan, Togo upon land donated to them by landowners in Akoumape. Currently a children's hospital is being built on this land and a number of other projects are planned as well, including: a main hospital, orchard, orphanage, and fish farm. See Figure 1 for a schematic of this property, including a probable location of a deep water well. It should also be mentioned that approximately 1 km from Mission B.I.G.'s property is a high school that is completely setup with plumbing, toilets and sinks but has no access to running water to make them functional.

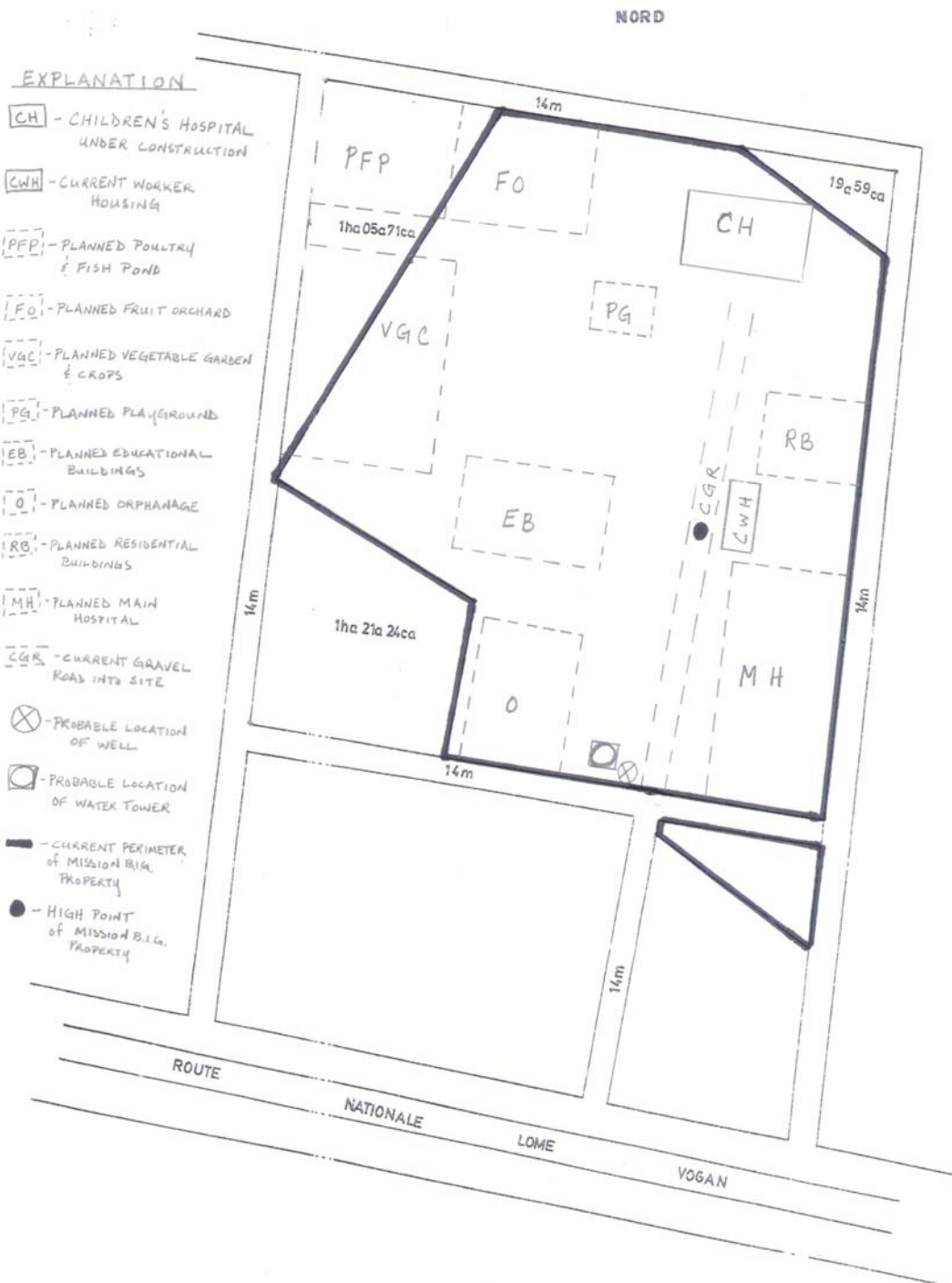


Figure 1. Projected layout of Mission BIG property. The Children's Hospital (CH) is the first building under construction.

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In order for all of these projects to work there needs to be access to clean water. Bradley Sunrise Rotary has the funds to drill a deep well (likely this summer), install a pump and piping, build a water tower, and provide electricity from the grid to the site. EWB-University of Mississippi will provide the engineering support for the Rotary funds to be used.

It is the chapter's goal to provide water to the children's hospital and to a community water access area (a public tap stand). Providing water to the high school may be a future project depending on the success of the initial project. The community access area will likely be very close to the well and act as a microbusiness where community members pay to collect their water.

EWB University of Mississippi has discussed in depth with Mission B.I.G. that in order to make this water project sustainable, it will need to be kept financially separate from the children's hospital and other future projects. At the request of the EWB University of Mississippi chapter, Mission B.I.G. will be creating a water board made up of Akoumape residents to oversee the usage of the water as well as handle the finances of the water well. The hospital and high school as well as any other entity to which water from the well is pumped will be setup with a meter and these entities will have to pay to the water board for their usage of the water.

The chapter foresees this project occurring in several phases, please note that all phases are tentative at this time:

- Phase 1: drilling and logging of borehole, installation of the well, pump testing
- Phase 2: construct the well house and tower and install an elevated tank
- Phase 3: install the submersible pump and construct the public tap stand
- Phase 4: assemble piping to the children's hospital

#### **4.0 Description Of Alternatives**

After the assessment trip to Akoumape, Togo, the EWB-University of Mississippi team discussed and developed three alternatives for the Akoumape Water Project. The three alternatives are as follows: Alternative 1: Surface Water Body, Alternative 2: Shallow Water Well, Alternative 3: Deep Water Well.

##### **Alternative 1: Surface Water Body**

The surface water body source would be pumped from the nearest water supply (Haho River) to the site that is 12 km away. See Figure 2 for the location of the Haho River (Water Body 1) to the Mission B.I.G. property.



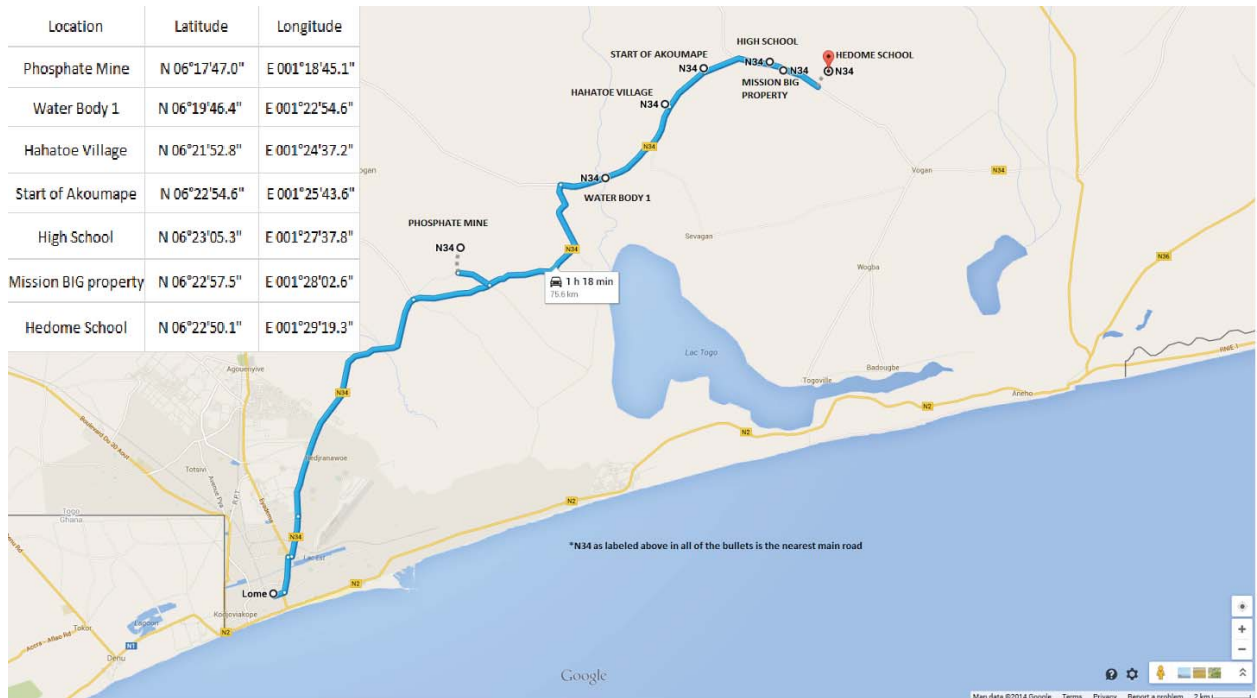


Figure 2. General area map.

**Alternative 2: Shallow Water Well**

The shallow water well could be built directly on the site and be of about 80 ft. or more in depth. As Mission B.I.G. owns a drilling rig capable of drilling a shallow water well, this is a viable, money saving alternative.

**Alternative 3: Deep Water Well**

The deep water well could be constructed to distribute water to various sites, such as the children’s hospital currently in construction on the Mission B.I.G. property, the high school which has facilities currently without running water, further buildings to be constructed on the Mission B.I.G. property, and a tap stand for people to utilize the water.

**5.0 Analysis Of Alternatives**

The pros and cons of each alternative are listed below. The least likely to be implemented is the surface water body. The shallow water well is the fallback option. The most preferred option is the deep water well. EWB-University of Mississippi has spoken about developing an Akoumape Water Board. This water board would be compromised of chosen community members, Mission B.I.G. representatives, and people in charge of maintenance and selling water. Keeping the water board balanced with members of various groups allows for a system that can implement a system of check and balances to regulate the use of the water and the maintenance of the chosen well or source of water.

**Alternative 1: Surface Water Body**

The main pro for use of the Haho River as a surface water source is that drilling is not necessary. As the Haho River is 12 km away from the Mission B.I.G. property, this would create challenges in planning a piping project of a large scale. With 12 km of piping, challenges would arise in sustainability and maintenance. Challenges would also arise from the fact that the Akoumape community does not travel often outside their own community, thus increasing the sustainability

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challenges. As the piping from the surface water body would pass other villages en route to its final source on the Mission B.I.G. property, challenges would arise from these villages wanting to use the water. Another con is that the water is to be used in a hospital and that a surface water body cannot provide the required quality of running water to such a facility. Although the river water was not tested while the EWB-University of Mississippi team was in Togo during August, 2014, it can be generally accepted that the water is contaminated due to the lack of proper wastewater treatment in the area.

### **Alternative 2: Shallow Water Well**

The shallow water well would be constructed on the Mission B.I.G. site. The drilling costs would be minimal due to the fact that Mission B.I.G., the project NGO, owns a drilling rig capable of drilling a shallow water well which would only have to penetrate through the first layer of sand through the water table. Power for the well would also be minimal as the site could be setup with a manual pump where power would not be necessary; however, manual labor would have to transport water to locations in this situation. One con of the shallow water well is the possibility of contamination. Another is the possibility of the well running dry if running water is supplied to the hospital.

### **Alternative 3: Deep Water Well**

A deep water well is the preferred option due to its capacity of being located on the Mission B.I.G. property. With a deep water well, the community could set up a small business selling water at a fixed price. Since a deep water well penetrates multiple layers of sand and bedrock, the water is less likely to be contaminated. The most prominent con is that drilling a deep water well would be the most expensive option. The need to pump the water from its depths up is also a challenge and expensive. The maintenance of the water well is also a complication that will have to be addressed.

## **6.0 Description Of The Preferred Alternative**

The deep water well is the preferred alternative. The well will be drilled by a professional company through multiple strata until it reaches the water below the bedrock. Figure 3 shows a typical well log by one of the companies that may be contracted to drill the well. A submersible pump will be used to push water up to the surface to an elevated storage tank. The water will be stored in an elevated storage tank that will provide enough water pressure for distribution to the desired locations. The system can be expanded to incorporate multiple tanks if needed. Water will then be drawn from the tank to supply the nearby tap stand, hospital, and school, with the potential to supply new buildings. The well pump will receive power from the grid that runs along the main road. Conduits will be incorporated into the well to allow for power to the pump. A well cap and seal will be in place to protect the well from contamination. Well casing will run the sides of the well until bedrock is reached to ensure the stability of the well and the cleanliness of the water source. The attendant will be employed by the Water Board and will oversee the use of the well and distribution of the water. Water at the tap stands will have a set fee per volume to purchase. Figure 4 shows a picture of a similar set-up in the same region of Togo, though the well is shallow. Entities such as the hospital or school will have their water usage metered, and charged accordingly. These fees will contribute to the maintenance of the well and provide salary for the attendant. Literature and signage will be installed to help educate the community about the merits of clean water and proper sanitation.

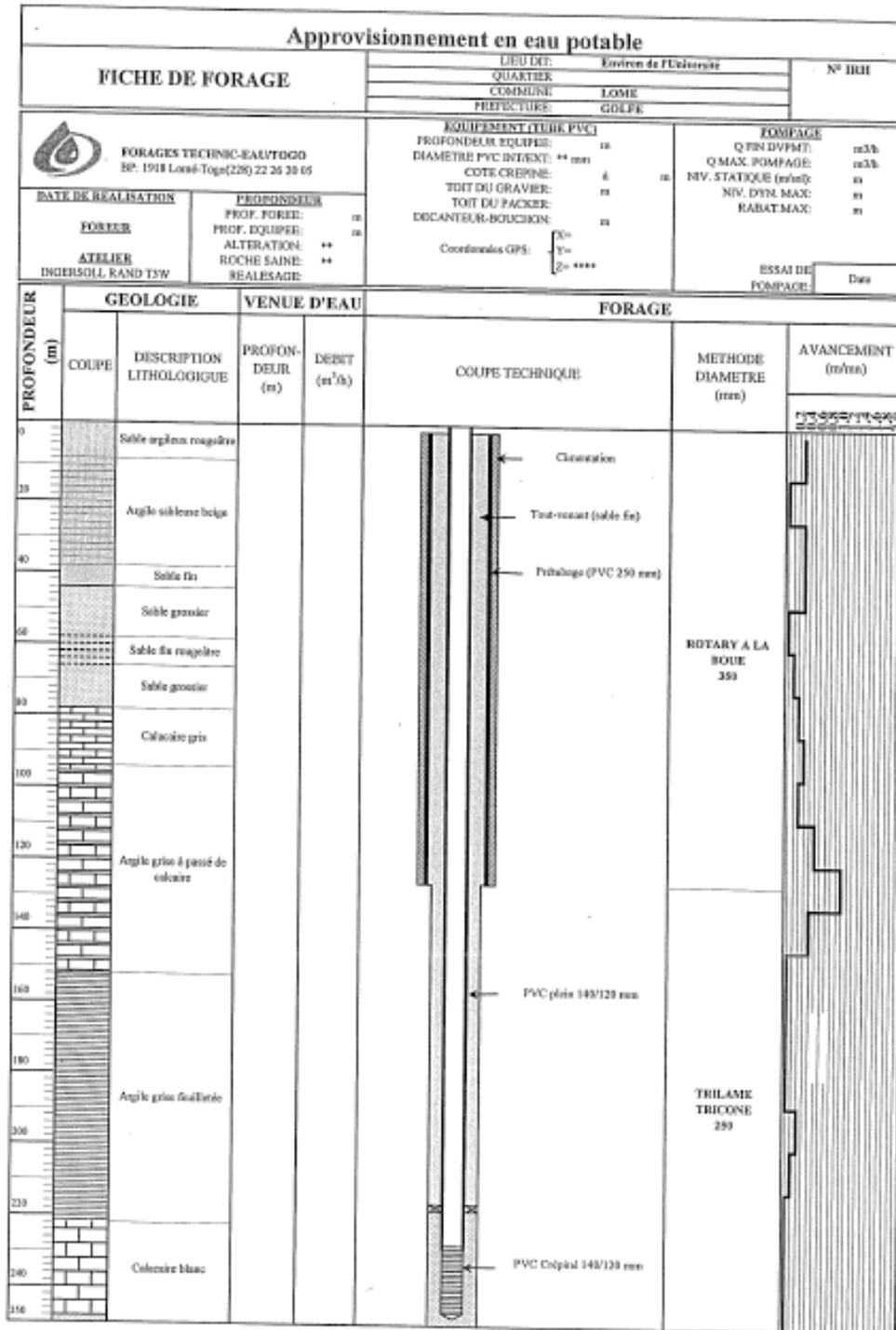


Figure 3. Typical well drilling log for deep water well.



Figure 4. Photo of shallow water well (encased in concrete box in the background), elevated storage tank, and tap stand nearest to location of project.

## 7.0 Professional Mentor Assessment

### 7.1 Professional Mentor Name and Role

Cristiane Surbeck, REIC. Traveled to Togo on assessment trips in August 2012 and August 2014.

### 7.2 Professional Mentor Assessment

The project is running smoothly, and the EWB-University of Mississippi team is diligently learning more about the project and staying in communication with the Bradley Sunrise Rotary Club. The two groups are working together on a final report to Rotary International to receive the grant that will pay for the main expenses of this project.

Water Board and 10% payment: Note that EWB-University of Mississippi is aware that the community (the Water Board, to be established) must pay for 10% of the costs of construction of the EWB project. As EWB-University of Mississippi is going to fundraise for the piping, then the community will pay for 10% of those costs. It is also worth noting that Rotary International also requires a Water Board to be established in order for funds to be disbursed.

Project Partnership Agreement: This agreement will be finalized and signed after we confidently secure the funds from Rotary International. Rev. Loko has translated our English version into French and has presented it to the prefect of Vo, Mr. Kokou Leguede. It appears that details are being worked out between the two, and we are awaiting further notice.

### **7.3 Professional Mentor Affirmation**

I, Cristiane Surbeck, acknowledge my involvement during the assessment trip and my acceptance of responsibility for the course that the project is taking.