

Report on Expenditure of Funding
Ann Campana Judge Foundation
National Ground Water Research and Educational Foundation
Well Drilling in Benin, West Africa
30 March 2008

Executive Summary

The University of Notre Dame has worked with key partners in Benin to advance the installation of groundwater wells in rural village settings in southern Benin, West Africa. The original intent of the project (combining funding received from the Anne Campana Judge Foundation (ACJF) with funding received from a second foundation) was to drill two wells based on an LS-100 drill rig already existing in Benin. During a field survey trip in February, 2007, two villages identified by a partner agency (Centre Afrika Obota, or CAO) were visited for initial site review. One site, located in a sedimentary plane in southwestern Benin, was appropriate for drilling with the LS-100. The second, located at higher elevation in a portion of a sedimentary rock sequence was more problematic from the standpoint of the limitations of the LS-100.

These observations lead to discussion among Notre Dame and its partners regarding alternative strategies to optimize use of the available funding. At the suggestion of the Benin government water agency (Direction de l'Hydraulique, or DH), it was determined that working in collaboration with this agency would provide an opportunity to drill approximately 25 wells in the region of the second village (in the sedimentary rock) using government contractors and in collaboration with an ongoing drilling project funded through the government agency by other monies.

Contact with Dr. Michael Campana confirmed that the ACJF was comfortable with this change in orientation of the project. Hence, a contract was signed with CAO to oversee the identification of potential villages, working with the villages to help them prepare their portion of the drilling project, and oversee the payment of funds to the government agency for each well to be drilled. During May/June, 2007, Dr. Silliman visited approximately 35 villages (identified by CAO) in two regions of Benin. Through collaboration among Notre Dame, CAO and DH, a group of villages was selected for the drilling program.

Between June, 2007, and January, 2008, CAO worked with each of the villages in the target region to prepare them for their new wells, and to complete all necessary government forms to request drilling of the wells. A portion of this effort involved using graduate students from the national university in Benin to map the individual villages and identify appropriate locations for the new wells.

As of January, 2008, all paperwork and commitment requirements had been completed and CAO received payment of their portion of the contract (approximately \$4,800). At that time, the project was waiting for action by DH. Since January, CAO has worked with DH in an effort to initiate the drilling. Although indications are that the drilling has initiated, Dr. Silliman will travel to Benin in early May, and again in June, 2008, to determine the current extent of drilling completed and to ensure that the drilling program will progress to completion prior to December, 2008.

Introduction

The University of Notre Dame would like to thank the Ann Campana Judge Foundation and the National Ground Water Research and Educational Foundation both for the financial support of water resources in Benin, West Africa, and in the confidence in Notre Dame's ability to accomplish significant water resource advances in Benin. As discussed below, the project evolved from a program to drill two wells with an existing LS-100 drill rig to a substantially broader program of drilling. This effort has formed the foundation of a broader program of development in Benin (involving drilling additional wells and work with local populations in developing wellhead protection strategies).

This report outlines the activities that have been pursued based on the ACJF and NGWREF funding. The report also outlines successes as well as the challenges addressed to date.

Geologic Setting

The geologic setting of Benin has contributed substantially to the evolution of this project. Specifically, the region of southern Benin in which our drilling efforts are progressing is composed of Mesozoic and Cenozoic sedimentary sequences including sandstone and siltstone formations, with clastic sediments filling the lowland valleys and coastal zone. Figure 1a provides an image of the fine sand terrain common in the lowland geology where a previous successful well was completed using the LS-100. In these valley regions, a shallow unconfined aquifer can provide abundant water sources (with the associated risk of contamination from local land use). In addition, deeper

confined aquifers are likely to be able to support substantial water with additional protection from surface contamination.

Figure 1b shows the siltstone that is the surface formation in the southern hill country in Benin. Shallow wells (typically hand-dug) have only limited capacity in this region due both to water quality and limited capacity. However, deep wells are regularly drilled in this region, with water derived from deeper, confined aquifers at typical depths of 30-50 meters.



Figure 1: Comparison of two geologic environments. (a) Left –sediments in lowland valleys, (b) Right – siltstones typical of the geology observed at the surface in much of the hill country.

Original Field Plan

Prior to our field efforts in February, 2007, CAO had identified two potential drill sites. These are shown in Figures 2a and 2b. The first location (Figure 2a) is in Western Benin and borders Lake Aheme. This location was chosen as it was quite close to a previous drill site (Vovio) where the LS-100 was successfully deployed to drill a well. The second location is in the Atlantique region of southern Benin, in the hill country on the sedimentary rock sequence.

Both locations were visited in February, 2008, with the populations able to present legitimate need for water as well as prior efforts at hand-dug water wells. Interestingly, this second location was originally visited by Dr. Silliman in 1998 during his initial field efforts in Benin. The local population was embarrassed to admit that they had kept this information from the CAO representative on the hopes that during this second visit, Dr. Silliman would come to a different conclusion regarding the inability of the LS-100 to successfully drill to water in this location.



Figure 2: Site locations original investigated for the drilling efforts using the LS-100. (a) Left: coast of Lake Aheme – the underlying geology consists of sands saturated with freshwater (the Lake appears to be a gaining lake during most periods of the year in this region of the Lake), (b) Right: location of second possible drill site (the same as shown in detail in figure 1b) which is at higher elevation and located on the sedimentary rock.

Following these site visits, Dr. Silliman indicated that the LS-100 could provide a reasonable drilling method at the first site. He reaffirmed his original opinion for the second location that the LS-100 could not be used to drill a successful well due both to the likely depth required for the well (substantially greater than 100 ft) and the relatively hard material existing in the subsurface.

Adjustment to Field Plan

Following site visits to the two proposed drill sites, Notre Dame held a meeting with CAO, DH and representatives of the national university (Universite d'Abomey-

Calavi, UAC) to discuss the advancement of the project. DH suggested that rather than spending our resources (a combined \$20,000 from ACJF/NGWREF and another foundation) on attempting to drill two wells with the LS-100, the money be spent to assist 25 villages in preparing the paperwork and cost-share required to join a government program for drilling of deep wells using government contractors. The concept was that the villages would be required to form a water committee, prepare required paperwork to demonstrate both need and interest in a new well, and develop an equivalent of \$500 cost-share for each well. The government agency indicated a willingness to allow our project to contribute all or part of the \$500 cost share if we could develop the water committees and paperwork for ~25 villages in a single region of Benin. With this number of villages, we were promised that DH would put drilling in this region as the highest priority with wells drilled within a year.

Notre Dame (represented by Dr. Silliman and his graduate student, Ms. Pamela Crane) immediately expressed concern that our assisting with the cost-share would undermine the concept of local contribution to the project. In response, DH indicated that the \$500 was set arbitrarily, and that many of the villages in the southern rural regions of Benin could not afford this level of cost share. Hence, they indicated belief that the village buy-in through the water committee and cost-share as possible was sufficient to ensure long-term commitment of each of the communities to the new wells.

Discussions among all Benin partners lead to agreement that the foundations (ACJF/NGWREF and the other foundation) would be contacted to determine agreement with this new approach to use of the funds provided. As Dr. Campana will recall,

communications via email confirmed ACJF's agreement to this plan with the goal of initiating drilling by the end of 2007.

Village Identification, Roles, and Initial Interactions

Based on the new project plan, Dr. Silliman returned to Benin in May/June of 2007 and visited approximately 35 villages identified by CAO as possible participants in the new drilling program. These villages were located in two "departments" (essentially the equivalent of large counties in Benin): Atlantique and Mono. The Atlantique department is largely located on the sedimentary rocks (similar to those shown above in figures 1b and 2b). There is substantial history in this region of drilling of successful (but deep) wells by DH. This region is also quite active in terms of population growth, agriculture, and small businesses. Finally, this region is represented by a strong local political leadership and an active sub-office of DH. It quickly became evident that the population in the villages in this region both appreciated the value of new wells and the responsibility associated with development of these wells. Thus this region was selected for the project efforts supported by the \$20,000 funding.

The Mono department is located in southwestern Benin, is largely located on coastal plane sediments (although it also includes some sedimentary sequences west of Lake Aheme) and is extremely rural. There is limited history of drilling in this region, hence the potential for successful drilling is less well characterized than in the Atlantique Department. While the population in this department was extremely interested in new water sources as represented by wells, the development of water committees, current understanding of the importance of water quality, and the potential impact of new wells

(in terms of number of people impacted) were all at lower levels in this area than in the Atlantique Department. Hence, while this region remains extremely high in terms of priority for drilling, it was considered beyond the scope of the ACJF project. {However, the ACJF may be interested to know that, should the drilling in the Atlantique Department be successfully completed, funding is already in hand to pursue an additional project in the Mono Department. }

Based on the May/June efforts in Benin, CAO was contracted to pursue identification of ~25 villages in the Atlantique department for drilling of new wells. Within this contract, CAO was responsible for all contact with the villages, development of water committees in each of the villages, and completion of all paperwork to DH for each of the villages. Further, graduate students from UAC were hired to map these villages and provide suggestions regarding location of the drilled wells relative to current village activities and willingness of the village population to walk to a new water source. CAO is also responsible for transferring funds to DH as the wells are initiated. {All funds rest with Notre Dame until appropriate evidence of activity and receipts are received from CAO. }

As of the end of 2007, CAO had assisted 25 villages in completing all necessary paperwork for initiation of drilling.

Project Progress Through March, 2008

Extensive communication between Dr. Silliman and Landry Loughbenon (our representative at CAO) in December, 2007, and January, 2008, indicated that CAO had completed all required efforts for initiation of drilling. However, an issue had arisen

within the hierarchy at DH as to where the funding was to be derived for the drilling of the wells. As of the end of January, Dr. Silliman was assured that these issues had been resolved through meetings among CAO, the national level DH, and DH from the Atlantique department. Accordingly, drilling was scheduled to start in February or March of 2008 with all drilling scheduled to be completed by the end of 2008.

As of the most recent communication from CAO, CAO has indicated that DH is prepared to start drilling and/or has initiated drilling. However, Dr. Silliman has not received direct confirmation of the initiation of drilling. Hence, he will travel to Benin during the first and second weeks of May, 2008, in part to determine the status of the drilling efforts. Further, as a result of the lack of direct evidence of the initiation of drilling, the only money that has been released to CAO has been their request for reimbursement of ~\$4,800 in receipts for their field efforts in the various villages.

While Dr. Silliman remains confident that the wells will be drilled and that the time line on the drilling will be approximately by the end of 2008 or early 2009, he will provide ACJF with an update report after his May travels. Further, he will return to Benin in early June for related projects and will once again check on progress of the drilling at that time. Finally, he will return to Benin in September, 2008, and/or January, 2009, as needed for this and his other projects in Benin. Hence, Dr. Silliman will be able to provide direct assessment of the drilling effort at regular intervals between May, 2008, and January, 2009.

Remaining Funds

As noted above, Dr. Silliman has authorized payment solely of ~\$4,800 in reimbursement for field expenses by CAO. Hence, approximately \$5,200 remains from

the original ACJF/NGWREF grant. It is hoped that ACJF/NGWREF will continue their faith in this project by continuing to commit these funds to this drilling effort subject to the continuing oversight of this project by Dr. Silliman.