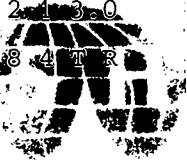


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TRAINING IN RAINWATER CATCHMENT FOR SANRU-86 VILLAGE HEALTH WORKERS AND PEACE CORPS VOLUNTEERS

WASH FIELD REPORT NO. 115

MARCH 1984

**Prepared for:
USAID Mission to the Republic of Zaire
Order of Technical Direction No. 167**

LO: 213.084TR
15N 1567

**WATER AND SANITATION
FOR HEALTH PROJECT**



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March 9, 1984

Richard Podel, Director
USAID Mission
Kinshasa, Zaire

Attention: Richard Thornton

Dear Mr. Podel:

On behalf of the WASH Project I am pleased to provide you with ten copies of a report on Training in Rainwater Catchment for SANRU-86 Village Health Workers and Peace Corps Volunteers.

This is the final report by David Yohalem and is based on his trip to Zaire from January 2, 1984 to February 2, 1984.

This assistance is the result of a request by the Mission on May 10, 1983. The work was undertaken by the WASH Project on October 13, 1983 by means of Order of Technical Direction No. 167, authorized by the USAID Office of Health in Washington.

If you have any questions or comments regarding the findings or recommendations contained in this report we will be happy to discuss them.

Sincerely,

David Donaldson
Acting Director
WASH Project

cc. Mr. Victor W.R. Wehman, Jr.
S&T/H/WS

DBW:ybw

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VILLAGE HEALTH WORKERS AND PEACE CORPS VOLUNTEERS

Prepared for the USAID Mission to the Republic of Zaire
Under Order of Technical Direction No. 167

Prepared by

David Yohalem

March 1984

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EXECUTIVE SUMMARY

Per Order of Technical Direction No. 167, WASH Consultant David Yohalem and Tin Sy Nguyen arrived in Zaire on January 4, 1984, to train village health workers attached to the SANRU-86* Project and Peace Corps Volunteers (PCV) in the construction of rainwater catchment (RWC) systems. After five days of preliminary preparations in Kinshasa, Yohalem and Tin went to Nsona Mpangu for an additional six days preparation at the training site.

Nineteen participants (ten Zairian village health workers and nine PCVs) attended the ten-and-a-half day workshop from January 16 to 27, 1984. The participants learned how to evaluate the technical feasibility and community interest in such a project, conduct an inventory of the needed materials, choose the most appropriate technologies for any given situation, design a system, organize materials and construction, engage the active participation of the local community and prepare it to monitor and maintain the system, and critically evaluate a complete system. The trainees also had 24 hours of practical hands-on experience in constructing a large catchment system for the hospital at Nsona Mpangu composed of 15 meters of gutters, a water filter, and a five cubic meter cistern, and built seven cement jars and a system for a thatched roof house in the nearby village of Bete.

The participants and trainers were very positive in their assessment of this technology for rural water supply needs in Zaire and of the design and implementation of the workshop. Based on experience at Nsona Mpangu and discussions with SANRU-86 and USAID Health Office staff, the following are recommended:

- SANRU-86 should train village health workers in other regions in this technology.
- SANRU-86 should adapt the adult learning model and approach to skill development, as set forth in the RWC Training Guide, to its other training programs in water supply.
- SANRU-86 should continue training Zairian trainers and use the Nsona Mpangu trainers in future workshops.
- USAID should continue to support the SANRU-86 efforts in rural water supply and to help SANRU-86 introduce RWC systems as a viable supplement and occasional alternative to other water supply technologies.
- USAID should investigate the feasibility of developing the capacity of a Government of Zaire (GOZ) or non-governmental organization (NGO) institution to provide logistic and technical support to existing programs in village water supply.
- USAID should continue to help, encourage, and facilitate the coordination and cooperation between SANRU-86 and the U.S. Peace Corps.

* "SANRU" is derived from "Sante Rurale" or "rural health," and SANRU-86 is a USAID supported rural health project.

ACKNOWLEDGEMENTS

There are always many people to thank when things go well, and the RWC Workshop at Nsona Mpangu is no exception. First of all, the co-trainers Tin Sy Nguyen and Citoyen Itoko Y'Oluki should be thanked for sharing the responsibility and work of the training. Their professionalism, skills and energy were responsible for the workshop's success. An equally strong thank you is reserved for Steven Brewster and Citoyenne Matondo Mansilu for keeping everything running smoothly.

Dr. Franklin Baer, Project Manager of SANRU-86, deserves special thanks for taking the time and allocating the resources to adequately prepare for the workshop. Thanks are also due to Rick Thornton and Citoyen Utshudi of the USAID Mission Health Office for all their logistic support.

In Nsona Mpangu the support and assistance of the community and hospital and school staffs was much appreciated. Special thanks go to PCVs Dee Borgman and Nanda Duhe and Director des Etudes, Citoyen Mbezi, for sharing their houses with participants and staff. Citoyen Bifuanga, Paster of Nsona Mpangu, and Citoyen Kapasi, Prefet des Etudes were also very helpful, as was the entire hospital staff. Special thanks are due to the four women who worked from dawn to late at night to make sure that we were well fed and also to those who did the laundry and the skilled workers who helped with the construction work. Thanks also are extended to the community and leaders of Bete who opened their village to the trainers and participants and helped them learn how to be more effective.

Thank you also to the administrative staff of SANRU-86 and to Citoyen Dianzola Lufwakasi who typed the draft of this report. Special thanks also to Citoyen Vangu Sadi, Commissaire de Zone Assistant de Songololo, for presiding over the closing ceremonies and Citoyen Kayi, Chef de Collectivite de Bamboma, who opened the workshop and returned for its closure.

Most of all thanks go to all the participants for their participation and cooperative spirit. If the workshop was a success, the credit goes to them.

Chapter 1

INTRODUCTION

The need for additional sources of potable water in the rural areas of Zaire is a major public health concern of the Government of Zaire and the agencies assisting it. The SANRU-86 rural water supply project is funded by USAID and the Government of Zaire (GOZ) and administered jointly by the GOZ Department of Public Health and the Church of Christ in Zaire (ECZ). SANRU-86 is a multi-purpose, five year public health project assisting 50 selected rural hospital zones. The project provides equipment, materials, and training to the Zairian staff of these rural hospital zones.* Appendix B gives the current status of the project.

SANRU became interested in WASH assistance for its nascent water supply efforts at the end of 1981. Planning for training programs and technical reviews in water supply were started in the spring of 1982. A formal request for WASH technical assistance was made by the USAID Mission in Kinshasa in June 1982. In 1982 WASH conducted a training of trainers workshop for SANRU-86 nurses, conducted a workshop in spring capping techniques for Peace Corps Volunteers working in public health projects alongside SANRU-86 nurses, and designed a spring capping workshop, and pilot tested a spring capping design for SANRU-86 nurses. Three more spring capping workshops were run in 1983 by SANRU-86 staff based on this design.

Given the success of the spring capping workshops, Dr. Baer became interested in training SANRU-86 nurses in other methods of rural water supply. WASH completed a design for such a workshop and tested it in Togo in February 1983 (see WASH Field Report No. 87). Baer requested Goff's participation at the SANRU-86 National Conference held in March 1983 to discuss spring capping, wells construction and rainwater harvesting with the doctors and other representatives of the 35 rural hospital zones included in the first two phases of the Project. The USAID Mission formally requested Goff to return to Zaire in February to attend the conference and plan two rainwater harvesting workshops if appropriate to the needs identified at the National Conference. Goff determined that a need existed for rainwater catchment systems and recommended holding rainwater catchment workshops in Bulape in Kasai Oriental and Nsona Mpangu in Bas-Zaire.

SANRU-86, through the USAID Mission in Kinshasa, requested WASH Project assistance in conducting these workshops in August and September. WASH was unable to meet the August schedule for Bulape and it was decided to hold one workshop in Nsona Mpangu. That workshop could not be held until after the end of the fall rainy season in Bas-Zaire and the date was set for January 1984.

* Further information concerning SANRU-86 can be found in WASH Field Report No. 73 "Training in Spring Capping for Field Agents in Zaire."

Chapter 2

PLANNING AND PREPARATION

2.1 Workshop Planning

As noted in Chapter 1, the initial planning for a rainwater catchment workshop began in January 1983. Various questions of site and consultant availability, Peace Corps Volunteer (PCV) participation, WASH assistance in wells training, and workshop dates kept arising over the eight months. A positive result of all the delays was to give SANRU-86 adequate time to do an excellent job of preparing for the workshop. The workshop planning was also facilitated by the prior production and pilot testing of the training guide. They also had the opportunity of talking with the WASH consultant trainer about his report on the workshop and his recommendations for design changes.

Yohalem and Tin were fully briefed at WASH on December 29 and 30, 1983, left the United States on January 2, and arrived in Kinshasa on January 4, 1984. They met with Dr. Baer and the ECZ staff on their arrival. During their first few days in Kinshasa they met and worked with Rick Thornton, Health Officer, and Citoyen Utshudi, USAID Project Manager for SANRU-86 at USAID; Steven Brewster, Logistics Coordinator, and Citoyen Itoko Y'Oluki, Zone Supervisor for Kasangulu and Yohalem's co-trainer at ECZ; Jerry Wilkinson, Associate Peace Corps Director for Health, and Peace Corps Director Bill Pruit at the Peace Corps Office; and several of the workshop participants. Final arrangements were made for their departure for Nsona Mpangu and supplies purchased before the trip. Yohalem and Tin also worked with Baer and Wilkinson on an initial design for the one week workshop in well construction and rehabilitation which was to follow the rainwater catchment workshop. They were greatly assisted by PCV Sarah Ford who had agreed to help facilitate that workshop with Tin's technical assistance. Citoyen Itoko left for Nsona Mpangu on Friday, January 6, and Yohalem, Tin, and Brewster followed on Monday, January 9, 1984.

2.2 Workshop Preparation

2.2.1 Logistic Preparation

Preparations for housing and feeding 25 participants at the Nsona Mpangu Mission were difficult because of the isolation of the site and the lack of a market at Nsona Mpangu. Because training in water supply ideally includes the variety of skills needed to plan, organize, implement and maintain a community based water supply program and a village community is needed as a "laboratory" in which to study and learn many of the organizational skills needed for project success, SANRU-86 had initially hoped to be able to find a village near Nsona Mpangu to use as a training site. However, the lack of adequate accommodations and potable water prevented them from selecting a village. The Mission of Nsona Mpangu had enough beds, available classroom and dining space, and a good source of potable water. It also had a generator which provided electricity from 6:30 to 9:30 p.m., an existing rainwater catchment system on one of the hospital buildings, a need for an additional potable water supply,

and an active and effective village health program under the direction of a dynamic SANRU-86 Zone Administrator, Citoyenne Matondo Mansilu. Its proximity to the village of Bete (five kilometers north of Nsona Mpangu) and the interest of the villagers of Bete in participating in the program was the final factor in leading SANRU-86 to decide on Nsona Mpangu for the training site.

Citoyen Itoko made three trips to Nsona Mpangu before the arrival of the WASH consultants and started making plans and preparing local villages to gather the sand and gravel needed for the cistern construction and to solicit their support for the workshop activities. During one of these visits Itoko and Brewster also talked to the mission hospital staff about their needs for water and discussed several possible sites for additional rainwater catchment systems. They also toured possible sites for the well construction and rehabilitation training which was scheduled to follow the rainwater catchment workshop.

Upon the arrival of Yohalem and Tin in Kinshasa, Itoko and Brewster briefed them on the logistics preparations and the various training options. Yohalem and Tin worked with Baer, Thornton, Utshudi, Wilkinson, and Ford on finalizing plans for the rainwater workshop and helping SANRU-86 and Peace Corps design the wells workshop up to the arrival of the participants on Sunday, January 15, 1984.

2.2.2 Training Session Preparation

The three co-trainers reviewed the Training Guide in detail and allocated responsibilities for all of the training activities in the 19 sessions and prepared all the flip charts that would be needed for the various sessions. (All the workshop's visual aids and handouts along with the revised French and English training guides were left with Frank Baer for future SANRU-86 workshops.)

Tin divided his time between reviewing the guide, preparing technical lecturettes, and supervising the start of the construction of the cistern and gutters for the demonstration system. A local mason and four assistants worked three days excavating and laying the foundation and starting to construct the brick walls of the cistern. A welder from a local cattle ranch worked for two days constructing the gutters and drain pipe out of 3 mm corrugated iron sheeting and bailing wire (see Appendix E for design drawings). It was decided to start this work before the workshop to allow the workers to be well supervised by Tin who would be occupied with teaching sessions once the workshop began. This approach proved useful in allowing the participants to complete the rainwater catchment system during the time allotted to this task during the workshop.

Chapter 3

THE WORKSHOP

3.1 Site and Logistic Considerations

The Rainwater Catchment Workshop was held from January 16-27, 1984, in Nsona Mpangu, Bas-Zaïre. Most of the 19 participants and four training staff were lodged in two houses which were made available by Citoyen Mbezi, Directeur des Etudes for the Secondary School, and the hospital administration. The four female Peace Corps Volunteers were put up by two PCV teachers at the mission secondary school, Dee Borgman and Nanda Duhe. Some of the staff and participants stayed with participants who came from Nsona Mpangu.

The primary school made a large classroom available for all classroom sessions. The room was large enough to allow the group to split up into subgroups. Field work took place in Nsona Mpangu and Bete with the cordial cooperation of both communities.

3.2 Participants

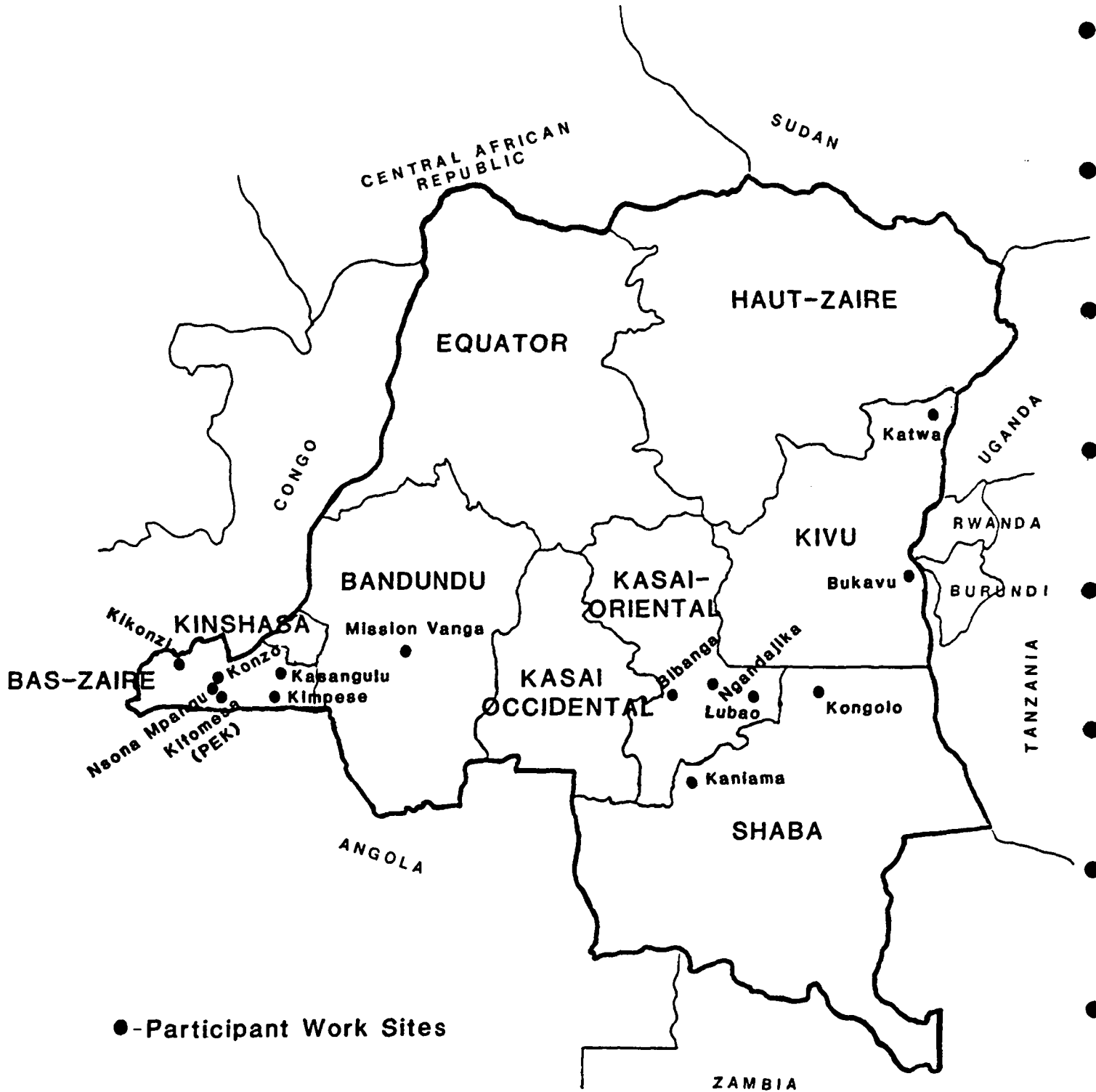
Nineteen participants (nine Peace Corps Volunteers and ten Zairian village health, agriculture, and rural development workers) came from 14 work sites in six regions (see attached map and Appendix C for a full list of the participants). Four of the Zairians and five of the Peace Corps participants had previously received spring capping and wells construction training at Nyangezi and Kimpese. All had experience in village water supply and health and sanitation projects and quickly grasped the subject matter of the training.

3.3 Workshop Goals

The overall goals of the workshop for the participants were as follows:

- To learn and practice the major steps and basic considerations in planning and developing a rainwater harvesting project.
- To learn and practice how to assess a community's willingness and ability to support a rooftop catchment system.
- To learn how to conduct an inventory of local skills, materials and techniques which can be used in rooftop catchment.
- To practice the basics of cement mixing and use of mortar.
- To learn and practice how to choose the most appropriate technologies for tank and gutter construction.
- To learn and practice how to design a rainwater harvesting system and all the detailed steps and procedures for ordering construction materials.

ZAIRE



● - Participant Work Sites

- To learn and practice the basics of tank and gutter construction.
- To learn how to develop and monitor a maintenance plan which the community can use and implement.
- To learn how to develop action plans for promoting rainwater harvesting in project areas.

3.4 Workshop Schedule

The workshop consisted of 78 hours of practical and classroom instruction over ten and a half days. The sessions followed the logical progression of steps in planning, organizing and implementing rainwater harvesting projects including initial technical and social evaluations, project planning and system design, preparing for and carrying out the construction of the system, and preparing the community for their responsibility in monitoring and maintaining the system. Classroom lectures and discussions were combined with practice in Nsona Mpangu and Bete. The participants conducted a resource inventory, built seven cement jars, and installed a RWC system on a thatched roof house in Bete, discussed rainfall patterns and RWC systems, and made presentations on system maintenance to the Nsona Mpangu community. They also built a 4.86 cubic meter tank attached to 15 meters of gutters on one of the hospital buildings in Nsona Mpangu. The workshop schedule is given below.

3.5 Workshop Methodology

The workshop methodology was based on accepted adult learning theory. Participants were given the opportunity to actively participate in activities structured to introduce new skills or to improve existing ones. These activities were divided between classroom lectures, discussions, and small group tasks and technical practicals designed to give them hands-on experience with RWC system construction and community survey techniques.

Throughout all sessions, whether in the classroom or the community, the participants as a group were given help in understanding their newly acquired skills and knowledge, in generalizing from these new skills to what they knew from their previous experiences, and applying what they had learned in an observable manner. This last step helped them and the trainers to monitor their skill development in light of the individual session learning objectives which were discussed at the start of each session and summarized at the end. Monitoring the progress of training was also helped by having a mid-point evaluation after the first five and a half days. There was also a final evaluation of the training held at the end.

The sessions were varied with different kinds of learning activities to maintain a productive learning climate. These activities included short lecturettes, large and small group discussions, case studies, role plays, and learning tasks done individually, in pairs, and in trios. The practicals were technical and community oriented in nature and held in Nsona Mpangu and Bete. Sessions were designed to take no more than four hours at a time with the

WORKSHOP SCHEDULE

DAY ONE	DAY TWO	DAY THREE	DAY FOUR	DAY FIVE	DAY SIX
a.m. #1 Introduction to workshop (30 min) #2 Developing a project (2 h 10 min)	#4 Conducting a community social assessment	#6 Building cement mortar jars	#7 Choosing the appropriate storage and guttering technology	#8 Sizing the tank	#10 Planning for construction Mid-term evaluation
p.m. #3 Initial technical assessment	#5 Conducting a community resource inventory	#6A Thatch roof catchment and filtration		#9 Designing the system	#13 Construction of RWC system
DAY EIGHT	DAY NINE	DAY TEN	DAY ELEVEN	DAY TWELVE	
a.m. #1 Preparation for construction	#12 Developing a plan for maintenance	#14 Critique design, refine design	#15 Making and connecting gutters	#16 Conclusion: planning of the workshop in "home villages" #17 Final evaluation	
p.m.	#13 Construction of the tank: Full time			Closing ceremony	

exception of Session 7 which was split up into morning and afternoon sessions, and Session 13, constructing the RWC system, which took five afternoons. Whenever possible, practicals were scheduled for the afternoon and classroom sessions in the morning.

The training was conducted by three trainers working in close collaboration. David Yohalem took primary responsibility for most classroom sessions and the overall management of the training program. Tin Sy Nguyen was responsible for the technical practicals, completing the demonstration systems, and providing technical information in classroom sessions. Citoyen Itoko Y'Oluki was responsible for assessing participant responses and learning, maintaining a healthy learning climate, assisting in the delivery of many classroom sessions and helping the logistics coordinator. The three trainers worked closely together during the week preceding the training and had meetings each night to review the day's work and make final preparations for the next day throughout the training program.

3.6 Training Activities

3.6.1 Opening Ceremonies and Introduction

The workshop was officially convened by Citoyen Kayi, Chef de Collectivite de Bamboma on Monday morning. The first session was taken up by staff and participant introductions, a brief presentation on the background of the workshop, and rainwater harvesting as a means of providing a rural water supply.

3.6.2 Developing a Rainwater Catchment Project

Tin introduced the steps required for the development of a RWC project as given in the Project Development Task Guide and discussed them with the participants. The participants then worked in small groups of three and four to discuss the applicability of the guide to their work in Zaire. The participants shared their views with each other and discussed the need for greater emphasis on community participation and involvement throughout the process, the need to evaluate the community's desire for a water project and its capacity to undertake a project before evaluating its technical feasibility, and the need for flexibility in following the steps. Afterwards the participants themselves listed the prerequisites for a successful RWC project and shared them with the group, and the session was brought to an end.

3.6.3 Initial Technical Assessment

Tin led the Monday afternoon session on how to conduct an initial technical assessment based on rainfall statistics and the computation of the yield of a given roof. The group practiced computing roof yields and discussed how to determine whether it is technically feasible to undertake a RWC project given roof yields, length of rainy season and consumption patterns. The participants were then divided up into small groups and went out into the community to collect rainfall information and determine the community's experience with and interest in RWC. After the groups reported back their findings to the entire group, the session was reviewed and closed.

3.6.4 Conducting a Community Social Assessment

Itoko introduced Tuesday morning's session on conducting a community social assessment and split the group into two sub-groups. The first group had to design a strategy to collect information concerning a community's interest in a RWC project, and the second group had to design a strategy to present a project plan requiring substantial community input to a community meeting. Each group presented their strategies through role plays (using the other group members as the local community), and the entire group discussed the issues raised in the role plays and strategies. Individuals were then asked to apply what they learned from these sessions by answering questions about how they would do this work in the future.

3.6.5 Conducting a Community Resource Inventory

Yohalem started the morning session on community resource inventories by reviewing the components of a RWC system and soliciting a list of all the resources needed by a community to develop such a project. The participants then developed a resource inventory checklist and broke into four groups to plan how they would gather the information in Bete that afternoon. After lunch everyone went to Bete and conducted the inventory. Upon their return from Bete, the participants reviewed their findings and discussed their experiences in conducting the inventory.

3.6.6 Building a RWC System on a Thatched Roof and Constructing Cement Jars in Bete

All day Wednesday was spent in Bete demonstrating the applicability of an RWC system to a thatched roof and how to filter the water collected from such a roof and an inexpensive method for constructing mortar jars to hold water for a household. Because of early morning rains, the thatched system was done in the morning and the jars in the afternoon. The participants made gutters out of bamboo, attached them to the house using simple bush pole tripods and made a gravel and charcoal filter out of an oil drum to remove the color and odor thatched roofs give to water. After eating lunch in Bete, the participants split into six work teams and constructed large mortar water jars ("Thailand jars") using molds of burlap bags filled with sand that were plastered over. Another jar was also made using a wicker basket as an internal structure. Each jar was large enough to hold over 100 liters of water and was built with fewer than 25 kilograms of cement. After returning to Nsona Mpangu at the end of the day, the participants discussed the day's work and the problems they had encountered and listed the advantages and disadvantages of the technologies used.

3.6.7 Choosing the Appropriate Storage and Guttering Technology

After an introduction to the session by Yohalem, Tin gave a brief lecture on the various appropriate storage technologies and solicited information from the participants about how water is stored in Zaire and what materials are available for the construction of cisterns. The participants were then broken into two groups and the first group told to gather information from the

hospital staff concerning their needs for water and where and what kind of RWC system they would like constructed at the hospital. While the task was somewhat academic due to the fact that the cistern construction was begun before the arrival of the participants, they still benefited a great deal from the session and suggested the same site and construction material though they recommended a larger size tank. The other group discussed how to construct and attach gutters and downpipes for the same system. After the two groups made their presentations to each other, Tin and Yohalem led a discussion on the need for foul flush systems or other means of cleaning or filtering the first water off the roof. After lunch and the afternoon break, the session continued for an hour with a discussion of what storage and guttering technology was most appropriate and why the trainers had decided to construct the system at the hospital on the site and in the form, size, and manner chosen. The cost, and advantages, and disadvantages of alternative construction techniques and materials were mentioned.

3.6.8 Sizing the Tank

Friday morning the participants learned how to determine the optimum size for a tank by comparing roof yield to anticipated consumption. The relationships between roof and tank size, rainy and dry seasons, and yield and consumption were all taken into account. The graphical analysis suggested in the design was not a helpful learning tool, and it took the trainers a little time to get the point across using charts of monthly and cumulative yields and consumption estimates. A supplemental review of this session after the mid-point evaluation cleared up any of the confusion which existed after this session.

3.6.9 Designing the System

Friday afternoon the participants learned how to compute tank dimensions given a required tank volume. While the math for rectangular tanks is not difficult, computing the diameter of a cylindrical tank from volume is not easy and took a little extra time and a few examples. The rest of the session was spent computing the amount of materials (predominantly cement) needed for different construction methods for each step in the construction of a RWC system. After this session the participants returned to Bete to empty the forms used in the production of the cement jars and finish them off.

3.6.10 Planning and Management of Construction Operations

On Saturday morning, all three trainers worked together to help the participants think through all of the construction steps required in completing a RWC system and all of the key factors which have to be organized to make the construction process go smoothly. This led to a discussion of the advantages of good planning and preconstruction preparation. The participants were introduced to a calendar of construction events which they could adapt for any method of construction to help them plan and monitor the construction of a RWC system.



Splitting bamboo for gutters.
for thatched roof RW catchment
system.



Testing bamboo gutter.



Finished thatch roof RWS system.



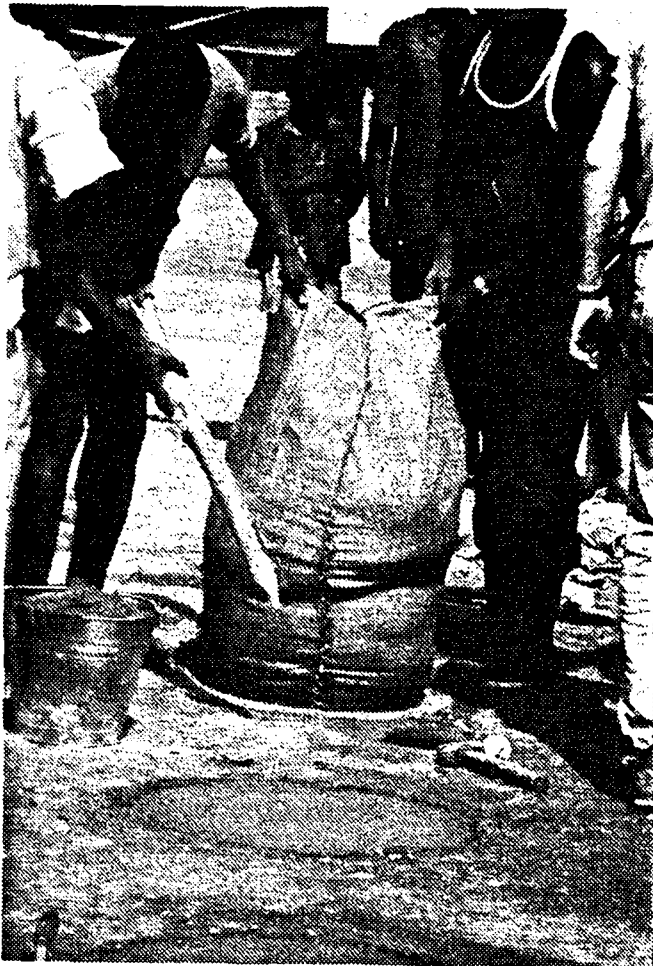
Making bases for jars.



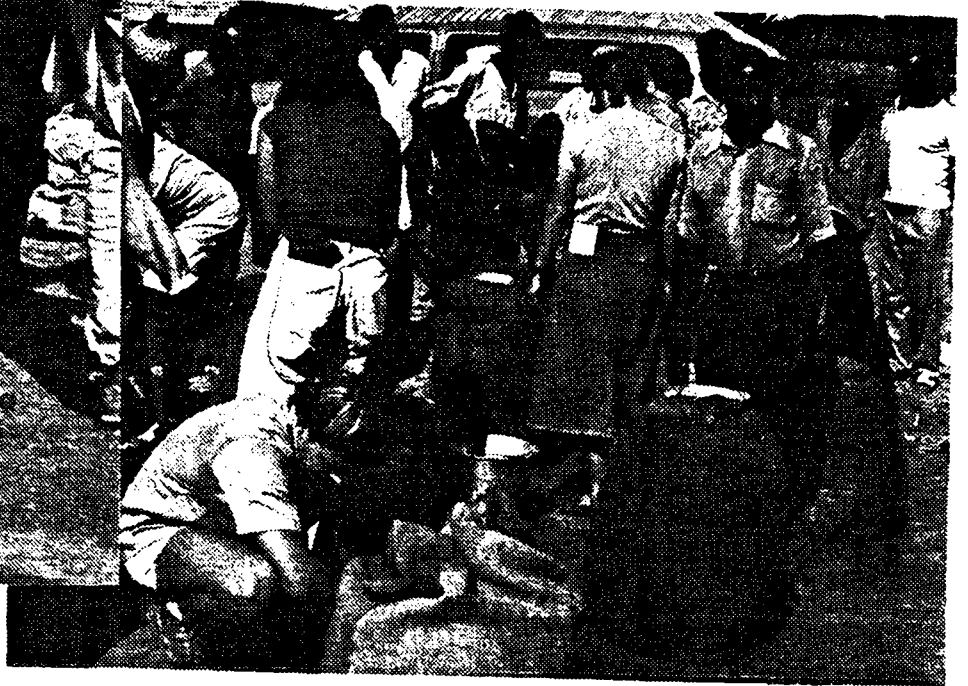
Stitching burlap for the mold.



Filling sacks with sand.



Distributing sand evenly in sack.



Making molds for jars.



Finishing plastering jar.

3.6.11 Mid-point Evaluation

The participants spent the last hour before lunch filling out a mid-point evaluation which the trainers used to monitor the progress of learning in the workshop. Two supplemental review sessions for some of the participants were scheduled as a result of the information gathered at this time.

3.6.12 Construction of the Demonstration System

On Saturday afternoon the participants started working on the demonstration system being built at the hospital. They made a reinforcing rod grill for a pavement under the faucet and poured that pavement and the base for the cistern using reinforced concrete. The construction of the cistern had been started by the masons under Tin's supervision the week before the start of the training so that it could be finished in the time allotted for practical work. By the time the participants started working, the site had been cleared and laid prepared, footings for the wall poured, and first foundation laid, and 50 cm of wall made of baked clay brick and mortar had been completed. One mason and four aids worked during the mornings to complete the rest of the work done by the participants. On Monday afternoon the participants laid brick (though this was cut short by rain). On Tuesday afternoon they applied a first coat of plaster to the finished wall. On Wednesday afternoon they applied a second coat of plaster, finishing the waterproofing of the tank, and on Thursday they completed the system by finishing the top and connecting gutters, downpipe, and filter to the cistern (see Tin's report on the practicals in Appendix E).

3.6.13 Preparation for Construction: Community Participation

After a day off on Sunday, the participants returned to work on Monday morning a little tired after an active weekend. Most of the morning was taken up discussing a case study of the problems involved in assuring active community participation and support for RWC projects. The discussion of the case touched a responsive chord and generated an in-depth discussion of the difficulties attached to getting a community involved in such a project. After this session, Yohalem reviewed Session 8 on determining the dimensions of a tank for those who were interested.

3.6.14 Developing a Plan for RWC System Monitoring and Maintenance

Tuesday morning was devoted to a long session on system monitoring and maintenance. The group generated a list of all the maintenance checks and procedures required in such a system, listened to a brief lecture, and discussed with Tin how to disinfect such a system. They then split into three groups and planned how to make three different presentations on these topics to different groups in Nsona Mpangu. After sharing their strategies for their presentations, they went out into the community to give them. The presentation on disinfecting a cistern for the high school students was followed by a demonstration of disinfection by Tin. After the demonstration Yohalem led a discussion of the morning's learning.

3.6.15 Critiquing and Refining the System Design

On Wednesday morning the participants worked in pairs and trios to go over the design of the demonstration system and critique the design now that it was in the process of being cast in concrete. The design groups were asked to make suggestions on how it could be done better the next time they did it. After each group made its presentations to the entire group, Yohalem and Tin led a discussion of the redesign suggestions. One criticism was used to change plans for a manual foul flush system and replace it with an automatic filter. After the session, Yohalem reviewed some of the math calculations from Session 9.

3.6.16 Making and Connecting the Gutters

On Thursday morning, after a brief review of the design of the gutters, the participants went to the work site and constructed and put in place the wooden supports to hold the 15 meters of guttering to catch the rain on one side of the roof. As the gutters themselves are simple to make but very time consuming, they were made before the session and only shown to the participants. While some participants were handling gutter supports, others constructed the sheet metal roof and prepared materials for the filter. They worked for three and a half hours and completed the work during the afternoon practical session.

3.6.17 Planning Applications of the Workshop in "Home" Villages

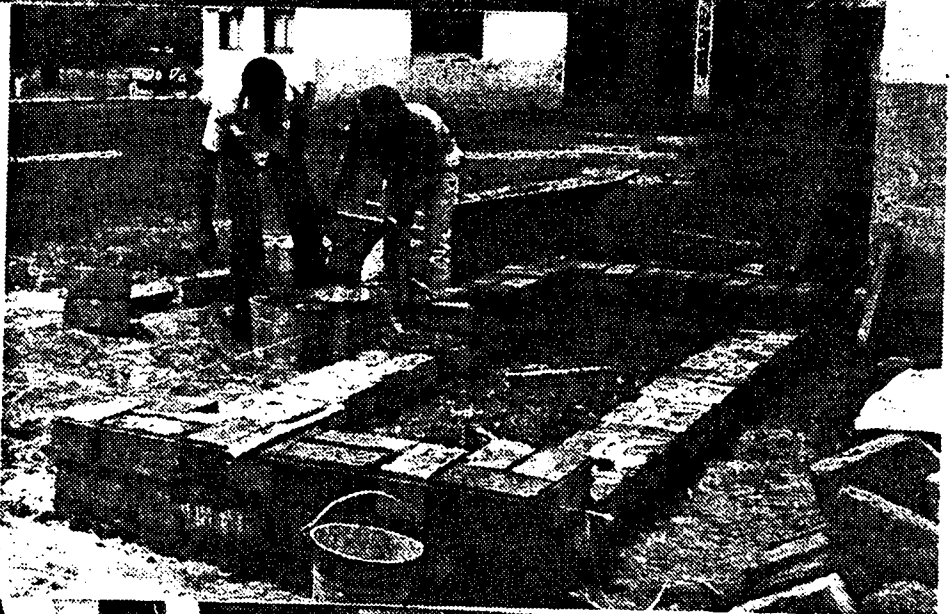
The final formal session of the workshop was held Friday morning, the eleventh day of the workshop. Participants spent time writing down any unresolved questions for which they needed answers and then discussed the changes in the project process that they would recommend. After this discussion, the participants came up with a list of the essential criteria in selecting a village for such a project. They were then asked to write down a personal action plan for how they would approach, starting work in such a village. After discussing their ideas with another participant, they presented their ideas to the rest of the group and a discussion on these points ensued. Afterwards, the group was asked to split into four groups and discuss their needs for institutional support to do their work. After sharing their lists with each other a final discussion took place. Their conclusions are reflected in the recommendations in Chapter 5.

3.6.18 Final Evaluation

Before ending the workshop on Friday, the participants were asked to fill out an individual evaluation form, a composite of which is contained in Appendix D. They also provided verbal feedback to the trainers on the strengths and weaknesses of the training. These will be discussed in the next chapter on the evaluation of the workshop.



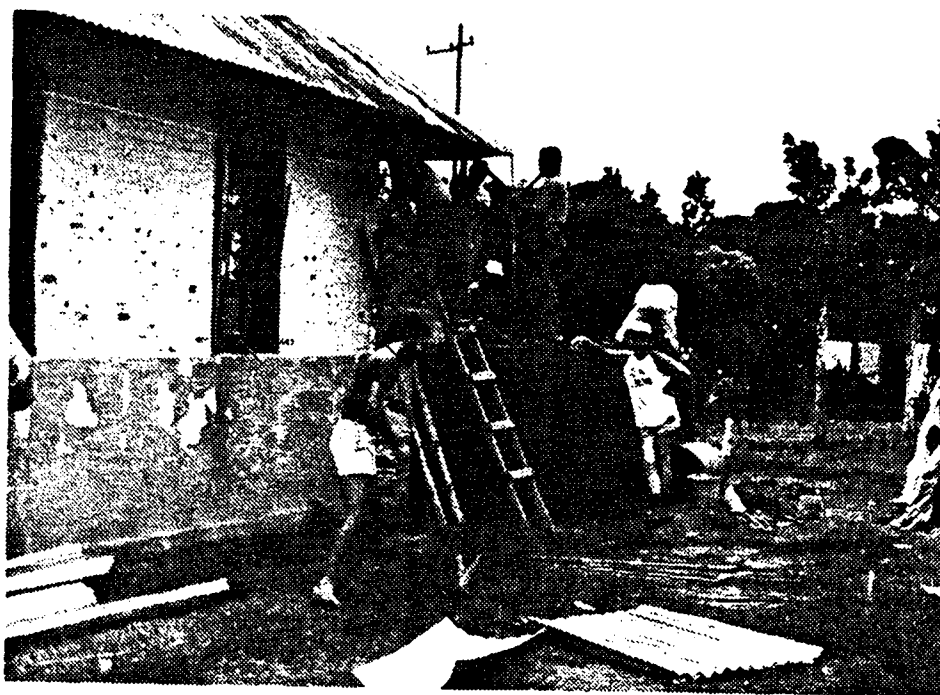
Starting footings for hospital tank.



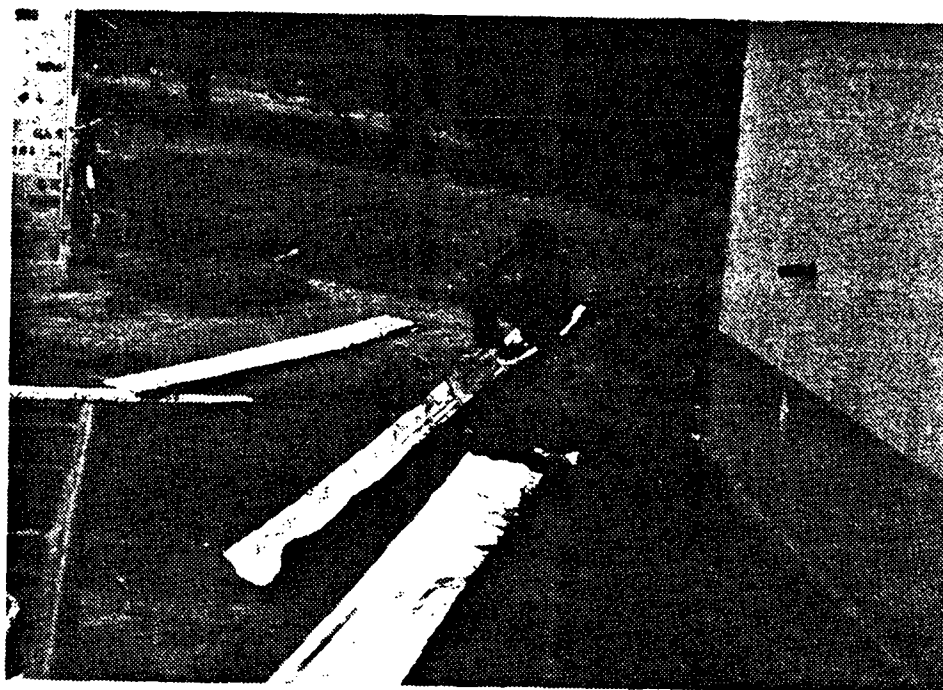
Starting tank walls.



Cementing tank walls.



Lining up slope, finished tank.



Making gutters out of C. I. sheet.



Intstalling gutters.



Digging evacuation channel.

3.6.19 Closing Ceremonies

The rainwater catchment workshop at Nsona Mpangu was formally brought to a close at an official ceremony presided over by Citoyen Vangu Sadi, Commissaire de Zone Assistant de Songololo. The Chef de Collectivite de Bamboma and the commandant of the Gendarmerie at Songololo were also present. Citoyen Matondo welcomed everyone, and, after a brief address on rural water supply by David Yohalem, Citoyen Vangu Sadi presented certificates (see Appendix G) to the 19 participants. Everyone then went to the hospital where the Commissaire de Zone read a brief address and cut the ribbon inaugurating the hospital's new rainwater catchment system.

3.7 Workshop Costs

The total cost of the workshop excluding trainer salaries and consultant travel and per diem was approximately \$4,000. This comes to \$105.00 per trainee per week for the 19 trainees over two weeks. The following table gives rounded dollar figures for several categories of expenditures. More detailed local currency figures can be found in Brewster's site report, Appendix F.

<u>Training and Practicals</u>	<u>Site and Logistic Costs</u>
Hospital RWC system \$335.00	Site preparation and training preparation visits \$335.00
Other construction 90.00	Food for 23 people for 14 days 1,100.00
Construction tools 525.00	Lodging 33.00
Pedagogic materials <u>60.00</u>	Personal expenditures 150.00
Total \$1,010.00	Salaries for Cooks, etc. 200.00
	Fuel for 2 vehicles 900.00
	Pocket money and other costs <u>272.00</u>
	Total \$2,990.00

Chapter 4

ASSESSMENT OF THE WORKSHOP

4.1 Participant Evaluations

The participants were quite pleased with the design and implementation of the workshop. This was shown as much by their active participation in all sessions as their comments on the final and mid-term evaluation forms and during formal feedback sessions. All of the 19 participants attended all sessions, arrived for them on time, and actively participated in discussions and practical work. There were also frequent discussions during free time of subject matter raised in the workshop.

The mid-point evaluation pointed out the need to review Sessions 8 and 9 which required extensive mathematical calculations, and time was made available for those reviews early in the second week. The evaluations were generally positive concerning the design and implementation of the training sessions and the logistic considerations though some participants complained that the pocket money allowance of 20 Z* per day was too low. The most positive aspect of the week for many of the participants were the practicals conducted at Bete on Wednesday. Several participants noted the growing tension and social separation between some of the Peace Corps and Zairian participants. Fortunately this conflict surfaced on Tuesday and was talked out and was no longer a problem during the workshop. Finally, one Peace Corps participant showed her knowledge of adult learning theory when she remarked "I'm not much for role plays and dividing up into small groups. I bet a case of Simba that this format was designed by someone from California!"

The final evaluations were quite positive. The evaluation form and a composite of the goal attachment scores and comments is included in Appendix D. The overall goal attainment for the workshop was 4.1 with a high of 4.5 for sessions 1, 2 and 5 and lows of 3.67 for Session 13 and 3.75 for Sessions 4, 8, 11, and 14. All the other sessions were rated between 4.0 and 4.4.

The most positive aspects of the workshop for the participants were the practicals and work within the two communities, the management and organization of the sessions, the emphasis on planning and organization, the open discussions and spirit among staff and participants, and the excellent logistics. The most negative things about the workshop in their opinion were the lack of structure of the first few RWC system practicals in which they were not involved in all the steps of the system's construction, there was not enough information on alternative construction technologies and costs, and for some PCVs too much emphasis on community evaluation and participation. Some Zairians felt that the last few sessions had become too repetitive.

Several things stood out as the most important thing about the workshop: the importance of community evaluation and participation (4 respondents), emphasis on planning and organization (3), RWC system construction at the hospital (2);

* US\$ 1.00 = 30 Zaires

thatched roof practical at Bete (2), realizing that RWC systems are practical and feasible for rural Zaire, participants helping each other after sessions, on-going critique of the work in progress, and calculating the dimensions of a cistern. The participants were generally positive about the way the workshop was planned and organized, though some added the criticisms noted above. These were also obvious in their responses to how to improve the workshop in the future. They said that the workshop needed to have better organized practicals, more trainee involvement in demonstration system planning and all stages of construction (i.e., not starting construction before the start of the workshop), more time in the schedule for practicals, more training on alternative construction technologies, information on costing out of all construction steps as they went along, waiting for everyone's arrival before starting practicals, more technical handouts, longer morning breaks, larger pocket money allowances, funds available for follow-up work, and both a shorter and a less time-conscious schedule and another week of training to cover everything that was missing.

The participants touched on one or two of almost all the workshop skills in their reply to the question about what they need to learn more of, and there were no clear patterns in the responses. Their comments on the trainers, on the other hand, were generally positive. With the exception of a few comments on the organization of the practicals and construction skills of the trainers, the rest of the comments were very positive stressing the professionalism, capability, friendliness, and collaborative style of the trainers (see Appendix D for details).

Finally, the following list was compiled during an oral feedback session during the final evaluation:

FEEDBACK ON WORKSHOP

<u>Workshop success</u>	<u>Suggestions to improve workshop</u>
- spirit of trainers	- less emphasis on time schedule
- finishing demonstration system on time	- more breaks during the sessions
- food and all logistics	- improve practicals through:
- trainer-participant collaboration	● better preparation, organization and direction
- acquiring additional knowledge through the participants' experiences with each other	● giving participants more responsibility for work
- logical progression of sessions	● better organization of masons' roles
- training schedule modeled on project development stages	● more specific instruction on mortar and concrete mixtures, rebar spacing, etc.
- Bete practicals	

Workshop success

- constructive use of free time

Suggestions to improve workshop

- more and better processing of discussions at end
- how to do same with less materials
- more discussion on alternative construction methods and technologies
- more practicals during first week

4.2 Trainer Assessments

The trainers' assessments of the workshop reflected the same generally positive evaluation of the participants and the same concerns for improvement. All three trainers were very pleased with the logistical support provided by SANRU-86 and everyone in Nsona Mpangu. The smooth running of activities at the site allowed everyone to concentrate on the training. Much of the success here was attributed to the adequate preparations done by Itoko, Brewster, and Matondo and the adequate time the two WASH consultants had in Kinshasa and Nsona Mpangu prior to the start of the workshop. This permitted them to have most pedagogic materials ready before the workshop began and to have started work with the local masons on the hospital cistern before the participants arrived. The advantage of starting the work before the workshop as recommended in the training guide is to allow the technical trainer to be more available for classroom lectures and discussions during the first week, but this must be balanced with the participants' need to observe all steps in the construction of a RWC system. Some of the participants' criticism of the practical session was based on not being involved in the design of the system and not witnessing the preparation of the site and most important the laying of the foundation and footings for the wall.

The trainers were in agreement with the participants that the first few practicals at the hospital site were not organized enough, given the large number of participants and the available space in which to work. This was aggravated by the local masons not being adequately briefed and supervised concerning their roles as helpers. They kept taking over from the participants if they were not doing the task properly rather than showing them how to do it. These problems were cleared up after the first few practical sessions and the work went smoother after that. This problem, coupled with the fact that the cistern had to be started before the start of the practicals on Day 6 in order for it to be completed and the inability to demonstrate more than one method of cistern construction at a time account for the low goal attainment score for the practical and the criticism of this session. This criticism should be balanced by the fact that the entire system was completed by the end of the workshop, and that all participants had 18 hours of practical hands-on training in concrete preparation and pouring, bricklaying, mortar mixing and plastering, and construction and placement of gutters, downpipes, and filters.

The trainers felt that the goals of the workshop were attained and that all the individual session objectives had been met. They also felt that the goals were appropriate to the needs and skill levels of the participants. The trainers enjoyed working together and felt that everyone was professional, committed, and cooperative with each other and the participants. They made the following assessment of how to improve the workshop in the future:

- Conduct a learning-needs assessment or entry-skills assessment at start of workshop.
- Switch Sessions 3 and 4 so that rainfall calculations and roof yield calculations are done on Tuesday morning rather than Monday afternoon when people are tired from having travelled all day to the workshop the previous day.
- Weave more community participation objectives into the first week's sessions.
- Spread the two Wednesday practicals throughout the week and schedule them in the afternoons so that Session 9 is in the morning rather than the afternoon.
- If desired by the workshop sponsors, add a third week to the training and start technical practicals earlier in the first week in order to be able to demonstrate two or even three methods of cistern construction.
- Redesign Session 8 to make the calculations of the volume of the cistern easier to understand.
- Increase the pocket money for the participants.

In general the trainers were very positive about the design of the workshop, the excellent logistic preparations and management of the site, the learning of the participants and their own relations as co-trainers. They all felt that they had learned something themselves from the workshop and had improved their own skills. In short, the workshop was very successful.

Chapter 5

RECOMMENDATIONS

5.1 Introduction

This consultant's recommendations fall into two categories. First, recommendations concerning the continuation and expansion of SANRU-86's training of village health workers in appropriate technologies for village water supply and sanitation. Second, recommendations to USAID and SANRU-86 to expand their institutional support for village water supply throughout Zaire.*

5.2 SANRU-86 Training in Village Water Supply

SANRU-86 should expand its program of training village health workers attached to the rural health zones with which it is affiliated in village water supply and sanitation. The participants at the Nsona Mpangu RWC Workshop who had also participated in last year's spring capping workshops are highly motivated and adequately skilled to carry out the program's goals in the areas in which they had been trained. Many have been actively involved in spring capping and have now expressed interest in applying what they have learned concerning RWC systems. It will be interesting to note in the upcoming year to what extent the newly acquired skills and knowledge regarding project development and management will affect participants' performance. These are skills which continually need improvement and should be included in the design of any technical workshop.

SANRU-86 should repeat this workshop in other regions in Zaire in which it is working. The general project development and management skills are important, and RWC systems throughout Zaire are ideal for practicing them. Even in regions with less than abundant rains, where an RWC system can only hope to supplement and not replace other sources of water it is a valuable technology to introduce. More water, especially water that is available at home, is important for better health. The proximity of a water source, even if it is only available during the rainy season, will free village women for other more productive uses of their time, especially in agricultural production, and the costs and technology for constructing individual family or larger community RWC systems are within the reach of Zairian villagers.

If the skills of the participants at Nsona Mpangu are representative of the skill levels of other village health workers in the Project, the learning goals and design of this training program are applicable to them. SANRU-86 now has the capacity to train its staff without recourse to expatriate training consultants. Citoyen Itoko has the skills to direct such training with the assistance of someone with enough experience in construction technologies and supervision of construction workers to direct the practicals. SANRU-86 could also benefit from Steven Brewster's experience and skills in adequately

* Specific recommendations will also be made to the WASH Project concerning the adaption of the RWC Workshop Training Guide, but need not be included in this report.

preparing and managing the logistics required for such training. The cost of the Nsona Mpangu workshop (\$4,000.00 excluding staff salaries) is well within acceptable costs for such an extensive training program.

Finally, SANRU-86 should follow the model of adult learning and emphasis on project development as well as technical skill development inherent in the RWC Training Guide to develop similar training programs in wells and latrine construction. These additional two training programs along with the existing programs in spring capping and rainwater catchment would cover all the basic water supply and sanitation skills needed by village health workers. As the U.S. Peace Corps has shown itself to be interested in cooperating with SANRU-86 in this area, it may be advisable to work along with them in their development of a technical training component in wells construction for the new volunteers due to arrive this summer. The training design they develop might be applicable or adaptable to SANRU-86's needs. (WASH is currently developing Training Guides similar to the RWC Guide for spring capping, latrine construction, and handpumps.) Based on the experience at Nsona Mpangu, more cooperative efforts in training and programming between Peace Corps and SANRU-86 seem advisable.

5.3 USAID and SANRU-86 Support for Village Water Supply

There is a pressing need throughout Zaire to improve village water supply and sanitation. USAID should continue to support SANRU-86 efforts in this area and should investigate means of increasing them through SANRU-86 and other appropriate GOZ and NGO institutions. As mentioned above, rainwater catchment systems are an appropriate, cost-effective alternative and supplement to the more common methods of spring capping, gravity-fed systems, and wells. The specific choice of what are the most appropriate technologies for any given village has to be made by the village health worker, rural development worker, or water supply engineer in conjunction with the community. The value of using the first two types of village-based workers along with the third is their greater experience in, and respect for, involving the community in every step of the development of a water supply or sanitation project. The engineer can provide the technical assistance which is often required by larger more sophisticated systems such as gravity fed systems and wells with handpumps.

The village health workers attached to SANRU-86 are capable of playing a valuable role in this process. To maximize their potential, SANRU-86 needs to make additional funds available for their mobility (bicycles and motorcycles), for the purchase and transport of construction materials which cannot be provided entirely by the community, and for construction and technical tools and equipment. It is important to note that funds for construction materials should be expended judiciously. All efforts should be made to get villagers to contribute as much money as they can to such projects, but it is clear that, given the cost of such materials in the interior, matching funds need to be available or generous subsidies provided to make them affordable.

SANRU-86 should also provide additional technical and follow-up training to these individuals. Additional technical trainings is needed in wells and latrine construction and handpump installation and maintenance to complement existing training in spring capping and RWC systems. Follow-up training should take the form of brief review workshops, regional meetings with time for a

discussion of technical work issues, and on-the-job training by qualified technical supervisors. Where possible additional technical workshops and courses should be made available for those who would benefit most from them. SANRU-86 should also try to make qualified technical assistants available to the village health workers, provide them with adequate technical resource materials in French, and expand its newsletter to provide a means for sharing technical information and experiences.

SANRU-86 and the USAID Mission in Zaire should investigate appropriate means for providing regional and subregional technical and logistic support for village health workers. This support could include materials warehousing and transport, availability of dump trucks or other similar size vehicles for transporting sand and gravel to construction sites, and technical assistants and supervisors to help answer technical questions and design more sophisticated systems for water supply. As Peace Corps, UNICEF, and other village water supply projects would also benefit from such support, it may be valuable to proceed in a coordinated manner. Hydraulique Rurale in the Department of Rural Development might be the institution to provide such a support function. USAID should investigate the institutional capacity of Hydraulique Rurale to see if such an idea is feasible.

USAID should also help SANRU-86 secure greater institutional support from the GOZ to facilitate the necessary collaboration between rural health zone authorities and the political and administrative institutions on which they often depend at the regional, subregional, and zonal levels.

Finally USAID and SANRU-86 should continue to encourage and facilitate cooperation between the Project and the Peace Corps to better coordinate and integrate their complementary efforts in this area.

APPENDIX A

WASH CONSULTANTS ITINERARY

2 January 1984	Yohalem and Tin leave New York and Washington respectively.
3 January 1984	Arrive London, travel to Brussels and depart for Kinshasa.
4 January 1984	Arrive Kinshasa..
4-9 January 1984	Kinshasa.
9 January 1984	Depart Kinshasa for Nsona Mpangu, overnight in Kimpese.
10 January 1984	Arrive Nsona Mpangu.
10-29 January 1984	Yohalem and Tin in Nsona Mpangu
29 January 1984	Yohalem travels from Nsona Mpangu to Kinshasa.
29 January - 1 February 1984	Yohalem in Kinshasa.
1 February 1984	Yohalem departs Kinshasa for New York via Paris.
29 January - 3 February 1984	Tin in Nsona Mpangu.
3 February 1984	Tin travels from Nsona Mpangu to Kinshasa.
3 February - 18 February 1984	Tin in Kinshasa.
18 February 1984	Tin departs Kinshasa for Washington.

Staff: Bureau Médical de l'E.C.Z., B.P. 3555, Kinshasa-Gombe.
 Citoyen NLABA-NSONA, Directeur du Projet
 Dr. MIATUDILA MALONGA, Représentant du D.S.P.
 Dr. FRANKLIN BAER, Project Manager.
 Rév. RALPH GALLOWAY, Planning Coordinateur
 Mme. FLORENCE GALLOWAY, Training Coordinatrice.

SANRU 86

Objectif général du Projet : Assister 50 hôpitaux ruraux à établir des zones de santé rurales conformément au Plan d'Action Sanitaire 1982-1986 du D.S.P. Chaque Z.S.R. cherchera, avec l'appui de la communauté et d'un système de centres de santé auto-suffisants, à lutter contre les 10 maladies les plus fréquentes.

Extrants attendus du projet :

1. Etablissement d'un système de diffusion d'information et de statistique sanitaires au niveau national et au niveau de chaque bureau central de la Z.S.R.
2. Transformation de 250 dispensaires en postes et centres de santé par l'aide en équipement/médicaments de base et en formation/recyclage du personnel en soins de santé primaires :
 - 1.500 agents de santé communautaires
 - 400 accoucheuses traditionnelles
 - 750 infirmiers
 - 50 infirmiers superviseurs
 - 30 administrateurs
 - 50 médecins.
3. Promotion des activités des S.S.P. au niveau du village par création/aménagement de :
 - 3.000 comités de développement
 - 2.000 sources d'eau ou puits
 - 1.000 unités de C.P.S.
 - 1.000 boîtes de secours
 - 25.000 latrines
 - 250 unités de Naissances Désirables.

Financement :

<u>Agence</u>	<u>Montant (\$)</u>	<u>Désignation</u>
USAID	4.486.000 (en espèce)	Véhicules, médicaments, équipement.
G.Z.	2.324.000 (Fonds C.P.)	Formation, matériel didactique, transport
Corps de la Paix	350.000 (en nature)	Volontaires attachés aux Z.S.R.
E.C.Z.	2.795.000 (en nature)	Locaux, personnel des Z.S.R.

Réalisations (jusqu'à ce jour):

36 zones de santé sont actuellement assistées par SANRU (voir table 1 en annexe): la qualité et la quantité de l'assistance de SANRU-86 est toujours déterminée en coordination avec toutes les agences donatrices qui assistent la Z.S.R.

Contraintes :

- A- Organisationnelles :
 - Le Plan d'Action Sanitaire 1982-1983 n'est pas encore officialisé.
 - L'organisation de l'auto-gestion de la Z.S.R. pose encore des problèmes.
- B- Humaines :
 - Réduction du nombre des infirmiers qui acceptent de rester travailler dans les milieux ruraux.
- C- Matérielles :
 - Manque sur le marché local de produits pouvant permettre le renouvellement des stocks.
- D- Financières :
 - Manque des fonds pour le fonctionnement du bureau central de la Z.S.R.
 - Insuffisance des fonds de SANRU-86 à cause de : inflation, augmentation de la demande.

APPENDIX C
PARTICIPANT LIST

Susan Baker	Lubao, Kasai Oriental
Bassidi-Yongulu	Nsona-Mpangu, Bas-Zaire
Budje-Ne-Budje	Department for the Environment, Kinshasa
Dueme-Lomeka	Kasangulu, Bas-Zaire
Susan Esser	Bibanga, Kasai Oriental
Sarah Ford	Kongolo, Shaba
Gerard Gach	Bukavu, Kivu
Kilola Ndongala	Kasangulu, Bas-Zaire
Kimbembe Kina-kia-Kanda	Nsona Mpangu, Bas-Zaire
David Wesley Lile	Mission Vanga, Bandundu
Maniame Nteto	Konzo, Bas-Zaire
Mpanda-wa-Lunda	Kongolo, Shaba
Matasisulwa-ma-Vumi	Cedelo IME, Kimpese, Bas-Zaire
Matsoni-L. Nguba Kangu	Kinkonzi, Bas-Zaire
Ndongala-Lusevakweno	Nsona-Mpangu, Bas-Zaire
Peter Ryan	Kaniama, Shaba
Paul Wesson	Gandajika, Kasai Oriental
Edward B. Wilson	Kongolo, Shaba
Renee Witherspoon	Katwa, Kivu

APPENDIX D

Evaluation Form for Rainwater Harvesting

(Please do not sign your name)

A. Goal Attainment: Please circle the appropriate number to indicate the degree to which the workshop goals have been achieved.

Session #1: To familiarize the participants with the overall workshop process and the expectations of their participation.

4,5

1	2	3	4	5
Low				High

Session #2: To impart knowledge of the major steps and basic considerations in planning and developing a rainwater harvesting project. To adapt these factors to the unique conditions of the local setting.

4,5

1	2	3	4	5
Low				High

Session #3: To examine the feasibility of a rooftop catchment program in light of local rainfall patterns.

4,3

1	2	3	4	5
Low				High

Session #4: To enable the participants to learn how to assess whether a community is willing and able to support a rooftop catchment project.

3,7,5

1	2	3	4	5
Low				High

Session #5: To enable the participants to learn how to conduct an inventory of local skills, materials, and techniques which can be used in rooftop catchment.

4,5

1	2	3	4	5
Low				High

Session #6: To teach the basics of mixing cement and plastering and how to build cement plaster jars for individual rain catchment storage.

4,1

1	2	3	4	5
Low				High

Session #7: To introduce and practice using a series of criteria to reach an informed consensus on which storage and guttering technology to design and construct.

4,1

1
Low

2

4
3

1

7
4

1

5
5

High

Session #8: To teach participants how to calculate an "optimum" tank size and evaluate the result.

3,75

1
Low

1
2

5
3

6
4

5
5

High

Session #9: To describe, in enough detail to plan construction, all the components (parts) of the system to be built.

4,2

1
Low

2

2
3

1

9
4

6
5

High

Session #10: To teach all of the steps and procedures necessary for detailing and ordering the materials for construction.

4,3

1
Low

2

2
3

6
4

9
5

High

Session #11: To consider the process of organizing the community into construction working groups and develop a plan to do so.

3,75

1
Low

2
2

5
3

1

5
4

5
5

High

Session #12: To learn how to develop and communicate a maintenance plan which the community will be able to use and follow.

4,0

1
Low

2

4
3

4
4

2

7
5

High

Session #13: To learn the basic steps and processes in larger (community) storage tank construction.

3,67

1
Low

2
2

4
3

6
4

5
5

High

Session #14: To critically examine the tank design under construction and refine it for future use.

3,75

1
Low

2
2

4
3

3
4

1

7
5

High

Session #15: To learn how to construct and connect gutters.

4,4		2	1	5	10
1	2	3	4	5	5
Low					High

Session #16: To plan applications of the workshop to the work setting.

4,2		4	1	5	8
1	2	3	4	5	5
Low					High

B. Workshop Feedback and Learning: Please answer the following questions as fully as possible so that the trainers can learn how effective the workshop methodology was.

1. What have been the most positive things about this workshop? Comments:
practical work at Bete and hospital; work within the two communities; management and organization of the sessions; open discussions; emphasis on planning and organization; spirit among participants and staff; excellent logistics.
2. What have been the most negative things about this workshop? Comments:
Organization and structure of first few practical work sessions at hospital which did not maximize learnings through enough hands on experience and adequate discussions; not being involved in design decision for hospital cistern and not participating in construction of foundation; not enough info on alternative construction methods + ec. for some PEs: too much emphasis on community evaluation + participation; for some Zairians: last few sessions becoming too repetitive.
3. What one thing stands out as important to you in this workshop? Comments:
Importance of community evaluation and involvement (4); emphasis on planning and organization (3); RWC system construction at hospital (2); Thatched roof RWC practical at Bete (2); realizing that RWC systems are practical + feasible for rural Zaire; participants helping each other after sessions; ongoing critique of work in progress; calculating reservoirs
4. What things have you learned that you did not know before? Comments:
Constructing a RWC system in general (10); calculating the dimensions of a reservoir (7); cement construction techniques (6); ferrocement; bricklaying; construction of cement jacks (5); Thatched roof RWC system (3); project planning and organization (3); four other specific skills

C. Workshop Organization and Training

1. What comments do you have about the way the workshop was planned and organized? Several said well organized and planned, very logical, understandable and professional, excellent-flowed very well; and others added the following to their positive assessments: dragged in some places, too much repetition, poor organization of hospital practicals, more theory than practice, and the time limitations allowed for only a glimpse of the planning process.

2. What can be done in the future to improve a workshop like this? Better organize practicals, more involvement in planning all steps of practical construction, more time for practicals, more on alternative construction technologies, cost out construction as you go along, don't start work until everyone is there, more technical hands, longer morning breaks, less time conscious could be shorter, add another week, add everything that's missing, larger walkaround allowance, funds for follow-up work.

3. What specific steps in developing a rainwater harvesting system do you feel you will need to learn more about in order to successfully promote and develop a project in the future? All construction skills, organization of construction, estimating material needs, designing foul flush systems - filters, constructing other forms + types of cisterns, involving and evaluating community, getting rainfall statistics, determining size and shape of cistern, do a RWE system with fewer materials, do one for a town.

4. What comments do you have about the trainers? With the exception of a few comments on the organization of the practicals and the construction skills of the trainers, the comments were very positive: very professional, friendly and well coordinated; trained in an exemplary manner; all did a good job; worked in frank collaboration with participants; very capable; aware and sensitive to different learning needs + styles; worked well together; impeccable spirit and enthusiasm; congratulations.

APPENDIX E
MATERIAUX POUR LES TRAVAUX PRATIQUES

Atelier de collecte d'eau de pluie. 16 au 27 janvier 1984.

I. Construction d'un système de collecte d'eau de pluie

Avec demi toit existant en tôle ondulée 15 m x 3 m = 45 m²

1- Construction d'une citerne 4 m x 1,50 m x 1,50 m de dimensions extérieures avec murs de 0,30 m d'épaisseur :

a- Briques 28 cm x 14 cm x 14 cm 770 briques
(y compris briques cassées pour fondation)

b- Ciment : (sac de 50 kg)

- Béton de fondation en briques cassées 3 sacs
- Dalle de fond de la citerne 1 sac
- Mortier pour joints de briques des murs 6 sacs
- Mortier de crépissage de murs 6 sacs

Total 16 sacs

c- Fer rond Ø 6 mm pour armature de la dalle 71 ml

d- Tôle 3 m x 0,90 m :

- gouttières et tuyau de descente : 4 pièces
- toiture de la citerne 5 pièces

Total 9 pièces

e- Filtre :

- Fût métallique 200 l 1 fût

2- 1 robinet et 6 m de tuyau galvanisé pour support de filtre, tuyau de trop plein et de drainage.

II. Construction de jarres et panier cimenté

- Construction de 6 jarres Thailand en ciment et un panier en bambou cimenté. 5,5 sacs *

- Construction d'un fût 200 l en ferrociment : 3/4 sac
2 m² de grillage et 8 ml de fer Ø 6mm

* 1.5 sacks used for mortar bases which cracked and were not used.
3 1/2 sacks were used for the 6 Thailand Jars and one for the whicker jar.

- Construction des gouttières en bambous avec filtre 1 fût 200 l 1 pièce

Tableau récapitulatif

- 1 - Ciment : $16 + 3,5 + 0,75 = 20,25$ sacs
- 2 - Fer rond \emptyset 6mm 71 ml + 8ml = 79 ml
- 3 - Tôles = 9 pièces
- 4 - Fûts métalliques 200 l = 2 fûts.

III. Main d'oeuvre

1 maçon et 4 aides-maçons

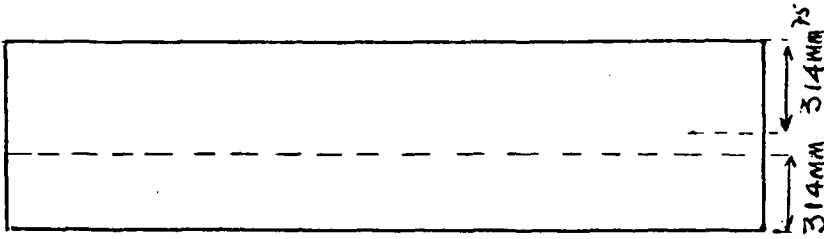
19 participants.

1 maçon et 4 aides travaillent 3 jours en avance pour la préparation de la fondation de la citerne et la fabrication des gouttières en tôles. Ils aident les participants pendant les heures de travaux pratiques et terminent leurs travaux inachevés.

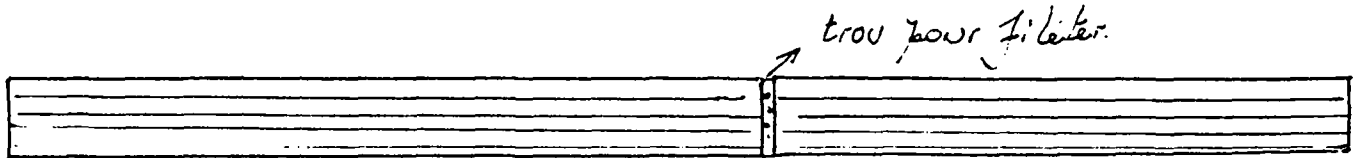
Nsona Mpangu, le 27 janvier 1984

Formateur de technique : Tin Sy Nguyen

TRAVAUX PRATIQUES



tôle de 3mm.



Ensemble de 2 pièces (tôles en de 20550)
(matière acier).
Epaisseur / 0,8mm.

CALCUL

Pour trouver le pliage du tôle.

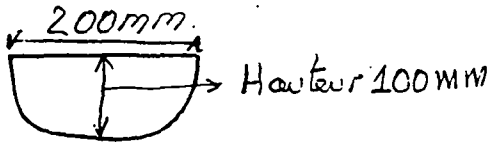
$$\frac{2\pi R}{2} = \frac{Circ}{2}$$

$$\pi \times 100$$

$$\pi = 3,14 \times 100$$

$$= 314mm$$

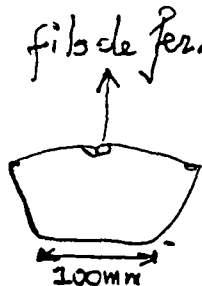
La longueur du tôle : $942 : 3 = 314mm$



- Pliage à main / 200mm.

- Hauteur / 100mm.

- Le support de Pliage est dit au fils S.V.P.



TECHNICIEN: ZOLA-VANA HENDRICK

CIE: P.E.K / B.P 94

POSTE RESTANTE / LUFU BAS-ZAIRE

PROJET / CONSTRUCTION DE GOUTTIERE D'EAU.-

APPENDIX F

SITE PREPARATION REPORT

SANRU/WASH Training Program For Rain Catchment
Nsona-Mpangu, Bas-Zaire

Prepared by
Steven Brewster.

Prior to being chosen as logistics coordinator, site checks had already been made and site preparation already discussed. Citoyen Itoko Y'Oluki, Co-trainer for this stage, had been to Nsona Mpangu twice. During his second visit in October, 1983, Citoyenne Matondo Mansilu, the Administrator of the Rural Health Zone of Nsona-Mpangu, agreed to help with the daily functioning of the seminar, ie. lodging, cooking, laundry, etc. It should be noted at this point that it is in large part due to her efforts that the practical aspects of the training session were accomplished without problems. Most of her free time and many hours taken out of her own work schedule were committed to the supervision of these activities, some of the lodging and classrooms were confirmed at this time. Availability of materials and laborers was discussed.

First meeting with Itoko and Matondo took place on December 23, 1983, in Kasangulu, 45 minutes from Kinshasa. We discussed the prior preparations, available facilities and materials, and a tentative menu.

The first part of the week of the 25th was spent planning and organizing logistics, and talking to various people working in water development in Zaire. It was suggested that Cit. Sowa, Director of Rural Water Development, be invited to help conduct the wells training session which was to follow the WASH training.

A final (site) check was made with Itoko Dec.29-31, 1983. On the trip down, a stop was made in Kimpese to make arrangements to buy cement at the factory. The first day was spent verifying and finalizing arrangements for accommodations and facilities, looking at possible sites for a cistern, and discussing with the population their water needs and its availability.

The second day was spent checking several possible well sites. A well was chosen for a pump placement during the wells session. We visited a source for sand located at 36 km from Nsona Mpangu which proved to be too fine for good concrete work. Another possible source of sand was suggested at 30 km from Nsona Mpangu in another direction. This was later found to be satisfactory. Noting the abundance of baked bricks available, it was decided to use them for the cistern construction. Arrangements were made to borrow shovels, picks, and wheelbarrows from a local agricultural school, Konzo Institute, for use during training.

The third day was spent discussing food and workers. A daily menu with estimated quantities was submitted to Matondo, along with Z 15,000, to help cover initial purchases. Numbers of workers and salaries were determined. The mason was hired. We arranged to borrow certain tools from the local carpenter.

The week of January 1, 1984, was spent finalizing the organization of the logistics, meeting and briefing the consultants from WASH about the preparations to date, discussing with them final arrangements to be made, and buying the construction and teaching materials. These purchases required trips to more than 15 stores and markets. Even with all of these stops, certain materials could not be located. Substitutions were made where appropriate. See Table A.

Itoko went to Nsona Mpangu with one of the vehicles on Jan.5, in advance of the rest of the trainers. This was to prepare the villagers for the work to come and the collection and transport of materials. Cement was purchased on the way down.

The trip with the consultants was made on Jan. 9 in the second vehicle. The back of the pick-up was filled with the various materials, including 4 barrels of fuel, an empty barrel, 56 meters of metal sheets, boxes of tools, trainers' luggage, etc. The week was spent preparing for the arrival of the participants on the 15th. Accommodations were made ready, local food purchases continued, and construction materials were collected. This included 5 trips over 20 km of bad mountain road (one hour to go one way) to get the bricks and 6 trips to get the sand at a distance of 30 km. These trips continued into the beginning of the training session.

The difficulty of organizing a seminar of 20+ people in a place like Nsona Mpangu cannot be overemphasized . It requires the cooperation of numerous groups and individuals, as well as many trips to various towns and cities for provisions, due to the site's relative isolation. Although it's fairly accessible by Zairian standards - 7 hours from Kinshasa by road and 2 hours from Matadi, there is little available in the immediate vicinity. Purchases must be made at a twice monthly market (very few items); Lufu - 40 minutes away (again, very few items); Matadi or Kimpese - each two hours away (most items must be bought there); or Kinshasa which is the only place to buy many materials and tools. This brings out very well the difficulties encountered working in Zaire, as Nsona Mpangu would be considered relatively easy to supply from a logistical point of view compared to other possible sites. The paragraphs that follow illustrate, in part, the cooperation needed and the difficulties faced discussed above.

Lodging was furnished by the school and the hospital. The trainers were lodged in the temporarily empty half of a missionary teacher's house. Female participants were lodged with two Peace Corps Volunteers who teach at the school. Male participants were divided between the same missionary's house as the trainers and an empty house of the hospital formerly occupied by a doctor. Beds and mattresses were supplied by the hospital and the public health team, blankets by the hospital, and sheets by SANRU. Towels were supplied by the Rural Public Health Zone of Kasangulu. All houses had running water and electricity in the evening, though it was suggested that there would be periods without due to lack of fuel, and that we would have to contribute some diesel if we wished to have electricity. This later proved to be the case.

The cooking for the two weeks of the training was done by 4 women working incredibly long hours - usually 6:00.A.M. to 10:00.P.M. The cooking for the one week in advance that the trainers were there was done by one cook. The laundry and house cleaning was done by two men. The dining room was in the trainers' house. Tables and chairs were contributed by the school and individuals on the mission. Dishes, utensils, pots, etc, were furnished by the Rural Public Health Zones of Nsona Mpangu and of Kasangulu and by Citoienne Matondo.

It was decided to have as varied a menu as possible. This was felt to be important to the good spirits of the participants - that if they were well fed, the rest of the training would be that much easier. Breakfast consisted of bread and margarine, coffee or tea, and fruit. Lunch and supper consisted of a main dish, vegetables, rice or potatoes or cassava, bread, and fruit. The main dish alternated between beef, goat, game, chicken, beans, fresh or salted or canned fish, and local dishes. The vegetable was usually cassava leaves, as that was the only one generally available. Fruit was usually bananas for the same reason, and even that was frequently not available. Fuel was dead wood.

The procurement of all these food stuffs was varied. Many items such as, rice, milk, salt, oil dried and canned fish, spices, soap, were bought in Matadi on two trips - one before the session and one during. Fresh fish was found at the Zaire River, one hour from Nsona Mpangu. Beef, chicken, and bread were obtained on a regular basis from a local ranch, 20 minutes away. Other small items were found in Lufu, 40 minutes away. A local hunter was hired for game. Goats, cassava roots, and beans were bought in surrounding villages; but the cassava had to be ground in Songololo, one ^{hour} away, on three different trips. Standing orders were given to several women from the villages to come in with their harvests of fruit and vegetables as often as possible. Deadwood was collected by hospital workers.

A classroom and fixtures were contributed by the church.

In sum, it required the cooperation of many organizations, the help of many people, and the nearly constant use of two vehicles. It took the cooperation of: the Rural Health Zones of Kasangulu and Nsona Mpangu; the hospital, school, and church of Nsona Mpangu; Konzo Agricultural Institute; and SANRU. The help included: Itoko, Matondo, 4 cooks, 2 laundry workers, 5 masonry workers, 3 chauffeurs, 2 carpenters, 1 welder, 6 local women who gave an occasional hand to the cooks on busy days and helped clean and ready the houses and other facilities, 3 members of the public health team who pointed out the various possible work sites, 2 Peace Corps Volunteers who shared their home, the chief of Bete, the villagers of Mpete who collected the sand, the people of Nsona Mpangu who collected the gravel, the hospital workers who collected the wood and ran other errands, and many others. Numerous trips were made to and/or purchases made in: Kinshasa - tools and materials (7 hours from Nsona-

Mpangu); Kimpese - cement (2 hours); Songololo - cassava mill and incidentals (1 hour); Kisonga - fuel (1 hour); Matadi - food stuffs (2 hours); Mpete - sand (1 hour); Lufu - incidentals (40 min); Kitomesa - food stuffs (20 min); Bete - vegetables (15 min); Mbata Bonde - cassava, etc (25 min); Kinganga - fish (1h15min); Ndemba - bricks (1 hour); and some others. All of which serve to illustrate that just the practical aspects alone of organizing a seminar in Zaire is a rather involved task.

Following is a cost break-down of the training session.

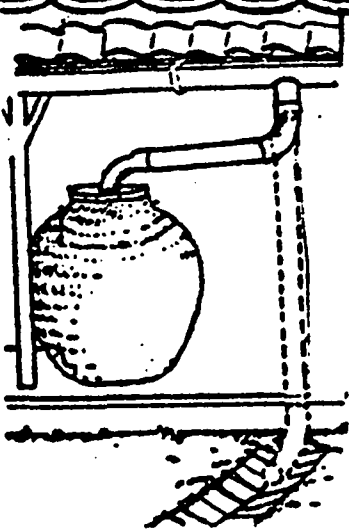
TABLE A Material and Construction Costs		
Item	Cost	
Construction Materials	Unit Cost x Quantity = Cost!	
I. Cistern		
A. Bricks	Z 1 x 770	Z 770.00!
B. Cement		
1. Foundation of wall	129.25 x 3 sacks	387.75
2. Center slab	" x 1 "	129.25
3. Mortar for wall	" x 6 "	777.50
4. Mortar for plastering	" x 6 "	777.50!
Sub-total	16	2068.00
C. Rebar (6mm)	6.92 x 71 m	491.32
D. Metal sheets		
1. Guttering	275 x 4 sheets	1100
2. Roof of cistern	" x 5 "	1375
Sub-total	9	2475
E. Filter		
1. Barrel	350 x 1	350
F. Piping		
1. Faucet	150 x 1	150
2. Pipe	108.42 x 6 m	650.52
Sub-total		800.52
T O T A L		6954.84

Item	Unit Cost x Quantity =	Cost	Cost
II. Jars			
A. Thailand Jars (6)			
1. Cement	129.25 x 5 sacks*	646.25!	
2. Sacking	65 x 12	780.00!	
<u>Subtotal</u>			1426.25!
(Cost of each	one = Z 237.70		!
B. Mortared Basket (1)			
1. Cement	129.25 x .5 c	64.60	
2. Basket	140. x 1	140.00	
<u>Subtotal (cost of each)</u>			204.60
C. Gutter and Filter			
1. Bamboo		0	
2. Barrel	300 x 1	300.	
3. Charcoal	50 x 1 sack	50.	
<u>Subtotal</u>			350.00
D. Ferrocement Jar (1)			
1. Rebar (6 mm)	6.92 x 6 m	41.52	
2. Chickenwire	40. x 3 m	120.00	
3. Cement	129.25 x 3/4 sack	96.94	
<u>Subtotal (cost of each)</u>			258.46
T O T A L			2,239.31
T O T A L all construction materials			9,194.15
Tools : 8 pails, 21 trowels, string, 3 kg of nails, 2 metal shears wire, 11 floats, 1 level, 2 metal brushes, 10 metal saw blades, 4 metal saws, 2 tape measures, 4 pliers, 1 hand drill, 4 bits, 2 meter sticks, 1 file			15,806.00
Salaries - 1 mason, 4 mason helpers, incidental help			3,675.00
Pedagogical materials - chalk, notebooks, paper, pencils, sharpeners, pens, erasers, tapes			1,872.65
T O T A L A L L M A T E R I A L S + L A B O U R			30,546.65

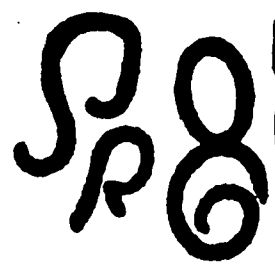
* see note on page 43 for actual usage.

T A B L E B

Item	Other	Costs	Cost
First site check - Itoko, May, 1983			1,400.00
Second " " - " , Oct. 1983			1,900.00
Third " " - " & Brewester, Dec. 1983			1,890.00
Pre-seminar stay of trainers - one week			4,820.00
Food - 2 weeks, 23 participants + trainers, 7 workers			33,179.00
Personal items - eg lamps, toilet paper			4,557.00
Lodging			1,000.00
Fuel - 409 l. gas 1181 l diesel			26,314.00
Salaries eg. cooks, laundry workers			6,000.00
Misc. - participants' per diem, transport, etc.			<u>7,376.00</u>
T O T A L			<u>89,455.00</u>
G R A N D T O T A L			Z 119,000.00



ATTESTATION



SANRU 86

Nous Soussignés, reconnaissons par la présente que

a suivi le cours de formation sur

**LA CONSTRUCTION DES SYSTEMES
POUR LA COLLECTE DES EAUX DE PLUIE**

En. foi de quoi la présente ATTESTATION lui est délivrée

**POUR LA DIRECTION DE
L'EQUIPE FORMATRICE**

David Yohalem

**DAVID YOHALEM
Water and Sanitation for
Health Project**



**POUR LA DIRECTION DE
SANRU-86**

Franklin C. Baer

**FRANKLIN C. BAER, Dr.PH.-
Administrateur du Projet**

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APPENDIX G