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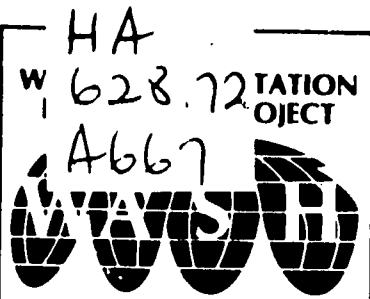
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**REVIEW
OF
AID
RURAL
POTABLE
WATER
PROGRAMS**

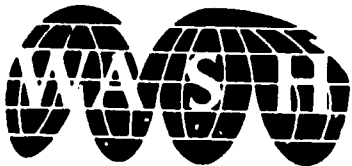
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16 - 29 NOVEMBER , 1980

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at Chapel Hill.

January 8, 1981

Mr. Allan R. Furman
Mission Director
United States Agency for
International Development
Port-au-Prince, Haiti

Dear Mr. Furman:

I have the honor to transmit to you herewith, for the WASH Project, twenty copies of a report on a review of the AID Rural Potable Water Program in Haiti. This review was made in consequence of the Mission's request of 28 October, 1980, in cable 5379. The WASH Project was authorized to perform this review by the AID/Washington Office of Health Order NO. 9, dated November 7, 1980.

The review was, in fact, made by myself during a visit to Haiti from November 16 to 29, 1980.

I will take this opportunity to thank you and you staff for the facilities provided me during my visit to Haiti, and particularly to thank you for providing me with the services of Engineer Edvard Oriol who was of great assistance in my work.

Either I, as a representative of the WASH Project, or the Office of Health, DSB, would be very interested in any comments which the mission staff may have on this report. If there are any questions about any of the comments made, I will be glad to try to answer them.

James Arbuthnot
Project Director

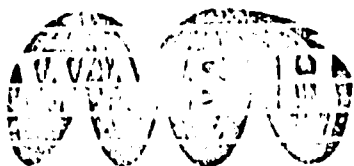


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Introduction

On October 30, 1980, AID/Haiti cabled AID/Washington requesting advisory services under AID's WASH Project "to help in review of one proposed and one on-going rural water systems OPG (Operational Program Grant) and to discuss program options in the rural water area". A copy of the cable is attached as appendix A. As a consequence of this cable, the Office of Health of the Development Support Bureau of AID authorized 14 days travel by WASH Staff to Haiti, and the writer arranged with AID/Haiti Chief Engineer, Tibor Nagy that the writer should visit Haiti for the period 16 thru 29 November.

The writer arrived in Port-au-Prince from Washington on Sunday, 16 November. On 17 November, discussions were held with the AID/Haiti mission chief, Mr. Allan Furman and with Mr. William Rhoads, Mr. Scott Smith, Mr. Gene George, Mr. Edvard Oriol and Mr. Frank Temmel of the AID mission. It was agreed that the writer would visit rural water programs assisted by AID in the north west and on the Isle La Gonave for the purposes set forth in the cable of October 30. The Mission kindly arranged that Mr. Edvard Oriol would accompany and assist the writer in these visits.

The writer's itinerary for the period November 16 thru 29 is given as Appendix B.

CARE Programs in Rural Water Supply

In 1976 CARE received an Operational Program Grant from U.S. AID/Haiti for the construction of about 25 small, rural, potable water systems (Phase I). In August 1978 CARE received a second grant, for \$101,000, for the construction of 18 to 25 additional small, rural potable water systems, three small irrigation systems and the repair or reconstruction of several of the original systems (Phase II). Phase II included provision for the assignment of an engineer from CARE's international cadre as Project Manager, but this person did not arrive and begin his work until July 1979.

In accord with the decisions of the meeting of November 17, the writer left Port-au-Prince on November 19 by road for north and west Haiti in the company of Engineer Edvard Oriol of the AID mission. CARE/AID water systems seen during this three day trip included those at:

Terre Neuve:	1.	Dolom
	2.	Rocher
	3.	Bois Neuf
	4.	Grosse Roche
Anse Rouge	5.	La Petite Place
	6.	Marrienne
	7.	Pointe des Mangles (well only)
Bombardopolis 8 and	9	Two deep wells (assisted informally by CARE)
	10.	Christ
Baie de Henne:	11.	Dug well
Chansolme:	12.	Nan Moreau
	13.	Nan Guerrier
	14.	Nan Beauvoir

The writer also had a number of discussions with Mr. Sami Boulos, the engineer assigned by CARE to be in charge of CARE's rural Water program.

The writer's principal conclusions are two fold:

1. The CARE/AID rural water supply program is an excellent program and should be continued.
2. The program is also highly imperfect and should be improved.

The program has in fact materially improved a number of Water Systems in rural Haiti. Most systems improved are really rural and improvements consisted of protecting a spring from contamination by people or animals using it and piping the water to a point convenient to rural people, who walk to it from, in some instances, miles away. One system seen provided a number of water taps in six locations on the main street of village of 3000 population.

The program has, in general, provided a sanitary, reasonably safe water to over 30,000 people who previously drank obviously polluted water. The program in a number of instances materially shortened the distance which water had to be carried every day. The program is also relatively cheap. Considering Phase I and II together, and allowing for incompleted and unsuccessful systems, costs may be in the order of \$8 per person served. This is a small fraction of the per capita costs projected for needed improvements in rural water supply around the world by the United Nations. (\$40 to \$25 per capita - 1978 dollars - in United Nations Decade Dossier, Page 12, released November 10, 1980).



One example of the health effects of spring improvement can be given. Carol Ann Crane, who operates a clinic adjacent to Christ spring near Bombardopolis, stated that typhoid materially decreased in the area within a month after the project improved this spring. She attributed the decrease to the improvements. Christ spring was highly insanitary before the improvements were made and is the only source of water in the area.

The project has also provided an example showing that reasonably sanitary water systems can, in fact, be quickly and cheaply constructed.

The principal defects noted in the project were:

1. Maintenance of the water systems by some local agency has not been arranged. In many of the water systems built, little or no maintenance will be required, but in some it will be, and no real provision has been made for this maintenance outside the project.

2. Not enough attention has been paid to the problem of drainage from the new water fountains provided. In many instances in strictly rural areas, this drainage has not resulted in additional drainage problems, even though the water fountains provided run day and night. In one instance observed, however, the wastage from the new fountains was breeding anopheline mosquitoes in a village of 3000 people. This problem must be addressed wherever new water pools are created, addressed either by providing good drainage, or by cutting down on water wasted, or both, or by some other measure.

3. In some instances it used PVC pipe in above ground, exposed conditions. This pipe is not sturdy enough for such use.

A number of other items considered to be defects, less important than those noted above, are listed in Appendix C.

Comments and Recommendations for CARE/AID Potable Water Program

An extension of the CARE/AID water program into a third phase is under consideration. The proposed Phase III is to provide five larger communities (4,000 to 7,000 persons each) with potable water as well as to construct three irrigation systems. Phases I and II have been very cost effective in providing good drinking water for rural people. They have provided safe, sanitary water sources where none existed before. A number of the new water systems have significantly decreased the distance water must be carried into the home.

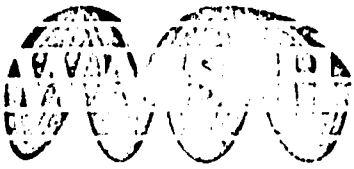
Phase III water systems will be similar to those of Phases I and II, except they will serve larger communities, and similar benefits should accrue from the systems of Phase III. The continuation of the program into Phase III is therefore recommended.

Defects in Phases I and II mentioned above and in Appendix C should of course be avoided in Phase III. Conversations with CARE Staff indicated the desirability of making suggestions in regard to two principal defects observed: poor drainage from fountains, and the lack of a maintenance organization outside the project. The writer's suggestions should not be taken as rules. They may be inapplicable at places or better methods may be developed.

Waste water from the fountains provided must not be allowed to breed additional mosquitoes. Probably the arrangement now followed at the Phase I and II water points of allowing water to run through these points continuously, day and night, will not be the best for Phase III. Taps on the lines will require maintenance, but could cut out three-fourths of the waste water and minimize the drainage to be provided. With the larger systems of Phase III, will come larger expenditures for larger and longer transmission mains, and the opportunity to save on the size of these mains by saving the water they transmit at night to use during the day, instead of running this water to waste. Drainage facilities which do not permit the development of new mosquito breeding facilities must be supplied for every new public water point of the new system. Probably most of these public water points should be supplied with faucets, or valves, or some method of minimizing waste of water, as this will also minimize the difficulty of providing drainage.

A system of maintenance which the CARE Engineer, Mr. Boulos, thought might be applicable would start by diverting part of the money to be collected from the communities served from the construction fund to a maintenance fund, and the selection of a man from each community served to be trained in operation and maintenance procedures. These men would be paid and supervised by the project, and would be provided from project funds with tools and equipment for maintenance and for making additional water connections.

During the projects' life, maintenance should be done by the project or under its supervision, but at the end of the project, each community would be left with necessary tools for maintenance, several years stock of supplies, at least one trained man, and money in the communities maintenance fund to pay the man and buy additional supplies.



Additional recommendations for Phase III are given in Appendix D.

Comments on the La Gonave Water Program

These comments must be tentative, based as they are upon less than 48 hours on La Gonave, and some conversations in Port-au-Prince.

1. There is a very great need for water systems in La Gonave. The people of about one-fourth of the island obtain water for their daily needs on average, from a distance of three and one-half miles! The rest of the island is somewhat better watered but still has a great need.

2. Several much improved, (much more sanitary) water systems were seen. Obviously some good work has been done in the Church World Services'(CWS) water program, even though only about half the water systems constructed are stated to be operating.

3. The project is very fortunate to have obtained the services of a professional hydrogeologist for several years at less than 10 percent of their commercial cost. His activities should result in basic information of great value to the development of a comprehensive plan for water supply on the island, and should be supported. At this time he needs complete chemical analyses of forty or fifty water samples, supplemented by perhaps half a dozen analyses monthly hereafter. He also needs facilities to determine chloride ion in water.

4. The proposed supply from the spring at Picmi entails about eleven kilometers of pipe to serve 4,000 people in four or five communities. This is a substantial engineering job but the Compassion International staff appear competent to design and construct it.

5. It appears Compassion International is permitted by AID to complete water systems not finished by CWS but is not permitted to repair systems completed but broken down. Repair of these broken systems, which in some instances operated hardly long enough for the people to become accustomed to them, would often be the most cost effective way to provide water in La Gonave. It is not the communities fault that the systems broke down, and these communities are not organized to repair them; neither are their people trained to perceive the difference in sanitary and insanitary water sources.

6. Food was not supplied for works done in September on a "Food for Work" program. This has happened a number of times.

7. Wells with pumps, such as that at Mahotiere, should provide entry of the pump pipe through a pipe sleeve cast into the concrete pump top. The sleeve should extend a couple of inches above the well cover and into the pump base, thus preventing the entrance of dirty water into the well under the pump base. At Mahotiere a mastic gasket was provided under the pump base to perform this function, but this gasket might not be replaced when the pump is removed and repaired in later years.

8. Experiments should be made in finding water, based on the premise that fresh water often floats on top, or overlays, brackish water, and can be obtained by skimming from above the brackish water.

A Suggestion for AID/Haiti's Rural Potable Water Program

The cable of AID/Haiti given in Appendix A asked for a "general review of USAID water system program" (third sentence from end).

The time allowed for this visit and the priority given to the CARE program and La Gonave field trip did not permit much of a general review, but one suggestion will be made.

The World Bank has offered Haiti, through SNEP, The National Water Supply Organization, as much money as it can absorb with its offer to finance systems in ten cities to the extent of about seven million dollars. (St. Marc, Jacmel, Miragoane, Aquin, Cayes, Leogane, Jérémie, Cap Haitien, Gonaives and Port- de Paix) PAHO/WHO has provided a technical advisor to SNEP.

It is understood that the Ministry of Health has also been offered considerable assistance for small water systems by international organizations.

AID/Haiti's decision to assist the rural water supply program primarily through Private Volunteer Organizations (PVO's) therefore still seems logical.

There are a multitude of PVO's doing water supply work in Haiti, with more or less technical competence, and greater



or less success. It appears that many of the PVO's have developed effective technical facilities or procedures quite suitable to the country. Nevertheless it is probable they could all profit from genuinely expert technical assistance if it were available.

Probably the most cost effective way to provide this expert technical advice would be by means of a well organized "workshop", or working seminar, in which each organization would present its successes and its problems and, hopefully, would learn from the successes of the other organizations and from the experts in attendance. The seminar should be moderated by an expert in rural water supply and sanitation, preferably one who has had some time to become familiar with the country and the staff of each of the PVO's working in rural water supply and sanitation.

The following PVO's and staff are reported to have done work in Haiti in this field:

CARE - Sami Boulos
Compassion International - Steve Goodwin and Dan Cook
Unevangelical Field Mission - Ben Loyer
Wesleyan Mission - Bernell Pudwell
DRIPP Project at Goave of the Canadian Government. (The work has ceased but the staff who performed it are still here)
Camp Perrin - Jean Sturmont
World Vision - George Fune
Oriental Missionary Society - Harold Brown
Albert Schweitzer Memorial hospital - Dr. Mellon or Levi Mast
Southern Baptist Mission - Jack Hancock
Catholic Church at Kenscoff - Pere Sicot

The list is probably incomplete.

Preferably an expert should discuss with each of these people or other representatives of their organizations, their successes and their failures and what they consider important problems. Preferably many of these people should write a short paper setting forth their successes, in some detail, for the elucidation of others. The papers should be reproduced in advance of the seminar, distributed, and taken as read, or some other method should be found to present facts and problems as a basis of discussion without taking up everybody's time listening to papers being read. Possibly synthesis statements of problems and successes could be prepared by workshop staff as a basis of discussion. In any case it would be expected that much transmission of information would occur and that a consensus of opinion would be obtained on many points, each of which would be set forth in a seminar report.



The operation of such a workshop might require the services of an expert in rural water supply and sanitation for one month; an expert in workshop or seminar operation for three weeks; a graphic artist (draftsman) for two weeks; a writer/editor for three weeks, stenographic and clerical help, etc.

The writer suggests that the opportunity of such a seminar should be taken to demonstrate the life cycle of the house fly and the mosquito, and simple methods of control of these insect vectors based on destruction of breeding places by sanitary measures. He believes PVO staff whom he met, would benefit from this information in their daily lives. Many PVO staff are influential in the communities in which they live, and would be in a position to spread this information. Perhaps two hours time of the workshop would be sufficient for this demonstration though it should be supplemented by volunteer field work in the company of workshop staff.

The writer also suggests that the seminar should discuss the basics of sanitary latrines suitable to rural Haiti, if the participants agree to such a discussion.

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INCOMING TELEGRAM

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ACTION OFFICE DIRECTOR
INFO AIA-01 LAEM-02 LA 3-03 LEAD-03 PACE-01 PDPP-01 PFFE-03
PPLA-01 STA-10 PPIA-02 IDCA-01 IF-01 POC-02 AADS-01
ENGT-02 CIR-02 DSAC-02 BORD-02 ENGR-02 ENG-01 PVC-02
ES-01 MEV-05 ONE-02 RELO-01 MAST-01 LACA-03 MP-01
/065 AI 3

6 GIVEN NEED TO AUTHORIZE CARE OPG BY DECEMBER, WOULD APPRECIATE KNOWING IF SUITABLE ASSISTANCE CAN BE PROVIDED ASAP. PLEASE ADVISE.
NIMELMAN

INFO OCT-01 /836 W 125544 2904492 /34

R 261930Z OCT 80
FM AMEMBASSY PORT AU PRINCE
TO SECSTATE WASHDC 7965

UNCLAS PORT AU PRINCE 5370

AIDAC

E.O. 12065: N/A

SUBJECT: WASH PROJECT-AVAILABILITY OF ADVISORY SERVICES

ATTN LAC/DR, DS/HEA

REF: STATE 278953

1. USAID PLEASED TO KNOW OF SERVICES OFFERED THROUGH WASH PROJECT AND INTERESTED IN AVAILABILITY OF 304EYERJAC VEH TECHNICAL ASSISTANCE FROM WASH EXPERT IN RURAL WATER PROJECTS TO HELP IN REVIEW OF ONE PROPOSED AND ONE ON-GOING RURAL WATER SYSTEMS OPG AND TO DISCUSS PROGRAM OPTIONS IN THE RURAL WATER AREA.

2. CAPE/HAITI HAS IMPLEMENTED TWO COMMUNITY WATER SYSTEMS PROJECTS IN NORTHWEST HAITI WITH OPG FINANCING FROM USAID. THESE PROJECTS HAVE CONSISTED PRIMARILY OF CAPPING SPRINGS AND DISTRIBUTING WATER TO SMALL RURAL COMMUNITIES. USAID IS NOW CONSIDERING A PHASE III PROJECT, ENTITLED COMMUNITY WATER SYSTEMS AND SMALL FARMER IRRIGATION, (521-D147) FOR APPROVAL IN DECEMBER 1980. THE PROPOSED PROJECT WOULD FINANCE THE CONSTRUCTION OF FIVE WATER SYSTEMS THROUGH CAPPING OF SPRINGS AND CONSTRUCTING DISTRIBUTION SYSTEMS IN COMMUNITIES WITH POPULATIONS OF 4,000 TO 7,000. THE PROJECT WOULD ALSO CONSTRUCT THREE SMALL IRRIGATION SYSTEMS IN THE SAME AREA OF THE COUNTRY.

3. USAID HAS AN ON-GOING OPG WITH A CONSORTIUM OF PVCS LED BY COMPASSION, INTERNATIONAL TO CONSTRUCT POTABLE WATER SYSTEMS ON LA CONHAVE ISLAND, BOTH THROUGH SPRING CAPPING AND WELL-DRILLING (PROJECT 521-D101). THIS PROJECT HAS EXPERIENCED SOME DELAYS, BUT IMPLEMENTATION IS EXPECTED TO ACCELERATE WITH THE RECENT PROCUREMENT OF A WELL-DRILLING RIG UNDER THE PROJECT.

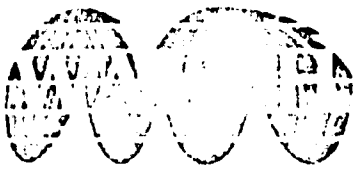
4. USAID ALSO PROVIDES GRANTS TO COMMUNITY GROUPS FOR WATER PROJECTS UNDER ITS SPECIAL DEVELOPMENT ACTIVITIES PROJECT 8062.

5. IN ADDITION TO THESE PROJECTS, USAID IS INTERESTED IN EXPLORING THE POSSIBILITIES FOR OTHER ACTIVITIES RELATED TO RURAL WATER SUPPLY. AVAILABILITY OF WATER IS A CRITICAL CONSTRAINT TO IMPROVING LIVING CONDITIONS IN MUCH OF RURAL HAITI.

TOB HAS RECENTLY MADE SIZEABLE LOAN TO COM MINISTRY OF HEALTH FOR SMALL RURAL WATER SYSTEMS, AND OTHER DONORS ARE ALSO ACTIVE IN WATER SUPPLY PROJECTS, SO USAID PLANS AND PROGRAMS MUST TAKE INTO ACCOUNT THEIR ACTIVITIES AS WELL AS BUDGET CONSTRAINTS ON USAID. WASH EXPERT IS NEEDED BOTH FOR SPECIFIC REVIEW OF CAPE PROJECT PROPOSAL AND MORE GENERAL REVIEW OF USAID RFR SYSTEM PROGRAM.

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APPENDIX B ITINERARY

- 16 November Travel from Washington to Port-au-Prince
- 17 November AID Office Port-au-Prince-Conference with Mission Director Allan R. Furman and staff. Discussion with Acting Chief Engineer Gene George and engineering staff. Called at CARE Office with Engineer Oriol.
- 18 November Observed well drilling operation of Compassion, Inc., with Steve Goodwin.
- 19 November Observed six AID/CARE water systems in Terre Nouve and Anse Rouge in company with AID Engineer Oriol.
- 20 November Observed three AID/CARE water systems in Bombardapolis and Christ with AID Engineer Oriol and CARE Engineer Bouloz.
- 21 November Observed three AID/CARE water systems in Chansolme
- 22 November Port-au-Prince
- 23 November Port-au-Prince
- 24 November Port-au-Prince-AID Office discussions in Engineering Office, and with Scott Smith, Head Project Design and Coordination and with Joel Cotten, AID Project Manager for La Gonave.
- 25 November To La Gonave Island with Steve Goodwin. Visited two water systems and Picmi spring (under construction). Discussions with Hans Spruijt, hydrogeologist, Compassion Inc.



APPENDIX B

- 26 November Observed several water systems including well Mahotiere near Pointe-a-Raquette. Discussed Picmi supply line with Dan Cook and an engineer employed by Compassion.
- 27 November Returned from Isle La Gonave to Port-au-Prince. Drafted Report on Haiti Trip.
- 28 November Presented Draft Report at meeting with Scott Smith, Head Project Design and Coordination, Joel Cotton, Frank Temmel and Edvard Oriol.
- 29 November Returned to Washington.



APPENDIX C

Minor defects noted in CARE/AID Rural Water Supply Project Phases I & II.

1. Basin manhole covers were usually sealed with concrete mortar. This may or may not be water tight but in any case is unlikely to be put back water tight with mortar once it is again opened. It is recommended that all manholes have a curb about ten centimeters high cast integral with the basin top completely around the manhole. The cover should have an overlapping edge turned down and should be heavy enough it will not be removed casually or by less than three men.
2. Some storage basins were constructed which have no function, other than possibly to meet SNEP suggestions (requirements ?)
3. Some springs protected went dry. Investigation of the dry season flow of all springs should be made before they are used as source. The spring may possibly be used as a source even if it is known to give little or no water in the dry season, but this should not come as a surprise.
4. Systems were constructed without any pipe bends smaller than 90 degrees. Some 45 and 22½ degree bends should be imported for future systems, and some existing systems could advantageously be altered by substituting smaller bends for present 90 degree ones (Nan Guerrier).
5. Threads of G.I. pipe have not been protected by a coating. (White lead in oil is often used). On average this may cut life of pipes from, say, 25 years to, say, 15 years, other things remaining the same. It is suggested that thread protective coatings be used in future and even for already installed pipes where pipes are exposed and need not be dug up to apply the coating.
6. Some transmission pipe lines were provided larger than they need be, except for SNEP suggestions (requirements ?) An effort should be made to obtain SNEP's agreement to the installation of the system at minimum cost, including minimum effective size of transmission lines. It is often economic in water supply construction to install transmission lines in stages (phases ?), say a 4" line now and a second 4" line ten years later instead of a 6" line now, even though the construction cost of two 4" lines is greater than that of one 6" line. This is done

APPENDIX C

on the basis that the present worth cost of the original 4" line plus the present worth cost of the second 4" line ten years later is usually less than the present worth cost of the original 6" line. This may be discussed with SNEP.

7. Two shallow wells were constructed, one at Baie de Henne and one at Point Des Mangles. Manhole covers of these wells should preferably be made as described in item 1 of this appendix. In addition, the pump suction should go through the well cover and not through the manhole cover. In the writers experience the pump installed is an inferior type which will not last long. For ordinary use a "pitcher" pump would be preferable with instruction of local people in changing pump leathers. Pitcher pumps are now in use successfully in the plain just north of Port-au-Prince. If irrigation water is required from these wells, a horizontal cylinder pump of about 4" diameter may be considered, set low upon the ground beside the well. A much cheaper design well may be used under the conditions in which these wells were constructed. In essence the recommended design consists of installing a good well screen or point horizontally at the bottom of the excavation, surrounding the well screen or point with sand to a depth of some feet, connecting the well screen or point to a pump at the ground surface and filling the balance of the excavation with the dirt removed. The saving arises in that the masonry walls of the well are not constructed. A masonry or concrete platform and drain must of course be built around the pump at the surface.



APPENDIX D

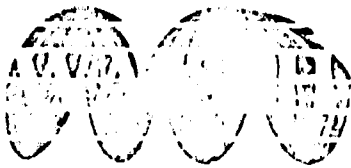
Additional Recommendations for Phase III

The small systems of Phases I & II have often been built without much effort at design, using for instance, the pipe that was available. This will not do for the larger systems of Phase III.

A rough engineering report should be made prior to construction of each water system, perhaps a dozen pages including sketches, (complete plans should not be required, as their preparation would be a substantial part of the cost of these systems). Included should be data on:

- A. Adequacy of source
- B. Information to permit check of hydraulics of transmission lines.
- C. Number of water distribution points, number of persons to be served at each, distribution system lay out, and information to permit check of hydraulics of distribution system.
- D. Maintenance System being developed, both short term and long term, to include statement of how funds for maintenance will be obtained, how competence of maintenance staff can be assured, who will make later connections to system, how these connections will be made physically and what equipment and supplies will be required to make them.
- E. Short description, or mention, of all elements of system.
- F. Quality of source.
- G. Possibility of extension of system to serve adjacent communities; Is source adequate, are there additional needy communities nearby?

As always in an engineering report at least one alternative design should be costed. In these water systems alternatives may include the cost of using alternative sources if available; the size of transmission mains weighed against providing storage near the point of use; the type of fountains provided whether with a valve at each point of flow or one for the fountain, weighed against difficulty of maintenance and cost of drainage not to breed additional mosquitoses, etc., etc.



APPENDIX D

2. Opportunity should be taken to go back and fix systems not properly done in Phases I & II, for instance among the systems seen:

Marianne - protective spring box missed most of spring.
No place to fill a bucket is provided.

La Petite Place - no place to fill a bucket at present, except in bathing place, at irrigation channel.

Nan Beauvoir - pipe starts up hill from reservoir!

3. Transmission lines will be relatively long, and plans must include means to handle air in these lines, which has not been a problem heretofore. Intermediate high and low points should be avoided whenever possible. Drains are advisable at low points, and air relief is necessary at high points on these lines.
4. Additional equipment should be provided including:
 - A. Price Pygmy current meter.
 - B. Battery operated conductance bridge.
 - C. Anaeroid Barometer
 - D. A couple of hand levels
 - E. Portable field method of testing water for coliform bacteria.

In regard to 4, E above, - springs to serve such large populations (4000 to 9000 people) should be checked bacteriologically. If no other source is apparent, the spring should be checked after it is sealed. This avoids having to dip a water sample which is difficult to do without contaminating the sample. The recommendation for purchase of equipment to do field testing arises from the adverse impression I have obtained of reports of laboratory analyses made in Port-au-Prince.

5. Some thought should be given as to how to conjoin our criteria for a water supply, - reasonably safe and in such quantity and so convenient as to induce cleanliness of person, clothes and utensils - with what the people may want from a water supply which is primarily a short haul, then possibly clothes washing facilities, bathing facilities, animal watering facilities and water for irrigation.