CONSORTIUM FOR INTERNATIONAL DEVELOPMENT

TARRAFAL WATER RESOURCES
CAPE VERDE
CONTRACT NUMBER: afr-c-1403

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FINAL PROJECT EVALUATION

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December, 1982

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EXECUTIVE SUMMARY

A Consortium for International evaluation study was commissioned by the CID Board of Trustees to fulfill the contract requirement calling for an end-of-project evaluation for the Tarrafal Water Resources (Cape Verde) project. The evaluation was conducted November, 1982 by a three-person team named by the Chairman of the CID Board of Trustees.

The team analyzed all pertinent project documents and one member conducted a one-week site review in Cape Verde. This report is a product of the team's effort.

Overall accomplishments may be described according to the following technical objectives of the project:

(1) Well drilling--a total of 15 months of technical assistance was provided; 42 wells were drilled by the Government of Cape Verde.

(2) Galleries--testing failed to demonstrate the feasibility of groundwater exploitation by galleries with the possible exception of the northern part of area.

(3) Dams--the GOCV was to collect necessary sediment and hydrological information for 15 potential dam sites but this information is still not available core drilling was done at 5 dites; preliminary plans were made for two dams.

(4) Soil conservation--the MRD implemented a CID plan for a 25 ha. pilot watershed project and constructed 283,959 m. of contour dikes with 176,354 acacia trees planted above them, 56,890 m. of rock windows and 324 channel dikes.

(5) Procurement--most commodities were provided by AAPC, Inc., an authorized agency.

CID team accomplishments included:

(1) Project management and supervision--CID assisted the GOCV in the management of the Tarrafal Water Resources Project, assuming an essential role of responding to GOCV expressed needs.

(2) Technical assistance--CID provided technical assistance in agronomy, soil science, irrigation engineering, hydrogeology, soil conservation, dam construction and site selection, meteorologic and hydrological data collection and agricultural economics.

(3) Training--CID provided fourteen person years of long-term training at the B.S. or M.S. level and 2 3/4 years of short-term training in relevant subject matter areas. An additional 60 person weeks of short-term training in-country were provided by CID technical consultants.

(4) Procurement--CID ordered, shipped, and received sprinkle and trickle irrigation equipment and a range of miscellaneous equipment and materials required for the project.

(5) Women and minority involvement--Minorities and/or women were actively recruited by CID and were involved in various aspects of the project.

The evaluation team found that:

(1) The contract requirements were fulfilled and realistic adjustment were made to the contract and project design in a timely manner throughout the life of the contract.

(2) Project management changed in response to recognized project design limitations.

(3) Technical assistance was provided by twelve technicians who made a total of 21 trips to Cape Verde. All requests for technical assistance were honored by CID and efforts were made by CID to provide additional help.

(4) The project provided long- and short-term training which met the needs and capabilities of the GOCV.

(5) The project impacted favorably by providing a model for future works related to water resources development and soil and water conservation in the Tarrafal area.

Recommendations include:

(1) The project should be continued in the Tarrafal region as part of a larger water development program.

(2) An improved hydrological data base should be developed for future use there.

(3) Participant trainees should be integrated into the on-going Cape Verde development effort.

II. EVALUATION INTRODUCTION

A. Objectives and Purpose of Evaluation

The evaluation of the Tarrafal Water Resources (Cape Verde) project serves two basic purposes; 1) to fulfill a contractual obligation requiring a final evaluation at the end of the project, and 2) to comply with the Consortium for International Development (CID) in-house requirements for project evaluation. Therefore, the evaluation scope is broader than reasonably expected of a review responding solely to a contractual obligation.

The specific objective of the evaluation is to assess how the project met or failed to meet the stated project goals. In addition, the recommendations which resulted from this evaluation will be utilized to improve on-going and future projects within the CID system.

Both CID funds and contract funds were utilized in this evaluation. The views set forth in this document are solely those of the evaluation team and do not necessarily represent those of the CID Board of Trustees and/or the CID Executive Office.

B. Scope of Evaluation

The entire Tarrafal Water Resources project is within the scope of the present evaluation. Previous evaluation reports were utilized for relevant information, but the present evaluation scrutinized the project from the pre-project period up to project termination.

C. Evaluation Team

The evaluation team was commissioned by Dean Ernest Briskey, Chairman, CID Board of Trustees, and Dr. John L. Fischer, Executive Director of CID. The evaluation was scheduled by the CID Executive Office, and the Deputy Director for the Project, Dr. Barry R. Bainton, provided leadership in setting up the evaluation process. Dr. Gerald Matlock, Director of International Agriculture Programs at the University of Arizona, was selected team leader. Dr. Howard Peterson, Professor of Agriculture and Irrigation Engineering at Utah State University, was selected as second team member. Dr. Peterson had fulfilled two short-term assignments on the Cape Verde project. Dr. Jean Ruley Kearns, the CID Scholar/Deputy Director for 1982-83, was selected as the third team member.

D. Evaluation Methodology

Preliminary plans for conducting the evaluation were made at an initial team meeting held in Tucson, Arizona on November 5, 1982. It was determined at that meeting that Dr. Matlock would visit the project site during November, 1982. The site visit was scheduled so as to coincide with the presence of Kern Stoller, Project Director/Coordinator, who would be in Cape Verde completing field work and preparing the final report.

A copy of the AID Evaluation Process publication was distributed to the team members in the initial meeting, as well as copies of previous project reports and other relevant documents. A listing of all documents reviewed by the team members appears in Section VIII, References.

III. PROJECT SETTING

A. General Description of Cape Verde

Cape Verde is a group of islands in the Atlantic Ocean, 600 km. off the west coast of Africa, directly west of Senegal. The archipelago consists of ten islands and five islets, divided into the windward (Barlavento) and the leeward (Sotavento) groups. The windward group includes Santo Antão, São Vicente, Santa Luzia, São Nicolau, Sal, and Boa Vista. The four leeward islands are São Tiago, Maio, Fogo, and Brava. The capital city, Praia, is on the island of São Tiago.

Each island is volcanic in origin. Some are quite rugged, with sheer cliffs rising from the sea and numerous small valleys running from the mountains to the shore. Fogo whose volcanic cone reaches to 2,839 meters, has the highest elevation, and the archipelago's last volcanic eruption occured there in 1951.

Temperatures and humidity vary with altitude, but the climate is warm and dry. The average temperature in Praia is 24°C (75°F). The hottest month, September, has an average temperature of 26°C (79°F); the coolest month, February, averages 22°C (72°F).

The Cape Verde islands have only two seasons--a dry season (November-July) and a rainy season (August-October). Rainfall is low and highly variable. In Praia, the average annual precipitation is only about 240 mm. The dry season is marked by gusting winds. Dust, sometimes originating in the distant Sahara Desert, reduces visibility and damages machinery, as well as irritates eyes and respiratory passages.

Cape Verdean culture reflects the long history of the islands as part of the Portuguese colonial empire. Portuguese navigators discovered the uninhabited archipelago in the mid-15th century. They established plantations and used the islands as a base for transatlantic slave trade.

Most Cape Verdeans are of mixed African and Portuguese origin. The official language is Portuguese, but a majority of Cape Verdeans speak Crioulo, a mixture of Portuguese and African languages. The 1980 census of the islands reported a population of 296,000. Current figures estimate this number at about 300,000. Annual population growth rate is about 1.9 percent, and population density is about 73 per square kilometer. The commercial center, Mindelo, on São Vicente, has 35,000 inhabitants and is the second largest town. Praia is the largest town and capital, with some 40,000 residents. Fifty percent of Cape Verde's population live on the island of São Tiago. Santo Antão, São Vicente, and Fogo contain most of the remainder.

Due to limited land area (only 4000 km^2 in total) and dry climate, and the resulting effect on economic opportunity, Cape Verdeans have emigrated to such countries as Portugal, Angola, Senegal, the Netherlands and the U.S. Most of the some 300,000 descendants of Cape Verdean immigrants living in the U.S. are located in Massachusetts, Connecticut, and Rhode Island. The United States Department of State Background Notes on Cape Verde (May, 1981), estimates worker remittances from abroad to be $8 million a year.

The islands have experienced recurrent drought and famine since the end of the 18th century, and their fragile prosperity slowly vanished with the declining slave trade. The worst drought in Cape Verdean history hit the Islands in 1968, crippling the economy and making Cape Verde heavily dependent on foreign aid for survival. Drought conditions continue periodically.

In 1951, Portugal changed the status of Cape Verde from a Portuguese colony to an overseas province. On December 18, 1974, Portugal and the African Party for the Independence of Guinea-Bissau and Cape Verde (PAIGC) signed an agreement in Lisbon that provided for a transitional government composed of Portuguese and Cape Verdean officials who would prepare Cape Verde for independence. On June 30, 1975, Cape Verdeans elected a National Assembly which received the instruments of independence from Portugal on July 5, 1975.

B. Pre-Project History

At the time of project design in 1976, there were no US Agency for International Development (USAID) staff in Cape Verde. A Country Development Officer responsible for both Cape Verde and Guinea-Bissau, was located in Guinea-Bissau and commuted to Cape Verde on an as-needed basis.

In 1977, a full-time Food and Agriculture Officer took over the project and managed it for two years. In January, 1980, an International Development Intern, who later became the Agricultural Projects Manager, was assigned to Cape Verde and began to manage all USAID agricultural projects.

The Tarrafal Water Resources Project Grant Agreement between the Government of Cape Verde (GOCV) and USAID was signed on March 29, 1977.

C. Description of Project Geographic Area

The project was concentrated in the Tarrafal region of São Tiago Island. Approximately 20,000 people live in the Tarrafal region, which is near the northern tip of the island. The region does not contain any industries and the production of consumer goods is almost non-existent. A majority of the people work in farming and fishing.

IV. PROJECT DESCRIPTION

A. Project Paper

The Cape Verde Irrigation Investigations and Training Project Paper, which was the basis for the CID/AID contract, was approved on January 3, 1977. The project goal, sub-goals and purpose, as stated in the logical framework of the project paper, are as follows:

GOAL: Increase income and employment opportunities for small farmers and rural workers in the Tarrafal region of Cape Verde;

SUB-GOAL: Assist the Government of Cape Verde in planning and training personnel for (1) the expansion of arable land under irrigation in the Tarrafal area, and (2) the identification and utilization of optimal watershed conservation and irrigated agriculture technologies.

PURPOSE: Provide the GOCV with the equipment, technical assistance and training required for carrying out appropriate investigations and planning regarding a proposed 600-hectare expansion in land under irrigation in the Tarrafal region with an additional 150 hectares at Chão Bom, 200 hectares at Achada Grande and 250 hectares at Achada Tomaz.

B. Project Administration

The arrangements for execution of the project distributed the responsibility for project components in the following manner:

1. Procurement of the commodities such as drilling equipment and vehicles was to be handled via contract with the Afro-American Purchasing Center (AAPC) in New York.

2. Procurement of technical services and technical training was to be handled by a contractor who would also provide general supervision. It was determined that technical training would probably be carried out in various locations in the U.S. and abroad.

3. Procurement of the local contract labor for constructing wells, galleries, terraces, and other public works, was to be handled directly by the GOCV, utilizing PL-480 revenue.

4. The project was to be financed through a $1,900,000 direct AID grant, $303,000 in GOCV revenue from PL-480 food sales, and $634,000 from the GOCV, which represented the cost of government land devoted to the project plus the cost of GOCV project technicians and trainees salaries.

C. Project Activities

The project proposed to finance (1) the drilling of some 50 test wells, the most productive of which would be converted to irrigation use; (2) exploration of 10 gallery sites; (3) appropriate testing and design work requisite to construction of two medium-size (100-foot elevation) storage dams and related tunnels and canals servicing the proposed irrigation sites; (4) development of capability in the preparation of terraces and dikes for control of soil erosion and rapid water runoff; (5) development of plans for appropriate irrigation systems and crop technologies; and (6) some 13 person-years of technical training in such areas as hydrology, geology, agronomy and agricultural economics.

D. The Tarrafal Water Resources Contract

Contract No. AID/afr-c-1403, a cost reimbursement type contract, was signed by Dr. Bruce Anderson for CID and James Anderson, representing AID on April 4, 1978. Subsequent amendments were signed on December 8, 1978; May 18, 1979; December 22, 1980; January 12, 1981; April 19, 1981 and January 4, 1982. Utah State University served as the lead university.

1. The project objective was as follows:

> To assist the Ministry of Rural Development (MRD) to test the viability of and make preparation for the expansion of land under irrigation in the Tarrafal region

from the present 30 hectare plot to some 600 hectares in the same area.

2. Description of Services

CID was to provide personnel, consultants and training services in support of the overall Tarrafal Water Resources Project. The project included:

(1) The drilling of 50 test wells, the most productive of which were to be converted to irrigation use;

(2) Exploration of 10 gallery sites;

(3) Appropriate testing and design work requisite to construction of two medium-size (100 foot elevation) storage dams and related tunnels and canals servicing the proposed irrigation sites;

(4) Development of capability in the preparation of terraces and dikes for control of soil erosion and rapid water runoff;

(5) Development of plans for appropriate systems and crop technologies; and

(6) Technical training in such areas as hydrology, geology, agronomy and agricultural economics.

It was assumed in the Project Paper that items (1) and (2) (wells and galleries) were largely within the capabilities of the MRD and would require only light assistance from the Contractor in follow-up to procurement problems (being done directly by the GOCV) and possible additional hydrologist expert advice. Items 3, 4, 5, and 6 were the major thrusts of the CID attempt to assist the GOCV/MRD through all of the steps requisite to determining the feasibility of irrigated agricultural development in the project area.

V. ISSUES AND PROBLEMS

A. Administrative Structure

The administrative structure of the overall project was not well defined. Neither USAID/Praia nor the GOCV coordinated the total effort. Therefore, CID and other contractors, the Koehring Company (well drilling) and the Afro-American Purchasing Center, Inc. (procurement) had unnecessary difficulties in carrying out their individual and collective responsibilities.

B. Project Design

There were shortcomings of a technical and managerial nature in the original project design (Project Paper). A comprehensive hydrologic evaluation, an essential first step for effective water resources development planning, was not called for. A thorough geologic study which would have forewarned of the difficulties associated with dam site selection, gallery construction and well drilling was also not stipulated. The well drilling equipment specified was not the most appropriate for the conditions. The preliminary evaluation of water resources was overly optimistic as was the projection of drilling 50 test wells. The project design did not provide for the continuous presence in Cape Verde of any CID personnel during the first two years; this reduced overall effectiveness of the project for that period.

C. Absorptive Capacity of GOCV

The GOCV did not have sufficient counterparts to work with and carry out the recommendations of the CID specialists. The lack of counterparts forced the CID personnel to relate to the organizational structure, rather than to individuals. There was a shortage of people for training programs, and some personnel trained by the project had to be assigned to other activities. Personnel and supporting facilities were not always available to collect recommended data. Well drillers experienced with project equipment were unavailable at the beginning of the project.

The complexities of dealing with many donors made it impossible to get the undivided attention of the Cape Verde project director. Planning capabilities of the GOCV were limited, and there appeared to be little time for the articulation of goals.

D. Continuity of USAID Personnel

Frequent turnover and inability to fill personnel vacancies reduced the effectiveness of USAID support in the early years. Delays were encountered in reviewing reports, and the USAID project representative was unable to participate in the first project evaluation.

E. Logistics Support

Lack of communications services and difficulty of transportation to, among, and within the islands, resulted in delays in arrival of personnel and

equipment. The procedure for releasing equipment from customs was unnecessarily time consuming.

F. Project Size

The overall project was too small and too short to capture effectively the attention of USAID or GOCV officials. The low level of inputs did not create a "critical mass" necessary for project activities. Under such conditions, accomplishments obviously were lessened and long-range planning was much more difficult. This had a particularly harmful effect on participant training in other countries.

G. Living Conditions

Initially, there were almost no facilities for project personnel in Tarrafal and Praia. In spite of this situation, no provisions were made for incentives to contractor personnel. Even some early USAID personnel did not have their families at post.

VI. ACCOMPLISHMENTS

Accomplishments of the project are described in two parts. First, are those activities which made up the overall project and which were primarily the responsibility of the GOCV and/or other contractors but for which CID provided technical assistance. This is followed by a description of those activities which were carried out by the CID project team. In both cases, accomplishments are related to the objectives of the earlier project documents, i.e., the Project Paper and the CID/AID contract. They also are related, where appropriate, to the 1979 and 1981 evaluation recommendations.

A. Overall Project Accomplishments

The overall project accomplishments are described below. A summary is presented in Table 1.

1. Well Drilling (Ground Water Exploration)

The project funds provided a rotary percussion drilling rig, utility truck, tanker truck, pickup, drilling equipment, test pumps, water level recorders and other miscellaneous materials to carry out the drilling program. Approximately five months of factory representative technical assistance was provided to instruct the Cape Verdean drilling crew in the operation of the equipment. An additional ten months of technical assistance was provided commencing in February, 1981.

Table 1 Summary of Overall Project Accomplishments

Action*	Status as of Joint Evaluation (Oct.-Nov.79)	Status as of AID Evaluation (Nov.81)	Status as of End of Project (Nov.-Dec.82)	Notes
I. B (1)				
Drilling 50 test wells	1 drilled	23 drilled	42 drilled	Program continuing, one well in process of drilling
Conversion of most productive to irrigation wells	0	0	0	2 wells being equipped with pumps
I. B (2)				
Exploration of 10 gallery sites	No action	One site being core-drilled Tools stuck in hole	Tools stuck in second hole	Tools partially recovered
I. B. (3)				
Testing and design work for 30 m storage dams	8 possible sites selected and surveyed topo maps drawn test drilling 4 sites potentially flooded areas surveyed	drilling completed at 5 sites	preliminary plans for 2 dams prepared	dams may be constructed but economic feasibility is questioned
I. B. (4)				
Development of capability in constructing terraces of dikes	conservation plan suggested soil survey made	conservation plan implemented		
Construction by GOCV				
- contour dikes (m)	1,200	159,840	283,959	
- trees planted behind dikes	4,500	89,004	176,354	±600 ha. if in one area, $0.40/tree
- rock windrows (m) (arretos)	10,500	19,000	56,890	
- channel dikes	86	251	324	hand placed loose rock, 1.5 - 2m. high, 10-30 m. long, cost about $4.50/$m^3$

*Identifying numbers and letters refer to paragraph numbers in the CID/AID contract document

Forty-two wells were drilled, however, at least half of these are not usable due to collapsed walls or plugged casings. Further, only six of the wells have been pump-tested to determine capacity, drawdown and aquifer characteristics. The information returned by this program is less than anticipated, but a monitoring program is underway, and a water level contour map has been drawn. Pumps are currently being installed in two wells. It is estimated that sufficient water for irrigation of about 40 ha. will be available.

The slow progress was primarily the result of difficult drilling conditions and equipment problems. The later problem was largely overcome after the arrival of the well drilling advisor.

Recommendations concerning placement of wells were generally adhered to, however, some requested data were not obtained. The water level recorders have not been installed and limited conductivity/chemical analysis data were collected.

2. Galleries

Gallery testing was performed by the GOCV. Core drilling tests did not demonstrate the feasibility of groundwater exploitation by galleries. Recently obtained groundwater data show that a gallery may be feasible in the northern part of the area (Ribeira Fontão).

3. Dams

The GOCV was responsible for performing the core drilling and developing the rainfall/runoff information. The core drilling work was carried out at five of 15 potential dam sites. Analysis of the results of core drilling and observations at the sites indicate that infiltration losses would be large. The GOCV was to collect necessary sediment and hydrological information. This information has not been gathered, but preliminary plans were made for two dams.

4. Soil Conservation

The MRD, under the supervision of Francisco Barbosa, engaged and directed work crews (numbering up to 600 men and women) in dike and terrace construction, contour furrowing and tree planting. The MRD implemented a CID plan for a 25-ha. pilot watershed on Monte Covado to establish and evaluate trial practices of Acacia plantings, terraces and furrows. Emphasis has shifted from larger rockwork dikes in streambeds to upstream soil conservation practices such as reforestation, terracing and furrowing.

Soil conservation public works of high quality are widespread throughout the project area. Since 1979, the project has completed 324 rockwork dikes, 284,000 meters of contour furrows and planted 176,000 trees, mostly on state lands. Almost all works have been maintained through at least one rainy season. Maintenance and repairs of these works have been expeditious. The

benefits have been direct in the form of workers' salaries and rebuilt flood-ravaged agricultural lands (Ribeira da Prata); and indirect in increased infiltration, hence aquifer recharge, topsoil retention and future firewood supplies, although no quantifiable results have been reported.

The MRD's budget figures for 1979 indicate that the costs of these works were reasonable; approximately $4.50 per cubic meter of rockwork and $0.40 per tree.

5. Procurement

Most of the commodities were procured via purchase orders with AAPC, Inc., as the authorized agent. AAPC's reporting on procurement status was inadequate for USAID/Praia to keep informed on how procurement was proceeding and how much unexpended funding remained in the purchase order. USAID/Praia later established a commodity control system.

B. CID Team Accomplishments

1. Project Management and Supervision (Support)

The project was implemented by the GOCV, and therefore, the CID role was passive, responding to requests for assistance. The contract statement of work reflected the above implementation strategy. The following narrative describes CID accomplishments which are summarized in Table 2.

The CID Project Directors were J. Alfaro (April, 1978-June, 1980) and K. Stutler (July, 1980-present). The initial project completion date of November 30, 1980 was extended to December 31, 1982.

Initially, project personnel were not able to have adequate influence on the GOCV. Having occassional technical assistance consultants accompanying the Project Director on trips was recognized as less effective than desired.

The consultants' recommendations were contained in separate trip reports. Although the GOCV accepted the recommendations, they did not have the capacity to follow through. Further, the GOCV had a limited number of counterparts to work with, and carry out, the consultants' recommendations.

Technical assstance momentum was improved by the designation of a resident engineer, Philip Coolidge, who arrived in Tarrafal during February, 1981. At that time, the capability of the GOCV to carry out the recommendations of the consultants improved somewhat. Technical assistance of a consultative nature become more effective. Unfortunately, Mr. Coolidge became ill and died in Cape Verde in September, 1982.

Table 2 Summary of CID Accomplishments

Item	Status as of Joint Evaluation (Oct.-Nov.79)	Status as of AID Evaluation (Nov.81)	Status as of End of Project (Nov.-Dec.82)	Notes
1. Project Management and Support (31 mos.)				18 mos. authorized in initial contract
a) Coordinate training and technical assistance	Jose Alfaro, beginning in April 1978, 4 trips to Cape Verde	Jose Alfaro thru June 1980 6 trips to Cape Verde, Kern Stutler beginning June 1980 5 trips to Cape Verde	Kern Stutler 5 additional trips to Cape Verde	16 total trips
b) Assist in commodity procurement	Phone calls, trip to AMPC in New York to facilitate delivery	CID purchased and delivered irrigation and lab equipment (1)	Coolidge helped prepare list of spare parts and equipment for submission to AMPC	(1) Equipment called for in Amendment #3 December 1980 (2) Miscellaneous small equipment and materials manuals, texts, calculators, maps, etc. were purchased and delivered to Cape Verde through the duration of contract
c) Develop and maintain time and progress chart	Updated with AID after each trip to Cape Verde	Formal chart initiated in Dec. 1980, updated by quarterly reports	Implementation chart for final project activities submitted in June 1982	Required every 90 days
d) Reports and evaluations	CID evaluation made on this date	Quarterly reports submitted beginning in Dec. 1980	Monthly and quarterly reports submitted by Coolidge Final evaluation completed Final report completed	
e) Resident Irrigation Engineer (13 mos.)	N.A.	Phil Coolidge beginning in Feb. 1981	Phil Coolidge deceased Sept. 1982 18 mos. provided	Provided for under Amendment #5 Jan 1981

TABLE 2 Summary of CID Accomplishments
(continued)

Item	Status as of Joint Evaluation (Oct.-Nov.79)	Status as of AID Evaluation (Nov.81)	Status as of End of Project (Nov.-Dec.82)	Notes
2. Technical Assistance				
a) Dams				
1) Geologist (1 mo.)	John Logan provided preliminary geologic evaluation of sites selected by Bishop, Hill, Stutler & Alfaro	Portuguese geologist planned for but never arrived in Cape Verde (3) Kiefer (civil engineer) outlined and initiated core drilling on dam sites Feb. 1980	(1.5 mos. provided)	(3) Provided for in Amendment #5
2) Sedimentation (1 mo.)		Bishop visited sites and recommended sediment data collection - not done by GOCV	(1 mo. provided)	
3) Surface Water Runoff Expert (1 mo.)	Hill outlined rainfall and runoff data collection plan		Limited data now available (1.0 mo. provided)	
4) U.S. Parent Agency Assistance (3 mos.)		Preliminary dam design was provided by Kiefer for Cincho I	Preliminary plans for Fontoo dam and for Garca I by Kiefer and Vera Cruz (1 mo. provided)	Civil engineer was used in lieu of U.S. Parent Agency assistance
b) Terracing & Dikes				
1) Soil Conservation Engineer (1 mo.)	Stutler developed plans for experimental watershed-being implemented by GOCV	Called for generating data on costs and benefits of soil conservation practices	Plan developed for data collection in 1982 (4) (3 mos. provided)	(4) Limited rainfall in 1982 gave no results

TABLE 2 Summary of CID Accomplishments
(continued)

Item	Status as of Joint Evaluation (Oct.-Nov./9)	Status as of AID Evaluation (Nov.81)	Status as of End of Project (Nov.-Dec.82)	Notes
2) Soil Scientist (1 mo.)	Southard and Queiroz made soil survey of (illegible) for irrigated area and watershed.	provided input to tentative guide to cropping pattern	(2 mo. provided)	
3) Hydraulic structures engineer (1 mo.)				Incorporated with soil conservation
c) Agronomy/Economics				
1) Agronomist (1 mo.)	Peterson outlined potential crops for irrigation	Peterson prepared tentative cropping guide	(1 mo. provided)	
2) Ag. Engineer (1 mo.)				This was farming system/ mechanization engineer and was considered not applicable by AID, GOCV, and CID.
3) Irrigation Engineer (1 mo.)	Plans made for experimental and demonstration irrigation plots Equipment need listed	Coolidge made preliminary pumping analysis for proposed area Hargreaves helped determine water requirements	Plans made for delivery of water from wells to irrigated area	
		Coolidge installed pilot sprinkler and trickle irrigation systems	system used for demonstration and training and testing crop response to water (2 mo. provided)	
d) Irrigation Economics				
1) Ag. Economist (1 mo.)			Radtke made economic analysis of irrigation and soil conservation work (1 mo. provided)	
2) Agronomist (1 mo.)			McGuire made cropping recommendations for irrigated area and watersheds (1 mo. provided)	
e) Wells and Galleries				
1) Hydrogeologist (2 mos.)	Logan made study of ground water potential & provided guidance in exploratory drilling program for wells & galleries	Second trip by Logan to review progress	Third trip by Logan analysis of data & recommendation for pumping, further data collection and gallery investigation.	Provided hydro-geologist in response to request by GOCV

Table 2 Summary of CID Accomplishments
(continued)

Item	Status as of Joint Evaluation (Oct.-Nov.79)	Status as of AID Evaluation (Nov.81)	Status as of End of Project (Nov.-Dec.82)	Notes
3. Training				
a) Long term training (planned)				
hydrology - 1 - 2 yrs. soil cons. soil sci - 2 - 2 yrs Ag. Engr. - 1 - 2 yrs	1 participant sent but returned for personal reasons			
Long term (carried out)	negotiated changes in program to include undergraduate	4 B.S. degree participants 2 in Ag. Engineering 1 in Ag. mechanization 1 in Soil Science	1 M.S. participant in Civil Engineering (rock fill dam design) completed degree & returned to project	changes due to interests, availability and qualifications of participants
b) Short term training (planned)				
hydro-geology-1- -6 mo. hydraulic engineering -1- - general hydrology -2 - - irrigation engineering- 2- - project mgt. - 1- -				
Short-term training (carried out)		Matos - irrigation and soil conservation-6 mos. Santos - irrigation and soil conservation-6 mos.		with NRD on Soo Vicente
		Sena - irrigation 15 mo.		working in Tarrafal
		Silva - irrigation economics- 2 wks.		
		Barbosa - galleries & dams 2 wks		worked in Tarrafal thru Dec. 1982
			Amarante-project mgmt. 3 months	working in Tarrafal

Table 2 Summary of CID Accomplishments
(continued)

Item	Status as of Joint Evaluation (Oct.-Nov.79)	Status as of AID Evaluation (Nov.81)	Status as of End of Project (Nov.-Dec.82)	Notes
c) Report Requirements				
1. Interim project evaluation	Submitted Nov. 79	N.A.	N.A.	40 copies in English 50 copies in Portuguese
2. Final project evaluation	N.A.	N.A.	In progress	Due 30 November 82
3. Final report	N.A.	N.A.	In progress	Due 31 December 81
4. Social Report Minorities and women involvement	Lots of women working on terraces and dikes	N.A.	In progress	Part of final report

CID also was to prepare and update a "Time and Progress Chart" every 90 days. This was not done regularly in chart form, however, quarterly reports provided the necessary information. Implementation charts were prepared in December, 1980 and July, 1982.

Project evaluations were carried out by CID in October - November, 1979 and November - December, 1982.

2. Technical Assistance

CID provided technical assistance in agronomy (two visits), soil science (two visits), irrigation engineering, hydrogeology (three visits), soil conservation (two visits), dam construction and site selection (three visits), meteorology and hydrologic data collection, and agricultural economics. A soil survey and map were completed. An interim guide to soils utilization and cropping alternatives was prepared. Existing irrigation systems were studied, and pilot sprinkle and trickle irrigation systems were installed and demonstrated.

3. Training

The initial CID contract called for 11-1/2 person-years of training in hydrogeology, hydrology, soil conservation/science, agricultural engineering, hydraulics and irrigation engineering, and project management. A contract amendment later included long-term dam construction training and short-term training in irrigation and well drilling. Two weeks of on-site training was also mentioned in this amendment.

To date, CID has provided the following training:

Long-term:*	Irrigation (B.S.)	3 person-year(s)
	Agronomy (B.S.)	3 "
	Soil Science (B.S.)	3 "
	Agricultural Mechanization (B.S.)	3 "
	Dam Construction (M.S.)	2 "
Short-term:	Irrigation	2 "
	Soil Conservation	1/2 "
	Project Management	1/4 "
	TOTAL	16 3/4 person years

*All long-term B.S. degree training was shifted to the Sahel Manpower Development Training Program.

In addition, CID's technical consultants also presented three short training programs in Cape Verde at the request of GOCV:

September, 1978:	Basics of Hydrology, Runoff Estimation, Soil Conservation	10 person-weeks
August, 1979:	Basic Hydrology, Soil Conservation, Soil-Water-Plant Relations, Water Requirements, Water Measurement, Infiltration, Water Conveyance, General Soils	30 person-weeks

August, 1981:	Hydrology, Irrigation Scheduling, Water & Soil Conservation	20 person-weeks
TOTAL:		60 person-weeks

There were no candidates for overseas training in hydrogeology or hydrology.

CID's training program has resulted or will result in eight university trained technical persons, and twenty-eight technicians with basic soil conservation and water management skills. At present, two returned trainees are assigned to the Tarrafal project.

4. Procurement

CID ordered, shipped, and received equipment for pilot trickle and sprinkle irrigation systems. Miscellaneous small equipment and materials, manuals, texts, maps, calculators, hand levels, soil sampling equipment and other instruments were purchased and delivered to Cape Verde by CID throughout the duration of the contract.

C. Accomplishments Related to Previous Evaluations

The Tarrafal Water Resources project received two previous evaluations.

The first evaluation was conducted in November, 1979, by a CID representative who visited the AID/Washington Africa Bureau, USAID/Praia, the Ministry of Rural Development--Praia and the project site in Tarrafal.

Representatives of MDR, USAID/Praia, and AID/W assisted in the in-country evaluation.

The second project evalution was a joint MRD and USAID evaluation conducted in November, 1981.

In both cases, recommendations for individual or joint action by CID, GOCV, or USAID were made. Summaries of CID accomplishments with respect to recommendations resulting from the evaluations are presented in Tables 3 and 4.

TABLE 3

ACCOMPLISHMENTS WITH RESPECT TO JOINT EVALUATION

(OCT. - NOV. 79) RECOMMENDATIONS

	RECOMMENDATION	ACTION
1.	Drill small exploratory diameter holes,	Policy of having exploratory wells of 8" diameter; production wells of 12" diameter without reaming was established and followed
2.	Divert diamond drilling to support gallery exploratory activity	GOCV complied with this
3.	Put priority on wells and galleries before large storage dams	Priority established on wells, then galleries, priority was later changed to wells, then dams
4.	Continue soil and water conservation dams, terraces of tree planting	Program was continued
5.	Visit Canary Islands	CID Project Director visited Canary Islands with Barbosa
6.	Complete soil survey map and report	Completed Jan. 1980
7.	Develop short-term soils and water conservation goals	GOCV did this for Garza and Cincho watersheds

TABLE 4

ACCOMPLISHMENTS WITH RESPECT TO CRITICISMS AND RECOMMENDATIONS OF NOVEMBER, 1981 EVALUATION

RECOMMENDATION/CRITICISM	ACTION
1. Revise implementation plan	Revised in cooperation with GOCV and USAID
2. Conduct a baseline survey on irrigation	Coolidge and Sena-Martins started, Coolidge continued, data not analyzed. MRD will complete
3. Develop water use plans	Latest version is in Final Report
4. Pursue conservation works higher in the watershed	GOCV pursuing, process encouraged by CID
5. Develop program for generating data on soil and water	Discussed, field layouts were made, lack of rain resulted in no data in 1982
6. Generate data on water resources explored	1982 Logan report has data
7. Establish priorities--wells, dams, galleries	Established: wells, dams, galleries in that order
8. Exploit wells for irrigation	Planned, 2 pumps being installed
9. Allocate water for domestic use, experimental farm and realistic small-farm plots close to experiment farms	Planned by GOCV, assisted by CID
10. Review spare parts situation, adjust accordingly	Assisted USAID in preparing lists of needed spare parts and in procurement of same

11.	Increase non-degree training in third countries	Amarante was sent to Mexico for irrigation district operation and maintenance
12.	Improve design and training for each participant	Improved
13.	Select candidates on basis of plans for employment	See number 11 above (only candidate since evaluation)
14.	Look for dam sites at higher elevation	Garca I is at such elevation other sites looked for, not found.
15.	Discuss soil fertility	Interim Guide to Cropping does this
16.	Make crop survey of crops now being irrigated	Surveyed--see McGuire/ Radtke reports
17.	Analyze present cropping systems and interpret data	See McGuire/Radtke reports
18.	Determine optimal production technologies	Some work was done, preliminary recommendations were made for further study.
19.	Compare traditional and alternative irrigation systems in terms of efficiency, water use, operation and maintenance costs and management	Comparisons were made, See Final Report
20.	Reach conclusions on irrigation techniques and economics	Reached, see number 19 above
21.	No overseas training in hydrogeology, hydrology or project management	Gongalo trained in project management. He was the only candidate for such training.
22.	Time and progress chart not updated as specified	Not kept up to date as a chart, done through quarterly and monthly reports.
23.	Absentee leader too far removed to coordinate	CID agreed--resident engineer was put in as soon as authorized by USAID

24.	CID complete studies--soils, crops, dams, hydrogeology, agricultural economics, farm management, et. al.	All were completed except farm management (GOCV did not want it)
25.	Discuss domestic water needs and develop strategies	Discussed with GOCV, included in overall plan

VII. EVALUATION FINDINGS AND RECOMMENDATIONS

The CID evaluation team has considered the contract obligations and the accomplishments in terms of project coordination and management, technical assistance, training and the involvement of women and minorities on the project.

A. Findings:

1. Overall Project Accomplishments

The overall accomplishments have essentially fulfilled the contract requirements. Many of the goals were realized but not always to the degree anticipated in the project paper. In several instances, the work plans were modified to be more realistic. It was found that the original contract period was too short and needed to be extended. In some cases, the contract scope of work was expanded in response to requests by the GOCV.

2. Project Management

The contract specifically identified Dr. Jose Alfaro as coordinator and required that any changes in key personnel be justified and approved. CID did appoint Dr. Alfaro and he served for a period from April, 1978 until June, 1980. The contract provided that the coordinator come to Cape Verde "on call" or at least four times a year. It was found by CID, the GOCV and USAID that this arrangement was not effectve. CID responded and proposed two changes; the appointment of a new coordinator and the addition of a resident engineer to supervise and participate in technical aspects. R.K. Stutler was selected as the coordinator (July, 1980 to December, 1982) and Phil Coolidge was appointed in February, 1981, as resident engineer. Alfaro, Stutler and Coolidge, in cooperation with USAID and the GOCV, identified,

recruited and assisted the appropriate technical consultants.

3. Technical Assistance

CID provided 12 technicians who made a total of 21 trips to Cape Verde. The technical consultants were effective, however, there were individual differences. In some instances, a specialist was requested by the GOCV before the necessary data and materials were ready so as to make best use of the visit. One example was the lack of core drillings for dam sites at the time the civil engineer first arrived.

The contract indicated there would be assistance from the US parent agency in the preliminary dam designs. These agencies were not used but the service was provided through a CID civil engineer who made two trips to the project site and supervised a Cape Verdean graduate trainee in the dam designs as a part of long-term training. No request for technical assistance were unfulfilled, and CID also offered to provide other technical assistance that was never requested by the GOCV.

4. Training

Terms of the contract provided long-term training of four specialists. In attempting to select these students, the GOCV found there were not enough qualified individuals interested in the specialization identified and/or the GOCV could not release key employees for the required time. These facts were recognized and the contract modified to provide undergraduate training for four students who are now in training. Their support was transferred to the Sahel Manpower Development Project. There is no indication, at this

time, whether or not the four undergraduate trainees will be employed on the Tarrafal project upon their return.

One trainee (30 months) received a Master's Degree. For his thesis project, he prepared a dam design under the supervision of consultant Dr. Kiefer. He also served as a counterpart for Dr. Kiefer while at the project site.

The non-degree short-term training in the U.S. consisted of one trainee for 15 months, two trainees for six months, two trainees for two weeks, one trainee for three months and one trainee for one week. The latter was selected as a long-term trainee, but for personal reasons, returned home. CID provided the kind and duration of training requested by the GOCV.

Provisions were made for in-country short courses. Three of these were provided and were well received by the participants. The USAID evaluation team in 1981 was critical of the in-country training and indicated CID had provided instructors that were too highly trained and could not relate to the participants. This was an erroneous conclusion. The instructors were highly experienced in successfully conducting similar courses in many parts of the world. Apparently, the evaluation team drew its conclusions from an interview with one participant who was well below the average in performance. In fact, many participants subsequently requested more courses of a similar nature.

In addition to the organized training, various employees of the GOCV were given on-the-job training by serving as counterparts to the consultants.

These persons gained experience in making the field investigations, installing of irrigation equipment and working with the resident engineer.

5. Involvement of Minorities and Women

During the life of the project, a total of twelve specialists made trips to Cape Verde. Two of the twelve were minorities (Hispanic). Dr. Jose Alfaro served as technical coordinator from April, 1978 until June, 1980, when he resigned from Utah State University. J.S. Queiroz, USU employee, participated in the soil survey of the Tarrafal Project.

The in-country personnel who served in the decision-making process and who were employed in various capacities were Cape Verdeans, who would have been identified as a U.S. Government recognized minority.

All of the trainees, both in Cape Verde and in other countries, were Cape Verdeans. A total of ten trainees participated in training out of Cape Verde. Five of these trainees were short-term, four were university baccalaureate degree candidates and one was in a graduate degree program. Ms. Maria Helena Azevedo, entered a B.S. degree program at Utah State University and is currently at the University of Arizona as a full-time undergraduate student.

In Cape Verde, the CID coordinator designed conservation practices to be used for watershed protection which proved to be effective and the GOCV initiated an extensive watershed improvement program. Approximately 600 people worked on the program--about one-half of whom were women. In addition, Mrs. Merrill Asay, USAID/Praia, participated extensively in

facilitating the work of technical specialists sent to the Islands and Ms. Maria de Lourdes Monteiro Lima, a professional engineer, represented the GOCV in the hydraulic designs of the project.

6. Responsiveness

In general, CID was responsive to the GOCV and USAID/Praia. This is evident by the services provided and by revisions of the work plans. At the request of GOCV and USAID, CID procured and installed irrigation equipment for a six ha. trial and demonstration area. They also procured the equipment for a soils laboratory.

When the coordinator and consultants traveled to the project, they usually carried equipment and spare parts to Cape Verde. The coordinators and consultants were frequently requested to provide assistance on other USAID projects and programs which they did.

7. Impact of Project

There will be favorable long-lasting impacts as a result of the project. Some examples are:

(a) It has been shown that watershed protection and improvement must start with control on the upper reaches and work downward, contrary to previous practices on the island. Current GOCV programs reflect this change.

(b) The importance of collecting precipitation and run-off data has been recognized by the GOCV. Additional rain gages have been installed and stream flow measurement stations have been established on three streams in the region.

(c) There has been successful stabilization of two small watersheds. This soil and water conservation success serves as a model for future work in the Tarrafal area, and it may serve as a model that will carry over to the reforestation program. There are now competent employees of the GOCV who have the training and experience to conduct water development investigations.

B. Recommendations

Based on the experiences with the project and from the evaluation findings, several suggestions or recommendations are presented below:

(a) Benefits from the project are evident and the needs in the Tarrafal area are many, hence a program of this nature should be continued.

(b) For any future water development projects of this kind, an improved hydrologic data base should be developed as a first step.

(c) Provisions for integrating the trainees into the program should be provided before their training begins or at least before they return home.

(d) All activities of any future program on water development, soil and water conservation, and training in Cape Verde should be integrated in one project. The current project was too small for efficient supervision and

management. Since irrigation development will be limited and slow in coming, there should be a concerted effort made to introduce new crops and farming techniques into rainfed agriculture. There are many possibilities for improvement in production at relatively low cost.

VIII. REFERENCES

The evaluation team reviewed the following documents as well as others in the process of evaluating the project. In addition, personnel both in Cape Verde and in the United States were interviewed relative to the project.

CID Technical Proposal
Prime Contract, AID/afr-c-1403
- Amendment No. 1
- Amendment No. 2
- Amendment No. 3
- Amendment No. 4
- Amendment No. 5
- Amendment No. 6
- Amendment No. 7

CID Agreements
- USU/CV-01
- USU/CV-01-02
- USU/CV-01-03

CID Evaluation Report, 1979
AID Evaluation Report, 1981
Peterson Trip Report, 11/12/79
Quarterly Report, 10/01/80
Coolidge Report, 11/15/81
Stutler Trip Report, 07/20/81
Stutler Trip Report, 10/09/82
Stutler Trip Report, 04/26/82
CID Annual Report, 1979
CID Annual Report, 1980
CID Annual Report, 1981
Status Report on Trainees, 05/06/80
Newspaper Article, November, 1979
Status Report on Trainees, 04/15/81
U.S. Dept. of State Cape Verde Background Notes, May, 1981
U.S. Dept. of State Cape Verde Post Report, April, 1982
Logan, John, 1979, Water Resources of the Tarrafal Area, São Tiago, Cape Verde Island

Kiefer, Fred, 1980, Preliminary Analysis of Dam Sites, Tarrafal Project, São Tiago, Cape Verde

Southard, A.R. and Queiroz, J.S., 1980, Soil Report for São Tiago, Isle Cape Verde Island

Stutler, R.K., Peterson, H.B. and Southard, A.R., 1981, Interim Guide to Soil Utilization and Cropping Alternative, Tarrafal Water Resources Project

Kiefer, Fred, 1982, Design Guidelines for Small Dams on Ribeira Garga

Logan, John, 1982, Groundwater Near Tarrafal

Radtke, Hans D., 1982, Feasibility of Irrigated Agriculture in Tarrafal

McGuire, W.F., 1982, Guide to Crops and Cropping Systems--Agronomic Aspects of Crops and Cropping Systems