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O.M.V.S. Integrated Development Project

Senegal - Mauritania - Mali

TECHNICAL REVIEW OF PROJECT PAPER

for

United States Agency for International Development

Bureau for Africa

James E. Stephenson
Engineering Consultant

August 1983

Contract No. AFR-0920-S-00-3041-00
Project No. 625-0929

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OMVS Integrated Development Project
Senegal - Mauritania - Mali

TECHNICAL REVIEW OF PROJECT PAPER

I. Introduction

This review is made in response to a request by the African Bureau of the U.S. Agency for International Development to appraise the technical soundness and practicality of implementing the "OMVS Integrated Development Project" as designed and presented by the USAID River Basin Development Office/Dakar (RBDO) in a Project Paper dated December 1982. "OMVS" is the French acronym for the Senegal River Basin Development Commission, "Organisation pour la Mise en Valeur du Fleuve Senegal".

The Project Paper is comprised specifically of the three-volume U.S.A.I.D./O.M.V.S. INTEGRATED DEVELOPMENT PROJECT, No. 625-0621, as follows:

VOLUME I Introduction and Summary

VOLUME II Project Paper

VOLUME III Technical Annexes

1.0 Economic and Financial Analysis

2.0 Social Analysis

3.0 Technical Analyses

3.1 Agriculture
3.2 Irrigation
3.3 Training
3.4 Feeder Roads
3.5 Health Component
3.6 Cooperative Development
3.7 Telecommunications
3.8 Policy and Feasibility Studies
3.9 Project Monitoring and Evaluation
3.10 Private Sector

4.0 Institutional Analysis

5.0 Environmental Analysis

6.0 Scopes of Work for Technical Assistance

7.0 Procurement Annexes

8.0 Draft Project Agreement

Each of the titles listed under VOLUME III as above in fact comprises a separate volume of its own. The total "paper" runs about two thousand pages.

In addition to reviewing the project paper, I spent the period June 15 - July 1 examining information available with RBDO/Dakar and making a field trip in the Senegal River Basin beginning some 800 kilometers upstream and carrying through to the delta. Of particular interest and concentration were the Bakel and Podor sectors in Senegal, the Kaedi sector in Mauritania, Diama Dam site near the mouth of the river, and the headquarters of SAED (Society for Development and Exploitation of the Lands of the Delta--translated from the French) at Saint-Louis, Senegal. See Appendix 1 for a map of the river basin and Appendix 2 for a listing of the principal contacts at the various places visited.

That which follows is an attempt with a minimum of technical jargon to establish the identity of the basic resource, the Senegal River and its planned development, on which the Integrated Development Project is hinged; to describe briefly the elements of the proposed project; and to present key technical considerations and implementation aspects that affect the viability of the project together with recommended courses of action.

II. The Senegal River

At its farthest source the stream rises in the Fouta Djalon highlands of northern Guinea some 1800 kilometors (km) from the sea. This beginning forms the northward flowing Bafing River which when joined by the principal tributaries in Mali and Senegal, the Bakoye and the Faleme, becomes the north-by-westward trending Senegal River comprising the border between Mauritania and Senegal until it empties into the Atlantic Ocean.

The river system drains an area of 289,000 square kilometers, with average rainfall of 1100-1400 millimeters (mm) on the upper Bating decreasing to 300-400 mm at Podor at the lower end of the Middle Valley of the Senegal.

Of particular interest is the flow in the Senegal at Bakel at the upper end of the Middle Valley below which no tributaries significantly augment the flow. Based on hydrological records covering the period 1903-1968, the average annual flow rate there is computed at 771 cubic meters per second (m^3/sec) or an annual discharge of 24,300 million cubic meters (MCM). This is not inconsiderable; equivalent to about 40 percent of the annual flow of the Nile. Unfortunately the fluctuation in annual discharge at Bakel between wet and dry years is extreme: plus or minus 60 percent. Monthly fluctuations are even more marred: in the hot dry season (March-June) river flows decrease to 10 m^3/sec or less and occasionally stop entirely; in September flood flows reach 7,200 m^3/sec (10-year return frequency).

The river channel exhibits a singular uniformity in its path through the Middle Valley from Bakel to Podor--some 550 kilometers in which it drops only about 12 meters. It flows to a very gentle gradient in a generally steep-sided trapezoidal notch some 400-500 meters wide cut 10-12 meters deep in the adjacent flat terrain. Typically, a low natural levee has formed at the top of the bank with the adjacent land (sandy to clayey loam) sloping slightly away from the river. Infrequently the bank is broken by a seasonal water course exiting to the river which fills as the river rises in flood stage.

At Podor some 265 kilometers from the river's mouth the average monthly water surface elevation is only 0-5.5 meters above sea level so that in low stages water quality is threatened by the saline wedge moving up the flat gradient from the Atlantic Ocean.

III. Diama and Manantali Dams

The disastrous drought in the Sahel in the 1970's dramatized the relationship of access to water and food security. It galvanized the OMVS member states of Senegal, Mauritania and Mali into taking joint steps toward development of the water resources of the Senegal River Basin. By 1981 they had secured international commitments to a long term development plan including $750 million for construction of two dams to attack the twin problems of widely fluctuating river flows and salt-water intrusion from the sea that may affect water quality some 250 kilometers above the river mouth. Both dams are now under contract and in the early stages of construction.

Diama Dam is located about 30 kilometers above the mouth of the Senegal. Its primary function is to prevent intrusion of sea water from the Atlantic Ocean to the delta and lower valley. The dam is a low gated structure that on the downstream side provides a salt water barrier and on the upstream side a reservoir at normal elevation 2.50 meters above sea level for delta irrigation and to feed two natural lakes (Guiers and R'Kiz) which provide water to urban centers in Mauritania and Senegal, including Dakar. A navigation lock 13 meters wide and 175 meters long will be provided integral with the dam to pass river traffic with a draft of 1.6 meters as far up as Kayes in Mali eventually. The dam is expected to be completed in 1986.

Manantali Dam is located on the Bafing River in Mali about 1200 kilometers from the sea, and 400 kilometers above Bakel. The 65-meter high dam will store water from a 27,800 square kilometer basin with an average annual inflow of 12,000 MCM (equivalent to 380 m^3/sec). At full reservoir level of 208 meters (above sea level) the reservoir will have a gross storage capacity of about 11,000 MCM. The majority of the inflow occurs in the flood period July-November; in periods of drought the flow falls to near zero.

The operation of Manantali Dam is designed to provide a minimum flow of 300 m^3/sec at Bakel (river Kilometer 815) and not less than 100 m^3/sec over the Mafou river-bed sill (river Kilometer 336) throughout the year. These minimum flows are sufficient for year-around navigation and irrigation of 300,000 hectares (ha) in the Upper and Middle Valleys and the Delta. The storage capability of Manantali will also provide flood attenuation, serving to reduce downstream flood stage

levels, but will not "control" floods in that the drainage basin between Manantali and Bakel contributes an average annual inflow to the Senegal approximately equal to the inflow above the dam. The storage and head developed by the Manantali reservoir will provide capability for generation of 800 million kilowatt-hours of electrical energy per year; however, a power plant is not included with initial dam construction. Studies are being made of potential power markets. The dam is expected to be completed in 1989.

IV. The Project

The focus of the Integrated Development Project (IDP) is farmers, their productivity and independence. It will be carried out through four related but separately managed components: a regional program in conjunction with the OMVS ($9.3 million) and three bilateral national programs in conjunction with the governments of Senegal ($21.0 million), Mauritania ($21.7 million), and Mali ($11.0 million) for a total of $63 million. The regional program will concentrate on coordinating and supporting the national programs. The national programs will concentrate on improving farm productivity and expanding irrigated agriculture in five geographic areas: Bakel and Podor in Senegal, Gouraye and Kaedi in Mauritania, and Kayes in Mali. Within each of the regional and national components are a number of separate but related activities or sub-projects which are described briefly below.

A. OMVS Regional Program

1. Technical Assistance - OMVS Project Management

Technical assistance will be provided to OMVS for project management, to increase institutional capabilities, and to provide implementation support for IDP regional activities. A total of 13-1/2 man years of assistance is planned over a four-year period to include specialists in Project and Financial Management, Applied Anthropology and Training, Management Information, Business Development and short-term consultants; estimated cost, $2,975,000.

2. Technical Assistance - RBDO Project Management

Technical assistance will be provided to RBDO project management to aid in direction of IDP activities. A Deputy Project Manager and an Irrigation Engineer are planned to serve on the staff of RBDO for periods of seven and five years respectively; estimated cost of $880,000 is included under "Operating Costs" below.

3. Studies

The IDP will finance contracts for additional technical expertise needed for various planned OMVS studies and surveys aggregating 903 man-months of effort of which 388 man-months would be secured under IDP contracts and the

balance supplied by the various government participating agencies. The studies envisaged are:

(a) Long-Range Development Plan for the Upper Valley; 18 specialists plus consultants and administrative staff (213 man-months/2 years duration --$1,300,000)

(b) Irrigation Feasibility Studies - 15,000 ha; 12 specialists plus administrative staff (81 man-months/12 months duration--$500,000).

(c) Land Tenure Policy Studies; six specialists plus consultants (48 man-months/6 years duration--$200,000).

(d) Studies on the impact of Senegal River basin development on Women, Pastoralists and Fishermen; five specialists plus research support staff (45 man-months /4 years duration--$40,000).

(e) Fishing Estuary Study; four specialists plus support personnel (16 man-months /6 months duration--$200,000).

(f) Telecommunications Policy Study; four specialists plus support personnel (17 man-months/6 months duration--$100,000).

(g) Farm/Household Surveys and Monitoring; three specialists plus research assistants and participating agency agronomists and social scientists to set up program and establish base line data (63 man-months/12 months duration--$60,000). Monitoring by project support staff in each zone will continue for five years.

(h) Health Surveillance Surveys; eight specialists plus staff support from participating agencies (420 man-months/7 years duration--$1,100,000).

4. Training

The IDP will finance special short term training, regional workshops and conferences, and the cost of sending participants to international conferences; estimated cost, $350,000.

5. Commodities

The IDP will finance commodities to support regional operations such as vehicles, house and office furnishings and equipment; estimated cost $550,000.

6. Operating Costs

The IDP will finance project-related travel costs of OMVS and other agency personnel; salaries of locally-hired project support staff; and costs of vehicle operation and maintenance, office operations and expendable supplies; estimated cost, $1,523,000.

B. Senegal National Program

The IDP component for Senegal in the amount of $21 million is focused on the geographical areas of Bakel and Podor. Bakel is a town of 8,000 population located at the upper end of the Middle Valley, some 800 kilometers (km) above the mouth of the Senegal River and about 400 km downstream from the Manantali Dam site. The project zone extends several kilometers along the river bank on either side of the town with a total population of about 25,000. Podor is located at the lower end of the Middle Valley some 250 km above the mouth of the Senegal River and about 950 km downstream from Manantali. The project zone encompasses the urban community of Podor and neighboring villages with a total population of about 14,000.

1. Bakel Irrigated Perimeters Development

The IDP program in Bakel will continue and expand the prototype agricultural development program initiated by AID with the Bakel Small Irrigated Perimeters Project in 1977. Included in the proposed new IDP are:

(a) Continuation of extension activities in the 25 villages that participated in the former small perimeters[1]/ project aggregating 611 hectares (ha).

(b) Upgrading/rehabilitating 13 existing small perimeters aggregating 281 ha; estimated cost, $203,000.

(c) Extending two existing small perimeters and creating 23 new small perimeters of approximately 20 ha each for a total of 470 ha of new construction; estimated cost, $463,000.

(d) Completing and expanding the 92 ha first phase of the Bakel-Collenga medium perimeter now being developed to 244 ha, estimated cost, $1,254,000.

2. Podor Irrigated Perimeter Development

The IDP will begin the development of the Podor perimeter which will be situated in a large silting basin lying between Doue Creek and the Senegal River. Every year the site is partially flooded depending on the Senegal's flood stage levels. A total of 1580 ha is available for development. The IDP aims at constructing and bringing into production 1063 ha in a phased approach. Initially, 382 ha will be developed progressively on the southern part of the basin bordering Doue Creek using small perimeter techniques. For the eastern part of the basin bordering the Senegal River, larger irrigated sections will be constructed--294 ha, 214 ha and 173 ha. The whole will be enclosed within a flood protection dike. Total cost is estimated at $6,432,000. In addition IDP will finance the design and construction of of project office space at Podor, about 100 square meters, at an estimated cost of $83,000.

1/ A "perimeter" is the term commonly used in the project areas for a composite of contiguous irrigated parcels of land located at the same geographic site. Such perimeters covering 10 to 100 hectares are referred to herein as "small" while an area of 100 to 300 hectares is designated "medium". A small perimeter generally consists of a diesel pump(s) at the river's edge discharging up the bank to a network of canals serving partially leveled cultivated plots.

3. Operating and Technical Support to Bakel and Podor Irrigated Agriculture

In addition to the physical aspects of irrigated agriculture development described above for Bakel and Podor the project will provide:

- Support to the activities of SAED 1/, the national rural development agency, in the two project zones.
- Support to existing farmer associations in Bakel, and new associations in Bakel and Podor.
- Training for farmers and agricultural technicians.
- Improved agricultural extension.
- Improved rural credit and production input supply system.
- Continuous monitoring and evaluation systems.

1/ "SAED" is the French acronym for the Society for Development and Exploitation of the Delta, a Senegal government agency headquartered in Saint-Louis.

The estimated costs of the above supporting activites may be summarized as follows:

- Technical Assistance, including five long term Technicians.	$ 2,995,000
- Commodities, including vehicles, and equipment for irrigation	2,189,000
- Operating Cost, including project support staff, technical operations, training vehicle operation and maintenance	2,377,000
- Rural Credit	1,200,000
Total for Agricultural Support Activities	$ 8,761,000

4. N'Thiagar Feasibility Study

N'Thiagar is a site proposed by SAED for rehabilitation under the IDP. It is one of the older large-scale perimeters developed in the Delta region in 1977-78 by SAED. It is a "problem" perimeter of some 870 ha which has fallen into disrepair with a record of low yields, high production costs and sociological problems. AID declined SAED's request to include funding of its rehabilitiation in the IDP but indicated a willingness to finance a feasibility study which would examine the technical and socioeconomic problems and prepare a project plan for possible financing by other donors. Estimated cost of the study is $100,000.

5. Health Surveillance Program

The program is designed to assist the Government of Senegal in deterring deterioration in human health in the river basin due to an increase in the prevalence of malaria, schistosomiasis, or other health problems which might occur with the introduction and practice of irrigated agriculture. Activities will include:

- Improving Senegal's disease surveillance and control capacity by the long-term training of epidemiologists, nurses and laboratory technicians.

- Monitoring by the use of periodic epidemiological surveys the prevalence of malaria, schistosomiasis, malnutrition, and other diseases in the villages around the perimeters of Bakel and Podor.

- Evaluating the effectiveness of different approaches to the control of the above diseases.

Project financing will be provided for training, commodities, vehicles, laboratory equipment, teaching aids, medicines, operating expenses, minor renovations of existing buildings, and some technical assistance; estimated cost, $1,100,000.

6. Telecommunications Program

There is at present no reliable telecommunications link between the project sites and SAED headquarters at Saint-Louis. The IDP provides for a rural satellite pilot project with the immediate objective of providing reliable long distance telephone links between an earth station in Saint-Louis and an earth station in Bakel via the INTELSTAT system. The cost is estimated at $1,500,000 from IDP funds and $500,000 from the Rural Satellite Project.

7. Feeder Roads Program

The program includes planning and construction of 51 kilometers of low-volume feeder roads to connect village perimeters to National Highway No 2 which runs roughly parallel to the river on high ground several kilometers back from the river bank. The construction would connect perimeters having a total of 730 hectares in the Bakel area to the national highway. Although planned as a part of IDP, funding for the feeder road component is being provided to Senegal under a separate USAID/Dakar undertaking, the Economic Support Fund Project.

C. Mauritania National Program

The IDP component for Mauritania in the amount of $21.7 million is focused on the geographical areas of Gouraye and Kaedi. Gouraye is located just across the river from Bakel. Kaedi is located some 300 km downstream; about 500 kilometers above the river mouth and 700 kilometers below Manantali Dam. The portion of the river encompassed by the Gouraye and Kaedi sectors contains a population of about 50,000 with over 20,000 in Kaedi, the regional capital.

1. Small Irrigated Perimeter Development in Gouraye and Kaedi Sectors

The irrigated agriculture program will involve 19 villages in the Kaedi sector and 14 villages in the Gouraye sector. These villages presently have about 650 ha of irrigated agriculture in small perimeters. An additional 300 ha are expected to come under production in the Kaedi sector in 1984 under a European Development Fund (FED) project.

The project provides for the development in close coordination with the World Bank of 2,250 ha of new irrigated perimeters to be accomplished in two phases. The first phase covering three years will involve only small perimeters. During this phase the World Bank will finance equipment, construction, operating costs and limited technical assistance required to develop 75 small perimeters covering 1,570 ha (about an $11,000,000 undertaking). The IDP will provide complementary assistance during this phase through Mauritania's national rural development agency to upgrade agricultural extension services, strengthen farmer organizations and improve agricultural credit and input supply systems.

In the second phase covering four years the IDP will finance the rehabilitation and upgrading of 190 ha of existing small perimeters (estimated cost $179,000) and an 80 ha extension of an existing perimeter (Soulou) in the Gouraye sector (estimated cost $297,000). Further, the IDP will begin the development of medium-sized perimeters as described immediately below.

2. Medium Perimeter Development in the Kaedi Sector

Once the World Bank and FED-financed small perimeters are constructed, possibilities for the developmnt of further small village perimeters are limited. A move to medium-sized perimeters is dictated both by topographical constraints and the need for higher land-to-farmer ratios of cultivation and productivity.

The Mauritanian government proposed sites in the Kaedi sector for development of two medium perimeters of approximately 300 ha each--Dirol and Winding--and the current IDP paper provides for both. However, after further consideration the RBDO has decided not to proceed with the Winding site.

The Dirol site is on a flat natural plain about 25 km downstream from Kaedi with heavy alluvial soils cut by the seasonal Dirol Creek which discharges into the Senegal River. The plain is flooded annually by rainfall run-off draining into the area. In years of good rainfall about 2,000 ha in the plain are cultivated with millet and sorghum. The total surface area of the plain is about 8,000 ha. There are eight villages in the area with a population of over 8,000. The development proposed in the IDP paper envisages a small barrage to retain water in the creek for irrigating a perimeter of approximately 300 ha along its banks.

The cost for development of the two 300 ha medium perimeters originally proposed was estimated at $2,981,000.

3. Operating and Technical Support to Gouraye and Kaedi Irrigated Agriculture

In addition to the physical aspects of irrigated agriculture development described above for Gouraye and Kaedi, the project will provide:

- Support to the activities of SONADER1/and other national institutions in the two project zones.

- Support to farmer associations in the 33 villages reached by the project.

- Training for farmers and agricultural technicians.

- Improved agricultural extension.

- Improved rural credit and production input supply systems.

- Continuous monitoring and evaluation systems.

The estimated cost of the above supporting activities may be summarized as follows:

- Technical Assistance, including seven long-term technicians	$ 3,260,000
- Commodities, including vehicles and equipment for irrigation	1,765,000
- Operating Costs, including project support staff, technical operations, training, vehicle operation and maintenance	3,134,000
- Rural Credit	1,500,000
Total for Support Activities	$ 9,659,000

1/"SONADER" is the French acronym for the National Rural Development Agency, a Mauritanian government agency with headquarters in the capital, Nouakchott.

4. Feeder Roads Program

The program will include final design and construction of 136 kilometers of feeder road to link the perimeters in the Gouraye sector to the main road running from Gouraye to Seleibaby. The construction would serve perimeters aggregating about 1,170 hectares. The implementing agency would be the Public Works Service within the Ministry of Equipment and Transport, the same agency responsible for the implementation of the separately AID-financed Rural Roads Improvement Project (682-0214) that will upgrade 206 kilometers of roads to all-weather status, including the Seleibaby-Gouraye section of National Highway No. 5. Feeder road maintenance costs for the first two years ($54,000) is included under "Operating Costs" in 3. above. Estimated cost to IDP for feeder road construction is $5,022,000.

5. Health Surveillance Program

The program is designed to assist the Government of Mauritania in improving its ability to conduct disease surveillance in the Senegal River basin and prevent the deterioration of the health of the population living in villages where irrigated perimeters will be renovated or constructed under the IDP. Activities will include:

- Training personnel in techniques of disease surveillance.

- Providing material and other support to the national and regional health centers at Kaedi and Seleibaby toward the conduct of disease surveillance and control activities in the target villages.

- Comparison of the efficacy of different strategies for the control of schistosomiasis and malaria in the target villages;

- Monitoring nutrition among childern under age three years in the target villages.

Project financing will be provided for technical assistance, training, vehicles, laboratory and office equipment, medicines, minor building renovations and operating expenses; estimated cost, $1,700,000.

D. Mali National Program

The IDP component for Mali in the amount of $11 million is focused on the geographical area extending some 130 kilometers upstream from the Senegal and Mauritania borders to about 30 kilometers above the regional capital of Kayes. This sector lies in the Upper Valley of the Senegal and is about 950 kilometers from the mouth of the Senegal River and 250 kilometers downstream from the Manantali Dam site. The Kayes sector has significantly greater rainfall than the sectors in the Middle Valley downstream -- annual precipitation 700-800 millimeters. The irrigated agriculture development program will concentrate on 17 villages with a population of 14,000 along the river.

1. Rehabilitation of Small Irrigated Perimeters

The IDP will finance the rehabilitation of 232 hectares of existing small perimeters in 10 villages. The perimeters generally consist of a diesel pump, a network of canals, surface drains, some small flood protection dikes and partially leveled plots that vary in size from 10 to 50 hectares. In the 1982 dry-season only 118 hectares out of 282 hectares in eleven villages were cultivated. Production suffers from a host of factors ranging from poorly maintained pumps and irrigation networks to poor application of irrigated farming techniques and uncertain and expensive supply of production inputs. Estimated cost of perimeter rehabilitation is $193,000.

2. New Irrigated Perimeter Development

As presented in the project paper, a total of 933 hectares was identified for possible new irrigation development. However this was considered tentative pending the outcome of the Kayes Regional Development Plan to be prepared under the auspices of OMVS, as mentioned heretofore under paragraph IV.A.3.(a), which would consider a mix of further irrigation development and upland rainfed agriculture and livestock development. Indeed, additional information already gathered by RBDO indicates that large scale cuvettel/ development is not desirable. The cost of such development as originally proposed was estimated at $2,960,000.

1/ "Cuvettes" are former river beds or depressions lying parallel to the river, agricultural alluvial areas with heavy loam soils.

3. Operating and Technical Support to Irrigated Agriculture

In addition to the physical aspects of development described above, the project will provide:

- Support to the activities of OVSTM1/ and other national institutions in the project zone.
- Support to farmer associations for perimeters in the project zone.
- Training for extension agents, farmers and farmer associations.
- Improved agricultural extension.
- Improved rural credit and production input supply systems.
- Continuous monitoring and evaluation systems.

1/"OVSTM" is the French acronym for Operating in the Valley of the Senegal and Lake Terekole - Magui, the rural development agency in western Mali under the Ministry of Agriculture.

The estimated cost of the above supporting activities may be summarized as follows:

- Technical Assistance, including four long-term technicians	$2,958,000
- Commodities, including vehicles, office and irrigation equipment	595,000
- Project Office Construction	95,000
- Farmer Association Offices	244,000
- Operating Costs, including project support staff, field operations, training, vehicle operation and maintenance	603,000
- Farmers functional literacy program	285,000
- Rural Credit	800,000
Total for Support Activities	$5,580,000

4. Feeder Roads Program

A program for 26 kilometers of low volume feeder roads was designed to connect village perimeters with National Highway No. 1 (RN 1). However, RN 1 which is set back from and roughly parallels the left bank of the river from Kayes to the Senegal border at Diboli is little more than a track battered by heavy trucks and seldom repaired or maintained. The upgrading of this section of RN 1 was found to be the top transportation development priority for the Kayes region. Therefore it was decided that IDP funds would be better spent for financing a feasibility study for improving the highway link serving the area. The terms of reference for the feasibility study have been developed and are included in the technical annex to the Project Paper. The cost of the study was estimated at $300,000.

5. Health Surveillance Program

The program is designed to help the Ministry of Health prevent the deterioration of the health of the population in the Kayes region because of the effects of construction of Manantali Dam and the expansion of irrigated agriculture. The program will be based in the Research and Training Center in Mahina which will establish an Epidemiological Surveillance Unit to carry out three major activitives:

- Conduct epidemiological surveys of specific diseases in the villages where irrigated perimeters will be constructed or in villages resettled because of the construction of Manantali Dam.

- Provide technical support to health center personnel to help them design surveillance and monitoring systems and to support some limited disease control activities.

- Provide training for medical and paramedical students in the theory and practice of epidemiologic surveys and surveillance.

Project financing will be provided for training and technical assistance, renovation and equipping the Center's buildings, logistical support and operating expenses, medicines and supplies; estimated cost, $1,100,000.

V. Observations and Recommendations

There is hesitation at attempting in a brief presentation to set down cogent "observations and conclusions" on a two-thousand-page project proposal that involves a number of disciplines, three countries and a regional organization. To be of value it is believed that such commentary should be directed toward specifics of project design and implementation that significantly affect the viability of the proposed undertaking. This I will endeavor to do; first with respect to the project as a whole and then sub-project specific by region and country.

A. The Project in General

What the IDP is about is increasing the agricultural production of the lands and the people of the Senegal River Basin through better utilization of its water resources, supported of course by the whole mix of inputs and activities--seed, fertilizer, extension services, communications, marketing, etc.--necessary for effective farm production.

The timing of the IDP is particularly appropriate as the completion of Diama and Manantali Dams (1986 and 1989 respectively) will reasonably assure water availability year-around, and year-to-year, for some 300,000 irrigable hectares. At present only about 10 percent of that area is under water control and there is no assurance of water for cropping during the dry season.

In terms of the increase in irrigated area and related food production directly attributable to the IDP the gain will be modest; in the short term, upgrading some 703 hectares of existing perimeters and development of 550 hectares of new small village perimeters, 1,907 hectares of medium-sized perimeters, and 933 hectares of cuvette irrigation (tentative) over a seven-year period. This aggregates to only about 4,100 hectares; hardly impressive considering the $63 million price tag of the overall project.

However the far greater benefit envisaged by a successful IDP is its long-term effect in strengthening institutions and demonstrating irrigated agriculture development through approaches that can be replicated throughout the Senegal River Basin.

Central to that successful replication is the role of the farmers: participants not just beneficiaries of a top-down undertaking. No perimeter is to be developed without a bona fide request from a self-organized farmer group in which land use rights are vested nor without a major labor input by the group--"sweat equity"--in its construction. Likewise the management of the perimeter, water application and cultivation will be in the hands of the farmer group with support of the rural development agency (RDA).

Given the crucial role of the national rural development agencies--SAED, SONADER, and OVSTM--in implementation of the IDP and their present shortcomings, the success of the project is hardly assured. Nonetheless the potential gain is worth the risk and there is no viable alternative to proceeding through existing institutions and in the process attempting to upgrade their service capability.

In proceeding with the project, one must never lose sight that the central aim is more area in the Senegal River Basin under more effective cultivation. All the concomitant activities--technical assistance, strengthening institutions, feeder roads and improved communications, health surveillance--have no life of their own (though there may be fall-out effects); their role in the project is to support the expansion of irrigated agriculture and the maintenance of a higher level of food production.

There are a number of considerations affecting the structure and implementation of the IDP that are common to the endeavors in each of the OMVS member states. Observations and recommendations with respect to these common items are presented immediately below rather than being successively repeated in each national program commentary.

1. <u>Performance of Rural Development Agencies</u>

As the main thrust of the IDP is irrigated agriculture production, the rural development agencies (RDA's) in each country--SAED, SONADER, and OVSTM--play the dominant roles in implementation of the project and its ultimate success. The Project Paper is quite clear on the considerable shortcomings of the RDA's in each of the countries--overstaffing, over-centralization, level of skills, lack of training, shortage of funds--and how the

RDA's are in a state of transition, emphasising technical services to farmers while moving away from commercial operations such as supply of production inputs, credit and purchasing of crops.

An obvious question is why build the IDP around SAED, SONADER AND OVSTM when their performance is suspect? In the answer there is an element of "the only gambling house in town" cliche. These are organizations in place through which perimeter development and operation to date have been carried out. They are virtually the only source to the farmers of seeds, fertilizer, pumps and pump maintenance, engine fuel, agricultural extension services, credit and marketing. With all their warts, abandoning them is not a viable alternative; rather, they must be strengthened while their roles are rigorously redefined and the private sector encouraged to take over input supply and market functions.

The IDP will strengthen the transition of the RDA's to service-oriented, technical support organizations by providing a whole spectrum of technical assistance, training and funds for perimeter development and operating support to irrigated agriculture. But in the end it will be the performance of the RDA's that makes the difference, their commitment to change and their capacity to provide qualified people in the field with the will to work productively with the farmers in the establishment and cultivation of the perimeters.

RECOMMENDATION: That RBDO and AID Mission project staff not become mesmerized with the construction element of the project but work unrelentingly with the RDA's to assure timely assignment of qualified or trainable personnel to project activities--counterparts for IDP technicians, field staff to assist farmer associations in perimeter development and operation, and extension workers to assist the cultivators.

2. Land Tenure and Farmer Associations

The land tenure system of the Senegal River Basin is varied in terms of ownership, land use and inheritance rights. Collective family ownership is the predominant pattern for the most valuable "walo" lands (terrain inundated yearly by flood). "Djeri" lands (valley lands not normally inundated by floods) are available to all under some form of village control.

Villages have a territoriality that no chief has the right to change and inalienability of land is a very strong principle in the practice of group ownership. No head of a family, clan or village can cede his groups rights, nor can higher authority expropriate them by means other than force or fiat.

The pattern of village ownership and control of land use has been utilized, and will be utilized by IDP, as a positive force in small irrigated perimeter development. Such development comes from the bottom up: by a group of farmers having use of land under village control organizing themselves into an association to construct, operate and cultivate an irrigated perimeter.

Challenges remain as to how to fit this basic system, which has been proven to work, to larger perimeters where group land use rights may have to be negotiated and federations of farmer associations formed for management and operation of joint facilities.

The good thing going for IDP here is that well designed and managed perimeters are accepted by the traditional economic and sociocultural systems. Thus one may be optimistic that with careful attention to sociocultural norms and principles of land ownership/use expansion can be made without undue strain on the system. And with a population of some 80,000 in the project zones residing in 56 villages and two towns, no colonization from outside will be required to farm the perimeters.

3. Economics and Marketing

It is not my mission or intention to appraise the economic analysis of the project. I would comment on two factors that are related and could significantly affect the benefit stream from farm production.

The level of output of each farm is of course dependent on many factors. Assuming basic production constraints are reasonably well-managed--seed, fertilizer, water, etc.--there remains the motivation of the cultivator to produce a second (dry season) crop. It is hot hard work, particularly when it is all done by hand, and there is little incentive to expend the labor and incur the expense of crop inputs to produce more than one's family can consume unless there is a market for the output that will return a profit.

With the RDA's phasing out of crop purchase (which was not particularly satisfactory for either the RDA or the farmer), and with the prospect of greater production attendant upon adequate water levels in the river (post Manantali Dam completion), it is far from clear where and how crop production excess to the farmers' needs will be sold.

The IDP as structured provides for a business development specialist under the OMVS regional component to promote private sector activities which is a move in the right direction. However, I perceive a need at the national and zone level for a thorough market analysis with respect to sale of production expected from the upgraded and newly-developed IDP perimeters; in particular, what is needed--rice, corn, sorghum, fresh vegetables, etc., how much is needed, where is it needed, when is it needed, what will be the likely price, how will it be transported and sold? Answers to such questions are basic to the production decisions and level of effort the farmer is prepared to undertake.

RECOMMENDATION: That RBDO include as an IDP activity, perhaps under the "Studies" portion of the OMVS regional component, a market study and analysis seeking the answers to the questions posed above.

4. Upgrading of Existing Perimeters

In the commentary which follows in each of the sections on national programs, perimeter "upgrading" programs are discussed. Rather than go into intricate detail in each instance, set forth below are representative items that must be examined at each of the existing perimeters slated for rehabilitation/upgrading:

- Condition of irrigable surfaces and need for plot leveling
- Soil characteristics; testing for permeability, crop suitability and crop water requirements
- Condition of the main canals; slope, section, seepage losses, erosion of banks
- Condition of the secondary canals and field distributaries
- Condition of the concrete or masonry works: head boxes, stilling basins, gates, turnouts, etc.

- Need for or condition of field drainage system and drainage canals

- Drainage of rain water and protection against runoff

- Condition and design of the pumping system: engine, pump floating platform, fuel consumption, intake, discharge piping, stilling basin

- Pumping rates and volumes

- Supply and storage of diesel fuel

After investigation of each of the above items, and any others applicable, a design study and detailed rehabilitation/upgrading plan must be prepared for each site.

5. Pump Design and Water Supply to Irrigated Perimeters

Although mentioned in the commentary following on each of the national programs, the pumping arrangement and water conveyance are so crucial to the operation of a perimeter that it deserves special emphasis.

Until electric power is generally available in the Senegal River basin (and it is many years away), the diesel-driven pump placed on a floating platform at the river's edge and discharging 4-16 meters up the bank through light-weight pipe to a headbox/stilling basin is clearly the most workable arrangement for supply of water to small perimeters. (A clear exposition of the options appears in the project paper Technical Analysis, Vol. III, Section 3.2, paragraph 3.2.6.D.) Such a pump unit is reasonably movable and can provide the water needed to irrigate a typical small perimeter of 20 ha gross area. This is the arrangement that has generally been employed and is within the operating capability of the farmer association with some technical and logistic support from the RDA.

Two factors are of critical importance: proper design of the pump unit and its dependability. Neither has a good track record to date but with proper attention can be much improved for the perimeters to be

upgraded or newly developed. Also a body of experience has been building which will improve pump operation and maintenance over time.

As to design, a sturdy diesel engine is required to drive a pump whose characteristics are matched both to the engine and the specific lift and discharge requirements for a specific perimeter. Experience has shown a particular engine (LISTER HR series) to be the sturdiest and easiest to maintain (mechanic familiarity and availability of space parts). The engine and pump required for best efficiency over the range of lift and discharge requirements peculiar to a particular perimeter is a basic design matter of no particular difficulty; but it does require site-specific design attention which appears to have been lacking in the past. The mounting of a unit on a proper floating platform is also important but experience has already led to progress in this area and design of an economic and reliable floating support (perhaps a cellular steel box or pontoon) poses no insurmountable problem. A serviceable supply and storage arrangement for diesel fuel is also needed to replace the present manhandling of oil drums.

Maintenance and repair is a crucial necessity even with the best designed pumping installation. If a pump goes out of service during the irrigation season for an appreciable period of time, a perimeter's crops can be severely damaged, or even lost. Much of this kind of experience can lead to abandonment of a perimeter. Cultivators simply cannot afford to make the inputs required and then watch their crops die for lack of water.

With respect to conveyance of the water from the pump discharge at the stilling basin to the farm plots, most of the existing perimeters utilize uncompacted earthen canals with high seepage losses and easily erodable banks. This is hardly avoidable with hand construction. High seepage losses are unacceptable as are inefficient pumps: pumped water is just too costly at best to waste on the way to the fields. Clearly, supply canals and distributaries must be better constructed even if it requires more costly machine work, lining or pipe in special cases, pipe.

RECOMMENDATION: (1) That extraordinary effort be made to assure proper design of engine-pump units and water supply canals to serve each perimeter

upgraded or newly developed under the IDP program. In my view the investigation and design should be contracted to an experienced engineering firm, at least at the beginning of the program.

(2) While maintaining the policy of maximum participation of the farmer groups in construction of perimeter works, that differentiation be made between work that can be reasonably well done by hand such as preliminary site preparation and individual plot work, and that which needs construction machine work--heavy excavation and earthmoving, compaction, land shaping and leveling.

(3) That IDP make an extraordinary effort with the RDA's to set up and maintain an effective pump maintenance and repair program to assure reliable water supply to the perimeters, including stocking of some "loaner" pump units to keep a perimeter going at critical times when there is a major breakdown of equipment.

6. Construction Costs - Irrigated Perimeters and Feeder Roads

A rigorous examination of construction costs for the IDP would be a special undertaking. Certainly in this review I am not inclined to second-guess the engineers on the ground and familiar with the area on the many individual items of direct cost that go into the make-up of a cost estimate. My concern with the IDP construction cost estimates is whether adequate allowance has been made for such informed judgment calls as Physical Contingencies, Price Contingencies, Engineering (Design and Construction), And Price Escalation (inflation).

At the feasibility stage of project definition rarely is the design of works precise enough for accurate determination of quantities or difficulty of the work. For example, the route for the Mauritania feeder road has yet to be determined on the ground; and, small irrigated perimeter preliminary design is based on a model layout not site specific. In such circumstances it is short-sighted not to make substantial allowance for both physical and price contingencies; else one borrows budget problems down the road. A "contingency" in most of the IDP estimates was noted at 10-15% (there were exceptions both above and below) with no differentiation between physical and price variations. In my experience with feasibility-grade construction cost estimates I have found

it prudent to add to directly generated costs an allowance of the order of 25% for physical contingencies and 15% for price contingencies.

RECOMMENDATION: (1) That in the final version of the Project Paper, cost estimates for construction of both perimeters and feeder roads be structured so that physical contingency, price contingency, engineering (design and construction), and price escalation (inflation) are easily identifiable.

(2) That in the absence of rational explanation to the contrary, estimates of construction costs for the various installations include an allowance of at least 25% and 15% respectively for physical and price contingencies.

7. Project Scheduling and Management

By any measure implementation of the IDP will be a complex undertaking. Three countries and a regional organization will be involved over a seven-year period with a host of sub-projects covering the gamut of engineering and construction, technical assistance, training and commodity procurement, going on simultaneously and often with critical interfacing.

Such an undertaking is really outside the scope of the conventional bar chart for effective scheduling and managing of such multiple and interrelated activities. Without a more sophisticated management tool it is my view that RBDO and the USAID Missions will find the implementation of the project bordering on chaos.

A PERT or Critical Path network type of analysis is needed to refine and sharpen the project implementation plan, to identify critical sequences and interfaces, and provide a plan and schedule that will enable effective monitoring for timely management response.

RECOMMENDATION: That a contract be sought with an appropriate professional services firm to develop a computer-assisted IDP implementation plan and schedule for the use of RBDO and the country USAID's in managing the multiple activities of the Integrated Development Project.

B. OMVS Regional Program - Observations and Recommendations

The regional component of IDP is entirely appropriate for a river basin development coordinating body such as OMVS with interests covering three national programs. The activities include:

- A long-range development plan for the upper valley
- Feasibility studies for irrigation development in the Upper and Middle Valleys and for a fishing estuary study in the Delta
- Policy development studies concerning land tenure, women, pastoralists, fishermen, and telecommunications
- Financial and programming coordination for all project activities
- A Management Information System supported by improved baseline studies, continuous monitoring, and periodic evaluation
- Private sector development though a regionally coordinated business promotion program
- Training, conferences and technical support for national program activities
- Donor coordination to improve project planning and to increase capital investments for agricultural development in the Basin

As I am in substantial agreement with the purpose and thrust of the above activities my comments will be directed only to those elements where implementation problems are perceived.

1. Organization and Staffing Within OMVS for IDP Activities

OMVS will have the dual role of implementing IDP regional project activities for which it will have direct authority and of coordinating the implementation of IDP national project activities of Senegal, Mauritania and Mali.

It has been proposed that the present General Studies Division of the Directorate of Development and Coordination be transformed into a "project management unit" and renamed the Division of Integrated Development. Unfortunately the Chief of the Division of General Studies is the only permanent employee in his division. Thus the five-man technical assistance staff provided to OMVS for project management under IDP will tend to be "the tail that wags the dog" unless OMVS is able to bolster the new Division with more of its own people, either by transfer or new hire. The point here is that counterparts or permanent associates are needed to work with IDP technical assistance staff both to make the project management an OMVS operation and to leave behind an effective, functioning Division at the end of IDP involvement.

2. Studies

A review of the various studies proposed (as outlined in Section IV.A.3. above) shows them to be well conceived in purpose and scope and generally with sufficient inputs provided for their accomplishment.

The glaring exception to the above are the Irrigation Feasibility Studies which are intended to develop site-specific social, economic and technical feasibility reports for 15,000 ha of irrigable land in the three OMVS member states. The studies are to be prepared, following completion of the Long Range Development Plan for the Upper Valley, for perimeters in the middle and upper valleys representing the various physical parameters of the areas--soils, crops, topography, drainage and water source. The objective is to formulate concrete projects, including feasibility studies, preliminary plans and cost estimates, to submit to prospective donors who will fund detailed design and construction. Appropriate terms of reference (except for "Preparation of Tender Documents", including detailed drawings, which is outside the scope of feasibility work) are included for the feasibility studies in the project paper Technical Annex, Vol. III, Section 3.8.

The rub is that the time allowed (12 months), the outside resource input (48 man-months of contract services), and the budget ($500,000) are totally unrealistic for achieving the 15,000 ha objective. Within these limitations and in consonance with the terms of reference, one would be fortunate to secure studies for two perimeters in each of the three OMVS member countries --likely less.

RECOMMENDATION: That the contract services level of effort involved in the studies and the budget required be re-examined by the RBDO based on a rational assumption of the number of perimeters that might be studied -- say a minimum of two small, one medium and one large perimeter in each of the three countries; many more if the 5,000 ha objective is to be attained. The number and types of perimeters to be studied are a better gage for projecting level of effort and cost than gross area.

C. Senegal National Program - Observations and Recommendations

1. Bakel - Upgrading of Small Irrigated Perimeters

Out of a total of 611 hectares of existing perimeters at 26 sites, 281 ha at 13 sites have been identified for upgrading/rehabilitation.

The existing perimeters appear to have been developed more by "main strength and awkwardness" than by careful investigation, design and quality construction. This is stated as a recognition of realities rather than a criticism of past effort. Indeed, given the situation, the accomplishment to date might be considered a minor miracle.

Typically, there was no soil testing at perimeter sites, no drainage data, no drainage system, little if any site specific pump design. Canals and distributaries were built by hand labor, with no compaction, as was land shaping and leveling of farm plots to the extent done. The result overall is an irrigation efficiency no more than half what it could reasonably be.

The IDP will provide the opportunity to apply some lessons learned, to step in and upgrade essentially to the standard contemplated for new perimeter construction discussed below. This means that the upgrading should not be undertaken on an ad hoc basis with whatever technical assistance and construction resources happen to be at hand. Rather, there must be a carefully drawn plan taking into account structure and fertility of the soil; soil percolation rate; crop water requirements; protection against run-off and drainage of rain water; reconstruction of canals and distributaries with attention to slope, section, seepage losses, compaction; land shaping and leveling of farm plots (with machinery if too severe to be

accomplished with hand labor); condition and design of the pumping system--engine and pump, floating platform (or other support), valves, piping, stilling basin and water control structures; the supply and storage of engine fuel.

There is nothing original about the importance of the above factors in good planning. The irrigation technical annex to the project paper recognizes the need for all of them either directly or implicitly. My concern is with the accomplishment. In my view, the entire job of carrying out the necessary investigations and surveys of all the sites, developing the detailed designs and technical specifications, and drawing up complete plans is outside the capability of SAED and technical assistance staff now, or likely soon to be at Bakel. And it would spread the RBDO Irrigation Engineer too thin to use him for detail work at the 13 sites.

RECOMMENDATION: That an engineering services firm with irrigation works, soils, agronomy and agricultural engineering expertise be retained to prepare the detailed upgrading plans for at least six perimeters. Construction management and supervision could be handled by SAED and IDP technical assistance staff. Construction equipment under SAED control should be utilized for selected earthwork and land shaping tasks that cannot be done effectively by farmer labor. The initial plans prepared as above could serve as models for the development of plans for the balance of the perimeters by SAED and technical assistance personnel, subject to confirmation by the RBDO Irrigation Engineer and the Agricultural Officer that such sufficiently qualified staff were in place. In short, getting the upgraded perimeters "right" the second time around is a must! The beginning of the program cannot be left to the vagaries of assignment of qualified SAED personned or the recruiting and effective establishment of the IDP technical assistance team.

2. Bakel - Development of New Small Perimeters

Two extensions of existing perimeters and 23 new perimeter sites aggregating 470 ha have been identified for development.

The typical small perimeter will consist of an irrigation scheme located at the top of the river bank occupying a 20-hectare area and operated by a group of 60 farmers. Water supply will be from a diesel-powered pump at the river edge discharging some 4 to 13 meters above

into a head box delivering water to a network of canals serving the farm plots. A drainage system and dike for protection against flooding will be provided if necessary.

For each new perimeter, a detailed topographic survey and soils survey (including determination of the soil's fertility, physical properties, and percolation rate) will be the first order of business after organization of the farmer group and site selection. From this basic information a detailed cropping and site construction plan will be developed which will include design and layout of the irrigation system (taking into account water application rates to suit crop requirements and soil conditions); the selection of pump and engine characteristics for most efficient operation at anticipated heads and discharge rates; land shaping and leveling of farm plots within the perimeter; a drainage system to dispose of excess irrigation water from the farm plots and to handle rainfall run-off; and, if necessary, dike protection of the area against run-off or stream flooding. NOTE: For some of the small perimeters the need for drainage may be minimal due to a favorable combination of soil permeability, low water table, and topography; however, the degree of drainage provided (or not) must be a specific determination based on careful evaluation of the characteristics of the site (including possible perimeter expansion) and not by default!

As in the case of rehabilitation/upgrading of perimeters as mentioned earlier, there is nothing original about recognition of the many factors that must be considered in proper design and construction of the small perimeter. The project paper's irrigation annex dwells on these matters at some length. My concern is how the necessary investigations and designs for 23 new perimeters are to be accomplished. Both in terms of work load and desired results it is my view that the entire task of necessary investigations, design, preparation of detailed plans, construction management and supervision is beyond the capabilities of the SAED and technical assistance staff now, or likely soon to be at Bakel. The kick-off of the new small perimeter program must be both timely and the final plans completed with a high degree of professionalism. Such complete plans are needed not only to guide the development work but also to serve as a permanent record of the details of the perimeter design and development.

RECOMMENDATIONS: (1) That an engineering services firm with expertise in irrigation works, soils,

agronomy and agricultural engineering be retained to make the necessary technical investigations, design the works and prepare the detailed plans for development of say the first 12 perimeters to be undertaken--representing at least a year's construction program, probably more. The plans prepared as above could serve as models for the development of designs and plans for the balance of the new perimeters by SAED and IDP technical assistance personnel, assuming such capability is ascertained by RBDO to be then in place.

(2) Supervision of the construction effort may remain in the hands of SAED and IDP technical assistance personnel though the need for involvement of the engineering firm in construction management should not be ruled out.

(3) Construction equipment under SAED's control should be used for selected earthwork and land shaping outside the capability of farmer labor.

3. Expansion of the Bakel-Collenga Medium Perimeter

The Collenga Plain lies adjacent to the Senegal River immediately upstream from Bakel and covers about 250 hectares. The run-off from a group of hills on the landward side with a catchment area of about 600 square kilometers (km^2) discharges to the plain and the river.

A total of 244 ha has been indentified as suitable for development into a medium-sized irrigated perimeter. Four small perimeters covering an area of 92 ha are now being developed primarily with hand labor under the usual farmer group arrangement. The existing canals and distributaries exhibit the high seepage rate and bank erosion associated with permeable earth shaped with hand tools and not compacted. Further, the interior shaping and leveling of farm plots with hand tools has left much to be desired.

The IDP envisages expanding the present development to a 10-unit, 244 ha medium perimeter with unit organization and management following small perimeter development techniques successfully introduced in the Bakel area. Some machine work will be utilised for earthwork and land shaping. Parts of the installation--pumping station, main canals, dikes, drains, etc.--will be integrated and managed collectively by a federation of the farmer groups.

As the Collenga development to date has proceeded generally with the shortcomings of small perimeters slated for rehabilitation as described in 1. above, the expansion to 244 ha should include upgrading of the existing 92 ha to the level of the anticipated six new units.

Accordingly, the entire site encompassing existing and planned new units should receive site investigation and detailed design attention discussed in 2. above for new small perimeters with much greater emphasis on drainage. A full-fledged drainage system will be required for the 2-1/2 square kilometers area. Flood protection will be required both from run-off from the 600 km^2 local catchment basin and back-flooding from the Senegal River via the seasonal water course that lies along the southern and eastern edges of the plain. Of crucial importance is the design of the flood protection dike and associated outlet drainage works to assure the security of the site.

The Project Paper indicated that topographic and soil survey work for the site would be contracted by SAED with final construction design performed by SAED. Upon further consideration RBDO has concluded that the necessary investigations (including highly important hydrology work), final design, and construction supervision should be placed under single responsibility in the hands of a highly qualified engineering firm. Such an arrangement meets with my full concurrence. Included herewith as Appendix 3 is the draft terms of reference for the design of the Bakel-Collenga Perimeter recently prepared by the RBDO Irrigation Engineer. It indicates a sound perception of the nature of the problems and the approach to their solution.

RECOMMENDATION: That an engineering services firm with expertise in irrigation and drainage works, hydrology, soils, agronomy and agricultural engineering be retained to make the necessary technical investigations of the site, design the works, and prepare the detailed construction plans; that the work (which will involve use of construction equipment and installation of pump and water control structures) be carried out by construction contract under supervision of the engineering services firm which develops the design. (NOTE: It is my view that SAED zone construction personnel and equipment will have their hands full with the upgrading and construction of <u>small</u> perimeters in the Bakel area).

4. Development of the Podor Large Perimeter

The site is located near the town of Podor in a large plain and silting basin lying between the Senegal River and Doue Creek which is partially flooded each year depending on the Senegal's flood stage. Annual flooding has left deposits of clayish soil in the lower part of the basin. Some 1580 ha have been identified as suitable for an irrigated perimeter. Various programs have been prepared over the years for the development of the basin and two small irrigated perimeters have been developed on the plain.

The IDP proposal to develop 1,063 ha is based on studies prepared for SAED by a French consulting group, "GERSAR"; specifically, "The Podor Pilot Scheme", March 1981. The IDP proposes a deviation from the scheme primarily with respect to the phasing of development over a longer period--five years instead of two--and beginning with some 300 ha to be developed as small perimeters by villagers along Doue Creek who hold traditional land rights in the area. This will permit early participation by near-by villages, will ease land tenure problems and enable gradual development of farmer associations and operating skills.

Development of the large Podor perimeter will proceed in two ways. First, the southern part bordering Doue Creek will be developed as conventional small perimeters of about 20 ha each, aggregating 382 ha. Second, the eastern part bordering the Senegal River will be constructed in three medium-sized irrigated sections aggregating 681 ha. These sections will be broken down into irrigation blocks of about 15 ha (net) each for cultivation by Podor inhabitants organized into farmer associations, with joint infrastructure managed by a federation of farmer associations. By the end of the five year development period a dike will have been constructed to protect the entire perimeter from flooding.

It is anticipated that each of the three medium-sixed irrigated sections will be served by its own electric pump(s) on the bank of the Senegal River with power generated by a central project station. In the small perimeter area, water supply for the initial development is expected to come from Doue Creek via conventional floating diesel pumps. At a later stage it is expected that the 382 ha "small perimeter" development will be organized and managed along larger-scale irrigated

network lines with a federation of farmer groups replacing the small diesels which serve the small perimeters with large electric pumps for reasons of economy and reliability.

In sum, the development of the large Podor Perimeter as proposed is based on a great deal of investigation and study and is expected to provide a fair test of design and implementation concepts beyond those so far tested with small perimeters. It will undoubtedly surface problems technical and human that will have to be overcome. Nonetheless it is believed accomplishable and should point the way for similar development in the Middle Valley--an absolute necessity as the sites for more simply developed small perimeters grow ever more scarce.

RECOMMENDATION: That all presently available technical data, studies and preliminary design work on the Podor site be collected and put in the hands of a highly qualified engineering services firm retained to make additional investigations and studies deemed required, design the works, and prepare detailed construction plans, specifications and bidding documents for securing a construction contract. The engineering firm's services should be further retained as SAED's agent for managing and supervising the construction work to completion.

5. Technical and Operating Support to Bakel and Podor Irrigated Agriculture.

The primary responsibility for implementation of the agricultural program rests with SAED with most activities in the hands of the Regional Directors at Bakel and Podor. A team composed of SAED and IDP technical assistance personnel will be set up in each area to direct project activities.

The performance of SAED will be all important to the success of the project from farmer organization and perimeter construction through harvesting the crop. Thus SAED will be the cutting edge with respect to assisting farmers in perimeter development, management and operations; training farmers and agricultural technicians; providing agricultural extension services; supplying crop inputs such as diesel fuel and fertilizer; providing pump maintenance and repair. SAED's performance in the past has left much to be desired and the trend is to move supply of inputs and marketing to the private sector.

To assist SAED in this host of activities IDP will provide a five-man technical assistance team composed of an irrigation engineer, an agronomist/extension specialist, a social scientist, an agronomist/research specialist and a credit specialist plus short term consultants for special tasks. IDP will also finance: commodities to support field level operations including pumps and irrigation equipment for perimeters, vehicles, office and technical equipment, training equipment, house furnishings for technical assistance personnel; a project office at Podor; operating costs for training, travel, vehicle operation and maintenance, project support staff, office and technical operations. An improved rural credit program funded by IDP will be established through the National Development Bank (BNDS) with SAED coordination to assist farmers (or farmer associations) with purchase of crop production inputs and irrigation and farm equipment. Except for the farmers "sweat equity", IDP will provide funds for almost everything associated with the project but salaries and remunerations of SAED and other government personnel.

Clearly as SAED goes, so goes the project. Technical assistance will be an important adjunct but in the end SAED's will and ability to place and keep in the field a substantial number of qualified personnel as technical assistance team counterparts, construction supervisors, extension workers, and trainers of farmers association personnel--pump operators, water managers, agricultural advisors, animal traction trainers, bookkeepers, functional literacy agents--will make the difference in whether the project moves or stagnates.

The recruiting and establishment of an effective IDP technical assistance team will be far from easy. Experienced, highly motivated technicians are needed to work in an area where amenities are few and living conditions difficult (on more than one occasion I heard Bakel characterized as a "punishment post" for government personnel).

RECOMMENDATIONS: (a) That RBDO make the most intensive effort to identify constraints to effective field staffing of SAED personnel and work unrelentingly with SAED to assure that needed personnel for IDP activites are in place.

(b) In recognition of the severe living conditions at Bakel (and to perhaps a lesser degree at Podor)--isolation, climate, health and medical facilities, uncertain water and electricity supply, no schools for dependent children--it is recommended that RBDO seriously consider the construction of an AID, or contractor, housing compound with basic amenities provided in order to attract and keep the kind of well-experienced, high-performance individuals needed for an effective technical assistance team.

(c) That the preparation of detailed perimeter development and construction plans for small perimeter upgrading and new construction not be left to the small IDP technical assistance team and as yet unassigned SAED civil and agricultural engineers, but contracted to an experienced engineering services firm; at least for the kick-off of the project.

6. N'Thiagar Feasibility Study

Financing the feasibility study for rehabilitation of this large problem perimeter (870 ha) in the Delta that has been under SAED administration since 1977-78 fits the Senegal portion of the IDP only in a general way. It is outside the geographic area of concentration. It is a large "sick" project under SAED management rather than farmer control with severe sociological and technical problems; altogether an operation that never really "got-going". Certainly a study might be useful toward resolution of some of the apparently fundamental problems plaguing the site, and might possibly form the basis for a rehabilitation project of interest to other donors. In sum, I find it a marginal activity with a strong smell of throwing good money after bad. In any event it would affect the thrust of the IDP in Senegal hardly at all.

RECOMMENDATION: That the N'Thiagar Study be omitted from the IDP package for Senegal. In the event RBDO feels a commitment to proceed with it, then it is recommended that it be included as a part of the package of feasibility studies in the OMVS component of the IDP.

7. Health Surveillance Program

It would be irresponsible to introduce irrigated agriculture in a region without assuring that steps are taken to monitor its effect on public health, in

particular malaria and schistosomiasis, and attempt to deal with the adverse consequences. The measures envisaged by IDP to be implemented through existing institutions in Senegal appear sound and practicable.

RECOMMENDATION: That a regular USAID/Senegal staff member be designated the control officer for the health component of the IDP in Senegal with the responsibility to follow-up with the involved national institutions the many facets of implementation of the project--detailed planning, training, commodity procurement, field operations.

8. Telecommunications Program

On the face of it, the IDP proposal to construct a new limited-capacity "thin-route" satellite-based communications system between Bakel and Saint-Louis parallel to an existing microwave "back-bone" telecommunication link at a cost of $2,000,000 is shocking. Even though the existing system is experiencing multiple operating, power supply, and outage problems (Bakel has been out of service since July 1981) as presented in Volume III, Section 3.7, paragraph 3.7.5. of the project paper, it would appear more cost effective to resolve the problems with the existing link than to in a sense rediscover the wheel which, though a different technology, might be just as difficult to maintain in operation.

RECOMMENDATION: That a Telecommunications Engineer such as Alfred Hotvedt of the NE/PD staff in AID/W review the Technical Analysis for Telecommunications and other relevant portions of the project paper dealing with the subject and assess the soundness of the IDP proposal.

9. Feeder Roads Program

Although designed as a part of IDP, financing for Senegal's feeder roads to serve the perimeters is being funded through the Economic Support Fund Project (ESFP). It is noted that the ESFP calls for 43 kilometers of road rather than the 51 kilometers in the Project Paper. Apparently the Gande-Galaldi link has been omitted.

RECOMMENDATION: That RBDO (a) confirm that the feeder road links to be constructed under ESFP will serve the perimeters planned and (b) check that the road

section design as set forth in ESFP, Annex G, Page G-2 is up to IDP standards. On the latter point see my comments below on Mauritania feeder roads.

D. The Mauritania National Program - Observations and Recommendations

1. Small Perimeter Development--Gouraye and Kaedi Sectors

A planned World Bank project to construct 75 new perimeters aggregating 1570 ha--780 ha in Kaedi and 790 ha in Gouraye--is at the heart of the new small perimeter development in Mauritania envisaged under the IDP. This effort will constitute the primary activity in the first phase (three years) of the overall undertaking. IDP will play a complementary role in this phase by the provision of assistance through SONADER to upgrade agricultural extension services, strengthen farmer organization, and improve agricultural credit and input supply systems. During this phase IDP will also finance through OMVS regional activities a long-term development plan for the upper valley which will include the Gouraye sector.

The World Bank is depending heavily on SONADER to design and construct the perimeters having concluded that, with technical assitance support, it has the capability to prepare final designs for each perimeter and lay out and supervise the construction. There will be a large labor input by farmer groups in the perimeter development. At the more difficult sites where the terrain requires earthmoving that exceeds the capability of the farmer groups, such work would be undertaken by local contractors under the supervision of SONADER.

In the second phase, IDP will undertake an 80 ha extension of an existing small perimeter, Soulou, and the rehabilitation of some 190 ha of existing small perimeters at ten sites in the Gouraye sector.

RECOMMENDATION: That the performance of SONADER during the development of the World Bank-financed small perimeters in the first phase of the project be carefully monitored by the RBDO as a guide to how best proceed with implementation of the small perimeter extension and upgrading program to be financed by AID in the second phase. In addition, some lessons may have been learned in the early years of IDP-sponsored small perimeter upgrading and new construction on the Senegal

side of the river that might be applicable to the similar undertaking in the Gouraye sector.

2. Medium Perimeter Development - Kaedi Sector

The Project Paper envisages development of two medium-sized perimeters at sites proposed by the Mauritanian government--Winding and Dirol--in the second phase of the IDP agricultural program. Closer examination by RBDO of the Winding site has led to its being dropped from the program as preliminary analysis showed the proposed development to be uneconomic. Also, the past history of a 32-hectare small perimeter in the area is not encouraging; it has gone out of cultivation three times--successful only when production inputs were furnished free to the farmers.

The Dirol site shows greater scope for development than that originally proposed. In addition to a medium perimeter, further investigation indicates considerable potential for development of controlled flood recession agriculture on part of the 8,000-hectare Dirol Plain. Such a development would be a natural follow-on for farmers who now cultivate up to 2,000 ha of millet and sorghum on the plain in good rainfall run-off years. it would serve to introduce these farmers in a gradual way to organization of groups for management of land and water as a forerunner to pumped irrigated perimeter development for off-season cultivation.

Preliminary analysis by the RBDO Irrigation Engineer of land area-water volume relationships obtainable with a low earth dam and water control structure on Dirol Creek near its confluence with the Senegal River shows good potential for a flood recession and irrigated perimeter development that needs to be followed-up. Toward that end RBDO has prepared PIO/Ts for contracts for both topographic and hydrologic studies of the Dirol Plain and its associated large drainage basin.

RECOMMENDATION: That RBDO proceed with securing necessary basic hydrologic and topographic data and that a full-fledged technical and socioeconomic feasibility study for development of the Dirol Plain by both controlled flood recession and pumped irrigated perimeter agriculture be completed by a highly qualified engineering firm early in the first phase of the Mauritanian irrigated agricultural program. And if results prove favorable, as expected, detailed site development and construction plans should be prepared by

services contract looking toward completion of the Dirol installation in the second phase of the program.

3. Technical and Operating Support to Kaedi and Gouraye Irrigated Agriculture

The responsibility for implementation of the irrigated agricultural program rests almost entirely with SONADER. Design and supervision of construction of perimeters will be centered in the Technical Directorate at headquarters in Nouakchott. Implementation of IDP activities will be primarily in the hands of the Regional Director at Kaedi and the Gouraye Sector Chief. A project team composed of SONADER and IDP technical assistance personnel will be set up in each area to direct the activities of the project.

SONADER is the instrument through which irrigated agriculture is introduced and maintained on the north bank of the Senegal River: perimeter development, management and operations; supply of crop inputs including fuel for pumps; maintenace and repair of pumps; farmer training and agricultural extension services; rural credit and marketing. SONADER's performance in the past has left much to be desired and the trend is to move supply of inputs and marketing to the private sector.

To assist SONADER and improve its performance in the above activities IDP will provide a seven-man technical assistance team composed at Kaedi of a Project Management and Credit specialist, an Agronomist/Extension specialist, a Sociologist, an Accountant, and an Irrigation Engineer; at Gouraye an Agronomist/Extension specialist and a Sociologist. Short-term consultants will be provided for special tasks. In addition, the World Bank will provide two Irrigation Engineers--one each at Kaedi and Gouraye--during the first phase (three years) of the project in connection with its 1,570 ha small perimeter development program.

IDP will also finance: commodities to support field operations including pumps and irrigation equipment, vehicles, office and technical equipment, training equipment, house furnishings for technical assistance personnel; operating costs for training, travel, vehicle operation and maintenance, project support staff, office and technical operations; and rural credit. Except for farmer's "sweat equity", IDP will provide funds for almost everything associated with the project but salaries and remunerations of SONADER and other government personnel.

Clearly as SONADER goes, so goes the project. Technical assistance will be an important adjunct but in the end SONADER's will and ability to place and keep in the field a substantial number of qualified personnel as technical assistance team counterparts, construction supervisors, agricultural extension workers, and trainers of farm association personnel--pump operators, water managers, agricultural advisors, animal traction trainers, bookkeepers--will make the difference in whether the project moves or stagnates.

The recruiting and establishment of an effective IDP technical assistance team will be far from easy. Experienced and highly motivated technicians are needed to work in an area where amenities are few and living conditions are difficult, more so in Gouraye than

RECOMMENDATIONS: (a) That RBDO make the most intensive effort to identify constraints to effective field staffing of SONADER personnel and work unrelentingly with SONADER to assure that needed personnel for IDP activities are in place.

(b) That an Irrigation Engineer be added to the IDP technical assistance team to be posted at Gouraye during the second phase of the project when extension of an 80 ha perimeter and upgrading of 190 ha of existing small perimeters will be undertaken.

(c) That RBDO make a careful survey of living conditions at both Kaedi and Gouraye and determine what must be done to provide reasonably comfortable living conditions for the IDP technical assistance team. To throw them on the local economy or "leave it to the contractor" is not good enough. The provision of basic amenities and logistic support is essential to recruitment and retention of the kind of well-experienced, productive individuals needed for an effective team.

(d) That the performance of SONADER be carefully monitored during the first phase of the project when World Bank input is high so that an informed judgment can be made as to whether SONADER bolstered by the IDP technical assistance team is up to the task of new perimeter extension at Soulou and the 190 ha perimeter upgrading program without outside contract assistance for design and construction.

4. Feeder Roads

The feeder roads program as proposed in the Project Paper relates only to the Gouraye sector perimeters. There is a need for farm-to-market roads in the Kaedi sector but apparently were not included in the IDP for funding reasons.

In the Gouraye sector 136 km of feeder roads will be built to serve about 1,170 ha of existing and proposed perimeters. The roads would be constructed by the Public Works Service of the Ministry of Equipment over a two-year period using the same equipment and construction brigade employed by the presently AID-financed Mauritanian Rural Roads Project for the Mbout-Selibaby-Gouraye portion of National Highway No. 5. The Project Paper was unclear as to who would prepare the final design of the feeder roads.

Climatic factors are more important in the design of the feeder roads than traffic intensity, although the roads must accomodate 13-ton truck axles. The level of construction proposed for the feeder roads is essentially an improved track. The terrain is relatively flat and the roadway proposed would lie essentially at ground level and be composed of compacted natural earth. In areas of surface water concentration culverts would be installed and the roadway surface raised 0.50-0.75 meters on compacted fill with a 0.15-meter wearing course of laterite or quartzite applied. The embankment section was estimated for 20% of the road alignment with the balance at or near ground level and without ditches. Only 60% of the roadway length was estimated to require application of a wearing course.

Road maintenance is expected to be a problem and IDP provides funds for operating costs for a period of two years following construction--estimated at $200 per kilometer per year.

OBSERVATION: It is my view that in the interest of reducing costs, the roadway design proposed is substandard even for feeder roads; that during the first rainy season the portion of the road constructed at ground level with no wearing course and no longitudinal ditches or drainage structures will become impassable water courses or sloughs.

RECOMMENDATION: (a) That the minimum design standard for the road be raised; at least, bring the profile of the road somewhat above ground level and provide longitudinal ditches with discharges at intervals. Submersible fords would in general be satisfactory for major drainage works.

(b) That an engineering firm with road experience in the area be retained to determine the final alignment and prepare final design of the roadway section(s) with careful attention to the trade-offs between design features/construction costs and durability/maintenance costs.

(c) That RBDO include in the Project Paper an assessment of the need for feeder roads to serve perimeters in the Kaedi area, their impact on the effective development of the perimeters, an order of magnitude cost estimate, and the prospect of funding for further feeder road construction by other donors.

5. Health Surveillance Program

It would be irresponsible to introduce irrigated agriculture in a region without assuring that steps are taken to monitor its effort on public health, in particular malaria and schistosomiasis, and attempt to deal with the adverse consequences. The measures envisaged by IDP to be implemented through existing institutions in Mauritania appear sound and practicable.

RECOMMENDATION: That a regular USAID/ Mauritania staff member be designated as the control officer for the health component of the IDP in Mauritania with the responsibility to follow-up with the involved national institutions the many facets of implementation of the project--detailed planning, training, commodity procurement, field operations.

E. Mali National Program - Observations and Recommendations

The agricultural program as presented in the Project Paper is in the process of major revision; in particular, with respect to reducing the scope of development of "cuvettes", former river bed or depressions lying parallel to the river. Significant changes were

indicated as a result of existing information and examination of perimeters in the Kayes sector by RBDO staff during a March 1983 field trip to Bamako and Kayes. Decisions reached and courses of action suggested by the ensuing reappraisal are well presented in the Stoner (Regional Project Manager) to USAID/Mali Memorandum dated April 18, 1983; subject, "OMVS IDP (625-0621): Malian Program". The highlights of that memorandum are incorporated in the commentary below.

1. Rehabilitation of Small Irrigated Perimeters

The emphasis during the first phase of the agricultural program will remain in upgrading existing small perimeters in the Kayes sector to improve water use efficiency and cultivation practices. This will require some reconstruction to overcome initial design and construction shortcomings, and the effects of unfavorable terrain and inadequate maintenance. Ten existing small perimeters aggregating 232 ha have been identified for rehabilitation. A site development and reconstruction plan must be developed for each perimeter site on a case-by-case basis. To the extent practicable interior irrigation earthworks will be carried out with hand labor of the farmers; major earthwork will require construction equipment.

During this rehabilitation phase emphasis will also be given to supporting farmer training and institutional building in key areas such as agricultural extension, functional literacy, and input supply and credit. This phase will also see a continuing effort to strengthen ties with other donors to encourage priority developments, particularly roads.

RECOMMENDATIONS: (a) That the rehabilitation and upgrading of existing small perimeters be carried out in accordance with a carefully drawn plan taking into account structure and fertility of the soil; soil percolation rate; crop water requirements; field drainage and protection against run-off; reconstruction of canals and distributaries with attention to slope, section, seepage losses, compaction; land shaping and leveling of farm plots; condition and design of the pumping systems--engine and pump, floating platform (or other support), valves, piping, stilling basin and water control structures; and the supply and storage of engine fuel. It is recommended hat the design be contracted to an engineering services firm with proven capability in soils

analysis, agronomy, irrigation works and agricultural engineering. Well conceived and complete plans are needed not only to guide the upgrading work but also to serve as a permanent record of the details of the perimeter development.

(b) Heavy construction equipment should be utilized for earthwork and landshaping that are outside the capability or cannot be effectively done by hand labor of farmer groups.

(c) RBDO must carefully evaluate the need for contracting for outside construction management and supervision against the capability of available OVSTM staff bolstered by the Irrigation Engineer on the IDP technical assistance team.

2. Development of New Small Perimeters - Kayes Sector

Careful examination of the earlier proposed 933-hectare "cuvette" development scheme involving the use of rainfall run-off and supplemental pumping from the river generally showed high construction costs and low benefits from a single crop per year.

Alternatively RBDO proposes a revised second phase program that would include only 83 ha of "cuvette" development (at two locations) and 351 ha of new pumped-irrigation small perimeters. The latter phase would be conditioned upon resolution of production and operation problems with existing perimeters during the first phase of the project. Annual precipitation is greater in the Kayes area than farther down the river valley. Rain-fed farming is thus more of a factor in agricultural production and RBDO proposes further examination of the scope for improvement of rain-fed agriculture as a part of IDP activity.

In sum, RBDO is in the process of restructuring IDP intervention in agriculture in the Kayes sector. A small RBDO-USAID/Mali technical team composed of an Agronomist, an Irrigation Engineer and an Agricultural Economist is analyzing the potential for effective intervention in both irrigated and rain-fed agriculture. The work of the team is expected to be completed September-October 1983 and indentify a mix of activities and inputs for a technically sound and economically viable project.

The above approach makes eminent sense and will replace the "shaky" initial cuvette development proposal with a sound one for small perimeter and rain-fed agriculture development.

RECOMMENDATION: That detailed development and construction plans for the new irrigated perimeters, identified as described above, be prepared by an engineering services firm with proven capability in soils analysis, agronomy, hydrology, agricultural engineering and design of irrigation and drainage works. The same firm should also be retained to manage and supervise construction of the works as OVSTM's agent.

3. Technical and Operating Support to Irrigated Agriculture in the Kayes Sector

The responsibility for implementation of the irrigated agriculture program rests with OVSTM, located in Kayes, which functions as a rural development agency within the West Mali Division of the Directorate of Agriculture of the Ministry of Agriculture. OVSTM'S budget is administered by the Ministry and its employees are civil servants; therefore, its operations are not as autonomous as its counterpart agencies, SAED and SONADER in Senegal and Mauritania. A project team composed of OVSTM and IDP technical assistance personnel will be set up at Kayes to direct the activities of the project.

OVSTM is the instrument through which upgrading and development of new perimeters will be implemented: perimeter development, management and operations; supply of crop inputs including fuel for pumps; maintenance and repair of pumps; farmer training and agricultural extension services. OVSTM'S performance in the past has left a great deal to be desired. Its problems are even more severe than those of counterpart agencies in Senegal and Mauritania.

To assist OVSTM and improve its performance in the above activities IDP will provide a four-man technical assistance team composed of a Project Management and Credit specialist, an Extension/Training specialist, an Irrigation Engineer and a Sociologist. Short-term consultants will be provided for special tasks.

IDP will also finance: construction of a project office; commodities to support field operations including pumps and irrigation equipment, vehicles, office and technical equipment, house furnishings for technical

assistance personnel; operating costs for training, travel, vehicle operation and maintenance, project support staff, office and technical operations. A rural credit program funded by IDP will be established through the National Agricultural Development Bank (BNDA). Except for farmer's "sweat equity", IDP will provide funds for almost everything associated with the project but salaries and remunerations of OVSTM personnel.

As OVSTM goes, so goes the project. Technical assistance will be an important adjunct but in the end OVSTM's will and ability to place and keep in the field a substantial number of qualified personnel as technical assistance team counterparts, construction supervisors, agricultural extension workers, and trainers of farm association personnel--pump operators, water managers, agricultural advisors, animal traction trainers, bookkeepers--will make the difference in whether the project moves or stagnates.

The recruiting and establishment of an effective IDP technical assistance team will be far from easy. experienced and highly motivated technicians are needed to work in an isolated area where amenities are few and living conditions difficult.

RECOMMENDATION: (a) That RBDO make the most intensive effort to identify constraints to effective staffing of OVSTM personnel in the project area and work unrelentingly with OVSTM to assure that needed personnel for IDP activities are in place.

(b) That RBDO make a careful survey of living conditions at Kayes and determine what must be done to provide reasonably comfortable living conditions for the IDP technical assistance team. To throw them on the local economy or "leave it to the contractor" is not good enough. The provision of basic amenities and logistic support is essential to the recruitment and retention of the kind of well-experienced, productive individuals needed for an effective team.

(c) That RBDO re-examine the make-up of skills needed for the technical assistance team in light of the restructuring of IDP intervention in Kayes sector agriculture that is currently being considered (as described in 2. above).

4. Feeder Road Program

As the National Highway (RN-1) serving the Kayes sector is little more than a track battered by trucks and seldom repaired or maintained, it makes little sense to build feeder roads to connect with it; rather, the upgrading of RN-1 to an all-weather, reliable road takes priority.

As a first step RBDO has concluded that a feasibility study be made for upgrading the RN-1 link between Kayes and the Senegal border at Diboli (about 96 km). The feasibility study when completed would form the basis for donor financing of construction of the highway link hopefully to be arranged through the OMVS Consultative Committee. USAID/Mali will handle contracting for the study with a U.S. or local engineering firm.

RECOMMENDATION: (a) That the RN-1 feasibility study be carried out in accordance with the terms of reference set forth in the Feeder Road Technical Analysis (Volume III, Section 3.4) with particular attention to alignment favorable, other things being equal, to serving the irrigated agriculture perimeters.

(b) That RBDO include in the Project Paper an assessment of the need for feeder roads to serve the perimeters in the Kayes area, their impact on the effective development of the perimeters, and an order of magnitude estimate of cost to connect such feeder roads with the RN-1 link when completed.

5. Health Surveillance Program

The program as proposed to deal with the effects on public health of the introduction of irrigated agriculture in the area is modest and recognizes the parlous state of rural health services and institutions in Mali, and particularly in the Kayes area. The measures to be implemented through the establishment and support of an Epidemiological Surveillance Unit at the Health Research and Training Center at Mahina appear well-conceived to fit the circumstances.

RECOMMENDATION: That a regular USAID/Mali staff member be designated as the control officer for the health component of the IDP in Mali with the responsibility to follow-up with the involved national institutions the many facets of implementation of the

project--detailed planning, building renovation, staffing, training, commodity procurement, field operations.

VI. THE BOTTOM LINE

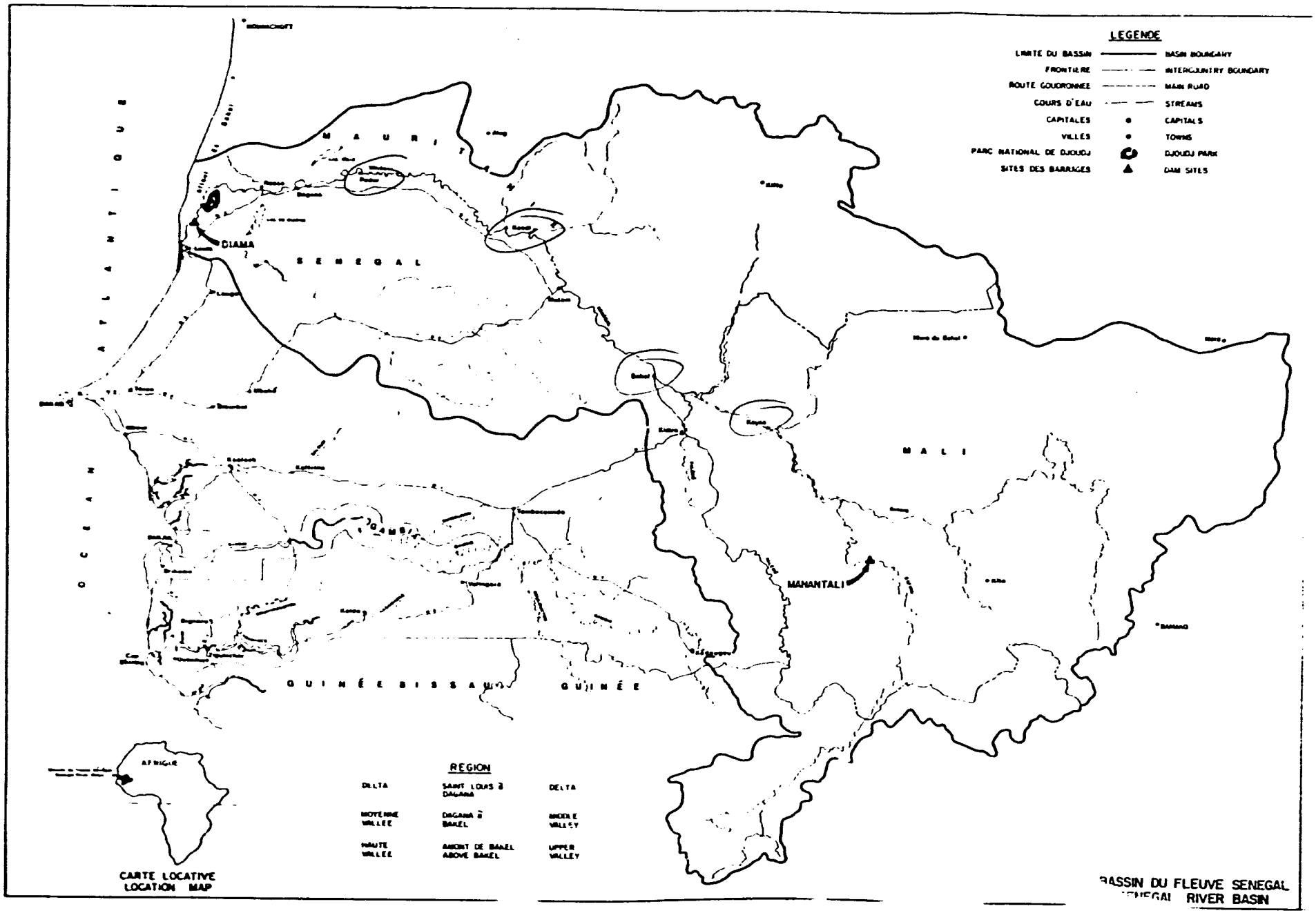
In a food-deficit region where yearly rainfall is sparse at best, and which suffers drought at worst, it is unthinkable to allow the better part of the water in a major river such as the Senegal to flow unutilized into the sea. Commendably the OMVS countries have taken the large initial step to develop the river resource more fully by constructing two dams. However, the benefit comes only when the water thus made available results in a significant increase in agricultural production.

That is what the Integrated Development Project is about--in a modest way with respect to directly attributable increase in production; in a large way toward building the institutions and demonstrating how to move to an ultimate 300,000 hectares under productive irrigated farming.

The tasks the Project has set itself are most difficult, and I am far from sure that the RBDO is fully aware of the complexity and sheer volume of its own (and the USAIDs) management task in Project implementation. Success is not assured but the potential gain is worth the risk in the attempt. Certainly the best chance of success is to strengthen the service capability of existing rural development agencies and work within existing farmer sociocultural patterns.

I have no doubt that the construction aspects of the Project can be achieved--upgrading the existing and building new irrigated perimeters, construction of farm-to-market roads--though I would counsel against its being done "on the cheap".

Infinitely more difficult will be upgrading the capability of SAED, SONADER and OVSTM and making them more responsive to the farmers' needs. This is the crux of the matter and will determine whether the Project becomes a one-shot affair of marginal benefit or indeed has a lasting effect toward helping Senegal, Mauritania and Mali achieve food self-sufficiency.


LEGENDE
LIMITE DU BASSIN — BASIN BOUNDARY
FRONTIERE — INTERCOUNTRY BOUNDARY
ROUTE GOUDRONNEE — MAIN ROAD
COURS D'EAU — STREAMS
CAPITALES — CAPITALS
VILLES — TOWNS
PARC NATIONAL DE DJOUDJ — DJOUDJ PARK
SITES DES BARRAGES — DAM SITES
OCEAN ATLANTIQUE
MAURITANIE
SENEGAL
MALI
GUINÉE BISSAU
GUINÉE
DIAMA
MANANTALI
REGION
DELTA — SAINT LOUIS À DAGANA — DELTA
MOYENNE VALLEE — DAGANA À BAKEL — MIDDLE VALLEY
HAUTE VALLEE — AMONT DE BAKEL — ABOVE BAKEL — UPPER VALLEY
AFRIQUE
CARTE LOCATIVE
LOCATION MAP
BASSIN DU FLEUVE SENEGAL
SENEGAL RIVER BASIN

APPENDIX 1

Appendix 2

June 1983

List of Principal Contacts

USAID/Dakar

David Shear, Director
Vito Stagliano, RBDO Coordinator
Ben Stoner, IDP Project Manager
Jean Le Bloas, RBDO Irrigation Engineer
Barnab y Mosley, Chief Engineer
Joe Salvo, Agricultural Officer

Bakel Sector - SAED

Yaya Dia, Director
Yatma N'Diaye, Deputy Director
Ni Van Nguyen, Irrigation Engineer

Kaedi Sector - SONADER

Mamadou Samba BA, Director
Jean-Marie Nee, Chief of Technical Department

Podor Sector - SAED

M. Fediore, Director

Saint Louis - SAED Headquarters

Oumar Kassimou Dia, President-Director General
Robert Chateaux, Chief Advisor
Abdou Dia, Director, Division of Planning and Land Development (DPA)
J. Claude Louarn, Chief of Studies, DPA
M. Fall, Director, Finance
M. Dromard, Director, Production
Khoi Nguyen Le, Chief, Rural Extension

Diama Dam Site

M. Hamoud, OMVS Engineer

DRAFT

Source:
Jean LeBloas
RBDO Irrigation Engineer

July 1983

Terms of Reference for the Final Design of the Bakel-Collenga Perimeter

This final design is planned during the first year of the OMVS Integrated Development Project (625-0621) and will be undertaken in three phases by an engineering firm chosen competitively in accordance with AID regulations.

1st Phase:

1. Collection and analysis of baseline data.
2. Outline of development plan for the Collenga plain, integrated with that of the watershed (presently being studied under an OMVS contract).
3. Development plan for the Collenga plain including:
   - upgrading of the existing perimeter.
   - new perimeter construction; pumping station.
   - diking and other protection structures.
   - possible variants.

2nd Phase:

1. Final Design Plan (selected option).
2. Invitation for Bids for construction.

3rd Phase:

Supervision of the construction work.

1.1. Collection and Analysis of Baseline Data

A. Topography:

a/ Collection and synthesis of existing topographic documents.
--SAED topo map of 100 ha at Collenga with scale of 1/2,000.
--other topo work of SAED.
--precise levelling established by the Institut Géographique National (IGN) and the German firm ZULDORFF along the Senegal River.
--photomaps and levelling established by Teledyne 1979-80.
--topo maps made by the Canadians in June 1983 at the future site of the port of Bakel (near the present pumping station for Collenga).

b/ Topographic work:
--completion of the topo map at the scale of 1/2,000 for the Collenga Plain, including the existing perimeter if necessary.
--topo surveys necessary for determining the placement of the protection dike and other construction works.
--topo surveys for pumping stations, reservoirs, irrigation networks, drainage, and other infrastructure.

B. Soils Surveys:

--Synthesis and evaluation of soils studies presently available (report of Cuetot/FAO, report Land-System).
--Complementary soils analysis.
--Soils reconnaissance and analysis for identifying borrow pits for construction of perimeter earthworks.

C. Hydrology:

--Concise synthesis of existing data (graphs and synoptic tables):
-hydrology of the Senegal River at Bakel; level of floods and lowflow at Collenga.
-hydrology of the watershed of Collenga (Land System Study).
--Proposal for height and structure of earthworks for perimeter protection and other infrastructure.
--Installation of measuring devices (rods, raingauges, etc.).

D. Socio-Economic Study:

The engineering firm undertaking the final design will also undertake a detailed socio-economic study of the population of the Bakel-Collenga area. This study will estimate the importance of the agrarian population, its work capacity and motivation. The study will evaluate the performance of farmers on the existing Collenga perimeter, propose a time phasing for development of the site, evaluate the opportunity for animal traction or small tractor utilization, propose a farmer organizational structure for the site, and evaluate the cropping patterns that are most preferred by farmers (rice, corn, fruit trees, vegetable, sorghum, as well as other upland crops).

1.2. Outline of the Development Plan for the Collenga Plain

--A detailed map of crop potential according to soils type on a topo map at the scale of 1/2,000.
--Need for irrigated land by the populations concerned; timeframe for land development and cultivation.
--General land development scheme for the plain, including several variants and providing:
-layout of irrigation networks and drainage networks
-location of pump stations (and drainage pumps if required)
-dikes and other perimeter protection infrastructure
-improvements for the existing perimeter of 92 has.
-extensions by adding hydraulic sections
-other site development, roads, windbreaks, etc.
--Plan for water management.

Note: The Development Plan for the Collenga Plain will integrate the recommendations accepted from the study of the watershed of the Collenga presented by the Land System Study funded by Italy through the OMVS.

1.3. Development Plan for the Collenga Plain

1. Baseline data taken into account.

2. Choice proposed and underlying hypotheses:
   - hydraulic unit, farmer organization.
   - cropping pattern, agricultural inputs, water needs.
   - pumping station, water management.

3. Characteristics of Perimeter Infrastructure:
   - diking.
   - irrigation network.
   - drainage network.
   - pumping stations, reservoirs, comparison of alternative power sources: Diesel powered pumps vs. electric pumps.

4. Quantitative estimation of recommended works (costs).

5. Organization of the perimeter, water management, water tariffs, mecanization or animal traction.

6. Economic evaluation of the project:
   - implementation plan for recommended program.
   - annual production expected, input requirements.
   - costs of production and returns.

2nd Phase:

1. Establishing the final design and implementation plan for the alternative selected by USAID and SAED in concertation with the farmers involved.

2. Preparation of the Invitation for Bids for the construction contract.

3rd Phase:

After a firm is chosen for the execution of the construction, the engineering design contractor will be responsible for supervising the construction in line with the construction contract.