PN-APA-194

SUMMARY OF THE MASTER PLAN FOR HYDRO-AGRICULTURE DEVELOPMENT OF THE RIGHT BANK (MAURITANIA) OF THE SENEGAL RIVER BASIN

(Original prepared in French by GERSAR, June 1980).
The General Report is available in English (Synthesis Report).

River Basin Development Office
USAID/Senegal
Dakar
May, 1984

I. BACKGROUND

This Master Plan for Hydro-Agricultural Development has been prepared for SONADER[1/] by the French firm GERSAR[2/], under a contract signed on June 8, 1979, funded by a French grant though FAC[3/]. This is the basic study currently used by the donors financing development of the right bank. These donors include: World Bank, FAC, CCCE, FED, Germany, Kuwait, and Holland.

II. CONTENTS OF THE STUDY

The preparation of the Master Plan was completed in June 1980. The Plan includes four main volumes, available only in French. These are:

*Volume "General Report":

Part 1: Narrative of the synthesis report, 138 pages.
Part 2: Maps and drawings of the master plan.

*Volume A, "Basic Data": A presentation and analysis of the data available for: environment, sociology, potentialities for agricultural production, existing irrigated perimeters.

*Volume B, "Definition of General Criteria for projects development", in the following sectors:

- Hydrology
- Agronomy
- Irrigated perimeters development
- Unit cost
- Inputs and manpower requirements.

*Volume C, "Development Program": It proposes 3 action programs based on the national objectives of the GIRM and development hypothesis issued from the above criteria:

for the short-term 1980-1986
midium-term 1987-1992
long-term 1993-2000

The program of perimeters proposed for irrigation development is based on the definition of the "geographical units", as defined by M. Juton (OMVS), called in French UNE, Unité Naturelle d'équipement.

The same definition is used on the left bank by the GERSAR master plan for the middle valley (Senegal).

1/ SONADER: Société Nationale pour le Développement Rural, which is the Mauritanian RDA for the Senegal Valley.

2/ GERSAR: Groupement d'Etudes et de Réalisations des Sociétés d'Aménagement Regional

3/ The French title of the study is: "Schéma Directeur des Aménagements Hydroagricoles de la Vallée du Sénégal Rive Droite en Mauritanie". GERSAR, Juin 1980.

III. DELIMITATION OF THE ZONES STUDIED

The study covers the right bank of the Senegal River from Rosso up to Maghama to the boundary between the Gorgol and the Guidimaka administrative regions of Mauritania. (This is roughly 20 km downstream from Bakel). The study also includes the Gorgol valley and some small perimeters in the Guidimaka region.

For the excluded zones, it is worthwile to note the following:

*The delta zone: was excluded from the study because of the unique problems encountered there: soils, topography, hydrology, agronomy, small population.

In 1983, the French FAC decided to finance a master plan for the delta zone. The terms of reference have been prepared with the concurrence of OMVS. The study will be completed in 1985 by a French firm.

*The Aftout-es-Sahel zone is also excluded because a set of studies already exists. These were done by the French firm SOGREAH and include:

- feasibility studies and final design for the hydraulic infrastructure to permit the filling of the depression from Senegal river floods, which will be facilitated by the Diama dam.

- final design for an experimental station (farming systems, livestock,...). The irrigation potential is about 20,000 ha.

*The Lake R'KIZ depression is covered by a master plan prepared by the French firm BCEOM, for a large area with an irrigable potential of 8,000 ha. BCEOM completed the feasibility study for lake R'Kiz in 1981 and the findings are integrated into the GERSAR master plan.

*The Guidimaka region was excluded from the study, because of the lack of data: pedology, topography, hydrology. Given the large population of this region, GERSAR and SONADER put the emphasis on the need of a specific master plan for this region.

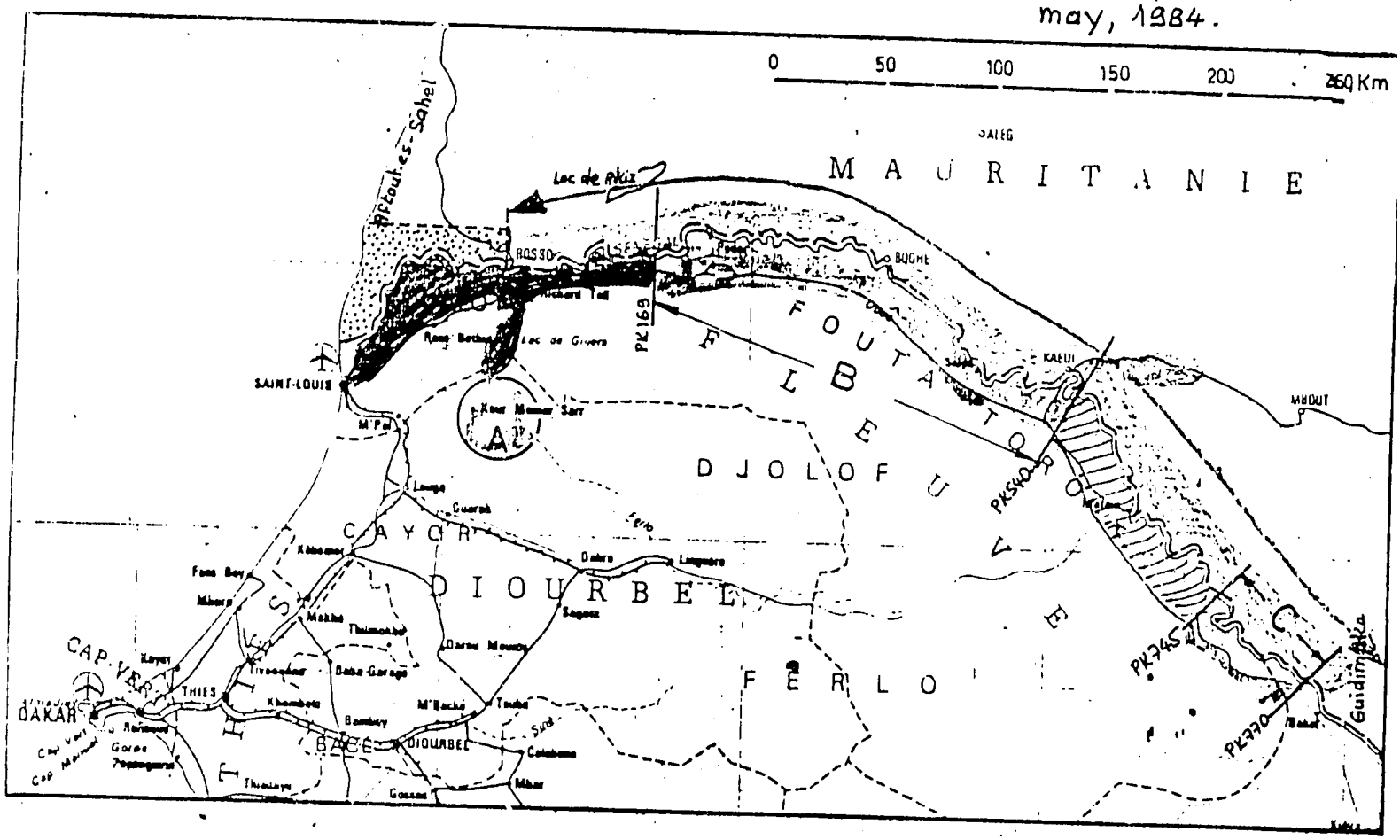
GERSAR noted (page 101 of the synthesis report) that the two studies of Guidimaka and delta regions, will be indispensable complements to the master plan of the right bank[1/].

1/ This is the reason why AID/RBDO decided to propose this work in the IDP, through a "Long-Term Development Plan for the Upper Valley".

IRRIGATION MASTER PLANNING in the SRB

JLB / USAID / RBDO

may, 1984.



✳ Senegal.

"GERSAR" IRRIGATION MASTER PLAN (1981) - IBRD financing. Zones A. B and C.

"SATEC-SOET-SONED IRRIGATION MASTER PLAN (1983) - FAC + CCCE financing.

"BCEOM" IRRIGATION MASTER PLAN for the Delta (1983-84). FAC financing.

✳ Mauritania.

"GERSAR" MASTER PLAN for IRRIGATION Right Bank (1980). FAC financing. From Rosso to Gouraye, including the Gorgol Valley.

Feasibility study of 284 small perimeters (4,717 ha) between Rosso and Selibaby by SATEC (1980). FAC. financing.

IV. CONTENTS OF VOLUME A:

This volume presents the basic data for the master plan, and includes 3 parts:

4.1. Physical Environment:

- Analysis of climate.
- Analysis of hydrology of the Senegal river under existing conditions, and after the construction of the Manantali and Diama dams, and for various hypothesis of embankment of perimeters projected on the two banks of the river. This analysis uses the ORSTOM studies[1/], and the mathematic model performed by SOGREAH[2/].
- Soils analysis, using the major study completed by SEDAGRI for OMVS in 1973, including two sets of maps at a scale of 1/50,000: pedology and geomorphology, and land suitability. These maps cover a zone from the delta to Selibaby.
- Groundwater in irrigable areas.

4.2. Rural Development Potential

This part contains an assessment of the agricultural production potential and a detailed analysis of existing irrigated perimeters and ongoing projects under construction.

4.3. Social and Economic Analysis

This part analyses and updates the findings of the study performed by LERICOLLAIS (ORSTOM) in 1971.

It recalls the objectives and programs of OMVS, review agricultural production in Mauritania and estimates future need for agricultural and livestock development, including related activities of the industrial sector. At a macroeconomic level, the chapter provides the main data concerning the Mauritanian National Plans up to the third plan 1976-1980.

V. CONTENTS OF VOLUME B: "DEFINITION OF DEVELOPMENT CRITERIA"

This volume uses the same framework as the master plan developed by GERSAR for the Senegalese middle-valley.

5.1. Hydrological Criteria

The peak water levels of the Senegal river, for various flood return periods and development hypotheses (dams, water management of the Manantali reservoir, embankments), are given by the OMVS mathematic model established by SOGREAH (See page 2 Volume B, Part 1), for several sections of the river.

1/ ORSTOM: Office de la Recherche Scientifique et Technique Outre Mer.
2/ SOGREAH: Société Grenobloise d'Etudes et d'Applications Hydrauliques.
3/ LERICOLLAIS: Culture de décrue dans la vallée du Sénégal, ORSTOM 1971.

These data are important for the following purposes:

- determination of the crest levels of dikes protecting the perimeters.
- Sills levels for hydraulic structures such as intake structures, flood gates,... and for determination of the total heads of pumping stations.
- Data for the choice of a specifc level of protection for each kind of perimeter (small, medium size, large).

GERSAR has established a detailed set of criteria for drainage networks; drainage of excess irrigation water, drainage of runoff from the catchment basins.

5.2. Agronomic Criteria

Five principal criteria for agriculture production and livestock are presented:

Cropping calendars for rice, corn, sorghum, cowpea, wheat vegetables and forages, in various conditions of soils found in the SRB: fondé, hollaldé, false hollaldé;
Yields and cropping intensity rates;
Farming systems; agriculture mechanization; manpower requirements in agriculture;
Livestock and breeding systems.

5.3. Technical Criteria for Hydro-Agricultural Development

The basic farm unit is a parcel of 0.5 ha; 60 parcels aggregate a plot of 15 net hectares which have an hydraulic autonomy.

Based on experience in the SRB, sets of technical norms are given for irrigation and drainage networks, pumping stations, embankments, rural roads and tracks, agriculture mechanization and maintenance, buildings and various types of construction, rice mills, etc.

5.4. Determinaton of Prices, Construction Cost Estimates

This section discusses the structure of prices for construction, hydraulic equipment, power plants, roads, and buildings in order to derive good cost estimates for feasibility-level studies.

A list of prices is provided based on a set of samples of unit prices obtained for various types of project construction.

5.5. Large irrigated perimeters

This section covers studies implementation and management, costs and requirements for manpower, equipment and inputs.

Norms are provided for a project of 1,000 hectares, and sensitivity calculations are made to show the influence of the size of a project on costs and other requirements.

An economic analysis at the farm level is also included in this section.

VI. PROPOSED DEVELOPMENT PROGRAM: VOLUME C.

The identification of sites to be developed for hydro-agriculture was done by GERSAR following field reconnaissance missions. This work was done with the concurrence of SONADER, and used the following principal materials:

- Map IGN/MAS at a scale of 1/50,000, with contour lines at one meter of equidistance[1/]
- SEDAGRI soils maps and land suitability map, scale 1/50,000[2/].
- Set of various OMVS studies, or GIRM studies.
- SATEC study[3/] (1980): identification and feasibility study of 200 small-scale perimeters on the right bank (roughly 2,000 ha).
- Social study by LERICOLLAIS (ORSTOM)[4/].

6.1. Objectives and Methodology

The objective is to develop agriculture production in order to reach self sufficiency for cereals and sugar by year 2000, and to involve a large farming population in this production. The choices for agricultural production policy include livestock; a priority for food crops, particularly rice; use of manual labour with a parcel size of 0.5 ha per family as a minimum, to be increase progressively, and leading to full employment in year 2000 for the entire population of the valley.

The methodology followed is based on these objectives, and determines an optimal pace for development of perimeters, taking into account the technical criteria chosen, economic and social factors, and institutional capacity. This multicriteria analysis led to the choice of priorities and to a development program proposal divided into 3 terms:

- Short term : 1980-1986
- Midium term: 1987-1992
- Long term: 1993-2000

1/ Fond planimètrique de l'Afrique de l'Ouest à 1/50,000 for the valley, between St. Louis and Bakel.

2/ Etude Hydroagricole du Bassin du Fleuve Sénégal: Etude Pédologique. Paris 1973

3/ Feasibility study of a program of a small scale village perimeters on the right bank of the Senegal river. SATEC, May 1980.

4/ Peuplement et cultures de saison sèche dans la vallée du Sénégal. Paris 1980.

An important hypothesis for this program is that in 1992 the water management of Manantali will stop the artificial floods needed for the flood recessional agriculture. Flood crop production will reach self sufficiency in year 2000 if about 56,000 hectares are developed at that time for irrigated food agricultural.

6.2. Sites identified for Irrigation Projects. Criteria.

The sites are located on a general map, with specific numbers, identification was based on the definition of "Natural units for development" (Unités naturelles d'équipement) as defined by M. Juton (OMVS).

Attached is a portion of this map, for the Dirol plain. It is divided into 5 zones Kaedi 1:

KA 1 a	called northern zone in the
KA 1 b	USAID/RBDO Dirol Plain Project
KA 1 c	(March 1984).
KA 1 d	Southern zone.
KA 1 e	ibid.

The site identification process was conducted during multicriteria analysis that took into account:

- nature of soils and land suitability;
- the total head for pumping;
- diking needed;
- access facilities;
- population/manpower available;
- current importance of flood recessional agriculture on the site;
- infrastructure already developed or ongoing.

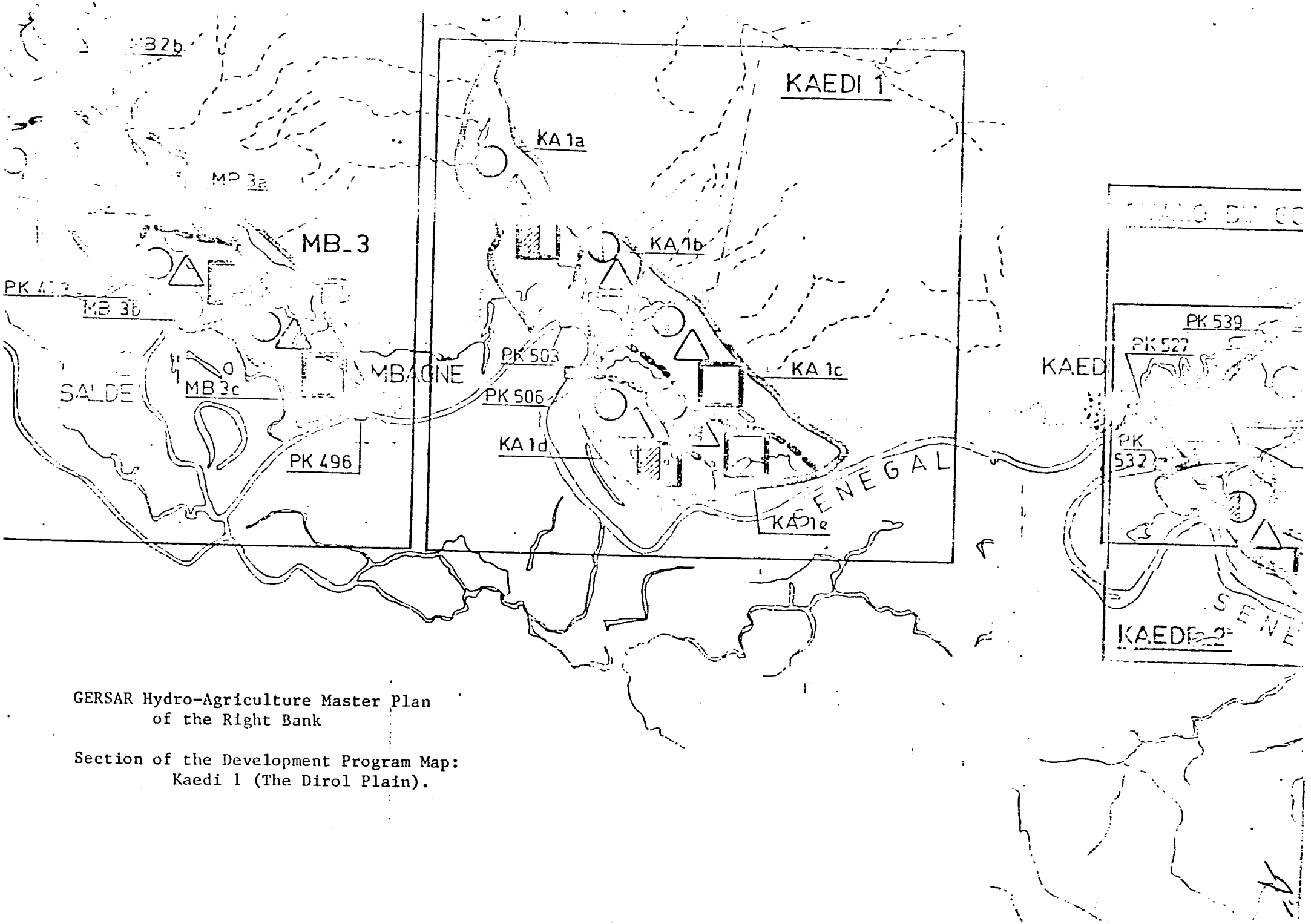
The choice of priorities was done in a way that provided a balance among the various regions of the valley, that would permit flood recessional agriculture until 1992.

6.3. The Short Term Program (1980-86)

During this period priority is given to small-scale irrigation development, while studies and programs are prepared for larger projects. The short term program established by GERSAR includes:

6.3.1. Continuation of Ongoing Projects, with the following actions (implementation)

- program of small-scale perimeters	4,820 net ha
- large perimeters:	
- Black Gorgol	3,600
- Boghe pilot scheme	980
	9,400 net ha.



GERSAR Hydro-Agriculture Master Plan
of the Right Bank

Section of the Development Program Map:
Kaedi 1 (The Dirol Plain).

TABLE OF SITES IDENTIFIED

REGIONS	PERIMETERS		SUPERFICIE (net hectare)
TRAZA	GARAK	1	8,150
	GARAK	2	4,860
	KOUNDI	1	3,590
	KOUNDI	2	6,680
	KOUNDI	3 Nord	5,640
	KOUNDI	3 Sud	4,660
	KOUNDI	4	2,120
		Total TRAZA	35,700 ha.
BRAKNA	KOUNDI	5	8,930
	KOUNDI	5 bis	3,530
	KOUNDI	6, 7, 8	16,900
	KOUNDI	9	770
	KOUNDI	10	960
	BOGHE	1	3,040
	BOGHE	2	1,470
	BOGHE	3	690
	BOGHE	4	470
	BOGHE	5	620
	BOGHE	6	520
	M'BAGNE	1a + 1b	2,070
	M'BAGNE	1c	870
	M'BAGNE	2	4,090
	M'BAGNE	3a + 3b	3,030
	M'BAGNE	3c	1,740
		Total BRAKNA	49,700
GORGOL	- Vallée du GORGOL		
	Casier pilote de Kaedi		700
	OUALO du GORGOL		7,000
	GORGOL NOIR		3,600
	- Vallée du SENEGAL		
	KAEDI	1a + 1b	2,700
	KAEDI	1c + 1d + 1e	3,600
	KAEDI	2	1,880
	KAEDI	3	970
	KAEDI	4	1,110
	GARLI	1	1,490
	DAO	1	2,990
	MAGHAMA	1	3,560
	MAGHAMA	2	4,780
	MAGHAMA	3	1,890
	MAGHAMA	4a + 4b	4,100
	MAGHAMA	4c	560
	MAGHAMA	5	970
			30,600 ha
		Total GORGOL	41,900 ha
GUIDIMAKA	MAGHAMA	6	1,000
	AUTRES (non précisés)		7,200
		Total GUIDIMAKA	8,200 ha

6.3.2. Ten feasibility studies to be performed:

Garak	2	4,680 ha
Koundi	4 and Koundi 5	11,050 ha
Koundi	7 and Koundi 6	
Koundi	5bis and Koundi 6b + c	
Koundi	8, Koundi 9, Koundi 10	15,320 ha
M'Bagne	1, M'Bagne 2 + M'Bagne 3 (on going)	11,800 ha
Kaedi	1 (Dirol Plain)	6,300 ha
Kaedi	3 and Kaedi 4	2,080 ha
Dao	1	2,990 ha
Maghama	1 to 5	15,860 ha
Maghama	6	1,000 ha
		78,100 ha

6.3.3. Four operations to be completed before 1987 (studies and implementation)

Koundi	7 (sugar cane project)	4,000 ha
Koundi	6a	650 ha
Koundi	8a + 8b	1,000 ha
M'Bagne	2a + 2b	1,000 ha
		6,650 ha

6.3.4. Four operations with implementation starting before 1987

Garak	2a	1,130 ha
Koundi	5b	1,400 ha
Kaedi	1d (a portion of the Dirol plain)	1,000 ha
Maghama	1c	1,100 ha
		4,630 ha

6.3.5. Three operations with final studies to be completed in 1986

M'Bagne	1a	1,000 ha
Dao	1a	630 ha
Maghama	2c	870 ha
		2,500 ha

This short term program will lead to a total of 19,500 ha developed as of 1986[1/].

1/ This program excludes the 2 following projects:

- Lake R'Kiz: for which feasibility studies of 2,000 ha are planned, and implementation of 1,000 ha.
- Aftout-es-Sahel project: execution of infrastructure works, and of the experimental farm.

The breakdown of this execution program, for each region, is given in the following table:

SHORT-TERM PROGRAM FOR FOOD CROP PROJECTS (1980-86)
TO BE IMPLEMENTED

(Ha)

	Situation in 1979	Situation in 1986
TRARZA		
M'Pourrie	1,450	1,450
R'Kiz	-	1,000
Small-scale perimeters	732	2,820
Total TRARZA	2,182	5,270
BRAKNA		
Koundi 6a	-	650
Koundi 8a + 3b	-	(1,000)
Boghe	-	980
M'Bagne	-	1,000
Small-scale perimeters	378	1,900
Total BRAKNA	378	4,530
GORGOL		
Kaedi (pilot project)	700	700
Black Gorgol	-	3,600
Small-Scale perimeters	190	900
Total GORGOL	890	5,200
GUIDIMAKA		
Small-scale perimeters	0	500
Total Large Perimeters	2,150	9,380
Total Small Perimeters	1,300	6,120
Grand Total	3,450	15,500

6.4. The Medium-Term Program

It includes 3 components:

*Completion of 4 projects started during the first term, which means about 4,630 ha under irrigation.

Garak	2a	1,130 ha
Koundi	5b	1,400 ha
Kaedi	1d (Dirol Plain)	1,000 ha
Maghama	1c	1,100 ha
		4,630 ha

*Actions on new sites:

-feasibility studies for 41,610 ha
-final design for 20,870 ha
-implementation started on 17,870 ha among which 11,870 to be completed before 1992.

*Furthermore, in the lake R'Kiz project, 1,000 ha will be put under cultivation.

6.5. The Long Term Program (1993-2000)

The long term program includes 29,000 hectares, comprising 5,000 ha of forage and industrial crops[1/].

The full completion of these programs will give a total of 65,000 ha of land developed for irrigation in year 2000.

6.6. Cost Estimate of the Development Program

An estimation of costs has been done by GERSAR, using a unit cost base for year 1979.

U.S.$ 1.00 = U.M. 56.00[2/].

	Costs of programs		Unit cost per ha.	
	UM.10⁶	$.10³	UM	$
Short term	12,400	221,428	743,000	13,267
Medium term	16,400	292,857	918,000	16,392
Long term	23,500	419,642	646,000	11,535
TOTAL	52,300	933,927	-	-

1/ Details given in Part 1 of Volume C.
2/ Rate beginning of 1984.

Cost break down, for the short term (cost base 1979).

	UM 10^6	$\$10^3$
Feasibility studies	310	5,535
Final designs	112	2,000
Implementation, works, starting production	11,500	205,357
Technical assistance/management	480	8,571
Total	12,400	221,463

6.7. Other Data Provided by the Master Plan

*Manpower needs: The study provides an assessment of manpower needs for the 3 programs (1986, 1992, 2000), for the several positions in hydro-agriculture projects:

a) General manager, engineer, administration officer, agronomist, chief mechanics.

b) Ag technician, accountant, mechanics.

*Water requirements: established for double cropping farming system, for each term 1979, 1986, 1992 and 2000, in:

- peak flow needed in various sections of the Senegal River.
- annual volumes needed in various sections of the Senegal River.

*Policy conditions: they concern:

- land tenure problems to be resolve at the GIRM level.
- SONADER: role that this agency must play in hydro-agriculture development; organisation and structures.

*Miscellaneous items:

- rural roads and feed roads
- policy for cereals prices, marketing
- training programs for farmers
- forestry
- crop diversification