République du Sénégal
Republic of Senegal

MINISTÈRE DU DÉVELOPPEMENT RURAL
MINISTRY OF RURAL DEVELOPMENT

AMENAGEMENT HYDRO-AGRICOLE DU BASSIN DE L'ANAMBE

Première phase : réalisation de 1000 ha

HYDRO-AGRICULTURAL DEVELOPMENT OF THE ANAMBE BASSIN

First phase : implementation of 1000 ha

SODAGRI :
23, Avenue Roume
B. P. 222 – Télex 477
Tél. : 22-18-18 – 21-04-16
DAKAR

Electrowatt Ingenieurs
Conseils S. A.
ZURICH

HYDRO AGRICULTURAL DEVELOPMENT OF THE ANAMBE BASIN

FIRST PHASE : IMPLEMENTATION OF 1 000 HA

SYNOPSIS

In recent years cereal imports to Senegal have accounted for about one-half of the national annual balance of payments deficit. Government strategy to ameliorate this burden on the economy emphacizes the development of large scale perennial irrigated agriculture, especially of rice which in the environments of Senegal offers the most attractive return on investment of any of the cereal crops.

The environment

Feasibility studies carried out by Electrowatt Engineering Services, Ltd. on behalf of SODAGRI indicate that the Anambe Basin (fig.1) has one of the most favorable physical and socio-economic environment in Senegal for the development of intensive cultivation of irrigated rice. The salient features of the basin are :

- Climate : the climate is subhumid with annual precipitation of about 1000 mm which is almost entirely distributed during the period mid-June to mid-October. Rainfed agriculture can be practiced only during the rainy season, but temperature and insolation impose no major constraints on year around cultivation of cereal crops.

- Human resources : the Anambe Basin has a population of about 43,000, equivalent to an active labor force of 25,000 essentially all of whom are engaged in seasonal agriculture in the cultivation of cereal (c.a. 1300 ha rice) and industrial crops during the rainy season on about 20,000 ha of the basin uplands. The labor force is fully occupied during the rainy season but largely unemployed or underemployed during the prolonged dry season.

- Land resources : the central lowlands of the Anambe Basin comprise about 54'000 ha which are largely undeveloped for uses other than livestock grazing, but which are favorably situated for irrigation. Land classification studies indicate that more than 25'000 ha are suitable for perennial cultivation of rice, and more than 16'000 ha are suitable for perennial cultivation of diversified crops including rice as the major wet-season crop.

In summary, the Anambe Basin has a favorable climate for perennial agriculture, aboundant, unused lands suitable for the cultivation of rice and diversified crops, and a large agricultural labor force which is unoccupied for most of the dry season. It follows that the only basic requirement for the mobilization of these resources is the provision of controlled irrigation water supplies for cultivation of crops during the dry season.

The Anambe Basin development project

The ground water and surface water resources of the Anambe Basin are insufficient to support large-scale, intensive irrigated agriculture. However, the Kayanga River, to which the Anambe is tributary, has a mean annual discharge of about 250 million m^3 which can be largely regulated for controlled irrigation diversions with the provision of seasonal storage of runoff.

A number of alternative schemes for regulating the runoff of the Kayanga River for irrigation of the lands of the Anambe Basin were formulated and evaluated during the course of the feasibility studies. The optimum scheme is portrayed on figure 2.

It provides for the development of 16,265 net ha in the Anambe Basin for perennial irrigation of rice and diversified crops distributed as follows :

Cropping pattern		net cultivated area (ha)
Rainy season	Dry season	
Rice	Rice	12,145
Rice	Diversified crops	3,410
Div. crops	Diversified crops	710
	total	16,265

Priority will be given to the development of peasant farms to meet the socio-economic objectives of the project. However, as the development plan calls for the introduction of high-yield irrigated agriculture and related technology, for the cultivation of rice, which is uncommon in the region, the first stage of development will be largely carried out on a pilot mechanized farm under the management of SODAGRI to develop the land and water management and cultivation practices most appropriate for the region. And as the project will produce surplus rice for export to other regions, agro-industry processing and storage facilities also will be required. Farm-size plots will be released to peasant enterprise as the lands are developed and in response to demand, but the mechanized farm and agro-industry operations will be sustained through the life of the project. After full development it is anticipated that the mechanized farm will encompass about 5,000 net ha of irrigated land.

As shown on figure 2, the principal project works include :

- an earthfill dam on the Kayanga River near Niandouba raised to elev 42 m IGN to create a storage reservoir with live storage capacity of about 350 million m^3 ;

- a hydropower plant at Niandouba Dam with an installed capacity of 2550 KW

- a low diversion dam on the Kayanga River below the confluence with the Anambe River to create a pool with live storage

capacity of about 50 million m^3 for secondary regulation of Kayanga runoff to command the inlets to the pumping stations in the Anambe Basin ;

- a flood protection dam on the Anambe River near the downstream border of the development area ;

- four pumping stations in the Anambe Basin to raise water from the confluence dam pool to points of entry into the primary canal system. Three of the pumping stations will be powered by electricity generated at Niandouba Dam ; the fourth will be diesel powered ;

- primary, secondary and tertiary gravity irrigation and drainage works, and appurtenant service roads to serve the project lands ;

- clearance, leveling and grading of the 16,265 ha irrigation service area ;

In addition, appurtenant works and facilities to be provided include buildings, farm machinery and equipment, and processing equipment for the mechanized farm and the agro-industry activities.

The estimated capital cost of the project is 40,350 million F.CFA. The project will be implemented in five stages, as follows :

Stage	Development period	Main hydraulic works	net area developed (ha)	Accumulated area developed (ha)	Capital cost (10^6 F.CFA)
1	1980 - 82	- Confluence dam - Sodagri pilot farm - Pumping station	1 420	1 420	3'648
2	1984 - 85	- Niandouba dam - Confluence dam - Main right bank Pumping station	3 020	4 440	14'502
3	1986 - 87	- Auxiliary pumping station - Extension of main right bank pumping station	3 050	7 490	5'666
4	1988 - 89	- Main left bank Pumping station	3 995	11 485	8'034
5	1990 - 96	- Extension of main Left bank pumping station	4 780	16 265	8'500

Phase I : Implementation of the 1000 ha of the Sodagri pilot farm

The first phase consisting largely of the SODAGRI Pilot Farm is crucial to the success of the project as the experience gained in the application of water and land management and cultural practices from the implementation and operation of the Pilot Farm will be the basis for planning and carrying out development of subsequent phases.

The Pilot Farm will encompass a gross area of 1000 ha of which a net area of 945 ha will be developed for perennial cultivation of irrigated crops.

The works required for the implementation of phase I are as follows :

- The Confluence dam on the Kayanga river with a live storage volume of 48 million m^3 ;
- The Pilot farm pumping station with a capacity of 3,75 m^3/s provided by two groups of diesel-driven pump ;
- Primary, secondary and tertiary irrigation and drainage works and appurtenant service roads ;
- Land development works, including clearing, levelling and grading the lands to be irrigated.

The estimated capital cost of works is 2 301 millions of F.CFA, distributed as follows :

Description	Costs (10^6 F.CFA)
Confluence dam	554
Pumping station phase I	336
Irrigated and drainage works	950
Service roads	192
Land development	270

Two modes of production will be developed and carried out on the Pilot Farm : 665 ha of perennial rice will be developed under mechanized farming and 280 ha of perennial cultivation of rice and diversified crops developed under improved peasant farm enterprise.

The cropping patterns and estimated average annual production are as follows :

Crops	Average yield (tons/ha)		Rainy season Production		Dry season Production		Total production
	Rainy season	Dry season	(ha)	(tons)	(ha)	(tons)	(tons)
Mechanized farming							
Rice (IKP-Lebonnet)	4	4,5	665	2 660	665	2 992,5	5 652,5
Peasant farming							
Rice (IKP)	3,5	-	175	612,5	-	-	612,5
Maïze (BDS-ZM10)	3,0	3,7	42	126	217	803	929
Sorghum (51-61)	3,0	3,2	63	189	63	201,6	390,6

To achieve these objectives of production through the introduction of irrigation and improved cultural practices the pilot farm will required a substantial and independent infrastructure including :

- agricultural material and equipment for carrying out operation on the mechanized farm and the peasant farms ;
- Machinery and equipment for carrying out land development, and maintenance of irrigation and drainage works ;
- headquarters plant including office buildings, maintenance and repair facilities, warehouse and stores facilities and transport and maintenance vehicles ;

- a rice mill of 2 T/h capacity and storage silos with a total capacity of 2 500 tons ;

The estimated capital cost of the project authority infrastructure facilities is 728 million FCFA, distributed as follow :

Description		Costs (10^6 FCFA)
- mechanized farm :		
- buildings and equipment	210	
- agriculture equipment	140	
Subtotal		350
- agricultural equipment for the peasant farms		26
- management control structure :		
- land development equipment	123	
- passenger and maintenance vehicle	72	
Subtotal		195
- rice mill and storage silos		157
Total		728

The project Authority also will require provision for working capital of 185 million FCFA which is equivalent to 8/12 of the total annual expenses of the Pilot Farm, distributed as follows :

Description	Costs (10^6 FCFA)
- mechanized farm	132
- peasant farms	14
- water charges	39

Finally, implementation of the Pilot Farm will entail costs of administration, engineering and additional studies and investigations. The estimated cost there of is 486 million FCFA, or about 13 % of the total cost.

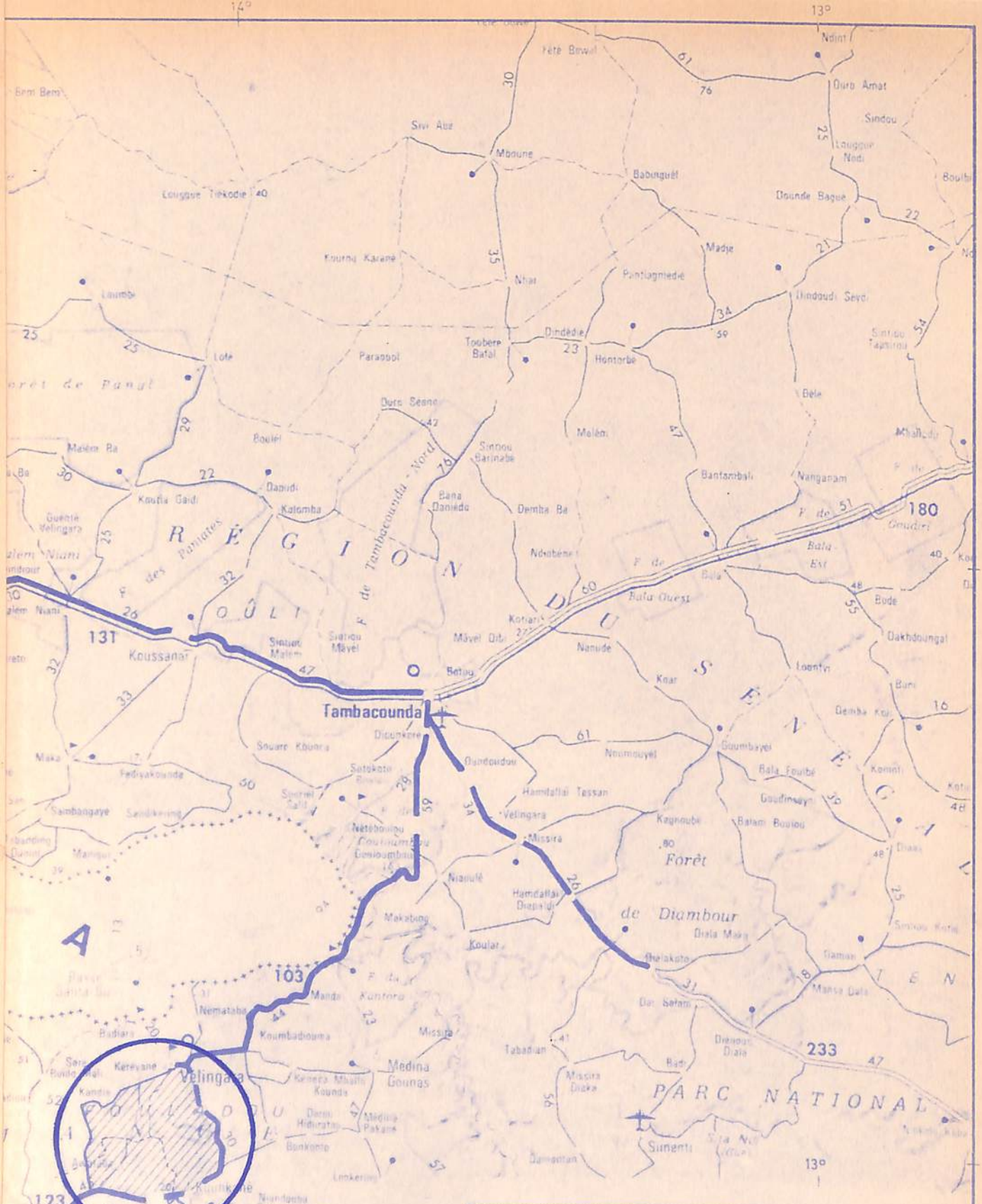
The schedule for implementation of the phase 1 program foresees that the works and land development will be executed in 1981 on 1982 in order to bring the first sector of 665 ha under cultivation in the 1981, rainy season and to proceed to a first dry season cultivation in 1982. To achieve this schedule construction of civil works will have to start in December 1980. It follows that the invitations to tenderers will have to be issued in June 1980 and the award of contract made in September 1980.

The total financial requirements for implementation of the Pilot Farm development is 3 700 millions FCFA distributed as follows :

Description	Costs (in 10^6 FCFA)
- Project works	2 301
- Infrastructure facilities	728
- Working capital	185
- Administration and engineering and additional investigations	486
Total	3 700

The financial plan for the implementation of the phase I development assumes that one-half of the cost will be provided by the Saudi Fund and one-half by the Government of Senegal and other sources. The following table gives the proposed allocation of specific project costs among the various sources of development funds.

RÉGION DU CAP VERT
DAGOUDANE PIKINE
Malika
Yof
Almadies
CAP VERT
DAKAR
Cap Manuel
Tiaroye
RUFISQUE
Bargny
Ile de Gorée
THIES
Diourbel
DIOURBEL
Bambey
Khombole
Mbaké
Touba
Gossas
MBOUR
Joal-Fadiout
Fatick
KAOLACK
Kaffrine
Koungheul
Koumpentoum
Nioro du Rip
Medina-Sabak
Mansa Konko
Georgetown
Bathurst
BATHURST
Cap Ste Mary
Brikama
Sokone
Foundiougne
Iles du Saloum
Niodior
Pnte de Sangomar
Bignona
ZIGUINCHOR
Oussouye
Cap Skirring
Kabrousse
Sédhiou
Kolda
OCEAN
ATLANTIQUE
SINE SALOUM
REGION DU SINE SALOUM
GAMBIE
FOGNI
PAKAO
NIANI
Réserve Sylvo Pastorale de Doli
Rés. Sylvo Pastorale du Sine Saloum
17°
16°
15°
14°
13°
10 0 10 20 30 40 50 60 km
40
30
43
76
106
60
82
85
110
17
41
149
111
188
25
50
10



REPUBLIQUE DU SENEGAL
MINISTERE DU DEVELOPPEMENT RURAL
SODAGRI

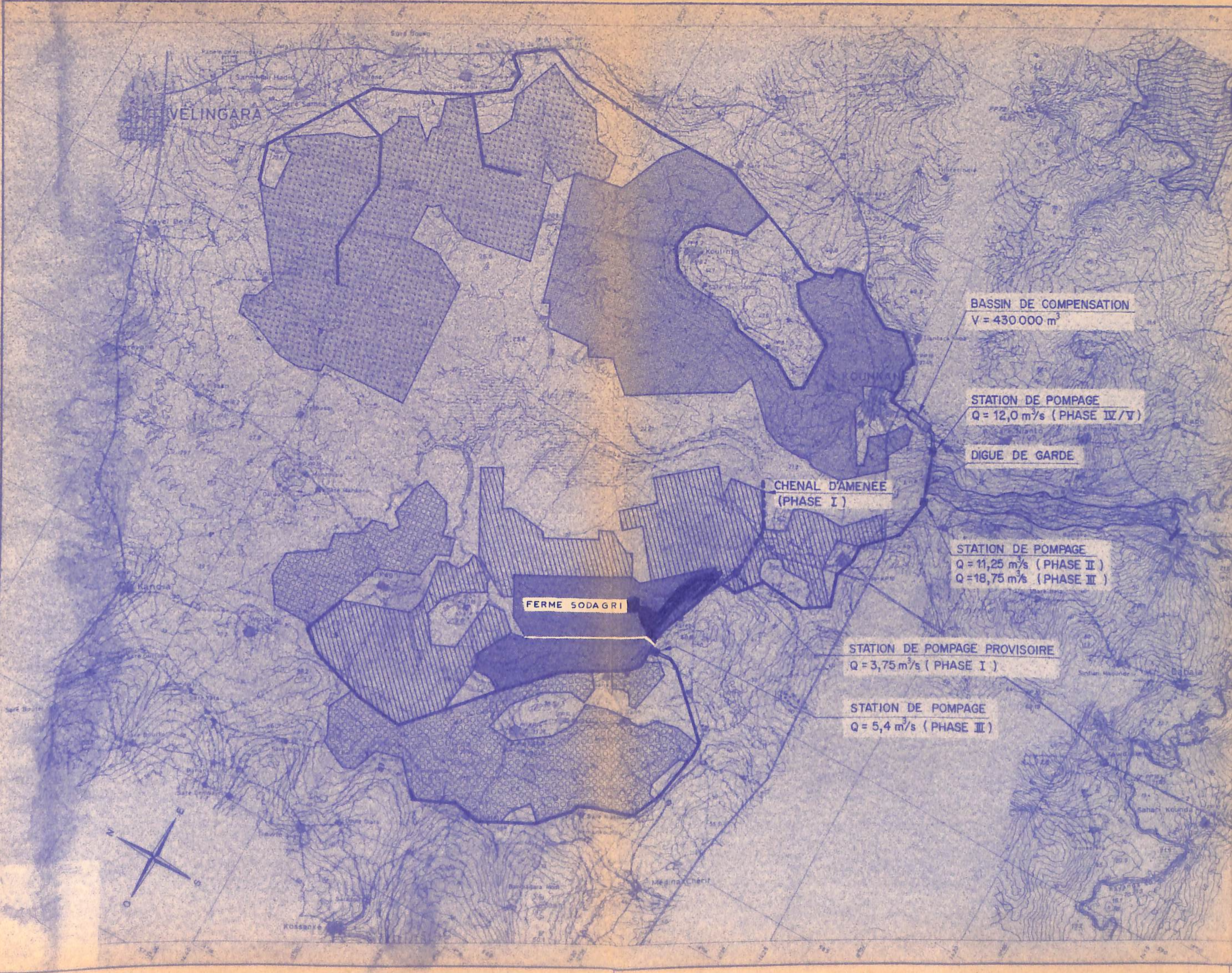
AMENAGEMENT DU BASSIN DE L'ANAMBE

SITUATION GENERALE

ELECTROWATT
INGENIEURS-CONSEILS S.A.
ZURICH DAKAR

DGMB

ECHELLE	DATE	NUMERO DU PLAN	ANNEXE
1 : 1000000	DEC 79	6158 - 207142	FS - 1


VELINGARA
KOUNKANE
BASSIN DE COMPENSATION
V = 430 000 m³
STATION DE POMPAGE
Q = 12,0 m³/s (PHASE IV/V)
DIGUE DE GARDE
CHENAL D'AMENEE
(PHASE I)
STATION DE POMPAGE
Q = 11,25 m³/s (PHASE II)
Q = 18,75 m³/s (PHASE III)
FERME SODAGRI
STATION DE POMPAGE PROVISOIRE
Q = 3,75 m³/s (PHASE I)
STATION DE POMPAGE
Q = 5,4 m³/s (PHASE III)
N
E
S
O

LEGENDE

- AMENAGEMENT PHASE I
- " " II
- " " III
- " " IV
- " " V
- BARRAGE
- STATION DE POMPAGE
- CANAL PRINCIPAL

REPUBLIQUE DU SENEGAL
MINISTERE DU DEVELOPPEMENT RURAL
SODAGRI

AMENAGEMENT DU BASSIN DE L'ANAMBE

PLAN DE SITUATION

FERME SODAGRI 945 ha.

ELECTROWATT
INGENIEURS-CONSEILS S.A.
ZURICH - DAKAR

DESS. DGMB
CONT.
VISA

ECHELLE	DATE	NUMERO DU PLAN	ANNEXE
1 100000	DEC 79	6158 - 209003	FS - 2