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**Report No. 7037**

**PROJECT PERFORMANCE AUDIT REPORT**

**TUNISIA**

**SIDI SALEM MULTIPURPOSE PROJECT  
(LOAN 1431-TUN)**

**December 11, 1987**

**Operations Evaluation Department**

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### CURRENCY EQUIVALENTS

Currency Unit	=	Tunisian Dinars (D)
US\$1.00	=	D 0.54
D 1.00	=	US\$1.85

### WEIGHTS AND MEASURES

The metric system is used throughout this report.

### ABBREVIATIONS

BNT	National Bank of Tunisia
CNEA	National Center for Agronomic Studies
DAFL	Directorate of Land Reform
DEGTH	Ministry of Hydraulic Works
DGTH	Directorate of Studies and Hydraulic Works (Min. of Ag.)
OED	Operations Evaluation Department
OMVPINA	Regional Office
OMVVM	Regional Agricultural Development Directorate
PCR	Project Completion Report
PPAM	Project Performance Audit Memorandum
PPAR	Project Performance Audit Report
SECEAN	National Company for Operation of the Canal and Northern Water Resources
SNCFT	Tunisian Railways
SONEDE	Tunisian Water Authority
STEG	Tunisian Electricity Authority

### FISCAL YEAR OF BORROWER

Government of Tunisia : January 1 to December 31

Office of Director-General  
Operations Evaluation

December 11, 1987

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Performance Audit Report on Tunisia:  
Sidi Salem Multipurpose Project  
(Loan 1431-TUN)

Attached, for information, is a copy of the report entitled "Project Performance Audit Report: Tunisia Sidi Salem Multipurpose Project (Loan 1431-TUN)" prepared by the Europe, Middle East and Northern Africa Regional Office based on completion reports prepared by the project executing agencies.

Attachment

A handwritten signature in black ink, appearing to be 'R. P. ...', is written over a faint rectangular box.

## PROJECT PERFORMANCE AUDIT REPORT

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(LOAN 1431-TUN)TABLE OF CONTENTS

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Maps: IBRD Nos. 12232, 12233, 12234, 12235, 12236

## PROJECT PERFORMANCE AUDIT REPORT

### TUNISIA

#### SIDI SALEM MULTIPURPOSE PROJECT (LOAN 1431-TUN)

### PREFACE

This is a performance audit of the Sidi Salem Multipurpose Project in Tunisia, for which Loan 1431-TUN in the sum of US\$42.0 million was lent to Government with the objective of carrying out the first phase of the Northern Tunisia Water Master Plan. This plan provides the framework for achieving Government's objectives in Northern Tunisia for agricultural development, an adequate urban and rural water supply and flood control of the Medjerda river. The loan was approved on May 24, 1977, became effective on July 31, 1978 and closed on August 1, 1985 after cancellation of US\$1,284,512. The project was cofinanced by the People's Republic of China (US\$53.6 million); KfW (US\$31.6 million); European Investment Bank (US\$19.9 million); the Kuwait Fund (US\$13.5 million) and the OPEC Fund (US\$6.0 million).

The PPAR consists of a Project Performance Audit Memorandum (PPAM) prepared by the Operations Evaluation Department (OED) and a Project Completion Report (PCR) dated June 11, 1986. The PCR was prepared by the EMENA Regional Office following a country visit in December 1985 and based upon completion reports prepared by project executing agencies. The PPAM is based upon a review of the Staff Appraisal Report (No. 1215-TUN) dated May 5, 1977, the President's Report (No. P-2974-TUN) dated May 12, 1977, the Loan Agreement of July 5, 1977 and the PCR; correspondence with the Borrower and internal Bank memoranda on project issues as contained in relevant Bank files have been consulted, and Bank staff associated with the project have been interviewed.

An OED mission visited Tunisia in June 1987. Discussions were held with officials of the Ministry of Finance and Planning, Ministry of Agriculture, Ministry of Large Hydraulic Works (DGTH), the national company for Tunisian Railways (SNCF), national company for Electricity and Gas (STEG), national company for the Exploitation and Distribution of Potable Water (SONEDE), and national company for the Operation of the Canal and Northern Water Resources (SECAEN). Field visits to project areas and participating farmers were undertaken with the respective agricultural regional offices (OMVVM and OMVINA). The valuable assistance provided by the Government of Tunisia and the project staff met during the preparation of this report is gratefully acknowledged.

The PCR well covers the project experience and results achieved and pays particular attention to the implementation schedule of the project, disbursements, changes in costs, the financing plan and analysis of project agricultural impact within the context of the older irrigation

perimeters. The PPAM generally agrees with its conclusions and in addition to summarizing the project's objectives and results, the PPAM expands upon the factors accounting for the project's success and the benefits which can be obtained from a land reform program.

The report was sent to Government and cofinanciers on September 25, 1987; comments received have been incorporated into the report and are reproduced in Appendix I.

**PROJECT PERFORMANCE AUDIT REPORT**

**SONED**  
**SOUS-SOLAI-AL-CHIMIQUE-SONED**  
 (Loan 1431-UN)  
 SOUS-SOLAI-SONED

**KEY PROJECT DATA**

	Appraisal Estimate	Actual	Actual as % of Appraisal Estimate
Project cost (US\$ million)	225.0	273.1	99
Loan amount (US\$ million)	42.0	42.7	99
Board Approval	02/04/77	02/04/77	-
State Approval	11/02/77	07/31/78	-
State Physical Components Completed	12/31/78	12/31/78	-
Closing Date	02/28/80	07/28/80	115
Current State of Return (R)	115	102	96
Statistical Performance		satisfactory	
Agreement Performance		satisfactory	

**COMPLETION PERFORMANCE**

	FY76	FY77	FY78	FY79	FY80	FY81	FY82	FY83	FY84
Appraisal Estimate (US\$ million)	11.0	25.0	34.0	35.0	45.0	41.0	42.0	-	40.7
Actual (US\$ million)	0	10.4	22.0	25.1	29.2	32.4	37.0	39.0	40.7
Actual as % of Estimate	0	42	75	72	72	81	90	90	99
Date of Final Disbursement									07/25/80

**MISCELLANEOUS**

Mission	Date	No. of Persons	Non-UN	Special Agree. (A)	Perform. Rating (B)	Trends	Type of Problems (C)
Identification Preparation	02/10/75						
Appraisal/Board	02/76	4	12.0	FAO/CP/Bank A/IE/EC/CE	-		
Supervision 1	07/77	3	3.0	IE/CE	2		N
Supervision 2	09/77	3	2.0	A/IE/CE	2	2	N
Supervision 3	01/78	3	1.7	CE/A	2	1	N
Supervision 4	04/78	3	2.0	A/IE/CE	2	0	N
Supervision 5	10/78	2	1.7	IE/CE	2	1	N
Supervision 6	12/78	2	1.1	IE/CE	2	1	N
Supervision 7	04/79	2	2.0	IE/CE	2	2	N
Supervision 8	07/79	2	3.1	IE/CE	2	2	T/N
Supervision 9	10/79	1	0.3	IE	1	1	T/N
Supervision 10	01/80	2	2.0	A/IE	1	2	T/N
Supervision 11	05/80	2	1.4	IE/CE	2	2	T/N
Supervision 12	09/80	1	3.7	IE	2	2	T/N
Supervision 13	01/81	1	0.6	IE	2	1	T/N
Supervision 14	10/81	2	3.0	IE	2	1	T/N
Supervision 15	04/82	2	2.0	IE/A	1	1	T/N
Supervision 16	10/82	2	3.1	IE/A	2	2	T/N
Supervision 17	06/83	2	2.0	IE/A	2	1	N
Supervision 18	12/83	2	2.0	IE/A	1	1	N
Subtotal			41.1				
Total			50.1				

**Staff Inputs g/**

FY	77	78	79	80	81	82	83	84	85	86	87	88	89	90	TOTAL
MANAGERIAL	.	.	1.4	13.2	46.9	3.0	.	.	.	.	.	.	.	.	67.3
TECHNICAL	.	.	.	.	34.0	42.4	.	.	.	.	.	.	.	.	117.0
OPERATION	.	.	.	.	.	30.1	.	.	.	.	.	.	.	.	30.1
SUPERVISION	.	.	.	.	.	1.1	22.1	14.7	4.9	14.3	14.2	3.9	.0	9.5	123.9
OTHER	.4	3.2	.	.	1.0	1.5	.	.	.	.2	.	.	.	.	6.3
	.4	3.2	1.4	13.2	82.7	84.2	24.1	22.1	14.7	4.9	14.7	14.2	3.9	.0	9.5

**OTHER PROJECT DATA**

Borrower: Government of Republic of Tunisia  
 Executing Agencies: OMVM, DEGTH, SNCFT, STEG, DAFL, DGTH, OTD, SONEDE  
 Name of Currency: Tunisian Dinar (D)  
 Exchange Rates: Appraisal Year Average: US\$1.00 = D 0.43  
 Intervening Year Average: US\$1.00 = D 0.54  
 Completion Year Average: US\$1.00 = D 0.76

- /a A = Agriculturist, CE = Civil Engineer, IE = Irrigation Engineer, EC = Economist.
- /b 1 = Problem free or minor problems, 2 = Moderate problems.
- /c 1 = Improving, 2 = stationary.
- /d M = Managerial, T = Technical, F = Financial.
- /e No special field mission.
- /f By consultants with the FAO/CP and Bank assistance.
- /g Staff inputs by weeks as recorded by TRS.

PROJECT PERFORMANCE AUDIT REPORT

TUNISIA

SIDI SALEM MULTIPURPOSE PROJECT  
(LOAN 1431-TUN)

EVALUATION SUMMARY

Introduction

The project was the centerpiece of Government's efforts to develop water resources for the urban, rural and agricultural sectors in Northern Tunisia. The project, cofinanced by the People's Republic of China, KfW, Kuwait Fund, OPEC Fund and European Investment Bank was the second Bank-assisted project in the irrigation sector, the sixth loan/credit to Tunisia for the agricultural sector.

Objectives

The project objectives were to (i) implement the first phase of the Water Master Plan for Northern Tunisia, a multipurpose plan to harness water resources for agricultural development, potable and industrial requirements; and (ii) assist in institutional strengthening. The project was to be implemented by two ministries and three agencies, with a project coordinating committee chaired by a third ministry. Total project costs were estimated at US\$386 million; the project was to be implemented over seven years.

Implementation Experience

The 550 Mm<sup>3</sup> dam was constructed as planned, with only minor delays. The scheduling of the associated works--relocation of the railway, road and water supply pipes which would be submerged by the dam--was also respected, the components completed as planned. Substantial delays were encountered in respect of civil works for which detailed designs had not been submitted at appraisal: the 125-km canal and the infrastructure for the three new irrigation perimeters totalling 10,600 ha. The irrigation rehabilitation component to safeguard a further 6,000 ha of citrus was delayed in part due to delays in constructing the canal. The canal is now complete and fully operational. Two of the three new irrigation perimeters (Testour and Medjez el Bab) have 4,436 ha under irrigation (85% of appraisal estimates); the third, at Cap Bon, has 2,080 ha (39% of appraisal estimates). The Safeguard of Citrus in Cap Bon commands 6,303 ha (100%) under irrigation. Studies, training and consultant assistance were carried out as expected. When the project closed, 13 months behind schedule, total project costs were US\$373.1 million; a 3% cost underrun in US dollar terms due to the appreciation of the US dollar but a 25% cost overrun in Tunisian dinar terms.



## Results

The project has made an important contribution to the supply of potable water to the capital city, Tunis, and surrounding urban areas. It is early to quantify agricultural benefits: initial trends indicate relatively low use of water per ha countered by a greater than expected shift towards higher value crops amongst small farmers. The irrigation rehabilitation component, the Safeguard of Citrus, appears to have been successful but data are weak. The power component has provided important benefits. The audit concurs with the 10% rate of return recalculated by the PCR (11.1% at appraisal).

## Sustainability

The project is clearly sustainable: the Water Master Plan for which the project is the cornerstone has successfully entered its second phase with financing from other sources. Civil works appear sound, but sustainability of benefits at the farm level will depend on the system of operation and maintenance put in place, at present this is not a farmer responsibility. Government is currently strengthening its operation and maintenance capacity under the auspices of the Irrigation Management Improvement project (Ln. 2573-TUN). Project impact on the environment has been generally positive: the salinity content of the Medjerda waters is better than was expected at appraisal, pollution monitoring has also been introduced and further studies are underway.

## Findings and Lessons

A large part of the success of the project, despite the complexity of design, range of cofinanciers and number of government agencies involved can be traced to (a) comprehensive and careful project preparation: the Northern Tunisia Water Master Plan first went to the drawing board in 1969 and all elements fully tested before the project was prepared in 1975; and (b) informal but effective coordination between key actors both within government and the Bank. The lessons being first that careful project preparation can contribute substantially to subsequent project success 1/ and second that coordinating committees are not always necessary even in multi-donor, multi-component projects.

The difficulties in measuring agricultural benefits of irrigation projects at project closure when the infrastructure is only recently completed. The lesson to be drawn is the potential usefulness of both monitoring and evaluation after project completion (which, if not undertaken can result in future investment needs being overlooked) and impact evaluations to the irrigation sector, in particular since, it is only at full development that there is an opportunity to measure project related changes in terms of agricultural benefits.

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1/ See for example, PPAR Mexico Papaloapan, OED report no. 5760 dated June 28, 1985 and PCR Yugoslavia Metohija Multipurpose project.

The relatively greater productivity of smaller farmers vis-a-vis larger farmers. In this project small farmers have adopted a technical package which utilizes the irrigation system and which largely follows extension themes. By contrast, large farmers have yet to change their cropping pattern substantially. This again points to the potential benefits to be derived from an effective monitoring and evaluation system. The lesson here is that although the Government has been tardy in implementing its land reform program there are significant production as well as equity gains to be made from accelerating the settlement of small farmers in irrigated areas.

PROJECT PERFORMANCE AUDIT MEMORANDUM

TUNISIA

SIDI SALEM MULTIPURPOSE PROJECT  
(LOAN 1431-TUN)

I. Background

1. At the time the project was appraised in 1975, the agricultural sector in Tunisia constituted an important source of employment (engaging 42% of the labor force) contributed about 21% of GDP, 20% of merchandise exports, principally olive oil, vegetables, citrus and other fruits. Annual sector growth rates immediately preceding the project were 3.6% in constant terms, above Plan projections; agricultural imports also accelerated rapidly during the period.

2. Principal agricultural objectives of the 5th Plan (1977-81), the backcloth for this project, were to obtain self sufficiency in major food-stuffs (cereals, dairy products and sugar); a balanced trade account for other agricultural products and increased rural employment and incomes.

3. Tunisia has a total land area of 16.4 million ha of which about 8.4 million ha are suitable for agriculture. In terms of crop production, some 35% is planted to cereals, 35% to fruit trees, the remainder to forage, vegetables, grain legumes and industrial crops; about 20% remains fallow each year.

4. The irrigation subsector accounts for about 25% of agricultural GDP although total irrigation potential is currently estimated at about 250,000 ha, or 5% of total arable land. At project appraisal, some 132,000 ha had been equipped (60%) with irrigation infrastructure, largely situated in Northern Tunisia. Low annual rainfall precludes significant increase in production except by expansion of irrigated lands. Slightly less than half of the irrigation infrastructure comprises public perimeters--large irrigation schemes built by Government and managed by public entities (OMVs) responsible for developing agricultural production by providing the necessary supporting services in their respective command areas. Irrigation in the remaining private schemes is largely from shallow wells equipped with pumps.

5. Planning for irrigation development has been systematic: a 10-year 'Minimum Plan' was enunciated by Government in 1962, covering the Lower Medjerda Valley, Tunisia's largest water course. Following increased demands for potable, industrial and agricultural waters, Government in 1968 called for the development of a Master Plan to cover the whole of Northern Tunisia. Beginning in 1969, the Bank provided technical assistance over a five-year period to carry out relevant studies. The Water Master Plan for

Northern Tunisia, which was approved by Government in 1975, constituted a multipurpose scheme to develop water resources in the the Medjerda and Ichkeul Basins. The Sidi Salem project was to be the premier phase of this Water Master Plan.

6. Bank/IDA lending to Tunisia began in 1967. This was the Bank Group's sixth loan/credit to Tunisia in support of the agricultural sector. Previous projects included fisheries and agricultural credit development. This project was the second in the irrigation subsector. The first, a rehabilitation project with the objective of using existing infrastructure in the Medjerda Valley more efficiently and strengthening supporting services was successfully completed in 1982.<sup>1/</sup>

## II. Project Design

7. The primary objective of the project was to execute the first phase of the Water Master Plan for Northern Tunisia. A secondary objective was to assist in institutional strengthening through reorganization, training and consultant assistance.

8. As approved by the Board in May 1977, the project consisted of:

- the construction of a 550 Mm<sup>3</sup> dam and relocation of rail, road and water pipes which would be flooded by the dam;
- construction of a 25 MW hydropower plant;
- construction of 126 km of main canal;
- construction of irrigation, drainage and road networks to serve two new and separate subprojects totalling 10,600 ha;
- rehabilitation works for 6,000 ha of citrus plantations and provision of a tertiary underground distribution network to complete the irrigation network; and
- provision of infrastructure for supporting services and to ensure operation and maintenance of project-financed activities, training and studies for institutional strengthening.

9. Two Ministries (Public Works and Agriculture) and three existing public agencies were responsible for project execution. The dam and associated major works were to be implemented by the Ministry of Public Works (DGTH); relocation and operation of the railway were the responsibility of the national company for Tunisian Railways (SNCFT); installation and operation of the power equipment for both the dam and the irrigation perimeters were to be implemented by the electricity authority (STEG); relocation of

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<sup>1/</sup> OED Report number 5344, dated December 13, 1984.

the water supply pipes and distribution of potable water to Tunis were the responsibility of the water authority (SONEDE) and the Ministry of Agriculture through its Directorate of Studies and Hydraulic Works (DEGTH) was to carry out operation and maintenance of the dam and the canal and, through a decentralized regional directorate (OMVVM) implement the design, construction, operation and maintenance of the irrigation networks as well as for agricultural development. Under the auspices of the Ministry of Finance and Planning, a Project Coordination Committee was to be established comprising representatives from all the agencies involved and was expected to meet at least every three months. Consultants were to be hired for the engineering and supervision of civil works. Farmer irrigation associations would be formed to operate and maintain irrigation systems beyond each canal outlet.

10. With its multipurpose nature, the project was to give rise to a range of direct benefits: (i) the provision of almost 40% of the estimated total requirements of potable and industrial water in Northern Tunisia by 1995; (ii) the supply of power to accommodate about 15% of the increased requirements in the decade following the project; (iii) increased agricultural production by about 8,000 farming families in the project areas and increased employment for 5,700 workers. The majority of beneficiaries in the agricultural sector were expected to be small-/medium-size farmers owning farms of less than 10 ha. The agricultural lands to be developed would be decreed public irrigation perimeters and thus subject to land reform legislation enacted in 1963 governing size of holding, land redistribution/consolidation and recovery of investment costs in irrigated areas.

11. Indirect benefits included: (i) improved agricultural production in about 30,000 ha already irrigated in the Lower Medjerda Valley; (ii) improvement in the salinity content, particularly in the summer months; and (iii) reduced flooding in the Medjerda Valley.

12. Total project costs were estimated at US\$386 million. A complex financing plan included several cofinanciers: the dam and major associated works were to be financed directly by KfW, Iran and supplier credit; the canal by the People's Republic of China; agricultural development jointly by Arab/OPEC funding and IBRD. The Bank's loan of US\$42 million was also to finance related costs associated with the relocation of infrastructure from the reservoir area; provision of consultants, studies and training.

13. The project was to be implemented over a seven-year period with an economic rate of return of 11.2%.

### III. Project Implementation

14. The loan became effective on July 31, 1978 following four extensions and nine months delay; difficulties were encountered in finalizing the KfW loan and obtaining detailed design plans for the canal to be financed and constructed by the People's Republic of China.

15. Implementation of the dam component proceeded according to plan with few modifications, detailed design plans having been drawn up prior to appraisal. The construction period was also very close to appraisal estimates. The dam is now operational and the reservoir has been filled to its maximum capacity. Scheduling and completion of major associated works--relocation of the population and infrastructure which would be submerged by the dam also proceeded without problem. Although some delays were encountered, the sequencing of these major associated works was respected, thus contributing to the timely execution of the dam. The power plant was also constructed as planned and is fully operational.

16. Construction of the canal, almost entirely by force account by teams sent from China, encountered substantial delays due to incomplete design at appraisal, which in turn resulted in subsequent civil engineering problems: a 2.7-km tunnel at Hamman Lif, for example, taking almost 3 years to complete. The technology developed and employed by the Chinese, however, to regulate the flow of water to take account of both up and downstream demand is sophisticated and has wider application beyond the Tunisian condition. Since completion, two years after appraisal estimates the lined canal is fully operational.

17. The new irrigation perimeters, in particular Medjez El Bab, situated in the central Medjerda Valley, and the new and rehabilitated perimeters both situated at Cap Bon, northeast of Tunis, all encountered substantial delays. Reasons given are poor performance of suppliers, the preliminary nature of the data at appraisal and adverse weather conditions. Technical problems were reported to the mission in respect of the irrigation works for the Safeguard of Citrus in the Cap Bon peninsula. These relate essentially to (i) in years of poor rainfall the reservoir at Bezirk requires supplemental water which has to be pumped up from the canal through the pumping station at Soliman and pumped back again to farmers' fields. In addition to the increased costs involved in this double pumping operation, the capacity of the pumping station and of the conduits from the canal to Bezirk reservoir are having to be expanded, and (ii) the original irrigation infrastructure at the field level is inadequate to cope with demand.

18. At the end of 1986, 6,303 ha were rehabilitated in the Safeguard of Citrus component at Cap Bon and 2,080 ha irrigated in the new irrigation perimeter, principally to citrus and vegetables with some intercropping. Citrus in the Cap Bon area are sold to collection centers, some of which are cooperatives run by farmers, for export to EEC countries. No marketing problems are anticipated; Tunisian varieties are not produced by new member countries of the EEC.

19. In the Central Medjerda Valley, 1,184 ha at Testour is under sprinkler irrigation and 3,252 ha at Medjez el Bab, providing a total of 4,436 ha as at June 1987. Farmers have purchased mobile sprinkler equipment on credit; extension is supplied by the OMVVM (1:6-800 ha for crops, with one agent for livestock in both Testour and Medjez el Bab) and by the

Tunisian Sugar Company which provides an integrated package of inputs, credit and extension for sugarbeet. Principal crops are wheat, summer vegetables, (mainly tomatoes and watermelon), fodder crops, fruit trees and winter vegetables. Most products are sold on local markets. Tomatoes are sold for processing--the factory is planning to increase capacity from 300 to 500 tons per day; pomegranate, grape and citrus have a strong following on the local market; milk can easily be sold to cooperative collection centers although the local market provides a better return. Livestock development has been slower than expected at appraisal, only 700 head are in the Testour/Medjez el Bab project areas compared with 3,200 improved cattle at appraisal. Principal reasons are delays in project implementation and the Government's price policy for milk which is regarded as unfavorable by producers.

20. All studies detailed in the covenants were carried out: those on water quality in the Sidi Salem dam and simulation of water resources were largely carried out on time; that on cost recovery experienced a two-year delay and required further work.

21. The Project Coordinating Committee met only once. The informal coordination which developed between the agencies, and largely chaired by the Ministry of Public Works, proved effective. Despite the complexity of the project--in design, timetable for implementation and numbers of co-financiers (para. 35)--there was close involvement of both government agencies/ministries and divisions within the Bank, which all contributed to relatively smooth project implementation, and in turn to the success of the project. No farmers' associations were established in the project areas. Consultant performance was considered satisfactory by Government.

22. When the project closed in December 31, 1984, six months later than expected, total project cost was US\$373 million, 3% lower in US dollar terms, but 25% higher in dinar terms. The latter overrun is largely explained by the delays encountered in the construction of the canal and in the irrigation perimeters.

23. The financing plan was modified somewhat during implementation: US\$15 million expected from Iranian sources and US\$19.6 million from OPEC funds were either not provided or scaled back, being replaced by funds from the European Investment Bank (US\$19.9 million) and Kuwait (US\$13.5 million); KfW increased its contribution from US\$28 million to US\$31.6 million; the Bank cancelled US\$1.3 million of its loan.

24. Farmers contribute to the recovery of project costs through payment of an investment contribution and water charges. At appraisal it was expected that farmers would pay a minimum of D 100/ha for investment costs and between 6-12 millimes/m<sup>3</sup> for water charges. Farmers' contribution to investment costs was subsequently calculated to be D 300/ha, based upon an estimated investment cost of D 1,231/ha and D 1,017/ha for Testour and Medjez el Bab respectively. Although actual investment costs increased to D 3,000/ha, farmers' contributions have not been increased accordingly; the

loan covenant being observed. Water charges are currently fixed at 23 millimes/m<sup>3</sup>, having been increased successively each year. No minimum charge per hectare is levied, as is the case in Morocco for example, nor are charges levied for pumping. In Cap Bon, water charges are higher; water from the canal is purchased by OMVPINA at 14 m/m<sup>3</sup> and on-sold to farmers at 42 millimes/m<sup>3</sup> in the peak season, 34 millimes/m<sup>3</sup> in winter. O&M costs in subproject areas are unavailable and thus no conclusion can be drawn as to whether these charges are sufficient to cover costs incurred. Indications are that the water charges levied contribute less than 50% of the relevant recurrent costs of the two OMVs. The system of cost recovery is currently under review in conjunction with the Bank.

#### IV. Project Impact

25. At project completion, it is evident that the most important benefit to date is the supply of potable and industrial water to the Tunis/Cap Bon area. Conflicting data on total water use makes the drawing of conclusions difficult; most likely estimates are as follows:

Table 1: POTABLE AND INDUSTRIAL WATER PURCHASED BY SONEDE<sup>2/</sup>  
(Mm<sup>3</sup>)

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1995</u>
SECAEN	35.0	49.8	59.5	--
Appraisal Estimate <u>/a</u>	20.0	30.0	--	100

/a Most Probable Demand Estimate assuming demand increases in Northern Tunisia of 6% p.a.; Djoumine completed in 1986.

26. Analysis of agricultural benefits is difficult given their premature nature. In this project, the delays encountered in construction/rehabilitation of the systems at the farm level make such measurement more difficult. The following trends, therefore, have to be treated with caution.

27. The oldest irrigation perimeter, Testour, which received its first irrigation in 1983 has not seen significant increase in water consumption per hectare over the subsequent four-year period.

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2/ SONEDE has supplied conflicting figures which likely include purchases from other sources in addition to that from Sidi Salem.



Table 2: WATER USE PER HA IN CENTRAL MEDJERDA VALLEY AND CAP BON  
(m<sup>3</sup>/ha)

	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>Full Development</u> /a
Testour	2,699	2,955	3,101	2,443	
Cap Bon (Safeguard of Citrus)	--	1,915	2,642	2,479	
Medjez el Bab	--	--	1,516	1,759	
Appraisal Estimates					7,545

/a Eleven years after first irrigation.

Water use per hectare in the neighboring Medjez El Bab perimeter, which has received two years of irrigation waters, is similarly low. Initial farmer uptake has not, therefore, been as rapid as has been noted in Morocco Doukkala--the project which was used as a model in the assumptions for the agricultural components in Tunisia--and which similarly introduced sprinkler irrigation technology. Reasons for low water demand are discussed below. Data on area, yields, production and cropping intensity for Testour and Medjez el Bab is given in Appendix Tables I-II; Appendix III provides a comparison between Appraisal, PCR estimates and 1986/87 actual data for area planted. These tables illustrate the continuing importance of wheat in the project areas, as well as its low yields compared to appraisal estimates, and emphasize the trends noted elsewhere in the shift to higher-value crops, particularly summer and winter vegetables, with yields equal to or higher than expected at appraisal.

28. Data on water use in the Cap Bon area concerns only the Safeguard of Citrus; the new irrigation perimeter is only now coming into operation. Water use from the canal has increased slightly over the three-year period as Table 2 shows; farmers are, however, using systems of irrigation which are more efficient at conserving water. Analysis of yields, which were expected to be adversely affected by the increasing salinity of the groundwater resources available, is unfortunately inconclusive because of lack of data. Although there is an adjacent perimeter of a further 2,900 ha where citrus are not receiving the benefit of project waters, no analysis has been undertaken to determine the benefits with and without project waters. Tentative data suggest yields of between 18.9 t/ha in 1984/85 increasing to 27.7 t/ha in 1986/87 compared with estimates of between 8-12 t/ha without the project. Although the new irrigation perimeter at Cap Bon will only now begin to see the benefits of the project, it is evident in the Cap Bon area that farmers are receptive to new technology; intercropping with vegetables is frequent--Cap Bon produces 50% of the country's total potato requirement; use of organic matter is widespread.

29. An indirect benefit of the project was to improve agricultural production on about 30,000 ha of land already under irrigation in the Lower Medjerda Valley. Recorded water use in the Lower Medjerda Valley to date

has been declining while total consumption for Testour/Medjez el Bab is currently about 15% of appraisal estimates for full development.

Table 3: AGRICULTURAL WATER CONSUMPTION IN MEDJERDA VALLEY  
(Mm<sup>3</sup>)

	<u>1982-83</u>	<u>83-84</u>	<u>84-85</u>
Central/Lower Medjerda Valley	79.2	73.0	66.0
Excluding Testour/Medjez El Bab	77.6		59.4

30. Benefits from the power component have been greater than expected at appraisal largely because the power plant provides electricity during the critical evening hours; a 36 mw plant was constructed rather than the 25 mw planned at appraisal.

31. The PCR has recalculated the economic rate of return at project completion at 10%. Although water use is lower than expected, this in part is explained by delays in completion of the works and is also offset to some extent by the shift to higher-value crops (paras. 42 et seq). Sensitivity analysis undertaken (a) delaying full development of agricultural benefits by two years beyond the 1988/89 assumption of the PCR causes the ERR to change only slightly to 9.5%;<sup>3/</sup> and (b) reducing agricultural benefits by 10% to take account of the slow development to higher-value crops lowers the return further to 9.1%.

32. The project's impact on the environment has been better than expected at appraisal. The waters of Sidi Salem are less saline than had been expected. Moreover, the two occasions when the dam has been filled to its full capacity of 110 m, salinity remained low: 1.1 mg/l in January 1983 and from 0.9-1.0 mg/l in April/May 1984. The environmental study on the water quality of the dam was carried out as planned and a strict system of pollution monitoring is now in place. Further work is continuing under German bilateral assistance regarding the disposal of effluent directly into the Medjerda River. OMVVM is monitoring the effects of the sugar factory upstream at Beja. An unexpected and adverse effect has been the discharge of oil into the Medjerda waters by the power plant due to technical problems encountered with the equipment provided under supplier credit. The discharge is of sufficient quantity that remedial steps should be taken.

33. The prospects for sustainability of project benefits appear good. Most important, the project has been a cornerstone in the implementation of the Water Master Plan for Northern Tunisia. The successful development of

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<sup>3/</sup> KfW point out that based upon the experience gained in nearby perimeters of Beu Heurtma there seems little evidence that the areas cultivated in 1986/87 will change as projected for 1988/89 with respect to fodder crops, livestock and fruit production.

the second phase which is currently taking place with the construction of three dams: Djoumine (78 Mm<sup>3</sup>); Sejnane (80 Mm<sup>3</sup>); and Sidi El Barrack (192 Mm<sup>3</sup>), although not being financed by the Bank, illustrates the importance of Sidi Salem as testimony to this overall development of water resources in Northern Tunisia.

34. The continuation in the supply of potable and industrial waters to Tunis and other urban areas appears not in doubt; full development and maintenance of agricultural benefits will depend on adequate operation and maintenance of the irrigation infrastructure. At present, this is being done exclusively by the OMVs in the absence of development of farmers' associations at the tertiary level; continued attention must be given to cost recovery at the farm level.

## V. Issues

### A. Benefits to the Project of Careful Preparation

35. There is no doubt that this project is deemed by all parties involved to be a success. This success is more striking given the project's size, scope, complexity and numbers of cofinanciers involved.<sup>4/</sup> The project was estimated to cost US\$385.8 million in 1977 prices. Its components were wide ranging: covering, inter alia, the construction of the largest dam in Tunisia's history;<sup>5/</sup> canal infrastructure to convey both potable water to the 1+million population of Tunis, and, in the future, to the cities of Sousse (140 km due south of Tunis) and Sfax (a further 129 km); and irrigation waters both to the surrounding Medjerda valley, and to the Cap Bon peninsula, north east of Tunis. At the same time, most components were interdependent in terms of both the sequencing of certain operations, to prevent implementation delays and the realization of project benefits and their contribution to the economic rate of return. Added to the complexity of the project and its tight scheduling was the large number of cofinanciers involved, including one with which the Bank at that time had no formal relations.

36. An important reason for the success of a project of this complexity is careful project preparation. Successive Annual Reviews have called attention to this finding; Sidi Salem is a good example of careful attention to all aspects of project design--technical/engineering, agricultural and the financing plan.

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<sup>4/</sup> Similar such complex projects have often failed in the past, see YAR Livestock project, OED Report No. 6335, dated June 30, 1986.

<sup>5/</sup> Previous dams were much smaller in size: Ben Metir constructed in 1947-50, 40 Mm<sup>3</sup>; El Arroussia (1950) about 4 Mm<sup>3</sup>; Nebeur (1950-54) 134 Mm<sup>3</sup>; Kasseb (1967-70) 36 Mm<sup>3</sup>; Lakmess (1974) 7 Mm<sup>3</sup> and Beu Heurtma (1976) 55 Mm<sup>3</sup>.

37. Although this project was approved in 1977, preparation essentially began in 1969 when the Bank provided technical assistance for the preparation by consultants of the Northern Tunisia Water Master Plan of which this project was expected to be a part. An initial draft was submitted in June 1970 when it was determined that four additional studies would need to be undertaken--for which the Bank was to be the executing agency; soil survey studies were to be undertaken in parallel. Completion of these four studies took four years, largely due to the complexity of the mathematical model and difficulties with computer programming and was finally submitted to Government in August 1974. Technical review of the Master Plan followed, including technical feasibility of the proposed dam and canal by another consultant firm, and was detailed resulting in further modifications to the model.

38. By June 1975 the first preparation mission by FAO/CP took place to analyze principally the agricultural aspects of the project, the land consolidation and cropping patterns, using assumptions employed in a similar project in Morocco which expected to introduce sprinkler irrigation over a wide area. In-depth Bank review of both the technical and agricultural aspects proceeded in October 1975; appraisal six months later.

39. Considerable emphasis was then given to how best to resolve the financing plan: KfW, People's Republic of China, the Kuwait Fund, Iran and the European Investment Bank all having expressed interest in financing the project. Resolution of the financing plan took a further year of detailed negotiation, principally between Government, which initially wanted to divide the project into two parts and KfW which, like the Bank, considered that all components were mutually interdependent. KfW also wanted assurances, however, that all parties, including the Chinese who were financing the canal, would guarantee their proposed financing contribution. The latter was particularly important since if the canal was not constructed many of the agricultural benefits and thus the economic rate of return would be adversely affected.

40. In view of this lengthy preparation it is of interest to examine the implementation schedule of the project. Table I in the PCR (para. 3.04) provides details and it can be seen that taking account the delays due to late effectiveness of the project, all the major infrastructure works followed very closely the sequencing laid down at appraisal. The principal exception being the irrigation perimeters, that in Cap Bon in particular suffered long delays. Informal but effective leadership supplied by the Ministry of Hydraulic Works, supported by frequent Bank supervision missions, particularly for the technical aspects, obviated the need for a project coordinating committee.

## B. Benefits of Land Reform

41. The project is a good example of how small farmers frequently make more productive use of available resources than do larger farmers. In this project, small farmers have been quicker in switching to higher-value

crops, increasing cropping intensities and as a result, are making greater use of the services supplied under the project.<sup>6/</sup>

42. At project appraisal, about 96% of the the Testour/Medjez el Bab area (5,200 ha) was dryfarmed, the principal crops being wheat (42% of cultivated area) vetch oats (15%) and orchards intercropped with cereals/-forage (13%). A very small area, close to the river, was irrigated with individual pumping stations and cultivated to summer and winter vegetables:

43. With the introduction of sprinkler irrigation in the project areas, it was expected that this cropping system would be largely maintained but intensified: both wheat and vetch crops were to be retained as important staples, higher-value crops, principally sugarbeet, sorghum and sunflower, with some vegetable and fruit trees were to be introduced.

44. The cropping pattern in Testour, now in its fifth year of irrigation, differs from these appraisal projections. In particular, there is considerable difference in the cropping patterns employed as between large and small farmers:

- only large farmers cultivate wheat/forage crops--relatively small farmers (those with landholdings under 10 ha) do not cultivate either. This is striking given the importance of cereals prior to the project and contrary to the experience noted in Morocco (from which the assumptions for the agricultural components were drawn) where both small and large farmers have continued to grow wheat in the rotation;
- while some large farmers in Tunisia are now cultivating sugarbeet this is not the case for small farmers--again contrary to the experience in Morocco. However, although the large farmers follow the cropping pattern laid down at appraisal, much of the wheat continues to be dryfarmed with low yields (1.8 t/ha). Furthermore, sugarbeet yields are significantly lower than those obtained in irrigated areas in Morocco, for example: where yields of 70 t/ha are reported in the 1986-87 campaign, yields in Testour are about 40 t/ha.

45. Small farmers have deviated significantly from the cropping pattern expected at appraisal towards higher value crops, almost all:

- cultivate winter and summer vegetables, of which potatoes (both winter and summer) and tomatoes (for both market and processing) are the principle cash crops;

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<sup>6/</sup> The following analysis concentrates specifically on the irrigation perimeters of Testour and Medjez el Bab, both situated in the Central Medjerda Valley since Testour, the oldest irrigation perimeter, has now been in operation for four agricultural seasons and thus allows some analysis of potential production trends.

- are increasingly introducing fruit trees, particularly pomegranate--intercropped with the vegetables--over a much greater area than expected;
- are very flexible in their crop rotations--although no specific crop rotation is respected or observed, farmers clearly follow market signals. Analysis of cropping patterns over the three agricultural seasons 1984-86 in Testour shows a wide variety of vegetables being cultivated in addition to the potato/tomato staple, varying from year to year both in crop planted (e.g., artichoke, melon, watermelon, fennel, onions, peas, etc.) and in area planted to each.

46. Such a cropping pattern clearly uses project services more intensively--in particular irrigation waters, which is counter to the overall finding that the average water use per hectare is low. This then raises the question as to the pattern of land ownership in the project perimeters and the extent to which the project area is made up of small farmers who are clearly making relatively greater productive use of resources provided under the auspices of the project.

47. Although the project sponsored land reform and consolidation it is evident that the pattern of landholdings has not yet changed significantly. Agricultural lands in the project were to be decreed 'public irrigation perimeters' thereby permitting land reform and consolidation to take place in accordance with land reform legislation adopted in 1963. This took effect in March 1980 for Testour and August 1981 for Medjez el Bab. Existing farm sizes were to be consolidated to a minimum of 3 ha with no farms exceeding 40 ha, below the 50 ha ceiling assumed by the appraisal report.

48. Changes in landholdings and ownership as a result of the introduction of irrigation in accordance with the land reform legislation have so far been slower than was expected at appraisal:

Table 4: PERCENTAGE OF PROJECT AREA BY SIZE OF PRIVATE\* FARM

<u>Size of Farm</u>	<u>Project Area</u> %			
	<u>Testour</u>		<u>Medjes el Bab</u>	
	<u>Before Project</u>	<u>After Project</u>	<u>Before Project</u>	<u>After Project</u>
0-3 ha	5.5	--	5	--
3-5 ha	3	15	3.5	14
5-10 ha	21	22	14	16
0-10 ha	30	37	23	30
10-20 ha	20	21	10	18
20-40 ha	22	16	18	27
40 ha <	29	25	50	26
10-40 ha <	70	63	78	71

\* Public sector irrigated lands, which include cooperatives, constitute approximately 40% of project area in Testour and 18% of project in Medjes el Bab.

Table 5: PERCENTAGE OF LANDOWNERS BY SIZE OF PRIVATE FARM

<u>Size of Farm</u>	<u>Landowners</u> %			
	<u>Testour</u>		<u>Medjes el Bab</u>	
	<u>Before Project</u>	<u>After Project</u>	<u>Before Project</u>	<u>After Project</u>
0-3 ha	36	--	37	--
3-5 ha	8	43	13	45
5-10 ha	29	33	28	28
0-10 ha	73	76	78	73
10-20 ha	14	17	9	15
20-40 ha	9	5	8	9
40 ha <	6	1	5/5	22
10-40 ha <	29	24	22	27

Source: "Note Relative au Périmètre Irrigué de Testour/Medjes el Bab." Mise en Valeur des PPI de Testour et de Medjes el Bab, 1987, OMVVM.

Table 4 shows that the total project area by size of landholding for both Testour and Medjez el Bab has increased only slightly for farms under 10 ha, the area with farms of between 10-20 ha has remained the same while that for farms over 20 ha has decreased slightly. As a result, and as was the case prior to the project, over two thirds of the project area continues to be made up of private farms whose size is greater than 20 ha of irrigated land. In contrast, the SAR expected that 55% of the private landholdings would be under 10 ha for both Testour and Medjez el Bab.

49. Table 5 shows that there has been a relatively greater increase in the number of farmers in the project areas, but the change is entirely at the small farm size category. Thus, in terms of the number of title holders, 7/ the first conclusion to be drawn is that the overall number has increased somewhat in Testour and more significantly in Medjez el Bab. However, it is also apparent that the majority of title holders (over 70%), as was the case prior to the project, have landholdings under 10 ha; the percentage of those with between 10-20 ha has increased slightly in both perimeters and declined somewhat for the farm holdings above 20 ha. Thus, the situation at project completion is that between 73-76 percent of title holders have access to between 30-37% of the project area. Conversely 24-27% of landowners have between 63-70% of the land developed under the project. The SAR expected that 89% of title holders would have farms under 10 ha.

50. This observation, together with that regarding the difference in cropping pattern between large and small farmers, in part explains the underutilization of water in the project areas.8/ Unfortunately, analysis of water use by size of exploitation is not available. Project data show only an average for the project area as a whole, which is clearly heavily weighted given the high preponderance of large landholdings. It seems likely, however, that the water use by small farmers is considerably higher per hectare than among the large--since the yields of the former, for example, for the vegetable crops, are in line with appraisal expectations which in turn expected a much higher average consumption of water.

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7/ As distinct from those having rights to cultivate the land--a considerably larger figure.

8/ PPR/AGR add: "the problem of relatively low irrigation intensity in the larger farms is difficult to resolve in the project area, as it is in the Lower Medjerda Valley as a whole, due to the profitability of mechanized rainfed cereal and vetch/oats hay production and labor constraints for large scale irrigated crop production without a higher degree of mechanization" and "Strengthening of research and extension on irrigation methods and mechanization is an essential precondition to further intensification of irrigation on the medium and larger sized farms."



51. If one can indeed conclude that small farmers are making more productive use of resources available, this finding can be of encouragement for accelerating future land reform in Tunisia.

.FTCCMAC 06-00457.01

TLX NO. 11/779 06.11.87 WL/SRO/DR 11.10H

ROM KREDITANSTALT FRANKFURT TO WORLD BANK WASHINGTON  
ATTN.: MR. R.J. VAN DER LUGT, OED  
ATTN.: MR. G. DONALDSON, OED

L IV B/3 - FINANCIAL COOPERATION WITH TUNISIA  
SIDI SALEM MULTIPURPOSE PROJECT.

MANY THANKS FOR DRAFT OF PROJECT PERFORMANCE AUDIT  
REPORT AND PCR WHICH WE HAVE READ WITH INTEREST. WE HAVE  
NOT YET PRODUCED OUR FINAL EVALUATION OF PROJECT BUT CARRIED  
OUT A PROJECT COMPLETION MISSION IN 1984 WHICH TREATED MAINLY  
TECHNICAL ASPECTS OF THE DAM AND RELATED WORK (KFW-COMPONENT).  
WILL SEND YOU A COPY OF PC-REPORT. YOU WILL SEE THAT NOTABLY  
COSTS CALCULATED DIFFER FROM YOUR FINDINGS.

IN GENERAL WOULD LIKE TO COMMENT DRAFT PPAR AS FOLLOWS:

1. REPORT DOESN'T MENTION THAT TWO FURTHER OBJECTIVES OF PROJECT WERE FLOOD PROTECTION AND ENERGY PRODUCTION. THESE TWO OBJECTIVES ALSO SHOULD BE EVALUATED IN MORE DETAIL. PCR para. 5.01 (b), (c) and paras. 4.09 & 5.03.
2. THE NEW POWER PLANT WAS NOT CONSTRUCTED AS PLANNED. INSTEAD OF 25 MW A 36 MW-CAPACITY WAS INSTALLED. THIS MODIFICATION CAUSED SEVERAL DELAYS. para. 30
3. WE SHOULD ALSO PROPOSE TO EVALUATE IN MORE DETAIL THE EXTENT TO WHICH THE ADDITIONAL SUGAR BEET PRODUCTION WOULD IMPROVE THE DEGREE OF UTILIZATION OF THE SUGAR FACTORY BEJA.
4. IT WOULD BE INTERESTING TO FIND OUT TO WHICH EXTENT RESULTS OF VARIOUS STUDIES HAVE BEEN USED TO INITIATE ACTIVITIES REGARDING IMPROVEMENTS OF WATER QUALITY, INVESTMENT CONTRIBUTION OF BENEFICIARIES AND WATER RATES. In fact, waters of Sidi Salem are less saline than expected (para. 32) while studies on cost recovery were delayed. (para. 20).
5. WONDER WHETHER IT WOULD BE USEFUL TO COMPARE WATER CHARGES WITH WATER PRODUCTION COSTS.
6. NEITHER PPAR NOR PCR INDICATE IN DETAIL ENERGY PRODUCED.
7. DEEM IT USEFUL TO ATTACH ALSO TABLE OF TOTAL IRRIGATION WATER CONSUMPTION WITHIN IN DIFFERENT PERIMETERS AND TO EXPLAIN FACTORS WHICH DETERMINED CONSUMPTION AND RECENT DECLINE. Added para. 29 and para. 51.
8. ECONOMIC REEVALUATION IN PCR IS BASED ON REVISED ASSUMPTIONS ON LAND USE WITHOUT AND WITH PROJECT. THERE SEEMS LITTLE EVIDENCE THAT AREAS CULTIVATED IN 1986/87 WILL CHANGE AS PROJECTED FOR 1988/89 PARTICULARLY WITH RESPECT TO FODDER CROPS, LIVESTOCK AND FRUIT PRODUCTION. ON BASIS OF EXPERIENCE GAINED WITHIN NEARY-BY PERIMETERS OF SOU HEURTHA PROJECTIONS SEEM TOO OPTIMISTIC. Added para. 31.

BEST REGARDS KREDITANSTALT/WOLF

411352A KWFH D

112153 FUND A  
REF.NO. 5775/15  
OCT.15.87

FROM:OPECFUND VIENNA  
TO:MR. GRAHAM DONALDSON, CHIEF, AGRICULTURE, INFRASTRUCTURE AND  
HUMAN RESOURCES DIV., OPS EVALUATION DEPT., WORLD BANK, WASH.  
D.C.

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REF. TUNISIA - PROJECT PERFORMANCE AUDIT REPORT AND SIDI SALEM  
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MULTIPURPOSE PROJECT  
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WOULD LIKE TO ACKNOWLEDGE RECEIPT WITH THANKS OF THE DOCUMENT  
YOU KINDLY SENT FOR OUR REVIEW. WE HAVE NO PARTICULAR COMMENTS  
ON ITS CONTENTS.

WITH BEST REGARDS

M. MIMOUNI  
DIRECTOR, AFRICA REGION  
OPS MGT  
OPECFUND

**PROJECT COMPLETION REPORT**

**TUNISIA**

**SIDI SALEM MULTIPURPOSE PROJECT**

**(Loan 1431-TUN)**

**June 11, 1986**

## PROJECT COMPLETION REPORT

### TUNISIA

#### SIDI SALEM MULTIPURPOSE PROJECT (Loan 1431-TUN)

### I. BACKGROUND

1.01 Regional differences in soil quality, rainfall, climate and terrain account partly for the limited portion of Tunisia devoted to agricultural production, but lack of water is a major constraint to wider and more intensive production. Although early focus was on the Medjerda valley where some 32,000 ha of land were irrigated, during the 1960s potable and industrial water needs were becoming increasingly important and a national strategy for the development of Tunisia's overall water resources was necessary if all water needs were to be met in the future. Tunisia's water resources, as well as the majority of the population, are situated in the north and the Government therefore decided to prepare a Water Master Plan for northern Tunisia. At the Government's request, the Bank provided a technical assistance loan in 1969 and acted as Executing Agency for the study, undertaken by consultants and completed in March 1975.

1.02 The Plan presents the best alternative for meeting the Government's objectives of increasing agricultural production and contributing to northern Tunisia's potable and industrial water requirements. The Sidi Salem Project represents the first phase of the Master Plan. The specific objectives of the Project were to: (a) contribute to supplying the Tunis, Cap Bon and subsequently Sousse areas with sufficient potable and industrial water to meet expected requirements to the year 2000; (b) raise agricultural output in the Central Medjerda valley and in the Cap Bon peninsula by supplying irrigation, drainage and road infrastructure and providing associated land reform and extension services; (c) safeguard production of existing citrus plantations in the Cap Bon area by providing sufficient irrigation water; (d) increase agricultural production by providing a better quality and quantity of summer irrigation water in the lower Medjerda valley; (e) control Medjerda river floods; and (f) generate hydroelectric power.

1.03 Bank group lending for agriculture in Tunisia started in 1967, and to date 17 projects have been approved for a total of US\$407.9 million of Bank/IDA funds. Directly related to the development of the northern region, the Irrigation Rehabilitation Project (Loan 1068-TUN) was completed in 1982, and the Northwest Rural Development Project (Loan 1997-TUN) and the Medjerda/Nebhana Irrigation Development Project (Loan 2157-TUN) are progressing satisfactorily. The latter would benefit from the increased irrigation water made available by the Sidi Salem Project.

1.04 The Project was estimated to cost a total of US\$385.8 million, with a foreign exchange component of US\$168.3 million. The Bank loan of US\$42.0 million would help finance part of the foreign exchange component related to: (a) relocation of the railroad, road and water pipeline associated with the construction of the Sidi Salem dam; (b) parts of agricultural development, machinery and equipment for on-farm development; (c) consultant services; and (d) training. The balance of the foreign exchange cost was to be shared by KfW, Iran, People's Republic of China, OPEC or Arab funds, supplier's credit, and Government, which would also finance local costs.

1.05 Several agencies of the Ministries of Public Works and Agriculture were responsible for planning, construction, operation and maintenance of project works. A number of other entities, notably the National Company for Tunisian Railways (SNCF), National Company for the Exploitation and Distribution of Drinking Water (SONEDE), Tunisian Company for Electricity and Gas (STEG), National Bank of Tunisia (BNT) and the Ministry of Planning were involved in various aspects of the project implementation. A Project Coordination Committee with representation of all agencies involved was established to coordinate and review project implementation.

1.06 The Project was expected to be implemented over a seven year period (1977-83). All sub-projects financed by the Bank were to be completed by the end of 1983. Full development was expected to take place in 1990. The Completion Date was scheduled for December 31, 1983, and the Closing Date for June 30, 1984. The Closing Date was extended by six months to December 31, 1984 (our telex of 6/28/84) and expenditures committed before that date were honored until July 30, 1985, when the loan account was closed. The extension was requested by the Government to permit the completion of irrigation and drainage structures which had been delayed due to unfavorable climatic conditions (para 3.04).

## II. PREPARATION AND APPRAISAL

### Chronology

2.01 The Project was appraised in February 1976 on the basis of the report prepared by consultants under FAO/CP supervision. After appraisal major issues were raised relating to (a) the financing plan; (b) land tenure; and (c) cost recovery. The financing plan issue was connected with the allocation among potential co-financiers of project components and costs and the Tunisian proposal for postponing the implementation of the irrigated perimeters to a later stage. The land tenure issue was related to the need for establishing by law the size of the maximum private holdings in the area to be irrigated under the Project. On the cost recovery issue, the Bank felt that Government should determine and implement a cost recovery strategy to be applied to various beneficiaries of the project investments.

2.02 Negotiations were completed on April 22, 1977, over a year after appraisal, mainly because of the difficult preliminary discussions on the co-financing issue. Agreement was reached on all the above issues and the

land tenure and cost recovery issues satisfactorily addressed through provisions in Loan covenants, and co-financing arrangements were finalized. The effectiveness of the KfW loan was a condition of cross-effectiveness of the World Bank loan and only final agreement on Arab or OPEC funds to finance the Cap Bon irrigation development, due to be constructed at a later stage, was pending at the time of Board presentation. Allocation of financing funds and project components were in line with the Bank's recommendations. Board presentation took place on May 24, 1977, and the Loan Agreement was signed on July 5, 1977. The Loan became effective on July 31, 1978, nine months after the initial date foreseen, because of difficulties in finalizing the KfW loan and detailed plans and designs for the Medjerda/Cap Bon canal to be financed under the Chinese loan.

### Targets and Goals

2.03 The Project aimed at increasing the quantity and quality of water along the Medjerda valley and beyond for irrigation and drinking purposes. In addition, it was expected to reduce floods, produce power, expand areas under irrigated crops and supplement water to land already irrigated but experiencing water shortage. As a result of the Project, some 8,000 farm families would have increased income; family and hired employment would go up; production of citrus, off-season vegetables and other fruits would expand and export earnings increase; about 40% of the estimated total requirements of potable and industrial water of Northern Tunisia would be met; and some 40 GWh of peak power would be generated.

### Project Description

2.04 The Project works were:

- (a) the Sidi Salem dam and storage reservoir with a capacity of 550 Mm<sup>3</sup>, and relocation of railroad, road and potable water pipes;
- (b) a 25 MW power plant;
- (c) 126 km of an interconnection canal for carrying water to the Tunis and Cap Bon areas;
- (d) irrigation, drainage and road networks, land preparation and wind breaks to serve an area of 10,600 ha divided into two separate subprojects: Testour/Medjez-El-Bab (5,200 ha) and Cap Bon (5,400 ha); and
- (e) rehabilitation works for 6,000 ha of citrus plantations in the Cap Bon area and provision of a tertiary underground distribution network for 935 ha to complete the irrigation network.

2.05 The Project also provided buildings, housing, and equipment for the extension services and for operation and maintenance of the items mentioned above as well as milk collecting centers for increased dairy activity in the irrigated areas. Consultants were to assist with water development and

policy studies and with the design, tendering and supervision of construction of project works. Training for project personnel was also provided.

2.06 Project components were not changed during implementation. The only amendment to the Loan Agreement was made by letter of December 23, 1980 to reflect reallocation of funds among categories.

### III. IMPLEMENTATION

#### Effectiveness

3.01 The original date of effectiveness was November 2, 1977. The following conditions were additional to the General Condition of Effectiveness: (a) the execution and delivery of the Project Agreement on behalf of OMVVM, and authorization and approval of the STEG, SONEDE and SNCFT Agreements on behalf of the Borrower and STEG, SONEDE and SNCFT, respectively; (b) the effectiveness of the KfW loan agreement; (c) the establishment of the Coordination Committee; (d) the appointment by SNCFT of a Project Manager; and (e) submission to the Bank of the timetable and plans to carry out the execution of the Medjerda/Cap Bon canal. The loan became effective on July 31, 1978 after four extensions. The agreements between the Government and SNCFT, SONEDE and STEG were signed only on March 31, 1978 and the KfW loan agreement on March 21, 1978. The cross-effectiveness of this loan with the Bank loan was the main outstanding condition. The delay had an impact on the implementation schedule of most of the components financed under the Bank loan.

#### Implementation Schedule

3.02 Chart 1 compares the actual with the estimated schedule of implementation for the major components of the Project under IBRD financing and under other sources of financing. This chart shows that: (a) the start of most of the activities was delayed from a few months to more than two years; (b) irrigation development took longer than estimated; and (c) some works were finished after the anticipated project completion date, including the Cap Bon subproject, which was still under implementation as of March 1986.

3.03 Delays in starting construction of the works were mainly due to the time needed to prepare detailed construction plans and to follow all the necessary procurement procedures. Combined with the impact of the late effectiveness, most delays in starting-up averaged about two years except for the dam. In spite of some initial problems due to contractor's mobilization difficulties, construction of the dam started close to the date foreseen.

3.04 The construction period was close to appraisal estimates for the dam and related works, slightly longer for the canal, but much longer for the irrigation development. The canal delays were caused by unexpected



PROJECT COMPLETION REPORT

TUNISIA

SIDI SALEM MULTIPURPOSE PROJECT

Implementation Schedule

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
<b>A. <u>UNDER IBRD LOAN</u></b>		o						*		
. Railroad relocation (Civil Works)	.....	.....	—————							
. Road Relocation	.....	.....	—————	—————						
. Waterpipe Relocation	.....	.....	—————	—————						
. Testour/Medjez-El- Bab sub-project (5,200 ha)		.....	.....	.....	.....	—————	—————	—————	—————	
. Safeguard of Citrus Plantations (6,000 ha)				.....	.....	—————	—————	—————	—————	
<b>B. <u>UNDER OTHER SOURCES OF FINANCING</u></b>										
. Dam & Hydropower Plant	.....	.....	.....	.....	.....	—————	—————	—————	—————	
. Interconnection Canal		.....	.....	.....	.....	.....	—————	—————	—————	
. Railroad Relocation (superstructure)	.....	.....	.....	—————						
. Cap Bon sub-project				.....	.....	.....	.....	—————	—————	—————

o Date of Effectiveness

\* Appraisal Estimated  
Completion Date

..... Appraisal Estimate  
————— Actual

(2123E/p50)

geologic formations and difficulties in executing tunnelling work because of lack of experience of the contractors. In the irrigation schemes, delays were mainly due to poor performance of some suppliers, who had taken on more work than they could handle properly, to unfavorable climatic conditions hampering the access to the site and the execution of works, and in the particular case of the Medjez-El-Bab perimeter, to problems of expropriation of land where construction was to be carried out. Other project components, like the construction of buildings, the supply of equipment, the studies and the resettlement and relocation of populations were implemented satisfactorily and completed on time. Because of an exceptionally rainy winter, which further slowed down construction, and at the Government's request (4/25/84), the closing date was extended by six months to December 31, 1984.

### Reporting

3.05 The execution of the major project components was the object of quarterly and annual progress reports prepared by OMVVM and the Directorate of Large Hydraulic Works (DGTH). Frequent supervision missions during the first two years of the project implementation obtained full information and reported on detailed progress in the execution of the other components. However, the reports to be prepared by the Project Coordinating Committee were never received because this Committee did not meet as foreseen (para 3.i2). Although overall progress reporting can be considered satisfactory, the situation differs as far as financial reporting is concerned. The OMVVM accounting system did not provide a framework for timely financial reporting and control; thus its accounts were not auditable during project implementation. A complete reform of the accounting and financial system of OMVVM is a priority action of the new Irrigation Management Improvement Project (Loan 2573-TUN), the execution of which is just starting.

### Procurement

3.06 For Bank-financed components, only minor civil works and supply of equipment, in the total amount of about US\$800,000 equivalent (five contracts), were awarded following local competitive bidding. This represents about 2% of the total costs of the components. All other items under Bank financed components were procured under international competitive bidding procedures in accordance with Bank guidelines. Civil works were awarded to Tunisian firms or joint ventures. Supply of equipment was awarded to local representatives of known international brands. The studies and provision of technical assistance were awarded to French firms after wide international consultation.

3.07 International competitive bidding was also the norm for procurement of goods and execution of works not financed under the Bank loan. One exception was the construction and equipment of the Medjerda/Cap Bon canal, financed by the Chinese Government, which was executed almost entirely by force account by teams sent from China for that purpose (one stretch of the canal was carried out by Tunisian contractors under Chinese technical supervision). In addition, some of the structures, such as the gates for the canal, were manufactured in China and installed by the Chinese.

Costs

3.08 The appraisal report estimated the project cost at US\$386 million, at the time equivalent to D 161 million. The actual total project cost was 25% higher in dinar terms than estimated at appraisal, but 3% lower in dollar terms (see Table 3.1). The canal and irrigation perimeters are mainly responsible for the dinar cost overruns. The higher cost of the canal is due to unexpected geological difficulties in tunnelling and unfavorable soil conditions along the route; in the case of the Safeguard subproject the cost overrun resulted from the preliminary nature of the basic data available at appraisal. Detailed plans showed the need for much higher investments than originally estimated as well as higher unit costs to undertake works in a densely occupied area. The lower cost of agricultural credit resulted from late completion of irrigation works and consequent delays in the need for on-farm investment. This component will continue to grow as the irrigation schemes come into full development. In general, the higher than estimated domestic inflation rates were mitigated by the lower than estimated increase in international prices (see Table 3.2). As a result, the total cost in dollar terms is lower because the dinar devalued relative to the dollar, as shown in Table 3.1, fn /c, and the rate of devaluation was greater than the rates of inflation affecting the project cost.

Table 3.1: PROJECT COST  
(D'000)

Component	<u>Appraisal Estimate</u>		<u>Actual</u>		Cost Overrun %
	1000 Dinar	% of Total Cost	1000 Dinar	% of Total Cost	
Dam and power plant	46,667	29	45,203	22	-3
Interconnection canal	54,649	34	82,085	40	+50
Railroad relocation	16,881	11	20,957	10	+24
Road & water pipe reloc.	6,554	4	7,242	4	+10
Testour/Medjez-El-Bab subproject	13,702	8	15,420 /a	8	+13
Cap Bon subproject	15,871	10	21,270 /b	11	+34
Safeguard of citrus plant.	3,350	2	7,439	4	+22
Credit & on-farm investment	2,891	2	1,603	1	-55
Studies	188	<1	113	<1	-40
<b>TOTAL</b>	<b>160,753</b>	<b>100</b>	<b>201,332</b>	<b>100</b>	<b>+25</b>
<b>US\$ Equivalent ('000) /c</b>	<b>385,807</b>		<b>373,065</b>		<b>-3</b>

/a Includes agricultural equipment for OMVVM & training of OMVVM staff.

/b Includes D 240,000 of studies.

/c Appraisal rate: US\$1.00 = D .417  
Actual average exchange rate:

1977	1978	1979	1980	1981	1982	1983	1984	1985
.429	.416	.406	.405	.494	.591	.679	.772	.753

**Table 3.2: INFLATION RATES: APPRAISAL AND ACTUAL (%)**

	1977	1978	1979	1980	1981	1982	1983	1984	1985
<b>Appraisal</b>									
- Imported equipment	8	8	7	7	7	7	7	7	7
- Civil works (fe)	12	12	12	10	10	10	10	10	10
- Interconnection canal	4	4	4	4	4	4	4	4	4
- Local costs	8	8	6	6	5	5	5	5	5
<b>Actual</b>									
- Foreign exchange /a	9.4	14.0	12.4	9.2	-0.5	-3.0	-1.2	-1.8	1.5
- Local expenditure	6.7	6.2	7.8	10.0	9.9	13.5	8.9	8.4	6.5

/a OPN 3.11 memorandum of August 15, 1985.

### Financing

3.09 The original financing plan, excluding interest during construction, showed that the Government would contribute 3% of the foreign cost, foreign sources other than IBRD would contribute 72% and IBRD 25%. The actual financing compared to that expected at appraisal is estimated based on information gathered during the mission and shown in Table 3.3. The IBRD loan of US\$40.7 million financed 24% of the total foreign exchange cost of the Project, and 100% of the foreign exchange costs of the elements financed, which included relocation of structures in reservoir areas, agricultural development of three irrigation schemes, consultants for Cap Bon, studies and training. The IBRD loan represented 11% of total project cost, the other foreign exchange and credits 33%, and the remaining 56% was Government's contribution. This was close to appraisal estimates.

**Table 3.3: FINANCING PLAN  
(US\$ Million)**

	Appraisal	(%)/ <u>g</u>	Actual	(%)/ <u>a</u>
<b>Foreign Exchange Cost</b>				
Government	4.4	3	-	-
IBRD	42.0	25	40.7	24
Iran	15.0	9	-	-
Suppliers' credit	5.1	3	3.6 / <u>b</u>	2
KfW	28.0	16	31.6	19
European Investment Bank	-	-	19.9	12
Kuwait	-	-	13.5	8
OPEC	19.6 / <u>c</u>	12	6.0	3
People's Republic of China	54.2	32	53.6	32
Subtotal	168.3	100	168.9	100
<b>Local Cost</b>				
Government	217.5		204.2	
<b>TOTAL COST</b>	<b>385.8</b>		<b>373.1</b>	

/a Shows percent of foreign exchange cost.

/b Of this amount about US\$2.58 M was originally in Swiss Francs and US\$1.05 M in French Francs.

/c At appraisal not completely assured and called "Arab or OPEC funds".

**Disbursements**

3.10 The Bank loan was to be disbursed over seven years to cover 100% of the foreign exchange cost of the following elements: (a) the relocation of the railroad (substructure), road and water pipeline; (b) parts of agriculture development (Testour, Medjez-El-Bab and Citrus Plantations sub-projects), machinery and equipment for on-farm development; (c) consultants for preparation of the final design and tender documents for the Cap Bon sub-project and for studies; and (d) training. Disbursements were made according to the following categories:

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	Category	% Expenditure to be Financed
1	Civil works for railroad relocation	55%
2 (a)(i)	Civil works for Testour/Medjez-El-Bab	50%
2 (a)(ii)	Civil works for safeguard of citrus plantation	50%
2 (b)(i)	Equipment & materials for Testour/Medjez-El-Bab	100% of foreign exchange or 100% of ex-factory cost
2 (b)(ii)	Equipment and materials for safeguard of citrus plantation	100% of foreign exchange or 100% of ex-factory cost
2 (c)	Consulting services and training	100% of foreign exchange
3	Consulting services fo DGTH and DEGTH	100% of foreign exchange
4	Civil works for water pipe relocation	50%
5	Civil works for road relocation	50%
6	Unallocated	-

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3.11 Chart II and Tables 3.4 and 3.5 compare appraisal estimates and actual disbursements, in global terms and by category. This indicates that: (a) disbursements started late due to postponement of the date of effectiveness and they had a slower pace than anticipated, particularly in the middle of the implementation period; (b) the cancelled balance of US\$1,284,512 results from the higher than expected value of the US dollar; and (c) the period 1978-1980 is characterized by a high pace of disbursement due to the timely execution of the dam related works; after 1980 irrigation works dominated and the implementation difficulties are reflected in the slower rhythm of disbursement. Procedure No. 1 (reimbursement) was extensively used.

**Table 3.4: DISBURSEMENTS  
(US\$'000 equivalent)**

Semester Ending	Appraisal Estimate	Actual	%
December 31, 1977	1.0	0.0	0
June 30, 1978	11.0	0.0	0
December 31, 1978	18.0	5.5	31
June 30, 1979	25.0	10.4	42
December 31, 1979	28.0	18.5	66
June 30, 1980	30.0	22.6	75
December 31, 1980	33.0	23.4	71
June 30, 1981	36.0	26.1	73
December 31, 1981	38.0	27.7	73
June 30, 1982	40.0	29.2	73
December 31, 1982	40.5	30.8	76
June 30, 1983	41.0	33.4	81
December 31, 1983	41.5	34.9	84
June 30, 1984	42.0	37.9	90
December 31, 1984		38.9	93
June 30, 1985		39.9	95
July 25, 1985 /a		40.7	97

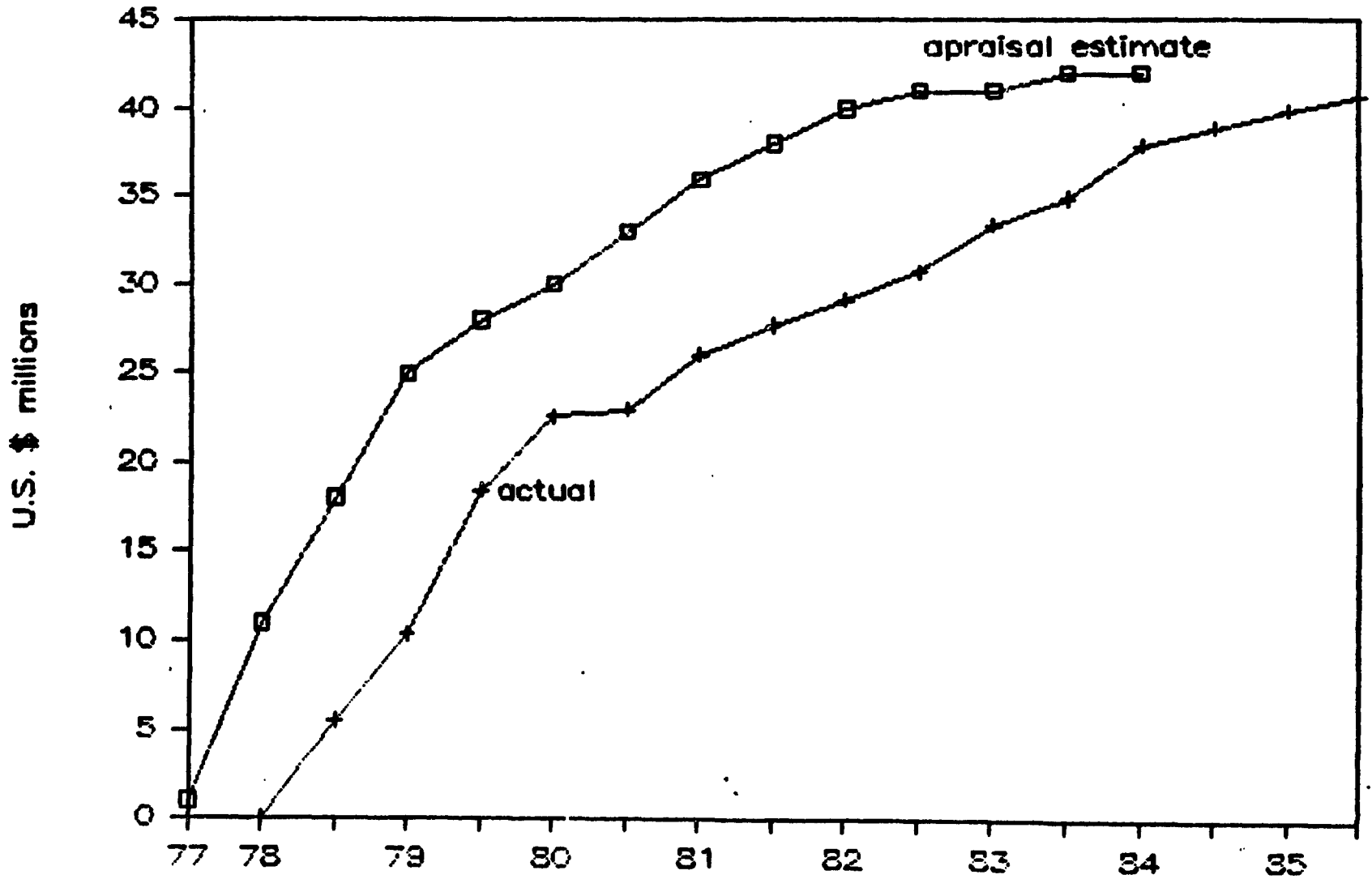
/a Last disbursement.

**Table 3.5: FINAL DISBURSEMENT PER CATEGORY  
(US\$)**

Category	Estimated at Appraisal	Amendment (01/22/81)	Actual	Balance
1	10,000,000	16,262,000	16,261,304.25	+695.75
2 (a)(i)	8,200,000	9,092,000	8,124,290.83	+967,709.17
2 (a)(ii)	2,000,000	2,000,000	3,155,641.36	-1,155,641.36
2 (b)(i)	5,000,000	5,150,000	4,289,281.09	+860,718.91
2 (b)(ii)	1,000,000	1,000,000	1,752,993.70	-752,993.70
2 (c)	2,000,000	2,000,000	749,570.87	+1,250,429.13
3	1,000,000	1,700,000	1,587,972.36	+112,027.64
4	6,000,000	3,684,000	3,683,280.48	+719.52
5	500,000	1,112,000	1,111,152.98	+847.02
Unallocated	6,300,000	-	-	-
	42,000,000	42,000,000	40,715,487.92	+1,284,512.08

**TUNISIA: SIDI SALEM MULTIPURPOSE PROJECT**  
**(Loan 1431-TUN)**

**Disbursements**





### Compliance with Loan Covenants

3.12 On the whole, covenants have been satisfactorily complied with, although with delays when compared with the dates in the Loan Agreement. However, the Project Coordinating Committee which was set up as a condition of effectiveness and was to meet at least every three months (LA 3.06c) in fact met only once during the first year of the Project. Therefore, it never served its function. This did not hamper the normal implementation of the Project, mainly because it had well defined independent components. Where bilateral arrangements with the executing agencies were needed they were satisfactorily concluded between the interested parties. Aspects related to investment and operation costs recovery were in Loan Agreement covenants 3.13, 4.02, 4.03 and 4.05. They specified that studies would be carried out to determine the allocation of investment costs among the users (STEG, SONEDE and Agriculture) and how operating costs should be paid, that investment contributions would be not less than L 100 per hectare, and that water charges would not be less than 6 millimes per m<sup>3</sup> for the farmers in Testour, Medjez-El-Bab and Cap Bon sub-projects and not less than 12 millimes per m<sup>3</sup> for the farmers in the Safeguard of Citrus Plantations subproject. A preliminary study of investment and operating costs was carried out by the National Center for Agronomic Studies (CNEA) and was updated and finalized in September 1985. It is now being considered by Government. Meanwhile, however, Government has established investment contributions of D 300 per hectare, except for the Cap Bon subproject, still under construction. Water charges have also been established in those schemes that are operational and the range is from D 18 to 28 millimes per m<sup>3</sup>. In these respects the covenants have been observed. The Government has yet to determine, however, the allocation of investment contribution from the other users (STEG and SONEDE), and in this respect the Government did not comply with the Loan Agreement [para. 4.02 (b)].

## IV. PROJECT IMPACT

### Water Supply

4.01 The objective of the Sidi Salem dam was to increase the supply of potable and industrial water as well as of water for irrigation purposes and to generate power. From 1981 onwards potable and industrial water was pumped by SONEDE from the interconnection canal for the Tunis and Cap Bon North areas and from 1984 additional water was diverted from the canal for the South (Sahel, Cap Bon Sud and Sfax) areas. Table 4.1 shows these amounts of water. The water quality was somewhat better than anticipated at appraisal, with 1.3-1.4 gram/liter level of salinity most of the time<sup>1/</sup> compared to 1.7-2.1 gram/liter as expected. This is already having a good effect on yields in the area served by the releases of the Sidi Salem dam.

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1/ The measures of salinity monitored during 1983 through October 1985 showed 0.8-1.3 gram/liter in the dam and 0.8-1.6 gram/liter in the canal.

**Table 4.1: POTABLE AND INDUSTRIAL WATER PURCHASED BY  
SONEDE FROM THE INTERCONNECTING CANAL  
(Million m<sup>3</sup>)**

	For Tunisia & Cap Bon	For the South (Cap Bon, Sahel, Sfax)	Total
1981	3.7	-	3.7
1982	11.5	-	11.5
1983	22.3	-	22.3
1984	31.3	8.5	39.8
1985 (estimated)	36.5	20.0	56.5
1986 (projected)	32.8	23.1	55.9
1987 ( " )	39.5	26.2	65.7
1988 ( " )	46.1	29.3	75.4
1989 ( " )	53.1	32.4	85.5
1990 ( " )	60.4	35.5	95.9
-	-	-	-
2000 ( " )	157.2	108.0	265.2

**Areas Planted, Crop Yields, and Incremental Production**

4.02 The Project's annual area planted, incremental primary production and crop yields are summarized in Tables 4.2, 4.3, and 4.4 respectively. They are based on data gathered during the mission and on mission estimates. For the irrigated areas of Testour and Medjez-El-Bab data were available from the first irrigations,<sup>1/</sup> while for Safeguard of Citrus Plantations, rough estimates were used based on overall production levels of citrus from the Cap Bon area; for the Cap Bon irrigation scheme, which has not yet received the benefits of irrigation (para. 3.02), estimates were extrapolated based on the experience of Testour and Medjez-El-Bab under the Project. Table 4.2 shows the estimated planted areas for Testour and Medjez-el-Bab. Farmers were in general more interested in growing summer and winter vegetables than in cereals. It should be noted that the figures in this table for the area planted at full development are projections for 1988/1989; in the actual situation as of 1985/1986, vegetables (both summer and winter) covered a larger area than shown in Table 4.2. It is expected, however, with the growing interest in cattle in the area, that more fodder crops are likely to grown in the next few years and this is reflected in the expected hectarage of 1,360 for vetch oats and green barley.

<sup>1/</sup> Irrigation in Testour began in 1982/83, in Medjez-El-Bab in 1984/85.

**Table 4.2: AREAS PLANTED: WITHOUT AND WITH PROJECT  
TESTOUR AND MEDJEZ-EL-BAB ONLY**

(In hectares)

	Appraisal		PCR	
	Without Project	With Project	Without Project	With Project /a
Wheat	2,120	950	2,430	800
Barley	-	-	980	-
Beerseem	280	860	-	-
Legumes	280	-	-	-
Luzerne/alfalfa	-	720	-	316
Vetch oats/ green barley	1,000	820	2,269	1,360
Sorghum/maize	-	860	-	-
Sugar beet	-	950	-	804
Sunflower	-	360	-	-
Winter vegetables	150	230	-	200
Summer vegetables	115	230	-	1,650
Fruit trees	670	670	48	1,265
Fallow	865	-	157	-
<b>TOTAL</b>	<b>5,200</b>	<b>6,650</b>	<b>4,904</b>	<b>6,395</b>
<b>Cropping Intensity(%)</b>	<b>83</b>	<b>127</b>	<b>97</b>	<b>130</b>

/a These figures are for 1988/89 at full development, and thus include projections. As of 1985/86 the cropping pattern was oriented more towards vegetable production than fodder production.

4.03 Table 4.3 shows projected incremental production based on data in Testour and Medjez-el-Bab and extrapolated to the Cap Bon area and include the citrus plantations as well. Both fodder crops and vegetables are expected to exceed estimated levels of production at appraisal because the areas planted to them are much greater than expected. For milk and meat production, the appraisal projected the gradual introduction of selected cows and improved nutrition from increased fodder production. The projections were that by 1985, or Project Year 8, an additional 2,300 head of selected cattle would have been purchased in Testour and Medjez-el-Bab and 1,600 head in the Cap Bon area. Total incremental milk production for all the schemes together was projected to reach 15,600 tons per year at full development (year 10). According to data available from the Testour/Medjez-El-Bab perimeters, the number of selected cattle at the end of 1985 was only about 520 head. While plans exist to increase this number within the next several years to 5,100 head, the development of livestock

activities has been much slower than expected. This is due in part to the delays in project implementation but principally to the milk price policy which did not motivate production. Since 1985, however, conditions have changed<sup>1/</sup> and the effect on the livestock development in the area is already noticeable. It is expected that at full development the farmers will be interested in growing more fodder crops as the livestock population grows. Estimates of milk yields and projections on milk production are not yet available, however. G

**Table 4.3: INCREMENTAL PRODUCTION  
ALL PROJECT AREAS**

	<u>At Full Development</u>		Estimated as % of Appraisal
	Appraisal	Estimated (PCR)	
	<u>(Tons)</u>		
Wheat /a	2,670	1,305	49
Berseem	94,950 )	-	-
Luzerne/alfalfa	43,200 )	257,660	187
Vetch oats/green barley	6,270	86,520	1,380
Sorghum & maize	5,800	-3,995	<0
Sugar beet	39,900	32,160	81
Sunflower	1,080	-	0
Winter vegetables	24,700 )	83,780	127
Summer vegetables	41,430 )		
Deciduous fruits/grapes	4,280	89,607	2,094
Milk	15,580	n.a.	n.a.
Meat	2,260	n.a.	n.a.
Citrus	90,000	43,500	48
<u>Cropping Intensity (%)</u>	133	130	98

/a Hard wheat only. The amount of soft wheat declined (by about 1,800 tons) under the Project as production was shifted to vegetables.

4.04 Incremental production of the crops is due under the Project to both (a) increased cropping intensity, from 97% before the Project to 130% during the Project, excepting the citrus plantations, which have the same

1/ Government has increased the margin available to collection centers and has increased the fresh milk farmgate price and is considering placing a small tariff on the import of low cost milk powder.

cropping intensity without as with the Project; and (b) increased yields. Actual data on yields were available to compare with/without project only for hard wheat and citrus fruits. For the other crops, data were available on yield levels for similar conditions. Table 4.4 shows the yield estimates. The yields, both with and without irrigation, estimated by field surveys and overall production estimates, are similar to those estimated at appraisal.<sup>1/</sup>

**Table 4.4: YIELDS: WITHOUT AND WITH PROJECT  
(tons/ha)**

	<u>Appraisal</u>		<u>Estimated (PCR) /a</u>	
	<u>Without Project</u>	<u>With Project</u>	<u>Without Project</u>	<u>With Project</u>
Wheat	1.8	3.8	1.8	4.0
Sugar beet	-	42.0		40.0
Winter vegetables	12.0	20.0		8-40 /b
Summer vegetables	13.0	21.0		14-40 /b
Fruit trees (pomegranates)	6.0	10.0	10.0	13.0
Citrus trees /c	10.0	25.0	13.5	20.0

/a Based on actual results from Testour/Medjez-El-Bab.

/b Depending on whether the crop is winter potatoes (8 tons), summer potatoes (14 tons), or tomatoes (40 tons). An average of 20-21 tons/ha taken at appraisal is not unrealistic, although it does not apply to any one crop. The most popular crops actually grown were tomatoes and melons.

/c For safeguard of citrus plantations; appraisal distinguished between the present yields of 18.0 tons/ha and those that would prevail over time with no improvement in irrigation, 10 tons/ha (see para. 4.07).

#### Marketing and Markets

4.05 Most of the output has ready local markets and farmers are usually easily able to sell their surplus cereals and vegetables at nearby wholesale markets. Usually after June, tomatoes are grown for processing at the nearby plant. Because the tomato factory is reluctant to purchase very small amounts, and gives preference to large individual suppliers, some farmers have had problems marketing their tomato production. As a result the OMVVM extension services have been advising some small-scale holders to avoid planting tomatoes to sell for processing.<sup>2/</sup> Sugar beet is grown by

1/ The field surveys, although not carried out by a systematic random sampling, can be taken as reasonably representative of cropping patterns and yields. The differences among individual observations were not great in terms of yields, input levels, or net incomes.

2/ An alternative might be to have farmers form a cooperative to sell their industrial tomatoes to the processing plant. Neither OMVVM nor the farmers were inclined to do this for a single crop when alternative crops were available.

individual farmers by contract, with inputs supplied on credit by the sugar factories and repayment deducted at the time of delivery and payment. For milk, the surplus amounts are sold to a farmers' cooperative at its milk collecting center; the Project had foreseen the construction of three such centers, but only one center had been implemented at completion because milk supplies have been insufficient to justify more collection centers (see para. 4.03). Important quantities of citrus fruits (20% of total production and 30% of the Maltaise variety) are sold to collection centers, all privately run (some centers are cooperatives run by farmers), for export.

4.06 The domestic markets continue to absorb most of the output from irrigation schemes implemented under the Project. Sugar from sugar beet serves as an import substitute, as does most of the project incremental production. Tunisia is a net importer of cereals, meat, and milk. Only in the case of certain fruits, such as oranges, and some off-season vegetables, are the products exported. The traditional citrus fruit export markets, which are mainly in Europe, have remained receptive to Tunisian produce. These are not expected to be affected by the change in the EEC because Tunisian varieties are not produced by the new members. Both quantities and average prices received for exports of vegetables and citrus fruits have increased in 1984 and 1985.

#### Farmers' Benefits

4.07 The analysis of farm budgets summarized in Table 4.4 is based on farm survey data from Testour/Medjez-El-Bab. The table shows that all farmers gain substantially from participation in the Project, the gains being due to: (a) greater intensity of land use; (b) cultivation of higher value crops; and (c) an increase in yields due to sufficient and timely water delivery. The main reason for the financial gain is due to (b), the shift to the higher value vegetable crops, which is more pronounced than anticipated at appraisal. While the increases in income are substantial in absolute terms they are not quite as great in relative (percentage) terms as projected at appraisal. This is due to the movements in relative prices rather than to physical yields. While nominal output prices by 1985 had roughly doubled since appraisal (1977), the nominal costs of production are three to four times greater.<sup>1/</sup> Other farm budgets were presented in the appraisal for Cap Bon, which at the time of the completion mission was not yet in operation (para. 3.02) and for the Citrus Plantations. For these latter budgets, data were available on yields and incremental costs which show that incremental income on a per hectare basis is estimated at about D 3,450. This probably represents a doubling of net revenue over the without project situation.<sup>2/</sup> Detailed information on on-farm costs were not available, but these rough estimates show that the results are somewhat less

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1/ This statement is based on a comparison of total per hectare on-farm costs expressed at appraisal in 1976 terms and in this report in 1985 terms.

2/ This is estimated on the basis of an incremental yield per hectare of 6.5 tons/ha at 350 D/ton, which includes an improved quality worth an additional 100 D/ton, less incremental costs of water and hired labor of D 190/ha.

than appraisal estimates, which had projected yields of 25 tons/ha with the Project, compared to an eventual decrease to 10 tons/ha with insufficient water in the without project situation. The yield differential in the mission's estimate is not so large (at 13.5 tons/ha to 20 tons/ha, or 6.5 tons/ha, rather than the appraisal estimate of 15 tons/ha) and thus the appraisal projection of almost a three-fold increase of citrus farm incomes due to the Project has not (yet) been realized. It is of course possible that in the future insufficient water would have caused a significant decrease in yields without the Project, but future verification would be required to determine this based on the citrus yields in the area not receiving improved irrigation (roughly 6,700 ha received improved irrigation under the Project out of a total 10,000 ha planted to citrus in the Cap Bon region).

**Table 4.5: IMPACT OF PROJECT ON FARMERS' INCOME /a  
(1985 Dinars Terms)**

	Net Income Without Project	Net Income With Project	% Change in Income	% Change Estimated at Appraisal	% of Farmers in this size Category / <u>b</u>
<b>Farm Type I</b>					
Testour/Medjez- El-Bab: 5 ha	656	4,542	690	725	46
<b>Farm Type II</b>					
Testour/Medjez- El-Bab: 15 ha	1,950	11,060	570	635	16
<b>Farm Type III</b>					
Testour/Medjez- El-Bab: 40 ha	5,160	29,090	565	685	<u>8</u>
<b>SUBTOTAL:</b>					<b>70</b>

/a Details in Annex 1, Tables 1-6.

/b Excluding farmers in cooperatives and state farms in the irrigation schemes.

4.08 The level of income with the Project of a 5 ha farm in Testour or Medjez-El-Bab is estimated at about D 4,550. On a per capita basis, this translates into D 813 (US\$1,083), which is comfortably above the relative poverty level for the rural population, estimated at US\$375 in 1984 (at 30% of per capita GNP). Since almost half the beneficiaries in Testour/Medjez-El-Bab had farms of 3-5 ha (see para. 4.09), the Project enabled these farmers to increase their incomes from well below this relative poverty level

before irrigation to a level which approaches the overall average per capita GNP (US\$1,250 in 1984). The farmers in the citrus plantations are estimated to have been, before the Project, above this poverty line (with per capita income estimated roughly at US\$680 for a 1 ha farm), but the increase in income from the Project also put most of the citrus farmers close to or above the national average per capita GNP.

4.09 The number of farm families affected by the Project is about 4,400, including an estimate for Cap Bon based on the land distribution pattern in Testour/Medjez El Bab. This compares to about 4,200 benefitting farm families estimated at appraisal.<sup>1/</sup> In the Testour/Medjez-El-Bab perimeter the largest group of farmers, or 46%, has 3-5 ha, with another 30% having 5-10 ha. This general distribution, with the majority of the farm families (or 76%) having 10 hectares or less, was the distribution expected at appraisal. Similarly in the citrus plantations, about 40% of the farmers have less than 1 hectare and another 30% have between 1 and 2 hectares. There has been no change in the citrus farms of land distribution as a result of the Project.

## V. ECONOMIC REVALUATION

5.01 The economic revaluation was calculated in a manner to permit comparison with the analysis done at appraisal. This means that the same elements of costs and benefits were included here as at appraisal. These include the following:

- (a) the rate of return was calculated over 50 years; costs and benefits exclude duties and taxes and are expressed in constant 1985 terms, using the GDP deflator to inflate figures prior to 1985;
- (b) the full investment costs of all construction (dam, canal, relocation of infrastructure), irrigation perimeters, on-farm investments and consultants are included, except for the costs of the power plant;
- (c) the costs and benefits of the power plant have not been included, as at appraisal, because its inclusion had no effect on the size of the dam and was chosen as a least cost alternative to providing additional peak generating capacity. At appraisal, its inclusion in the economic evaluation would have increased the ERR by 0.1% (one tenth of one percent) only;
- (d) benefits from potable and industrial water were included here using the actual and projected volumes purchased from the canal and the

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<sup>1/</sup> The appraisal also expected that about 3,800 farm families in the Lower Medjerda Valley would benefit from an assured supply and improved quality of summer irrigation water. Thus a total of 8,000 farm families were to benefit directly from the Project, as noted in para 2.04. No precise data are available on the impact of the Project on the Lower Medjerda Valley but the above estimate of 8,000 - 8,200 families is thought to remain valid.



price of water paid by SONEDE for the water from the canal. This differs somewhat from the appraisal, which used the tariff levels to the consumers as a proxy for benefits, and deducted distribution and incremental replacement costs (from using more saline water) to arrive at the value of raw water. To avoid the possibility of double counting benefits to investments in the distribution network, which has taken place under the Northern Tunisia Water Supply Project, Loan 1445-TUN, the mission used the tariff actually paid for the water up to 1985 and a future projected tariff that would cover operating and depreciation costs of the canal; and

- (e) economic prices for tradeables were derived from World Bank commodity price projections and the most recent World Bank appraisal report on Tunisia's Gabes Irrigation Project (SAR 5511-TUN, May 30, 1985, Implementation Volume).

5.02 The benefits from the Testour and Medjez-El-Bab perimeters (4,900 ha) are based on survey data from 1982/83 through 1984/85 on yields and cropping patterns. The information reflects the situation as irrigation was gradually phased in and beyond 1984/85 projections were made on likely cropping patterns and yield levels. For Cap Bon (5,400 ha), not yet in operation (para. 3.02), the benefits were estimated to be similar in magnitude to those of Testour and Medjez-El-Bab and thus were prorated on the basis of the hectareage to receive the irrigation water. The benefits of the Citrus Plantation were estimated by using data provided on overall production levels, yields and improved quality of the fruit.

5.03 While no data were available on the lower Medjerda Valley, benefits from 32,800 hectares were included at appraisal because the Project was to reduce water deficits to the existing irrigated area that would have otherwise occurred 20-25% of the time and to increase water quality. Net incremental benefits were thus included here at a rate of D 750/ha which is based on the relationship of benefits in the Testour/Medjez-El-Bab perimeters at appraisal and at completion.<sup>1/</sup> These estimates, for the lower Medjerda Valley, as well as for Cap Bon, are very rough, and thus would be considered as orders of magnitude.

5.04 The results including sensitivity analysis are in Annex 1, Table 7. The resulting rate of return of 10% compares to 11% estimated at appraisal. It should be noted that sensitivity analysis at appraisal showed that if all crop benefits were delayed by two years the rate of return would decrease to 10.2%. In the event, crop benefits were delayed by between 2 and, in the case of Cap Bon benefits, 4 years. In addition the Project was

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<sup>1/</sup> Net incremental benefits in Testour/Medjez-El-Bab are estimated to be about 5 times higher than projected at appraisal in nominal economic terms; most of this increase is due to higher nominal 1985 economic prices over 1976 economic prices. Benefits in the lower Medjerda Valley were estimated at appraisal at 150 D/ha and were increased here five-fold to 750 D/ha.

the first phase of a master plan which involves additional dam and conveyance systems construction. As a result, the full benefits of the canal will only be realized as the other phases are implemented. Considering these factors, a rate of return of 10% should be considered an acceptable result compared to expectations at appraisal.

## VI. PERFORMANCE

6.01 Consultants. The Project estimated a substantial assistance in the form of consultant service for designing, procurement and supervision of works as well as for carrying out particular studies. The Bank loan would finance the part related to these particular studies (pollution, water resources and cost recovery) to be carried out by DEGTH, those concerning irrigation development (Cap Bon, Testour and Medjez-el-Bab) under the responsibility of the OMVVM, and the design for the execution of the railway infrastructure to be carried out by DGTH. On the whole and in spite of delays in recruiting and completing some of the studies (water resources and cost recovery), the performance of consultants was satisfactory. Special emphasis was given to training of local staff and transfer of knowledge. This was particularly relevant in the on-the-job training of OMVVM technicians in engineering design. Further, the water resources studies set up a mathematical model simulation in Tunisia that can now be run by local experts without foreign assistance.

6.02 Contractors for the execution of works, and suppliers. Irrigation related works financed by the Bank loan were executed by local firms. In particular, small contractors (usually for the construction of buildings) often showed lack of qualified technical staff and management capabilities which led to the need to increase the effort of the supervision team. The execution was also occasionally hampered by shortages of construction materials (cement) or spare parts for equipment. Most of the equipment was imported by local representatives, but certain items (pipes and pipe accessories) were made in Tunisia. Delays in furnishing large diameter concrete pipes due to lack of production capacity of the local supplier had caused significant delays in the completion date of irrigation networks. Contractual penalties were applied but they were not sufficiently persuasive and pressure from the concerned ministries had occasionally to be used to ensure contractors' performance.

6.03 Works and supplies not financed by the Bank were essentially the construction of the Sidi Salem dam and related structures, the interconnection canal and the Cap Bon irrigation works (in progress). Most of the dam works and equipment were undertaken by a large foreign firm or its subcontractors who performed, as a whole, in a satisfactory fashion, in spite of some initial mobilization difficulties (para. 3.03). The canal was partially executed on force account led by Chinese teams and partially by a Chinese-Tunisian consortium (para 3.09). Although the techniques and equipment used under this system led to some problems with speed of work and supply of parts, the final quality of the works is good and the structures operate well.

6.04 The Borrower. The difficulties resulting from the complexity and scattered nature of project components were offset by a large degree of autonomy granted to the executing agencies in the execution of works; the delays experienced in certain components did not hamper the normal development of the Project as a whole, i.e., the delayed completion of the dam and of the canal did not conflict with the normal development of the water supply and irrigation. All executing agencies had experience with similar works in the past and they performed satisfactorily. The role anticipated for the Project Coordinating Committee (which did not function) was therefore replaced by direct contact among the executing agencies themselves. The relatively recent start of irrigated production in the newly created perimeters (Testour/Medjez-el-Bab) does not permit a full assessment of their operation and maintenance performance. However, in spite of some difficulties in staff and resources, recent missions have noted that OMVVM is performing adequately as far as the operation, maintenance and agricultural development activities (extension, market promotion) are concerned. Managerial problems systematically recorded by supervision missions refer to aspects related to the established administrative procedures related to project execution (condition of effectiveness, recruitment of staff and consultants, difficulties in dealing with land ownership, etc.) but do not necessarily imply a lack of management capability of the executing agencies.

6.05 The Bank. The Bank sent 18 supervision missions, usually two per year comprising to a total of 43.1 staff-weeks. In 1978, which was a critical period of important works being launched or executed, four missions took place. Sixteen missions had the participation of an irrigation engineer and eight of an agriculturist. Bank missions always concluded either by leaving in the field an aide memoire or by sending to Government an action letter after returning to headquarters. This permitted the Borrower, and in particular the executing agencies to identify the issues and take the necessary steps for their correction or follow-up and also to make up for the lack of formal coordination, a role assigned to the Project Coordinating Committee (para. 3.12). Design of project components and targets were, in general, adequate. The full development of the livestock component so far delayed is still possible, now that recent policy changes have ensured that the milk production has become financially more attractive to farmers. Cost overruns of some components were due to lack of detailed design, particularly for the safeguard of citrus plantation components. This problem has since been minimized in Bank projects, because detailed project design is now required prior to Board Presentation.

## VII. SPECIAL ISSUES AND LESSONS LEARNED

7.01 In spite of its complexity (scope, number of executing agencies involved, and technical aspects of some major structures), the Project has been implemented successfully without major problems and it is fulfilling its objectives. However, the reasons for the delayed implementation and the cost overrun (partially interrelated) are worth mentioning, particularly because its analysis can be beneficial for future projects.

7.02 It is important to note that the components which were most advanced in design at appraisal were those which have respected more closely the implementation schedule and the cost estimates. This shows the importance of having, at an early stage, reliable and detailed technical studies and of starting, as soon as possible, all the preliminary steps for procurement of the execution of works and supply of goods.

7.03 A major factor responsible for long delays in the irrigation component, was the delay in the resolution of land ownership for the location of the pumping station complex of Medjez-El-Bab. Projects often take for granted the release of ownership rights of land needed for the execution of works. However, in densely populated areas where land is extremely valuable, this issue cannot be minimized and should be more closely examined, the predictable bottlenecks identified in time, and legal procedures, if needed, started at an early stage.

7.04 Other aspects responsible for the delays, like the temporary shortages of construction materials, cement and the lack of production capacity of local suppliers (pipes) are to a certain extent external to the Project. They result essentially from the fact that local industry is not equipped to respond to peak demands, although it is competitive in price and quality with foreign suppliers. In case of such bottlenecks in the supply, priorities must be decided at the ministerial level and this retards the development of an effective contracting industry. Overall, project execution suffers. This problem has been noted in other projects and the situation would be improved by Government programs currently under consideration regarding investment and import liberalization. This situation could also be improved if a stricter control of suppliers capability to respond to the commitments prior to award would be done, and if heavier penalties for not complying with contractual delivery time would be imposed.

7.05 The limited development of the livestock component to date compared to the benefits anticipated at appraisal show the importance of taking into account unresolved sectoral issues. The controlled and low consumer price and the limited margins available for processing plants to cover collecting and processing costs resulted in a farmgate price which did not provide enough incentive for farmers to invest in acquiring improved cattle and to expand livestock activity. This pricing structure was in turn due to inexpensive (subsidized) imported milk powder. Therefore, project investments for the livestock component were minor. After the policy changes introduced in early 1985 (para. 4.03), the situation is now changing towards the development projected ten years ago. The impact of certain macro policies, such as the importing of subsidized milk powder, on project design and benefits was not fully assessed at appraisal.

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TUNISIA

SIDI SALEM MULTIPURPOSE PROJECT  
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**5 HA FARM MODEL: PRODUCTION AND INPUTS**

	Unit	CROP YEAR		
		1 to 10	1 to 10	1 to 10
	Percent	98.0	100.0	42.0
<b>Cropping Intensity</b>				
<b>Cropping Pattern</b>				
Existing Technology				
HARD WHEAT	HA	1.3	-	-1.3
SOFT WHEAT	HA	1.3	-	-1.3
VETCH OATS	HA	1.4	-	-1.4
BARLEY	HA	0.7	-	-0.7
<b>Sub-Total Existing Technology Area</b>		<b>4.9</b>	<b>-</b>	<b>-4.9</b>
<b>New Technology</b>				
POTATOES WINTER	HA	-	2.0	2.0
POTATOES SUMMER	HA	-	2.0	2.0
TOMATOES	HA	-	1.0	1.0
ONIONS	HA	-	1.0	1.0
WATERMELON	HA	-	1.0	1.0
<b>Sub-Total New Technology Area</b>		<b>-</b>	<b>7.0</b>	<b>7.0</b>
<b>Cropped Area</b>		<b>4.9</b>	<b>7.0</b>	<b>2.1</b>
<b>Main Production</b>				
HARD WHEAT	TONS	2.7	-	-2.7
SOFT WHEAT	TONS	2.3	-	-2.3
VETCH OAT	TONS	3.6	-	-3.6
BARLEY	TONS	1.4	-	-1.4
POTATOES WINTER	TONS	-	12.2	12.2
POTATOES SUMMER	TONS	-	31.2	31.2
TOMATOES	TONS	-	40.0	40.0
ONIONS	TONS	-	10.0	10.0
WATERMELON	TONS	-	20.0	20.0
<b>Sales</b>				
HARD WHEAT	TONS	2.7	-	-2.7
SOFT WHEAT	TONS	2.3	-	-2.3
VETCH OAT	TONS	3.6	-	-3.6
BARLEY	TONS	1.4	-	-1.4
POTATOES WINTER	TONS	-	12.2	12.2
POTATOES SUMMER	TONS	-	31.2	31.2
TOMATOES	TONS	-	40.0	40.0
ONIONS	TONS	-	10.0	10.0
WATERMELON	TONS	-	20.0	20.0
<b>Operating Inputs</b>				
<b>TOTAL COSTS</b>	<b>AMOUNT</b>	<b>424.9</b>	<b>6,539.0</b>	<b>6,114.1</b>

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SIDI SALEM MULTIPURPOSE PROJECT  
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**5 HA FARM MODEL: FINANCIAL BUDGET (in Dinars)**

	CROP YEAR		
	Without	With Project	Incremental
	1 to 10	1 to 10	1 to 10
	*****	*****	*****
<b>Main Production</b>			
HARD WHEAT	391.5	-	-391.5
SOFT WHEAT	339.3	-	-339.3
VETCH OAT	182.0	-	-182.0
BARLEY	182.0	-	-182.0
POTATOES WINTER	-	2,220.4	2,220.4
POTATOES SUMMER	-	3,641.0	3,641.0
TOMATOES	-	2,200.0	2,200.0
ONIONS	-	1,600.0	1,600.0
WATERMELON	-	1,340.0	1,340.0
<b>Sub-Total Main Production</b>	<b>1,000.8</b>	<b>11,081.4</b>	<b>10,080.6</b>
<b>Net Value Of Production</b>	<b>1,000.8</b>	<b>11,081.4</b>	<b>10,080.6</b>
<b>Production Cost</b>			
Operating			
Inputs			
<b>TOTAL COSTS</b>	<b>424.0</b>	<b>8,539.0</b>	<b>8,114.1</b>
<b>CASH FLOW BEFORE FINANCING</b>	<b>576.8</b>	<b>4,542.4</b>	<b>3,866.5</b>
<b>Sources Of Finance</b>			
Transfer from Previous Period	424.0	8,539.0	8,114.1
Less Transfer To Next Period	424.0	8,539.0	8,114.1
<b>FARM FAMILY BENEFITS AFTER FINANCING</b>	<b>576.8</b>	<b>4,542.4</b>	<b>3,866.5</b>

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**15 HA FARM MODEL: PRODUCTION AND INPUTS**

	Unit Percent	CROP YEAR		
		Without Project Incremental		
		1 to 18 98.7	1 to 18 128.7	1 to 18 38.0
<b>Cropping Intensity</b>				
<b>Cropping Pattern</b>				
Existing Technology				
HARD WHEAT	HA	4.5	-	-4.5
SOFT WHEAT	HA	3.9	-	-3.9
VETCH OATS	HA	4.1	-	-4.1
BARLEY	HA	2.0	-	-2.0
<b>Sub-Total Existing Technology Area</b>		<b>14.5</b>	<b>-</b>	<b>-14.5</b>
New Technology				
POTATOES WINTER	HA	-	2.0	2.0
POTATOES SUMMER	HA	-	2.0	2.0
TOMATOES	HA	-	2.0	2.0
ONIONS	HA	-	1.0	1.0
WATERMELON	HA	-	2.0	2.0
POMEGRANATES	HA	-	8.0	8.0
SUGAR BEET	HA	-	2.0	2.0
<b>Sub-Total New Technology Area</b>		<b>-</b>	<b>19.0</b>	<b>19.0</b>
<b>Cropped Area</b>		<b>14.5</b>	<b>19.0</b>	<b>4.5</b>
<b>Main Production</b>				
HARD WHEAT	TONS	8.1	-	-8.1
SOFT WHEAT	TONS	7.0	-	-7.0
VETCH OAT	TONS	18.4	-	-18.4
BARLEY	TONS	4.0	-	-4.0
POTATOES WINTER	TONS	-	12.2	12.2
POTATOES SUMMER	TONS	-	31.2	31.2
TOMATOES	TONS	-	80.0	80.0
ONIONS	TONS	-	10.0	10.0
WATERMELON	TONS	-	40.0	40.0
POMEGRANATES	TONS	-	104.0	104.0
SUGAR BEET	TONS	-	80.0	80.0
<b>Sales</b>				
HARD WHEAT	TONS	8.1	-	-8.1
SOFT WHEAT	TONS	7.0	-	-7.0
VETCH OAT	TONS	18.4	-	-18.4
BARLEY	TONS	4.0	-	-4.0
POTATOES WINTER	TONS	-	12.2	12.2
POTATOES SUMMER	TONS	-	31.2	31.2
TOMATOES	TONS	-	80.0	80.0
ONIONS	TONS	-	10.0	10.0
WATERMELON	TONS	-	40.0	40.0
POMEGRANATES	TONS	-	104.0	104.0
SUGAR BEET	TONS	-	80.0	80.0
<b>Operating Inputs</b>				
TOTAL COSTS	AMOUNT	1,258.0	18,641.0	17,383.0

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15 HA FARM MODEL: FINANCIAL BUDGET (in Dinars)

	CROP YEAR		
	Without	With Project	Incremental
	1 to 10 years	1 to 10 years	1 to 10 years
<b>Rain Production</b>			
HARD WHEAT	1,174.9	-	-1,174.9
SOFT WHEAT	1,017.0	-	-1,017.0
VETCH GRASS	482.0	-	-482.0
BARLEY	320.0	-	-320.0
POTATOES WINTER	-	2,220.4	2,220.4
POTATOES SUMMER	-	3,641.0	3,641.0
TOMATOES	-	4,500.0	4,500.0
ONIONS	-	1,000.0	1,000.0
WATERMELON	-	2,000.0	2,000.0
POPPERMINTS	-	12,000.0	12,000.0
SUGAR BEET	-	2,000.0	2,000.0
<b>Sub-Total Rain Production</b>	<b>2,204.4</b>	<b>28,701.4</b>	<b>26,497.0</b>
<b>Net Value Of Production</b>	<b>2,204.4</b>	<b>28,701.4</b>	<b>26,497.0</b>
<b>Production Cost</b>			
Operating			
Inputs			
TOTAL COSTS	1,250.0	18,641.6	17,393.6
<b>CASH FLOW BEFORE FINANCING</b>	<b>1,048.4</b>	<b>11,059.8</b>	<b>9,113.4</b>
<b>Sources Of Finance</b>			
Transfer From Previous Period	1,250.0	18,641.6	17,393.6
Less Transfer To Next Period	1,250.0	18,641.6	17,393.6
<b>FARM FAMILY BENEFITS AFTER FINANCING</b>	<b>1,048.4</b>	<b>11,059.8</b>	<b>9,113.4</b>

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**40 HA FARM MODEL: PRODUCTION AND INPUTS**

	Unit	CROP YEAR		
		Without Project		Incremental
		1 to 10	1 to 10	1 to 10
Cropping Intensity	Percent	98.5	120.0	21.5
<b>Cropping Pattern</b>				
<b>Existing Technology</b>				
HARD WHEAT	HA	12.0	-	-12.0
SOFT WHEAT	HA	10.0	-	-10.0
VETCH OATS	HA	11.1	-	-11.1
BARLEY	HA	5.5	-	-5.5
<b>Sub-Total Existing Technology Area</b>		<b>38.6</b>	<b>-</b>	<b>-38.6</b>
<b>New Technology</b>				
HARD WHEAT	HA	-	5.0	5.0
POTATOES WINTER	HA	-	5.0	5.0
POTATOES SUMMER	HA	-	5.0	5.0
TOMATOES	HA	-	5.0	5.0
ONIONS	HA	-	3.0	3.0
WATERMELON	HA	-	5.0	5.0
POMEGRANATES	HA	-	10.0	10.0
SUGAR BEET	HA	-	10.0	10.0
<b>Sub-Total New Technology Area</b>		<b>-</b>	<b>48.0</b>	<b>48.0</b>
<b>Cropped Area</b>		<b>38.6</b>	<b>48.0</b>	<b>9.4</b>
<b>Main Production</b>				
HARD WHEAT	TONS	21.0	21.0	-0.0
SOFT WHEAT	TONS	10.0	-	-10.0
VETCH OAT	TONS	44.4	-	-44.4
BARLEY	TONS	11.0	-	-11.0
POTATOES WINTER	TONS	-	30.5	30.5
POTATOES SUMMER	TONS	-	78.0	78.0
TOMATOES	TONS	-	200.0	200.0
ONIONS	TONS	-	30.0	30.0
WATERMELON	TONS	-	100.0	100.0
POMEGRANATES	TONS	-	130.0	130.0
SUGAR BEET	TONS	-	400.0	400.0
<b>Sales</b>				
HARD WHEAT	TONS	21.0	21.0	-0.0
SOFT WHEAT	TONS	10.0	-	-10.0
VETCH OAT	TONS	44.4	-	-44.4
BARLEY	TONS	11.0	-	-11.0
POTATOES WINTER	TONS	-	30.5	30.5
POTATOES SUMMER	TONS	-	78.0	78.0
TOMATOES	TONS	-	200.0	200.0
ONIONS	TONS	-	30.0	30.0
WATERMELON	TONS	-	100.0	100.0
POMEGRANATES	TONS	-	130.0	130.0
SUGAR BEET	TONS	-	400.0	400.0
<b>Operating Inputs</b>				
<b>TOTAL COSTS</b>	<b>AMOUNT</b>	<b>3,348.5</b>	<b>37,758.9</b>	<b>34,412.4</b>

PROJECT COMPLETION REPORT

TUNISIA

SIDI SALEM MULTIPURPOSE PROJECT  
(Loan 1431-TUN)

40 HA FARM MODEL: FINANCIAL BUDGET (in Dinars)

	CROP YEAR		
	Without	With Project	Incremental
	1 to 10	1 to 10	1 to 10
	-----	-----	-----
Main Production			
HARD WHEAT	3,132.0	3,045.0	-87.0
SOFT WHEAT	2,810.0	-	-2,810.0
VETCH OAT	1,332.0	-	-1,332.0
BARLEY	1,430.0	-	-1,430.0
POTATOES WINTER	-	5,951.0	5,951.0
POTATOES SUMMER	-	2,102.0	2,102.0
TOMATOES	-	11,400.0	11,400.0
ONIONS	-	4,800.0	4,800.0
WATERMELON	-	2,700.0	2,700.0
POMEGRANATES	-	10,250.0	10,250.0
SUGAR BEET	-	10,000.0	10,000.0
Sub-Total Main Production	8,504.0	68,848.0	58,344.0
Net Value Of Production	8,504.0	68,848.0	58,344.0
Production Cost			
Operating Inputs			
TOTAL COSTS	3,348.9	37,758.9	34,412.4
CASH FLOW BEFORE FINANCING	5,157.9	29,089.7	23,932.2
Sources Of Finance			
Transfer From Previous Period	3,348.9	37,758.9	34,412.4
Less Transfer To Next Period	3,348.9	37,758.9	34,412.4
FARM FAMILY BENEFITS AFTER FINANCING	5,157.9	29,089.7	23,932.2
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SIOT SALEM MULTIPURPOSE PROJECT  
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Incremental Benefits and Costs

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994-2026
INCREMENTAL BENEFITS																		
LITRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LUNER MEJERDA VALLEY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SKIMMING WATER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ESTOUR-MEJER EL MAD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAP BON	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL BENEFITS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INCREMENTAL COSTS																		
INVESTMENT COSTS	7773.8	26006.1	29024.1	41220.2	28315.7	22612.2	29949.7	40710.1	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6
OPERATING COSTS DAN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OPERATING COSTS INTER, CMM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL COSTS	7773.8	26006.1	29024.1	41220.2	28315.7	22612.2	29949.7	40710.1	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6	12706.6
NET INCREMENTAL BENEFITS	-7773.8	-26006.1	-29024.1	-41220.2	-28315.7	-22612.2	-29949.7	-40710.1	-12706.6	-12706.6	-12706.6	-12706.6	-12706.6	-12706.6	-12706.6	-12706.6	-12706.6	-12706.6

PROJECT COMPLETION REPORT

TUNISIA

SIDI SALEM MULTIPURPOSE PROJECT  
(Loan 1431-TUN)

Economic Rate of Return

Internal Rates of Return of Net Streams

\*\*\*\*\*  
NTOT 9.69%

Present Value of Streams at 10.00%

\*\*\*\*\*  
BTOT 217,329.32  
CTOT 224,118.10  
NTOT -6,788.78

SWITCHING VALUES AT 10%

\*\*\*\*\*

STREAM	APPRAISAL VALUE	SWITCHING VALUE	PERCENTAGE CHANGE
B1	54,581.69	61,370.46	12.44%
B2	84,138.35	90,927.13	8.07%
B3	6,567.93	13,356.71	103.36%
B4	40,923.20	47,711.98	16.59%
B5	31,118.15	37,906.93	21.82%
C1	216,769.21	209,980.43	-3.13%
C2	898.89	-5,889.89	-755.24%
C3	6,450.01	-338.77	-105.25%
TOTAL BENEFITS	217,329.32	224,118.10	3.12%
TOTAL COSTS	224,118.10	217,329.32	-3.03%

Net Present Value at OCC 10% = -6,788.8

Internal Rate of Return = 9.7%

Coupon Equivalent Rate of Return = 9.7%

Table 7: Areas Planted: Comparison Between Appraisal and PCR Estimates and 1986/87 Actual Data

	Appraisal		PCR		PPAR
	Without Project	With Project	Without Project	With Project	1986/87
Wheat	2120	950	2430	800	1558
Barley	0	0	0	0	172
Legumes	280	0	0	0	0
Berseem	0	860	0	0	(
Alfalfa	0	720	0	316	( 910
Vetch oats/ green barley	1000	820	2269	1360	(
Sorghum/maize	0	860	0	0	0
Sugar beet	0	950	0	804	350
Sunflower	0	360	0	0	0
Winter vegetables	150	230	0	200	559
Summer vegetables	115	230	0	1650	1260
Fruit trees	670	670	48	1265	786
Fallow	865	0	157	0	0
Others	0	0	0	0	140
Total	5200	6650	4904	6395	4825
Cropping Intensity (%)	83	127	97	130	117

\*Note: These figures are for 1988/89 at full development, and thus include projections.

Table 8: Areas Planted Yields and Production

TESTOUR

CROPS	1983-84			1984-85			1985-86			1986-87		
	Area	Yield	Product.	Area	Yield	Product.	Area	Yield	Product.	Area	Yield	Product.
	(ha)	(t/ha)	(t)	(ha)	(t/ha)	(t)	(ha)	(t/ha)	(t)	(ha)	(t/ha)	(t)
Winter Vegetables	106.50		699.00	113.00		976.00	159.00		1280.00	166.00		1030.00
Potato	70.50	8.00	564.00	83.00	11.00	913.00	85.00	12.00	1020.00	85.00	10.00	850.00
Artichoke	0.00	0.00	0.00	0.00	0.00		0.00	0.00		0.00	N.A.	
Vegetables (Leaf)	21.00	N.A.		23.00	N.A.		48.00	N.A.		63.00	N.A.	
Vegetables (Root)	15.00	9.00	135.00	7.00	9.00	63.00	26.00	10.00	260.00	18.00	10.00	180.00
Fodder Crops	59.00	N.A.		42.00	N.A.		66.00	N.A.		132.00	N.A.	
Wheat	56.00	1.40	78.40	177.00	1.60	283.20	170.00	1.80	306.00	245.00	N.A.	
Barley	0.00	0.00	0.00	45.00	N.A.		0.00	0.00	0.00	65.00	N.A.	
Sugar beet	44.00	40.00	1760.00	50.00	44.00	2200.00	80.00	45.00	3600.00	81.00	N.A.	
Summer Vegetables	270.00		7300.00	378.00		9609.00	430.00		12100.00	339.00		
Potato	75.00	14.00	1050.00	63.00	13.00	819.00	80.00	13.00	1040.00	30.00	N.A.	
Tomato	60.00	40.00	2400.00	120.00	30.00	3600.00	100.00	35.00	3500.00	115.00	N.A.	
Pepper	25.00	10.00	250.00	45.00	10.00	450.00	60.00	10.00	600.00	55.00	N.A.	
Water-melon	85.00	35.00	2975.00	120.00	35.00	4200.00	150.00	40.00	6000.00	90.00	N.A.	
Melon	25.00	25.00	625.00	30.00	18.00	540.00	40.00	24.00	960.00	40.00	N.A.	
Others	36.00	8.00	288.00	48.00	8.00	384.00	97.00	9.00	873.00	80.00	N.A.	
Fruit Trees	255.00	N.A.		380.00	N.A.		410.00	N.A.		517.00	N.A.	
Total	926.50		10125.40	1233.00		13452.20	1412.00		18159.00	1616.00		1030.00
Total Irrigated Area	585.00			908.00			1086.00			1124.00		
Cropping Intensity (%)		141.28			135.79			130.02				

APPENDIX TABLE III

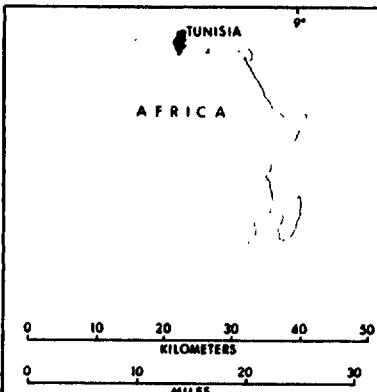
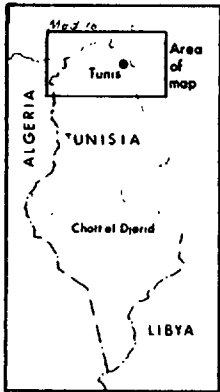
Table 9: Areas Planted, Yields and Production

MEDJEZ EL BAB

CROPS	1984-85			1985-86			1986-87		
	Area	Yield	Product.	Area	Yield	Product.	Area	Yield	Product.
	(ha)			(ha)			(ha)		
Winter Vegetables	0.00			256.00		3025.00	393.00		4464.00
Potato	0.00			70.00	20.00	1400.00	83.00	18.00	1494.00
Artichoke	0.00			60.00	11.00	660.00	100.00	11.00	1100.00
Vegetables (Leaf)	0.00			59.00	5.00	295.00	80.00	5.50	440.00
Vegetables (Root)	0.00			67.00	10.00	670.00	130.00	11.00	1430.00
Fodder Crops	41.00	35.00	1435.00	492.00	32.00	15744.00	778.00	35.00	27230.00
Wheat	300.00	4.00	1200.00	579.00	2.50	1447.50	1313.00	N.A.	
Barley	0.00			50.00	2.50	125.00	107.00	N.A.	
Sugar beet	110.00	30.00	3300.00	350.00	40.00	14000.00	269.00	N.A.	
Summer Vegetables	847.00		26717.00	1109.00		34751.00	930.00		
Potato	37.00	16.00	592.00	60.00	N.A.		32.00	N.A.	
Tomato	630.00	35.00	22050.00	640.00	43.00	27520.00	718.00	N.A.	
Pepper	25.00	8.00	200.00	73.00	7.00	511.00	66.00	N.A.	
Water-melon	80.00	25.00	2000.00	191.00	20.00	3820.00	42.00	N.A.	
Melon	75.00	25.00	1875.00	145.00	20.00	2900.00	72.00	N.A.	
Others	48.00	10.00	480.00	70.00	12.00	840.00	60.00	N.A.	
Fruit Trees	50.00	N.A.		200.00	N.A.		269.00	N.A.	
Total	1396.00		33132.00	3106.00		69932.50	4119.00		31694.00
Total Irrigated Area	N.A.			2118.00			2997.00		
Cropping Intensity (%)					146.65				

**MAP SECTION**

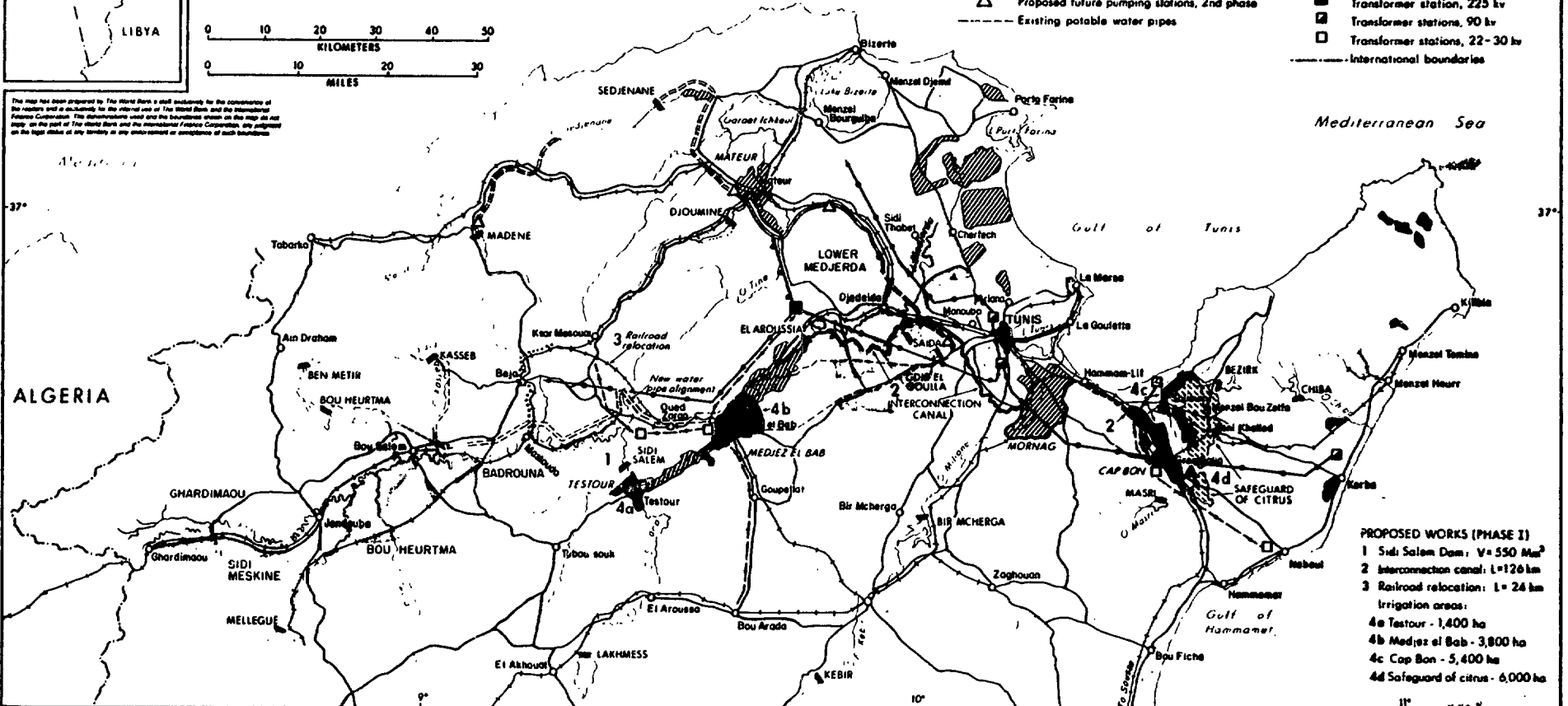




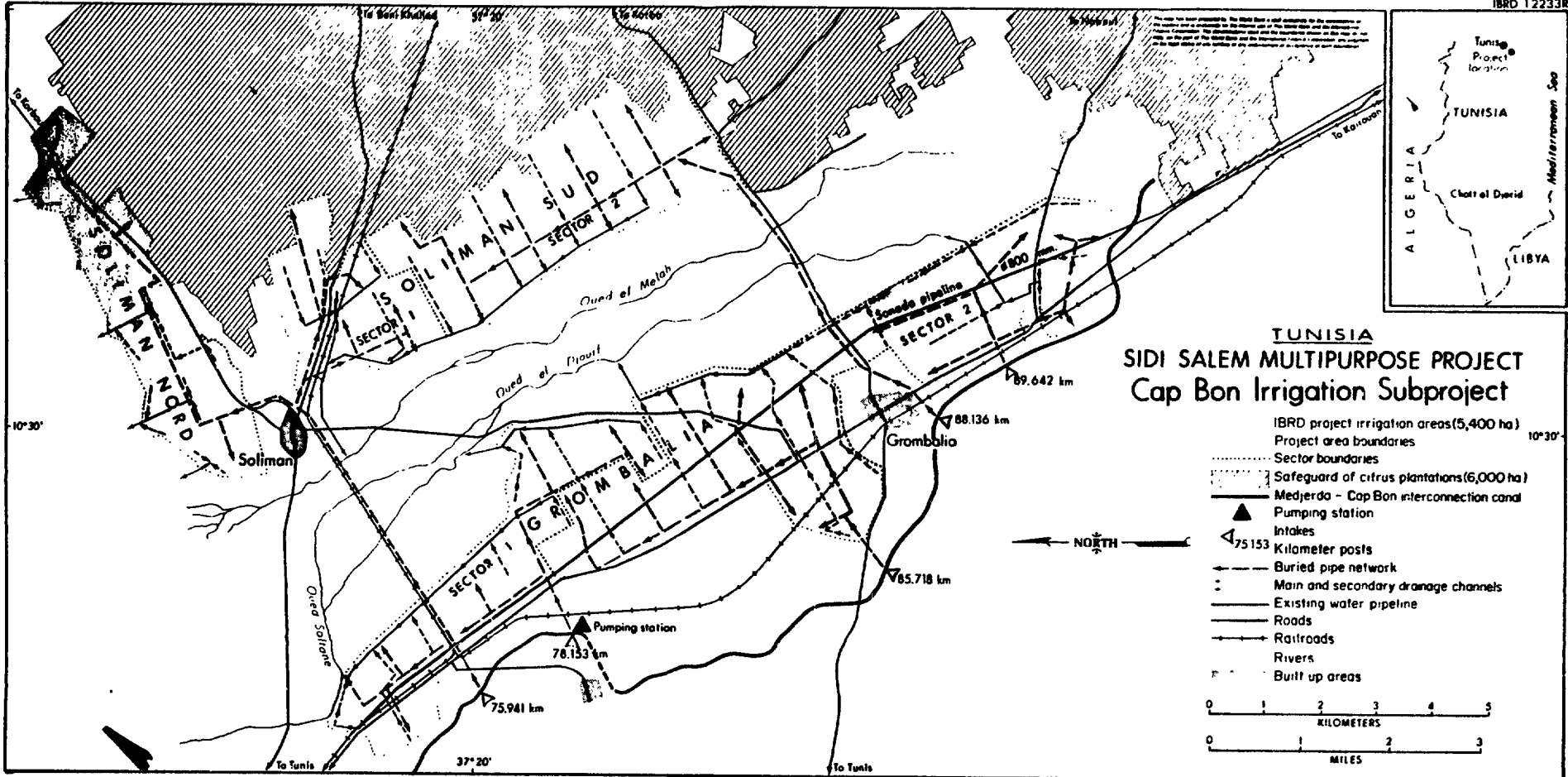
## TUNISIA SIDI SALEM MULTIPURPOSE PROJECT Water Master Plan for Northern Tunisia

- |   |   |                                     |
|---|---|-------------------------------------|
| IBRD project areas, 1st phase (10,600 ha)           | Interconnection canal, 1st phase            | Main roads                          |
| Safeguard of citrus plantations (6,000 ha)          | Open canal                                  | Railroads                           |
| Proposed irrigation areas, 2nd phase                | Underground pipe                            | Rehabilitation of existing railroad |
| Existing irrigation areas (in operation or ongoing) | Proposed future canal, 2nd phase            | New railroad (relocation)           |
| Existing dams and reservoirs                        | Open canal                                  | High tension line, 150 kv           |
| Proposed dams and reservoirs                        | Underground pipe                            | High tension lines, 90 kv           |
| Rivers  | Proposed pumping station, 1st phase         | Medium tension lines, 22-30 kv      |
|   | Proposed future pumping stations, 2nd phase | Transformer stations, 225 kv        |
|   | Existing potable water pipes                | Transformer stations, 90 kv         |
|   |   | Transformer stations, 22-30 kv      |
|   |   | International boundaries            |

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















- PROPOSED WORKS (PHASE I)**
- 1 Sidi Salem Dam: V=550 Mm<sup>3</sup>
  - 2 Interconnection canal: L=126 km
  - 3 Railroad relocation: L=24 km
- Irrigation areas:**
- 4a Testour - 1,400 ha
  - 4b Medjez el Bab - 3,800 ha
  - 4c Cap Bon - 5,400 ha
  - 4d Safeguard of citrus - 6,000 ha



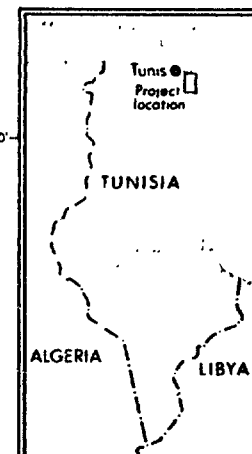
# TUNISIA

## SIDI SALEM MULTIPURPOSE PROJECT

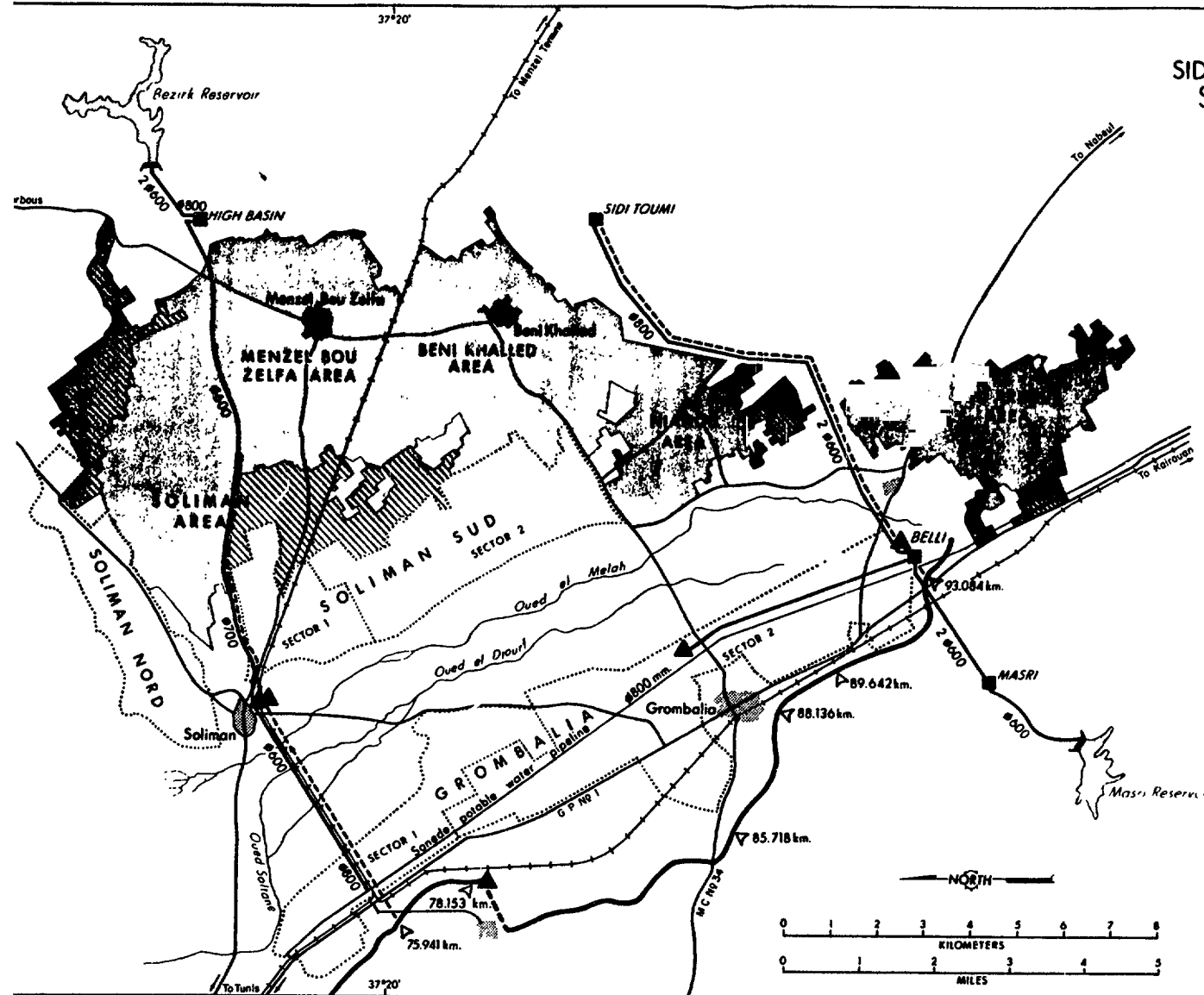
### Safeguard of Citrus Plantations

-  Safeguard of citrus, area equipped (15,065 ha)
-  Safeguard of citrus, area proposed to be equipped (935 ha)
-  Perimeter of Cap Bon irrigation area
-  Sector boundaries
-  Medjerda - Cap Bon interconnection canal
-  Pumping stations
-  Intakes
-  Kilometer posts
-  Projected pipes
-  Existing pipes
-  Existing pumping stations
-  Pressure reservoirs
-  Existing potable water pipeline
-  Dams
-  Roads
-  Railroads
-  Rivers
-  Built-up areas

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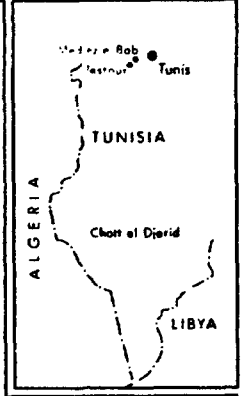


DECEMBER 1987



# TUNISIA SIDI SALEM MULTIPURPOSE PROJECT Testour and Medjez el Bab Subproject

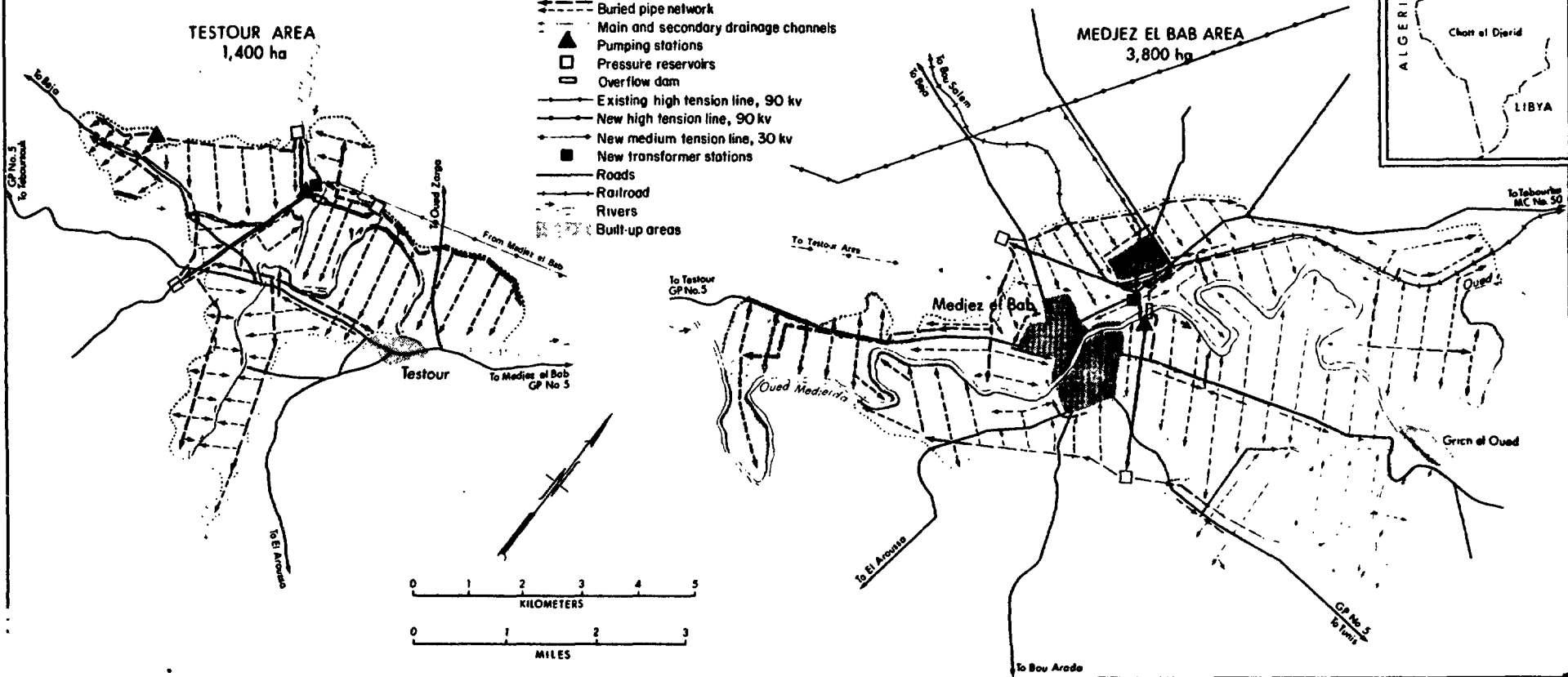
This map has been prepared by The World Bank in cooperation with the Government of Tunisia for the Sidi Salem Multipurpose Project. The boundaries shown on this map do not represent the actual boundaries of the project area. The information shown on this map is not intended to be used for any purpose other than that for which it was prepared.



- IBRD project irrigation areas
- Project area boundaries
- Pressure pipes
- Buried pipe network
- Main and secondary drainage channels
- Pumping stations
- Pressure reservoirs
- Overflow dam
- Existing high tension line, 90 kv
- New high tension line, 90 kv
- New medium tension line, 30 kv
- New transformer stations
- Roads
- Railroad
- Rivers
- Built-up areas

TESTOUR AREA  
1,400 ha

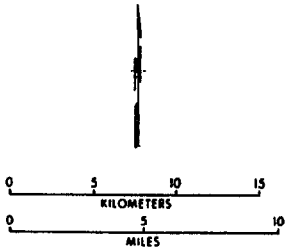
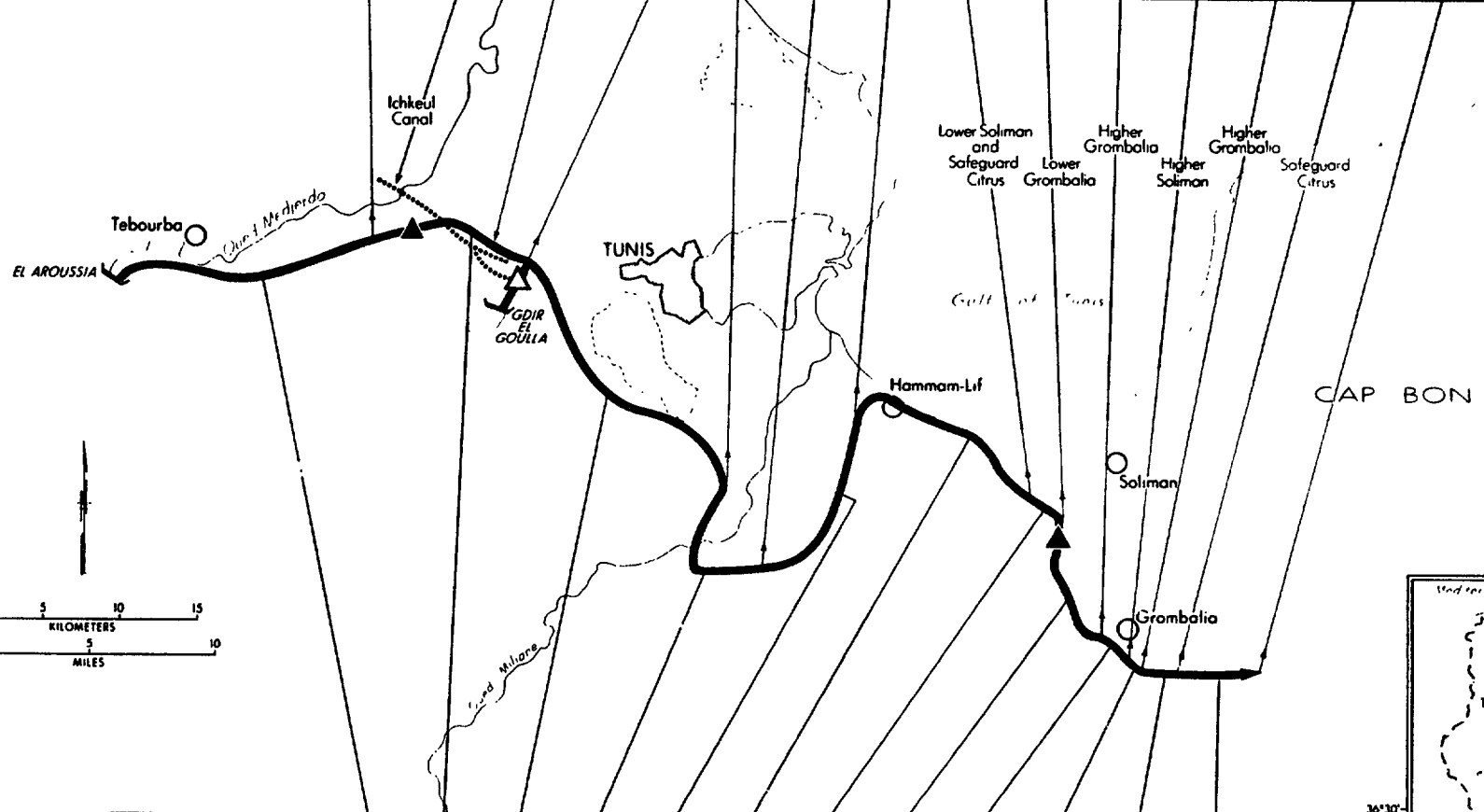
MEDJEZ EL BAB AREA  
3,800 ha



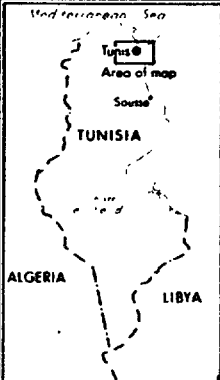
# SIDI SAÏ ROJECT Medjerda - Cap Bon Interconnection Canal and Its Users

- Interconnection canal - first phase
- Ichkeul canal - second phase
- Pumping stations
- Existing dams and reservoirs
- Rivers

Areas	Lower Valley Irrigation	Ichkeul Supply	El-Lil Supply	Tunis Potable Water	Mornag Irrigation			Cap Bon + Safeguard of Citrus Plantations					Sousse Potable Water	
<i>Discharge of Water Intakes (m<sup>3</sup>/sec)</i>	5.000	10.000	3.775	3 570	0 825	0 615	0 935	2 100	0 650	0 600	0 810	0 860	1 450	2 35
<i>Kilometer Post</i>	28 320	-	6 950	7 150	37 300	49 000	60 890	75 941	78 153	85 718	88 136	89 642	93 084	97 420



<i>Water Discharges (m<sup>3</sup>/sec)</i>	16 00	11 00	11 21	10 39	9 77	8 83	6 73	6 08	5 48	4 67	3 81	2 35
<i>Length (km)</i>	28 32	7 41	30 15	11 70	11 89	15 05	2 21	7 56	2 42	1 51	3 44	4 34
<i>Cumulative Length (km)</i>	-	35 73	65 88	77 59	89 47	104 52	106 73	114 29	116 71	118 22	121 66	126 00



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